IBM System Storage TS3100 Tape Library and TS3200 Tape Library

Setup, Operator, and Service Guide

Machine Type 3573

GA32-0545-04

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Note!

Before using this information and the product it supports, be sure to read the general information under "Notices" on page F-1 in the *IBM System Storage TS3100 and TS3200 Tape Library Setup, Operator, and Service Guide*.

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

This edition applies to the *IBM System Storage TS3100 Tape Library and TS3200 Tape Library Setup, Operator, and Service Guide*, GA32-0545-04, and to the subsequent releases and modifications until otherwise indicated in new editions.

Read this First

Accessing Online Technical Support

For online Technical Support for your Library, visit:

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

Registering for Support Notification

Support Notification registration provides email notification when new firmware levels have been updated and are available for download and installation. To register for Support Notification, visit the web at **http://www-304.ibm.com/jct01004c/systems/support/storage/news/05072007SupportNotif.html**.

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Summary of Changes

The following information has been added to this edition:

- Internet Protocol version 6 overview and support
- Factory Restore Default settings
- Updated Encryption information

Contents

Figures

Tables

Safety and Environmental Notices

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

Most danger or caution notices contain a reference number (Dxxxx or Cxxxx). Use the reference number to check the translation in the *IBM @server Safety Notices* (G229-9054) publication included in your ship group.

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

Danger Notice

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

Caution Notice

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

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

Laser Safety and Compliance

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

Class I Laser Product

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

Performing the Safety Inspection Procedure

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

1. Stop all activity between the host and the library's tape drives.
2. Turn off the power to the library by pushing in on the **Power** button (1) shown in Figure 1-1 on Page 1-1 for 4 seconds.
3. If drives are SCSI attached, disconnect the SCSI cable and check the SCSI bus terminator for damage.
4. Unplug the library's power cord or cords from the electrical outlet and the library power supply.
5. Check the library's power cord for damage, such as a pinched, cut, or frayed cord.
6. If drives are SCSI attached, check the tape drive's SCSI bus (signal) cable for damage.
7. If drives are SAS attached, check the tape drive's SAS cable for damage.
8. Check the cover of the library for sharp edges, damage, or alterations that expose its internal parts.
9. Check the cover of the library for proper fit. It should be in place and secure.
10. 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 should be used for all rack mounted devices.

DANGER

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

CAUTION:

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

(R001)

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

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

(R002)

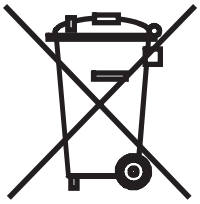
Disposal of Library Components Containing Mercury

The fluorescent lamp in the liquid crystal display contains mercury. Dispose of it as required by local ordinances and regulations.

Product Recycling and Disposal

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

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



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

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

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

Battery Return Program

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

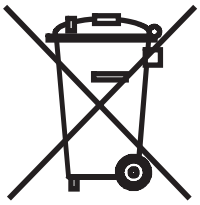
In the United States, IBM has established a return process for reuse, recycling, or proper disposal of used IBM sealed lead acid, nickel cadmium, nickel metal hydride, and other battery packs from IBM Equipment. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333. Please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

For Taiwan:

Please recycle batteries

廢電池請回收

For the European Union:



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

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

For California:

Perchlorate Material - special handling may apply. See `www.dtsc.ca.gov/hazardouswaste/perchlorate`.

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

End of Life (EOL) Plan

This box is a purchased unit. Therefore, it is the sole responsibility of the purchaser to dispose of it in accordance with local laws and regulations at the time of disposal.

This unit contains recyclable materials. The materials should be recycled where facilities are available and according to local regulations. In some areas IBM may provide a product take-back program that ensures proper handling of the product. For more information, contact your IBM representative.

Preface

This manual contains information and instructions necessary for the installation, operation, and service of the IBM® System Storage™ TS3100 Tape Library and TS3200 Tape Library.

Note: The IBM System Storage™ TS3100 Tape Library and TS3200 Tape Library is a customer installed unit. The customer is responsible for the setup and maintenance of the tape library.

Related Publications

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

- *IBM System Storage TS3100 Tape Library and TS3200 Tape Library Quick Reference* (GA32-0546) provides information for installation information.
- *IBM System Storage TS3100 Tape Library and TS3200 Tape Library SCSI Reference* (GA32-0547) provides supported SCSI commands and protocol governing the behavior of SCSI interface.
- *IBM Tape Device Driver Installation and User's Guide* (GC27-2130) 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 adapter cards, and tells how to configure hosts to use the device driver. All of the above are with the Ultrium family of devices.
- *IBM Tape Device Driver Programming Reference* (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.

Chapter 1. Product Description

The IBM System Storage™ TS3100 Tape Library (2U library) and the IBM System Storage TS3200 Tape Library (4U library) provide compact, high-capacity, low-cost solutions for simple, unattended data backup. The 4U library houses up to 48 tape cartridges (or 45 and an elective 3-slot I/O Station) in a compact 4U form factor with easy access to tape cartridges via four removable magazines. The 2U library houses up to 24 tape cartridges (or 23 and an elective 1-slot I/O Station) in a compact 2U form factor with easy access to tape cartridges via two removable magazines.

The fourth generation of the Ultrium series of products are available with interfaces to suit your needs: a Small Computer Systems Interface (SCSI), Fibre Channel interface (FC), or Serial Attached SCSI interface (SAS).

By using the IBM TotalStorage LTO Ultrium 800 GB Data Cartridge, the Ultrium 4 Tape Drive has the capability of writing up to 800 GB native capacity (1600 GB with 2:1 compression). The 4U library media capacity with maximum storage of 48 cartridges is up to 38.4 TB (76.8 TB with 2:1 compression) data storage per unit. The 2U library media capacity with maximum storage of 24 cartridges is up to 19.2 TB (38.4 TB with 2:1 compression) data storage per unit.

By using the IBM TotalStorage® LTO Ultrium 400 GB Data Cartridge, the Ultrium 3 Tape Drive has the capability of writing up to 400 GB native capacity (800 GB with 2:1 compression). The 4U library media capacity with maximum storage of 48 cartridges is up to 19.2 TB (38.4 TB with 2:1 compression) data storage per unit. The 2U library media capacity with maximum storage of 24 cartridges is up to 9.6 TB (19.2 TB with 2:1 compression) data storage per unit

IBM Ultrium 4 tape drives can read and write LTO Ultrium 4 Data Cartridges. IBM Ultrium 4 tape drives can read and write LTO Ultrium 3 Data Cartridges at original Ultrium 3 capacities, and can also read LTO Ultrium 2 Data Cartridges with improved data rates. IBM Ultrium 3 Tape Drives can read and write LTO Ultrium 2 Data Cartridges at original Ultrium 2 capacities, and can also read LTO Ultrium 1 Data Cartridges with improved data rates of up to 20 MB/second native data transfer rate (40 MB/second with 2:1 compression). Ultrium 4 tape drives cannot read Ultrium 1 tapes.

Front Panel

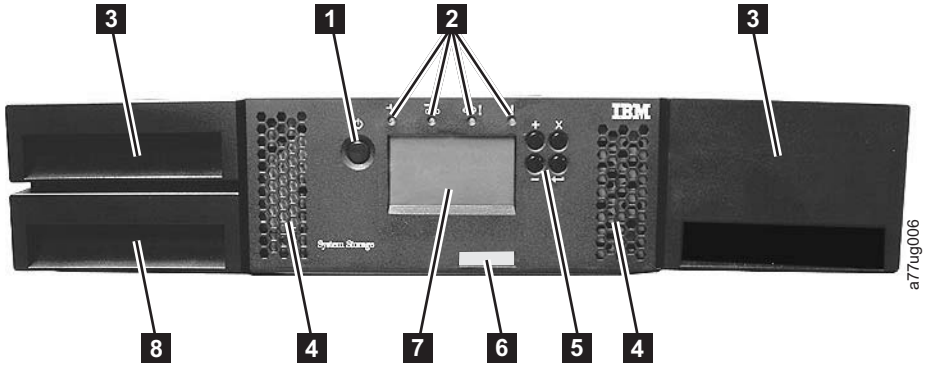


Figure 1-1. Front panel of a 2U library

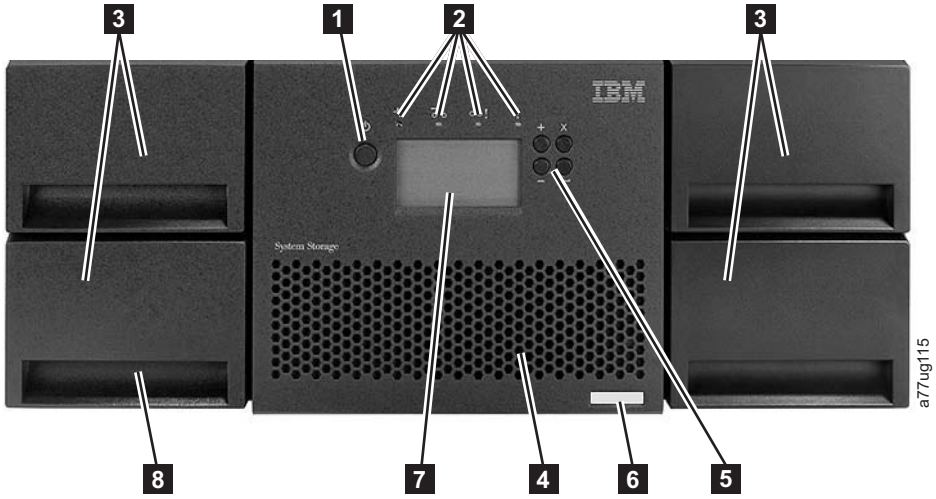


Figure 1-2. Front panel of a 4U library

Table 1-1 below contains front panel descriptions for both the 2U library in Figure 1-1 and the 4U library in Figure 1-2.

Table 1-1. 2U library and 4U library front panel descriptions

Number	Item	Description
1	Power button	Pressing this button will power ON the library. Pressing and holding this button for 4 seconds will power OFF the unit (soft power down). No power switch or button can be found on the back panel of the library.

Table 1-1. 2U library and 4U library front panel descriptions (continued)

Number	Item	Description
2	Front panel LEDs (left to right)	• **Ready/Activity** (Green LED) - It is lit any time the unit is powered ON and able to function. It should blink whenever there is library or drive activity, or when the library is in the process of powering up. • **Clean Drive** (Amber LED) - It will be lit when the drive needs to be cleaned. The LED will be turned OFF after the drive is cleaned successfully. • **Attention** (Amber LED) - It will be lit when there has been a failure that indicates a piece of media is bad, marginal, or invalid. It will be cleared when all invalid cartridges have been exported from the library. The amber LED may also be lit because a power supply, or a power supply fan is failing. • **Error** (Amber LED) - It will be lit when there is an unrecoverable library or drive failure. A message is displayed at the same time on the Operator Control Panel display.
3	Cartridge magazines	• The 2U library contains two cartridge magazines. – The left magazine can hold up to 12 cartridges (or 11 data cartridges and the elective 1-slot I/O Station.) – The right magazine can hold up to 12 cartridges. • The 4U library contains four cartridge magazines. – The upper left magazine can hold up to 12 cartridges. – The lower left magazine can hold up to 12 cartridges (or 9 data cartridges and the elective 3-slot I/O Station.) – The upper right magazine can hold up to 12 cartridges. – The lower right magazine can hold up to 12 cartridges.
4	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.
5	Control keys	• **Up (+)** - The upper left button is used to scroll upward through menu items. • **Down (-)** - The lower left button is used to scroll downward through menu items. • **Cancel** - The upper right button is used to cancel a user action and return to the previous menu screen. • **Enter** - The lower right button is used to display a sub-menu or force an accessor action.
6	Machine type, Model number, and Serial Number label	The machine type, model number and serial number of the library are located on this label. This serial number is the number that links the library to your warranty.
7	Operator Control Panel display	This component is a 128 X 64 monochrome graphic display.
8	I/O Station	The Input/Output (I/O) Station is used to import and export cartridges into and out of the library. • The 2U library has an elective 1-slot I/O Station. • The 4U library has an elective 3-slot I/O Station.

Rear Panel

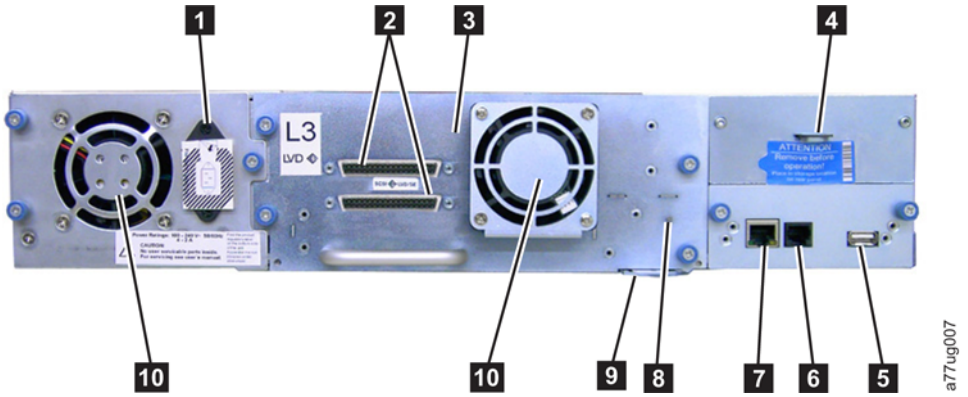


Figure 1-3. Rear panel of a 2U library with a SCSI drive

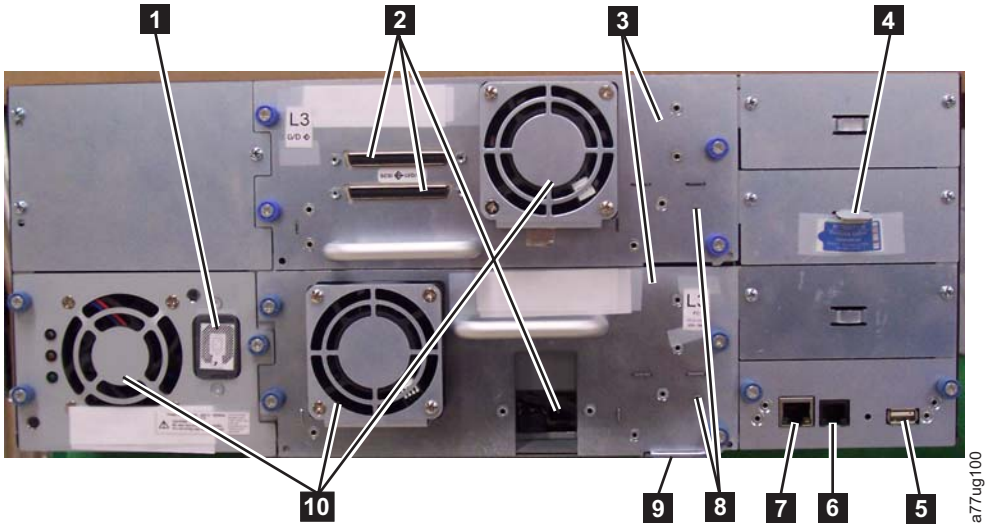


Figure 1-4. Rear panel of a 4U library with one SCSI drive and one Fibre Channel drive.

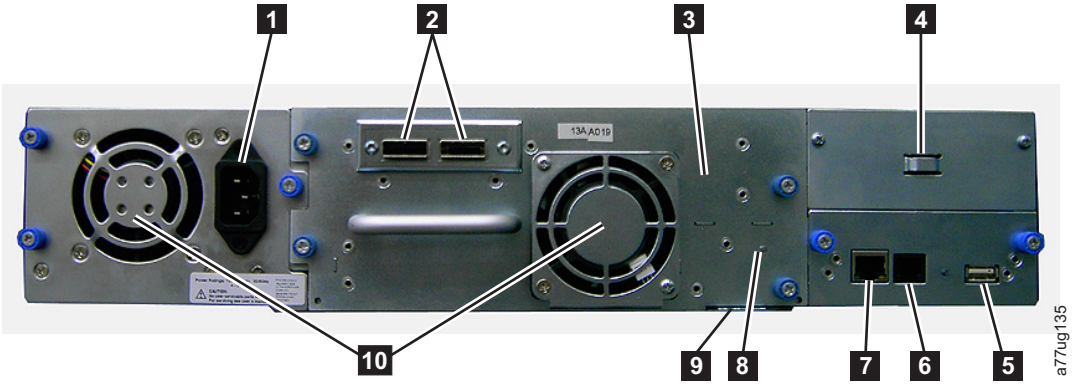


Figure 1-5. Rear panel of a 2U library with a full high dual port SAS drive

Table 1-2. 2U library and 4U library rear panel descriptions

Number	Item	Description
1	Power connector(s)	Both libraries require a 110/220 volt AC power connection. • The 2U library has one power supply. • The 4U library has a minimum of one power supply, but has the capability of adding a redundant power supply.
2	Host interface connectors	The library has one or more of the following host interface connectors on the drive sled: • a 68-pin HD SCSI connector • a Fibre Channel connector • a SFF-8088 mini-SAS connector
3	Tape drive sled	This library supports the Ultrium 3 and Ultrium 4 Tape Drive. The tape drive in the library is packaged in a container called a drive sled. Ultrium 3 drive sleds come in Full High (as shown) or in a Half High configuration (not shown). Ultrium 4 drive sleds are available only in Full High configurations. The drive sled is a customer replaceable unit (CRU), and is hot-pluggable - designed for easy removal and replacement.
4	Shipping lock and label storage location	The shipping lock, which secures the accessor during shipping, and associated label are stored on the rear panel of the library for future use.
5	USB port	An alternative communication path to the library. For use by Service Personnel.
6	Serial port	This port is used to communicate serially with the library using an RJ-11 connector. For use by Service Personnel.
7	Ethernet port	This port is used to connect the library to a network.
8	Tape drive LED	This LED indicates the current status of the drive. When the LED is green, it indicates normal drive activity.
9	Machine type, Model number, and Serial Number pull-out label	The machine type, model number and serial number of the library are located on this pull-out label. This serial number is the number that links the library to your warranty.
10	Fan vents	These vents allow air to escape from the power supply and tape drive sled.

Internal View of Library

Important: FOR REFERENCE ONLY. The customer is not authorized to remove the top cover of the library. No customer serviceable components are inside the library.

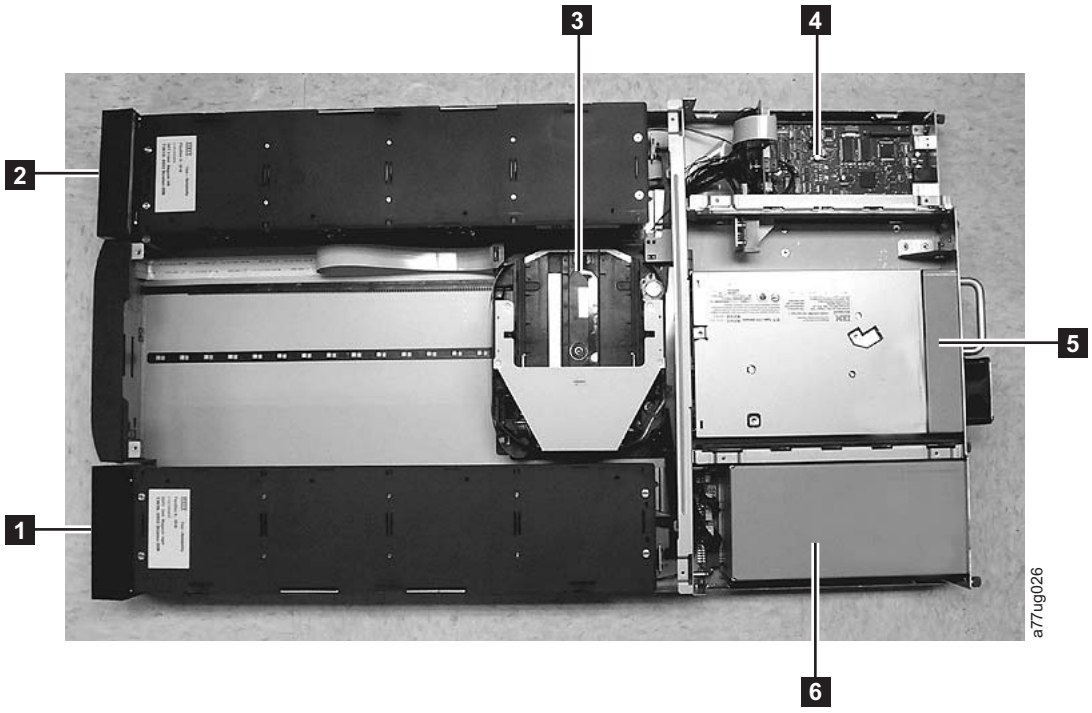


Figure 1-6. Internal view of the library

Table 1-3. Internal view description

Number	Item	Description
1	Right cartridge magazine(s)	• In a 2U library, the right magazine can hold up to 12 cartridges. • In a 4U library, the right magazines can hold up to 24 cartridges.
2	Left cartridge magazine(s)	• In a 2U library, the left magazine can hold up to 11 cartridges and houses the 1-slot I/O Station. • In a 4U library, the left magazines can hold up to 21 cartridges and houses the 3-slot I/O Station.
3	Accessor	This component contains the library robot and bar code reader. The accessor moves cartridges to/from the following: • I/O Station • storage slots • tape drive(s)
4	Library Controller Board	This component is a customer replaceable unit (CRU) and stores the user configuration information or vital product data (VPD).
5	Tape drive sled	Both libraries support the Ultrium 3 and Ultrium 4 Tape Drive. Each tape drive in the library is packaged in a container called a drive sled. The drive sled is a customer replaceable unit (CRU), and is designed for easy removal and replacement. • The 2U library houses one full high tape drive sled or up to two half high tape drive sleds. • The 4U library houses up to two full high tape drive sleds or up to four half high tape drive sleds. Combinations of full high and half high drive sleds are allowed.
6	Power supply	The power supply is a customer replaceable unit (CRU) and the sole source of power for the library. The 2U has one power supply. The 4U has one or can have an optional second power supply for redundancy.

Bar Code Reader

The bar code reader is an integral part of the library accessor. The bar code reader provides inventory feedback to the host application, Operator Control Panel display, and Web User Interface by reading cartridge bar code labels. The library stores the customized inventory data in memory.

Code for this library supports an 8 or more character VOLSER (volume serial number) on the barcode on the tape cartridge. This library does not support a 6 character VOLSER.

Configuring I/O Stations and Reserving Slots

2U libraries usually have 1 slot for an I/O Station, while 4U libraries have 3 slots assigned as an I/O Station. These slots can be configured as storage if needed.

To configure the I/O Station using the web user interface, follow these steps.

- Go to **Configure Library->General**.
- To enable the I/O Station, place a check mark in the **I/O Station Enabled** box. If it is checked as enabled, the first 3 physical slots in the lower left magazine in a 4U or the first physical slot in the left magazine in a 2U is configured as an I/O station. If it is not checked, the slots are configured as storage.

Dedicated Cleaning Slot

Earlier versions of the 4U library contained a Dedicated Cleaning Slot (DCS). This DCS can be retained and is supported by future library firmware updates. Library firmware after 1.95 will allow removal of the DCS, thus enabling this slot to be used as a storage slot. To remove the DCS, perform the following procedures using the Operator Control Panel (OCP). **OCP->Configure->Library Settings->General->Remove DCS->No/Yes->Save**. Once a Dedicated Cleaning slot (DCS) is removed, it cannot be reinstated. The DCS option will no longer show up in the OCP. To cause automatic cleaning of the drives when needed, a slot must be reserved, a cleaning cartridge must be present in the reserved slot, and Auto Clean must be enabled.

Reserving Slots

Reserving a slot is accomplished by reducing the **Active Slot** count in any particular logical library. Slots are reserved beginning with the last available slot in the last magazine of the library. A cleaning cartridge in a reserved slot is available to any logical library drive even if the reserved slot is not in that logical library. Typically, if the library contains multiple logical libraries, the last logical library is chosen to be the reserved slot containing the cleaning cartridge. As with a library with a single logical library, this slot is the last physical slot in the library (top right magazine, uppermost rear slot).

To reserve a cleaning slot, follow these steps.

- To reserve slots in your library, go to the web interface at “Choosing Library Settings” on page 2-17 or the OCP at “Choosing Library Settings” on page 2-25 to get directions on reducing the Active slot count.
- Go to **Configure Library->General**.
- Place a checkmark in the **Auto Clean Enabled** box. If it is checked as enabled, the Auto Clean function will work if the cleaning cartridge is in the reserved

slot. If it is not checked, even if the cleaning cartridge is in the appropriate location, automatic cleaning will not occur.

Encryption

The LTO Ultrium 4 Tape Drive supports host Application Managed Encryption (AME), Library Managed Encryption (LME), and System Managed Encryption (SME), using T10 encryption methods, for SAS and Fibre Channel drives only. Data encryption is supported with LTO Ultrium 4 Data Cartridges only. Encryption is also supported with library firmware higher than version 1.95.

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 may validate each drive instance by checking the drive's digital certificate.

Application Managed Encryption is supported on AIX®, Windows Server 2003, Linux®, and Solaris. Encryption requires the latest device drivers available on the ftp download site: **ftp://ftp.software.ibm.com/storage/devdrvr/**.

The LTO Ultrium 4 encryption environment can be complex and require knowledge beyond that of a product trained SSR. In the Tape Storage environment, the Encryption function on tape drives (desktop, stand alone and within libraries) is configured and managed by the customer. In some instances SSRs will be 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 via support line contract.

The library firmware should always allow the user to select ″None″ or ″Application Managed Encryption″ from the web user interface, as long as there is at least one encryption capable drive in the logical library. If a valid Transparent Encryption license key has been previously entered, ″System Managed Encryption″ or ″Library Managed Encryption″ can be selected. The factory default should be ″None.″

Note: The optional Transparent Encryption Key feature enabling System Managed Encryption and Library Managed Encryption is not available on TS3200 and TS3100 models purchased through High Volume (HVEC) channels.

Note: All encryption settings should be configured or re-verified in the drive after any library or drive reset. This is because a new drive may have been added or an existing drive may have been swapped with another drive.

For more details, see the IBM Tape Device Drivers Encryption Support documentation, and the IBM LTO Ultrium Tape Drive SCSI Reference documentation.

Internet Protocol version 6 (IPv6)

This section is licensed under the GNU Free Documentation License. It uses material from the Wikipedia article ″IPv6″.

Internet Protocol version 6 (IPv6) is a network layer protocol for packet-switched internetworks. It is designated as the successor of IPv4, the current version of the Internet Protocol, for general use on the Internet.

The main improvement brought by IPv6 is the increase in the number of addresses available for networked devices, allowing, for example, each mobile phone and mobile electronic device to have its own address. IPv4 supports 2^{32} (about 4.3 billion) addresses, which is inadequate for giving even one address to every living person, let alone supporting embedded and portable devices. IPv6, however, supports approximately 5×10^{28} addresses for each of the roughly 6.5 billion people alive today. With such a large address space available, IPv6 nodes can have as many universally scoped addresses as they need, and network address translation is not required.

Features of IPv6:

- **Larger Address Space:** The main feature of IPv6 that is driving adoption today is the larger address space: addresses in IPv6 are 128 bits long versus 32 bits in IPv4. The larger address space avoids the potential exhaustion of the IPv4 address space without the need for NAT (Network Address Translation) and other devices that break the end-to-end nature of Internet traffic. It also makes administration of medium and large networks simpler, by avoiding the need for complex Subnetting schemes. The drawback of the large address size is that IPv6 carries some bandwidth overhead over IPv4, which may hurt regions where bandwidth is limited (header compression can be used to alleviate this problem).
- **Stateless Autoconfiguration of Hosts:** IPv6 hosts can be configured automatically when connected to a routed IPv6 network. When first connected to a network, a host sends a link-local multicast (broadcast) request for its configuration parameters; if configured suitably, routers respond to such a request with a router advertisement packet that contains network-layer configuration parameters. If IPv6 autoconfiguration is not suitable, a host can use stateful autoconfiguration (DHCPv6) or be configured manually. Stateless autoconfiguration is only suitable for hosts: routers must be configured manually or by other means.
- **Multicast:** Multicast is part of the base protocol suite in IPv6. This is in opposition to IPv4, where multicast is optional. Most environments do not currently have their network infrastructures configured to route multicast; that is - the link-scoped aspect of multicast will work but the site-scope, organization-scope and global-scope multicast will not be routed. IPv6 does not have a link-local broadcast facility; the same effect can be achieved by multicasting to the all-hosts group.
- **Jumbograms:** In IPv4, packets are limited to 64 KB of payload. When used between capable communication partners and on communication links with a maximum transmission unit larger than 65,576 octets, IPv6 has optional support for packets over this limit, referred to as jumbograms which can be as large as 4 GB. The use of jumbograms may improve performance over high-MTU (Maximum Transmission Unit) networks.
- **Mobility:** Unlike mobile IPv4, Mobile IPv6 (MIPv6) avoids triangular routing and is therefore as efficient as normal IPv6. This advantage is mostly hypothetical, as neither MIP nor MIPv6 are widely deployed today.

Addressing

128-bit Length

The primary change from IPv4 to IPv6 is the length of network addresses. IPv6 addresses are 128 bits long (as defined by Request for Comments (RFC) Document 4291), whereas IPv4 addresses are 32 bits; where the IPv4 address space contains roughly 4 billion addresses, IPv6 has enough room for 3.4×10^{38} unique addresses. IPv6 addresses are typically composed of two logical parts: a 64-bit (sub-)network prefix, and a 64-bit host part, which is either automatically generated from the interface's MAC (Media Access Control) address or assigned sequentially.

Notation

IPv6 addresses are normally written as eight groups of four hexadecimal digits. For example, 2001:0db8:85a3:08d3:1319:8a2e:0370:7334 is a valid IPv6 address. If a four-digit group is 0000, the zeros may be omitted and replaced with two colons(::). For example, 2001:0db8:0000:0000:0000:0000:1428:57ab can be shortened as 2001:0db8::1428:57ab. Following this rule, any number of consecutive 0000 groups may be reduced to two colons, as long as there is only one double colon used in an address. Leading zeros in a group can also be omitted. Thus, the addresses below are all valid and equivalent:

```
2001:0db8:0000:0000:0000:0000:1428:57ab
2001:0db8:0000:0000:0000::1428:57ab
2001:0db8:0:0:0:0:1428:57ab
2001:0db8:0:0::1428:57ab
2001:0db8::1428:57ab
2001:db8::1428:57ab
```

Having more than one double-colon abbreviation in an address is invalid, as it would make the notation ambiguous.

Kinds of IPv6 Addresses

IPv6 addresses are divided into 3 categories:

- **Unicast Addresses**
- **Multicast Addresses**
- **Anycast Addresses**

A Unicast address defines a single interface. It identifies a single network interface. A packet sent to a unicast address is delivered to that specific computer.

Multicast addresses are used to define a set of interfaces that typically belong to different nodes instead of just one. When a packet is sent to a multicast address, the protocol delivers the packet to all interfaces identified by that address. Multicast addresses begin with the prefix FF00::/8, and their second octet identifies the addresses scope, i.e. the range over which the multicast address is propagated. Commonly used scopes include link-local, site-local, and global.

Anycast addresses, are also assigned to more than one interface, belonging to different nodes. However, a packet sent to an anycast address is delivered to just one of the member interfaces, typically the "nearest" according to the routing protocol's idea of distance. Anycast addresses cannot be identified easily: they have the structure of normal unicast addresses, and differ only by being injected into the routing protocol at multiple points in the network.

Host Interfaces

The 2U library and the 4U library can be attached to servers using the following interfaces:

- SCSI (LVD Ultrium 160)
- Serial Attached SCSI (SAS)
- Fibre Channel

Table 1-4. Host Drive Interface Support

Drive	SCSI (LVD Ultra 160)	SAS	FC
Ultrium 3 FH	X		X
Ultrium 3 HH	X	X	
Ultrium 4 FH	X	X*	X
Note: * = Dual Port SAS			

SCSI Interface

Note: Although the LVD hardware in the library is capable of operating in single-ended (SE) mode, SE operation is not recommended.

The library supports SCSI LVD attachments by using SCSI cables with 68-pin, HD-connectors. SCSI adapters must be properly terminated.

Before installing the SCSI cables, inspect all cables for damage. Do not install a cable if it is damaged. Report the damage immediately by contacting your place of purchase.

The maximum allowable length of your bus cabling depends on the type of SCSI bus that you use (LVD).

- For a server with an LVD SCSI bus:
  - Use a maximum system-to-device cable length of 10 m (33 ft) when attaching to the host interface board (SCSI) and one or two daisy-chained drives.
  - Use a maximum system-to-device cable length of 5 m (17 ft) when attaching to the host interface board (SCSI) and three to six daisy-chained drives.

    Note: For maximum performance, it is recommended to have a maximum of one drive per SCSI bus.
  - Only use the maximum system-to-device cable length of 25 m (82 ft) when attaching directly to one device (a point to point interconnection).

Physical Characteristics of the SCSI Interface

The library operates as a set of SCSI-3 devices. The Ultrium Tape Drives attach to servers using an LVD Ultra160 SCSI interface. Each SCSI drive sled uses shielded, HD68-pin connectors, and can attach directly to a 2-byte-wide SCSI cable.

Any combination of up to two initiators (servers) and up to four targets (devices) is allowed on a single SCSI bus if the following conditions are met:

- The SCSI bus is terminated properly at each end
- Cable restrictions are followed according to the SCSI-3 specification

Under the SCSI-3 protocol, this type of attachment allows cable lengths of up to 25 m (81 ft) with the appropriate cable and terminator. The table below gives the maximum bus length between terminators for the LVD interface. For information about cable connectors, see "SCSI Connectors and Adapters" on page 1-13.

Table 1-5. Maximum bus length between terminators

Type of Interconnection	Maximum Bus Length Between Terminators (in meters)
Point-to-point (1 server and 1 drive)	25
Multi-drop/daisy-chain (1 server and multiple drives)	12 (LVD)
Note: The maximum bus lengths stated in this table include the internal length of the bus.	

For maximum performance, multiple SCSI buses may be required (see "Using Multiple SCSI Buses"), and IBM Ultrium Tape Drives must be the only target devices that are active on the bus.

Note: For maximum performance, the quantity of tape drives that you can attach to one SCSI bus is limited, and is based on the type of bus that you have and the amount of data compression achieved. Ultra160 SCSI buses have a bandwidth of 160 MB per second. The table below lists the types of SCSI buses and gives the recommended maximum quantity of drives that you can attach.

Table 1-6. Recommended maximum quantity of drives per SCSI bus

Type of Drive	Ultra 160 SCSI Bus
LVD Ultrium 3	1 drive at 2:1 compression

Using Multiple SCSI Buses

The library has two SCSI connectors for each tape drive in the library. Each drive can be daisy-chained using a SCSI bus jumper.

Removal of any jumpers will create a SCSI bus for each drive installed in your library for attachment to multiple servers or to multiple SCSI adapter cards on one server. Remember that each SCSI bus must be terminated. Multiple SCSI buses may be required for maximum performance, depending on the application and data compression ratio. Note, however, that library (Medium Changer) control is required on at least one SCSI bus.

The Medium Changer device is required to be addressed via LUN 1 of the lowest-numbered drive position of each logical library. The Medium Changer device may additionally be addressed via LUN 1 of other drives in any logical library.

Any bus containing a Medium Changer device via LUN 1 of a drive is referred to as a control and data path. Any other bus is referred to as a data path. For information about control paths, see "Using Multiple Control Paths" on page 1-22.

Terminating the Bus

The SCSI bus and all of the wires in the SCSI cable must be properly terminated according to the SCSI standard.

You can plug an external terminator into one of the SCSI connectors. A terminator must be installed on the last device on each end of a string of multiple devices. A terminator is included with each SCSI Ultrium Tape Drive.

SCSI Connectors and Adapters

The library is supported by a wide variety of servers (hosts), operating systems, and adapters. These attachments can change throughout the product's life cycle. To determine the latest supported attachments, visit the web at **http://www.ibm.com/storage/lto**. Or, contact your IBM Sales Representative.

SCSI Differential - LVD

IBM LVD tape devices support a bus length of 25 meters (82 ft.) point-to-point, and 12 meters (39 ft.) using multi-drop interconnection (daisy-chaining). For each daisy-chained device, the maximum cable length must be reduced by 0.5 meters (1.6 ft.).

Important: A faster bus does not imply that an attached device will support that data rate, but that multiple devices can operate on the bus at that maximum speed. For a detailed table of SCSI terms and related specifications, refer to the SCSI Trade Association Web site at http://www.scsita.org/terms/scsiterms.html. To ensure best performance, if possible, avoid daisy-chaining.

SAS Interface

A drive sled with a SAS (Serial Attached SCSI) interface can be linked directly to controllers. SAS is a performance improvement over traditional SCSI because SAS enables multiple devices (up to 128) of different sizes and types to be connected simultaneously with thinner and longer cables; its full-duplex signal transmission supports 3.0 Gb/s. Up to four Ultrium 3 single port half high drives or two Ultrium 4 dual port drives can be attached to one HBA port by using an interposer cable with one connection at the HBA port and 4 connections at the library end. At the library end, each of four drive sleds or ports can be attached via a SFF-8088 cable to the interposer cable. In addition, SAS drives can be hot-plugged.

SAS drives will auto-negotiate speed. There are no configurable topologies thus no feature switches associated with SAS. The SAS Ultrium 3 Half High drive sleds are single ported and can only be attached to one host. While the Ultrium 4 Full High drive is dual ported and can be attached to a maximum of two hosts, the intention of the second port is for redundancy rather than sharing. Sharing between these two hosts is limited to active/passive cluster failover. LAN-free drive sharing is not supported. Ultrium 3 and Ultrium 4 SAS drive sleds use the SFF-8088 connection at the drive sled end and SFF-8088 or SFF-8470 at the host adapter end. Initially, only point-to-point connections are supported.

Fibre Channel Interface

Fibre Channel allows for an active intelligent interconnection scheme, called a Fabric, to connect devices. Everything between the ports on Fibre Channel is called the Fabric. The Fabric is most often a switch or series of switches that takes the responsibility for routing.

The library allows the selection of the following Fibre channel port behaviors:

- LN Port: (default setting) - an automatic configuration that tries arbitrated loop first, then switched fabric
- L Port - arbitrated loop

- N Port - point to point protocol in a switched fabric topology

Cables and Speeds

Ultrium 3 and Ultrium 4 Fibre Channel tape drives use LC duplex fiber optics cables.

The maximum distances that the library supports on a Fibre Channel link is determined by the link speed, the type of fiber (50-micron or 62.5-micron), and the device to which the library is attached.

If the library attaches to an HBA (Host Bus Adapter), refer to the distances that are supported by the HBA. If the library attaches to a switch, the supported distances are:

- For a 50-micron cable:
  - 1-Gbit link speed = up to 500 m (1640 ft)
  - 2-Gbit link speed = up to 300 m (984 ft)
  - 4-Gbit link speed = up to 150 m (492 ft)
- For a 62.5-micron cable:
  - 1-Gbit link speed = up to 175 m (574 ft)
  - 2-Gbit link speed = up to 150 m (492 ft)
  - 4-Gbit link speed = up to 70 m (230 ft)

Using Zoning to Isolate Devices and Enhance Security

For security reasons, it is important to limit the devices that a server or servers can recognize or access. Also, some performance configurations and SAN configurations can result in a device being seen multiple times from the same server. For example, if you have two HBAs from the same server connected to an Ultrium Tape Drive in the library, the drive will be detected and appear as two logical devices. That is, there will be two special files for one physical device. Zoning can address these issues.

Zoning allows you to partition your SAN into logical groupings of devices so that each group is isolated from the other and can only access the devices in its own group. Two types of zoning exist: hardware zoning and software zoning. Hardware zoning is based on physical fabric port number. Software zoning is defined with a World Wide Node Name (WWNN) or World Wide Port Name (WWPN). While zoning can be reconfigured without causing an outage, some zoning configurations can become complicated. The advantage of the library's WWNN implementation is that you can avoid the exposure of introducing zoning errors because you do not have to change the zoning configuration if a drive needs service or replacement.

Attention: It is recommended that tape storage devices be connected on a separate HBA from disk storage devices to avoid potential configuration incompatibilities.

Fibre Channel Host Environment

The library is supported by a wide variety of servers (hosts), operating systems, and adapters. These attachments can change throughout the product's life cycle. To determine the latest supported attachments, visit the web at **http://www.ibm.com/storage/lto**.

Sharing on a Storage Area Network

With Storage Area Network (SAN) components, the possibilities for connecting multiple systems and multiple drives have increased. Not all software and systems

are designed to share drives. Before you install a drive that would allow two systems to share it, check that the systems and their software support sharing. If your software does not support sharing, note that Fibre Channel switches have a zoning capability to form a SAN partition. For systems that do not cooperate, use zoning to prevent the systems from sharing the same drive. You can remove zoned partitions as you upgrade software and system levels.

Using Persistent Binding to Ensure SCSI ID Assignment

When a server is booted, devices are discovered and assigned SCSI target and LUN IDs. It is possible for these SCSI assignments to change between boots. Some operating systems do not guarantee that devices will always be allocated the same SCSI target ID after rebooting. Also, some software depends on this association, so you do not want it to change. The issue of SCSI ID assignment is addressed by persistent binding.

Persistent binding is an HBA function that allows a subset of discovered targets to be bound between a server and device. Implemented by a World Wide Node Name (WWNN) or World Wide Port Name (WWPN), persistent binding causes a tape drive's WWNN to be bound to a specific SCSI target ID. After a configuration has been set, it survives reboots and any hardware configuration changes because the information is preserved. If a drive needs to be replaced, the new drive assumes the WWNN of the old drive because the WWNN for the drive is location-dependent within the library. Because the WWNN does not change, persistent binding does not need to be changed thus preventing a potential outage.

Logical Unit Number (LUN) Scanning

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

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

Library Partitioning and Element Addressing

Library 4U systems with firmware versions of 1.70 and higher, and containing at least 2 drives, have the ability to configure two logical libraries (create two partitions). This partitioning has been expanded with the new library firmware and half-high drive integration. Now it is possible to configure 1, 2, 3 or 4 partitions in the 4U library. Additionally the 2U library can now be configured into one or two partitions. Each library must contain at least one drive per logical library (partition).

Partitioning of 2U Libraries

When two half-high drives are installed in a 2U library, the library firmware will support partitioning in the same way that the 4U supports partitioning with two full-high drives today. The first partition will contain the first magazine and the first drive. The second partition will contain the second magazine and the second drive. The I/O station (if configured as I/O) will be shared, as is done with the partitioned 4U library.

One full-high drive is ″Drive 1″. When using half-high drives, the first half-high drive position will be called ″Drive 1″, The second half-high drive position will be called ″Drive 2.″

Partitioning of 4U Libraries

When one or more half-high drives are added to a 4U library, the drive naming will change. Currently, the first full-high drive is ″Drive 1″ and the second full-high drive is ″Drive 2″. When you consider that each full-high drive slot may contain one or two half-high drives, there are four potential drives in the space that used to occupy two. As a result, the first half-high drive position, or the first full-high drive position, will be called ″Drive 1″. The second half-high drive position will be called ″Drive 2″. The third half-high drive position, or the second full-high drive position, will be called ″Drive 3″. The fourth half-high drive position will be called ″Drive 4″.

Mixing of Drives

The library will support a mix of full-high and half-high drives in the same physical library and the same logical library. They will support a mix of Gen 3 and Gen 4 drives in the same physical library and the same logical library. They will also support a mix of SCSI, SAS, and Fibre Channel in the same physical library and the same logical library.

Configuration of a 1 Partition System

A one partition system configured for a 4U library contains any and all drives present in any drive positions, and it will contain all four magazines.

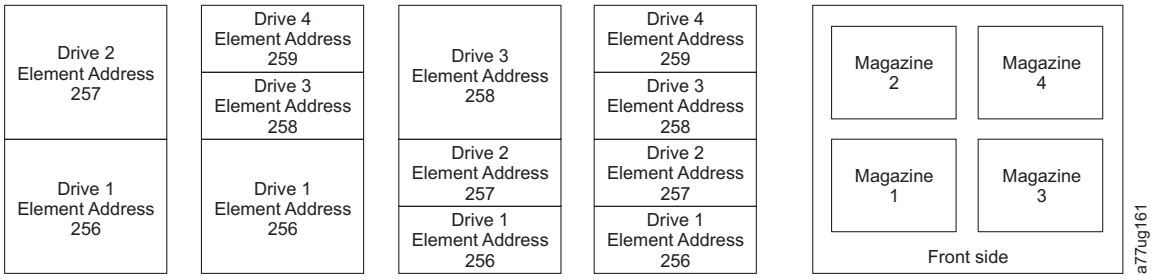


Figure 1-7. Configuration of a One Partition System

Configuration of a 2 Partition System

A two partition system must have at least two drives installed. One drive must be installed in either drive position 1 or drive position 2, and another drive must be installed in either drive position 3 or drive position 4. Partition 1 will contain any drives in drive position 1 and drive position 2. Partition 1 will also contain magazine 1 and magazine 2. Partition 2 will contain any drives in drive position 3 and drive position 4. Partition 2 will also contain magazine 3 and magazine 4.

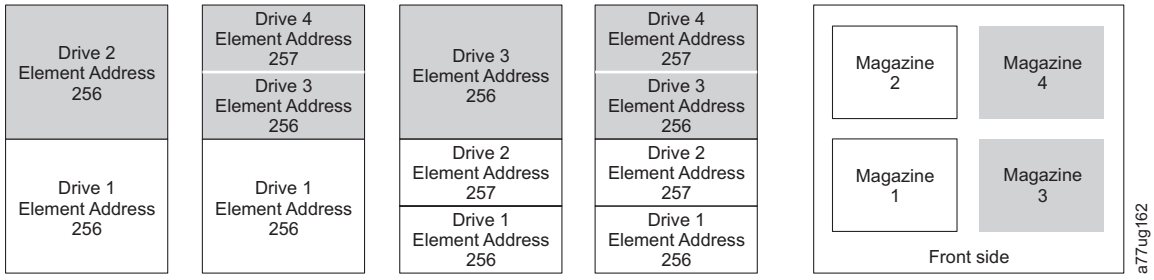


Figure 1-8. Configuration of a Two Partition System

Configuration of a 3 Partition System

A three partition system must have at least three drives installed. A drive must be installed in drive position 1, another drive must be installed in drive position 2, and another drive must be installed in either drive position 3 or drive position 4. Partition 1 will contain the first drive and the first magazine. Partition 2 will contain the second drive and the second magazine. Partition 3 will contain any drives in drive position 3 and drive position 4. Partition 3 will also contain magazine 3 and magazine 4.

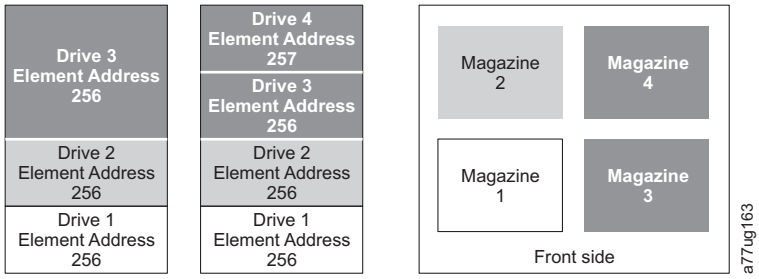


Figure 1-9. Configuration of a Three Partition System

Configuration of a 4 Partition System

A four partition system must have four drives. Each partition will contain one drive and one magazine.

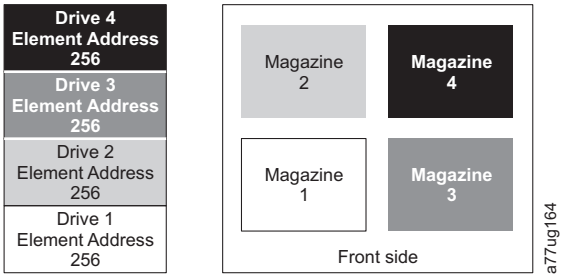


Figure 1-10. Configuration of a Four Partition System

SCSI Element Addressing

Every logical library starts at the first drive slot with the current assigned element start address (default value 256). It will be incremented from the bottom to the top slots for every drive slot. There is one exception to this addressing scheme to accommodate libraries currently in the field. A 4U library which contains only

full-high drives will continue to have the addresses assignments 256 and 257, thus causing no interruptions to their operation. Drive slots will still be incremented by 1 for each drive slot position.

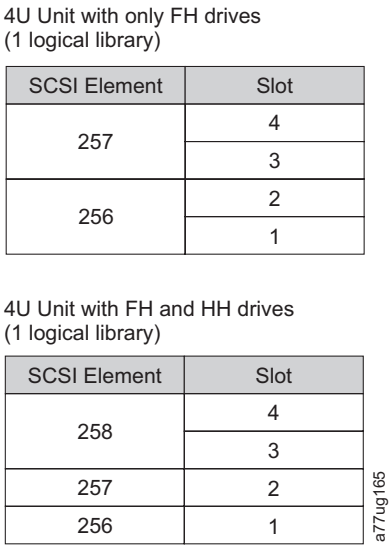


Figure 1-11. Examples of SCSI Element Addressing

The SCSI specification does not allow gaps in the SCSI element addressing. Special handling is needed for empty drive slots to fulfill the specification. Also drives which are temporarily removed need to have their address preserved to not confuse the attached host and host application. Generally only drives are reported which are currently physically available or temporarily removed. Empty (unused) slots which are located at the bottom or the top should not be reported, with an exception in case of a “removed” condition. A drive slot which does not contain a drive and has a position between used slots needs to be reported as a SCSI element. To signal the host application that this slot is not usable, its ACCESS bit will be disabled.

SCSI Element Types and Addresses

The following tables contain element addresses for the 2U library and the 4U library.

Table 1-7. 2U library SCSI Element Types and Element Addresses

Element Type	**Element Address Range**
Media Transport (Accessor) Element (MTE)	1 (0x01)
I/O Station Element (IEE)	16 (0x10)
Data Transfer (Drive) Element (DTE)	256 (0x100), 257 (0x101)
Storage Elements (STE)	4096 (0x1000) - 4117 (0x1015)

Table 1-8. 4U library SCSI Element Types and Element Addresses

Element Type	**Element Address Range**
Media Transport (Accessor) Element (MTE)	1 (0x01)
I/O Station Elements (IEE)	16 (0x10), 17 (0x11), 18 (0x12)

Table 1-8. 4U library SCSI Element Types and Element Addresses (continued)

Element Type	Element Address Range
Data Transfer (Drives) Elements (DTE)	256 (0x100), 257 (0x101), 258 (0x102, 259 (0x103)
Storage Elements (STE)	4096 (0x1000) - 4139 (0x102B)

2U Library I/O Slot, Storage Slots and Drive Slot Element Addresses and Physical Locations

The following table contains the physical location and SCSI element address (decimal and hexadecimal) of the I/O slot, storage slots, and drive slot in the 2U library containing only one drive. If a second drive were installed, it would be located at address 257 (0x101).

Table 1-9. 2U library SCSI element addresses for storage slots and drive slot

Left Magazine ⇐ Front of 2U library				**Library Rear Panel**	**Right Magazine** Front of 2U library ⇒			
Slot 8 4103 (0x1007)	Slot 9 4104 (0x1008)	Slot 10 4105 (0x1009)	Slot 11 4106 (0x100A)		Slot 23 4118 (0x1016)	Slot 22 4117 (0x1015)	Slot 21 4116 (0x1014)	Slot 20 4115 (0x1013)
Slot 4 4099 (0x1003)	Slot 5 4100 (0x1004)	Slot 6 4101 (0x1005)	Slot 7 4102 (0x1006)	Drive 1 256 (0x100)	Slot 19 4114 (0x1012)	Slot 18 4113 (0x1011)	Slot 17 4112 (0x1010)	Slot 16 4111 (0x100F)
I/O slot 16 (0x10)	Slot 1 4096 (0x1000)	Slot 2 4097 (0x1001)	Slot 3 4098 (0x1002)		Slot 15 4110 (0x100E)	Slot 14 4109 (0x100D)	Slot 13 4108 (0x100C)	Slot 12 4107 (0x100B)

4U Library I/O Slots, Storage Slots, and Drive Slots Element Addresses and Physical Locations

The following table contains the physical location (Slot x) and SCSI element address in decimal (4xxx) and in hexadecimal (0x10xx) of the I/O slots, storage slots, and drive slots in the 4U library containing only two drive sleds.

In older 4U libraries where the Dedicated Cleaning Slot (DCS) is in a fixed location (slot 9) and elected by the user to be retained as a DCS (option to delete DCS is available in library firmware greater than 1.95), the above slot numbering and element address changes starting with slot 10. In 4U libraries with a DCS, the information shown in slot 9 below moves to slot 10 and so forth through the remaining magazine slots. The final slot is slot 44 instead of slot 45 for libraries without a DCS. See "Configuring I/O Stations and Reserving Slots" on page 1-7 for information on how to delete the dedicated cleaning slot. Once the DCS is deleted, you cannot get it back. You will have to create a reserved slot if you want to clean the drive(s).

Table 1-10. 4U library SCSI element addresses for storage slots and drive slot

Upper Left Magazine ⇐**Front of 4U library**	**Library Rear Panel**	**Upper Right Magazine** **Front of 4U library**⇒

Table 1-10. 4U library SCSI element addresses for storage slots and drive slot (continued)

Slot 18 4113 (0x1011)	**Slot 19** 4114 (0x1012)	**Slot 20** 4115 (0x1013)	**Slot 21** 4116 (0x1014)		**Slot 45** 4140 (0x102C)	**Slot 44** 4139 (0x102B)	**Slot 43** 4138 (0x102A)	**Slot 42** 4137 (0x1029)
Slot 14 4109 (0x100D)	**Slot 15** 4110 (0x100E)	**Slot 16** 4111 (0x100F)	**Slot 17** 4112 (0x1010)	**Drive 2** 257 (0x101)	**Slot 41** 4136 (0x1028)	**Slot 40** 4135 (0x1027)	**Slot 39** 4134 (0x1026)	**Slot 38** 4133 (0x1025)
Slot 10 4105 (0x1009)	**Slot 11** 4106 (0x100A)	**Slot 12** 4107 (0x100B)	**Slot 13** 4108 (0x100C)		**Slot 37** 4132 (0x1024)	**Slot 36** 4131 (0x1023)	**Slot 35** 4130 (0x1022)	**Slot 34** 4129 (0x1021)
Lower Left Magazine								**Lower Right Magazine**
I/O Slot 3 18 (0x12)	**Slot 7** 4102 (0x1006)	**Slot 8** 4103 (0x1007)	**Slot 9** 4104 (0x1008)		**Slot 33** 4128 (0x1020)	**Slot 32** 4127 (0x101F)	**Slot 31** 4126 (0x101E)	**Slot 30** 4125 (0x101D)
I/O Slot 2 17 (0x11)	**Slot 4** 4099 (0x1003)	**Slot 5** 4100 (0x1004)	**Slot 6** 4101 (0x1005)	**Drive 1** 256 (0x100)	**Slot 29** 4124 (0x101C	**Slot 28** 4123 (0x101B)	**Slot 27** 4122 (0x101A)	**Slot 26** 4121 (0x1019)
I/O Slot 1 16 (0x10)	**Slot 1** 4096 (0x1000)	**Slot 2** 4097 (0x1001)	**Slot 3** 4098 (0x1002)		**Slot 25** 4120 (0x1018)	**Slot 24** 4119 (0x1017)	**Slot 23** 4118 (0x1016)	**Slot 22** 4117 (0x1015)

Maximum Library Storage Capacity and Data Transfer Rate

Maximum library storage capacity and maximum data transfer rates are as follows:

Table 1-11. Tape drive model and interface type

Tape Drive Model	Host Interface
Ultrium 4 drives	• Ultra160 SCSI LVD (depending on drive; single-ended (SE) is not recommended as it will severely degrade performance) • 4 Gb/s Fibre Channel • 3 Gb/s Serial Attached SCSI (SAS) - dual port
Ultrium 3 Full High drives	• Ultra160 SCSI LVD (depending on drive; single-ended (SE) is not recommended as it will severely degrade performance) • 4 Gb/s Fibre Channel
Ultrium 3 Half High drives	• Ultra 160 SCSI LVD (depending on drive; single-ended (SE) is not recommended as it will severely degrade performance) • 3 Gb/s SAS - single port

Table 1-12. Library storage capacity and data transfer rate

Characteristic	2U Library Specification	4U Library Specification
Maximum storage capacity - Ultrium 4 Data Cartridges	• 24 data cartridges • Native: 19.2 TB • Compressed: 37.6 TB (2:1 compression)	• 48 data cartridges • Native: 37.6 TB • Compressed: 75.2 TB (2:1 compression)
Maximum storage capacity - Ultrium 3 Data Cartridges	• 24 data cartridges • Native: 9.6 TB • Compressed: 19.2 TB (2:1 compression)	• 48 data cartridges • Native: 19.2 TB • Compressed: 38.4 TB (2:1 compression)

Table 1-12. Library storage capacity and data transfer rate (continued)

Characteristic	2U Library Specification	4U Library Specification
Maximum data transfer rate	Native: 80 MBs (288 GB/hr.) Compressed: 160 MBs (576 GB/hr.) (2:1 compression)	

Determining the Number of Logical Libraries

You can partition the library into as many logical libraries as there are drives in the library.

Basic Guidelines

- Each logical library must contain at least one drive.
- A library configuration of exactly one logical library equals the entire physical library.
- The library issues a warning to the user if media is moved across logical libraries.

Library Sharing

The library's default configuration allows a single application to operate the library through a single control path. Often, however, it is advantageous to be able to share a single library between heterogeneous (dissimilar) or homogeneous (similar) applications. Some applications (and some servers) do not allow for sharing a library between systems. Configurations can be created that enable the library to process commands from multiple heterogeneous applications (such as an IBM System p application and a Windows NT® application) and multiple homogeneous applications (for example, the same application run by several System p servers).

From the library's Web User Interface or Operator Panel, the following actions can be performed:

- Configure the library so that it is partitioned into separate logical libraries that independently communicate with separate applications through separate control paths. This configuration requires no special capabilities from the server or application. (For more information, see "Using Multiple Logical Libraries for Library Sharing" on page 1-22.)
- Configure any single logical library (including the entire physical library) so that it is shared by two or more servers that are running the same application. Depending on the capabilities of the server and application, there are several ways to set up this type of configuration. Three typical ways include:
  - Configuring one server (host) to communicate with the library through a single control path; all other servers send requests to that server through a network. This configuration is used by Tivoli® Storage Manager (TSM).
  - Configuring all of the servers to communicate with the library through a single, common control path. This configuration is used in high-availability environments such as IBM's High Availability Clustered Microprocessing (HACMP) and Microsoft's Systems Management Server (SMS) and Clustered Server Environments. Multi-initiator configurations are only supported by certain adapters and independent software vendors (ISVs). Check with your ISV.
  - Configuring a single logical library to communicate with multiple servers through multiple control paths. This configuration requires that control paths

be added (see "Using Multiple Control Paths"). It is used by Backup Recovery and Media Services (BRMS).

Library configuration is not limited to the examples given above. Many configurations are possible, and can be designed according to your business needs. For additional information, refer to your host application documentation.

Using Multiple Logical Libraries for Library Sharing

Multiple logical libraries are an effective way for the library to simultaneously back up and restore data from heterogeneous applications. For example, the library can be partitioned so that it processes:

- Commands from Application A (about Department X) in Logical Library 1
- Commands from Application B (about Department Y) in Logical Library 2

In this configuration, the storage slots and drives in each logical library are dedicated to that library and are not shared among other libraries. Commands issued by the applications travel to the library through two unique control paths. Thus, the data processing for:

- Department X is confined to the storage slots and drives in Logical Library 1
- Department Y is confined to the storage slots and drives in Logical Library 2

Using Multiple Control Paths

In addition to creating multiple logical libraries, any logical library can be configured to have more than one control path. When configuring additional control paths, additional library sharing configurations and availability options are made possible. Access to the logical library is on a first-come, first-served basis and each control path for a logical library can accept commands while the library is in use by another control path. By default, only the first drive in a logical library will be LUN-1 enabled.

Note: Microsoft Windows® 2000 and Microsoft Windows 2003 Removable Storage Manager (RSM) does not support multiple control paths within a logical library. It is recommended that RSM be disabled to use this feature.

For a particular logical library, you can enable as many control paths as there are drives in that logical library.

Using Multiple Control Paths for System i Attachment

The use of control paths for the System i servers is unique. In general, every System i adapter must recognize the control path that is associated with the drives to which it is connected. For the System i servers, one to fifteen drives are supported by LVD and Fibre Channel adapters and the OS/400 V5R2 or later, i5/OS V5R3 or later, or AIX V5.1, V5.2, V5.3 or later operating system.

Using Multiple Control Paths for Path Failover

Command failures and timeouts are costly. You want your library to run smoothly and efficiently. To ensure continued processing, the library offers an optional path failover feature that enables the host device driver to resend the command to an alternate control path for the same logical library. With control path failover installed, the alternate control path can include another HBA, SAN, or library control path drive. The device driver initiates error recovery and continues the

operation on the alternate control path without interrupting the application. AIX, Linux, Solaris, HP-UX, and Windows hosts are currently supported for this feature.

The 2U library will not support Control Path Failover and Data Path Failover. As a result, there should be no license key entry for ″Path Failover″ on the 2U library. Path Failover is a combination of two previous features: Control Path Failover (key entered at the library user interface) and Data Path Failover (key entered at the device driver interface). A single activation key entered at the library user interface now activates both features unless the LTO-3 drive firmware level is equal to or lower than 69U2 and/or the library firmware is equal to or lower than 1.95. For either or both of these two cases, the device driver interface Data Path Failover key activation will still be required. The Path Failover feature is available for select LTO 4 tape drives. Path Failover is not supported for half high drives.

The Path Failover feature can be installed by the customer. For ordering information, see Chapter 10, “Optional Features, Replacement Parts and Power Cords,” on page 10-1.

Note: The optional Path Failover feature is not available on TS3200 models purchased through High Volume (HVEC) channels.

For more information about using the path failover feature, see the *IBM Ultrium Device Drivers Installation and User's Guide*.

Ultrium Tape Drives

This library supports the Ultrium 3 and Ultrium 4 Tape Drives. Each tape drive in the library is packaged in a container called a drive sled. The drive sled is a customer replaceable unit (CRU), and is designed for quick removal and replacement in the library.

The Ultrium 4 Tape Drives support LVD Ultra160, Serial Attached SCSI (SAS), or Fibre Channel interfaces. It features two HD68 connectors, two SFF-8088 SAS connectors, or one LC Fibre Channel connector.

The Ultrium 3 Full High Tape Drive supports LVD Ultra160, or Fibre Channel interfaces. It features two HD68 connectors or one LC Fibre Channel connector. The Ultrium 3 Half-high Drive supports one SAS SFF-8088 connector or two HD68 SCSI connectors. It does not support the Fibre Channel attachment.

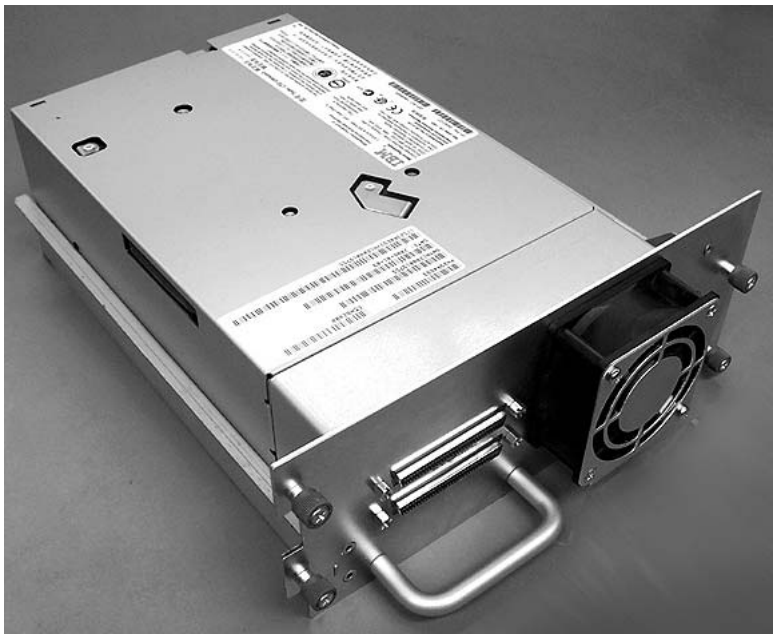


Figure 1-12. Library drive sled with Ultrium 4 SCSI Tape Drive (also available with Fibre Channel and SAS drive)

Note: Ultrium 3 and 4 SCSI and Fibre Channel drives are allowed in the same physical and logical library.

Speed Matching

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

Channel Calibration

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

Power Management

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

Media

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

Supported cartridges include:

- IBM LTO Ultrium 800 GB Data Cartridge (Ultrium 4)
- IBM LTO Ultrium 400 GB Data Cartridge (Ultrium 3)
- IBM Write-Once-Read-Many Data Cartridge (WORM; Ultrium 3 and Ultrium 4)

- IBM LTO Ultrium 200 GB Data Cartridge (Ultrium 2)
- IBM 100 GB Data Cartridge (Ultrium 1; read only)
- IBM LTO Ultrium Cleaning Cartridge

For additional information, see Chapter 5, "Using Ultrium Media," on page 5-1.

Library Specifications

Physical Specifications

Specification	2U library	4U library
Height	Rack mount 87.6 mm (3.44 in), stand-alone 97.6 mm (3.84 in)	Rack mount 175.2 mm (6.9 in), stand-alone 185.2 mm (7.3 in)
Width	447.5 mm (17.6 in.)	447.5 mm (17.6 in.)
Depth	Rack mount 740 mm (29.13 in), stand-alone 810 mm (31.9 in)	Rack mount 740 mm (29.13 in), stand-alone 810 mm (31.9 in)
Weight with 1 drive and without media	15.59 kg (34.37 lbs.)	21.32 kg (47 lbs.)
Weight with media	20.67 kg (45.57 lbs.)	31.71 kg (69.9 lbs.)

Power Specifications

AC power voltage	100-127 VAC; 200-240 VAC (4 - 2 A)
Line frequency	50-60 Hz

Operation Specifications

Library with Ultrium 4 drive(s)	2U Library	4U Library
Maximum storage capacity	Maximum number of data cartridges: 24 Native: 19.2 TB Compressed: 37.6 TB (2:1 compression)	Maximum number of data cartridges: 48 Native: 37.6 TB Compressed: 75.2 TB (2:1 compression)
Number of slots	24 (including I/O Station)	48 (Including 3 I/O station slots)
Maximum data transfer rate (maximum sustained with optimally compressible data - MB/sec)	140 - SCSI 240 - SAS full high drive 350 - Fibre Channel*	
Drive types	Ultrium 4 Full High Drive: SCSI, Fibre Channel, SAS	
Interfaces	Ultra160 SCSI LVD 4 Gb/s Fibre Channel 3 Gb/s SAS	
*Host Interface Drive Transfer Rates may vary depending on host usage and interface utilization.		

Library with Ultrium 3 drive(s)	2U library	4U library
Maximum storage capacity	Maximum number of data cartridges: 24 Native: 9.6 TB Compressed: 19.2 TB (2:1 compression)	Maximum number of data cartridges: 48 Native: 19.2 TB Compressed: 38.4 TB (2:1 compression)
Number of slots	24 (including I/O Station)	48 (Including 3 I/O station slots.)
Maximum data transfer rate	Native: 80 MBs (288 GB/hour) Compressed: 160 MBs (576 GB/hour (2:1 compression)	
Drive types	Ultrium 3 Full High Drive: SCSI, Fibre Channel Ultrium 3 Half High Drive: SCSI, Serial Attached SCSI (SAS)	
Interfaces	Ultra160 SCSI LVD 4 Gb/s Fibre Channel 3 Gb/s SAS	

Environmental Specifications

Temperature	
Operating	10° to 35° C (50° to 95° F)
Storage, without cartridges	-30° to 60° C (-22° to 140° F)
Wet bulb, operating	26° C (79.0° F) maximum
Temperature shock immunity - maximum rate of change	10° C (18° F) per hour
Miscellaneous	
Dust concentration	less than 200 microgram/cubic meter
Altitude (operating)	2500 meters (8200 ft.) at 25°C ambient
Maximum acoustical noise sound power levels LwAd in bels	6.6/6.8
Humidity	
Operating	15% to 80% RH non-condensing
Storage, without cartridges	10% to 90% RH non-condensing

Product Environment

The library is designed to operate in a general business environment.

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

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

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

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

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

Supported Servers, Operating Systems, and Software

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

To determine the latest supported attachments, visit the web at **http://www.ibm.com/storage/lto**, and look at the **Interoperability Matrix** or the **System Storage Interoperation Center** (SSIC).

Supported Device Drivers

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

- Using a browser, type one of the following:
  - **http://www.ibm.com/storage/lto**
  - **ftp://ftp.software.ibm.com/storage/devdrvr**
- Using File Transfer Protocol (FTP), enter the following specifications:
  - FTP site: `ftp.software.ibm.com`
  - IP Addr: `207.25.253.26`
  - Userid: `anonymous`
  - Password: (use your current e-mail address)
  - Directory: `/storage/devdrvr`

IBM provides Portable Document Format (.pdf) and Postscript (.ps) versions of its device driver documentation in the `/storage/devdrvr/Doc` directory:

- IBM_tape_IUG.pdf and IBM_tape_IUG.ps contain the current version of the *IBM Tape Device Drivers Installation and User's Guide*.
- IBM_tape_PROGREF.pdf and IBM_tape_PROGREF.ps contain the current version of the *IBM Tape Device Drivers Programming Reference*.

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

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

Chapter 2. Installation

The IBM TS3100 Tape Library and TS3200 Tape Library is a customer installed unit. The customer is responsible for the setup and maintenance of the tape library.

To install a desktop or rack mounted 2U library or 4U library, perform the procedures in this chapter in the order they are presented.

Choosing a Location

Choose a location that meets the following criteria:

Table 2-1. Location criteria

Criteria	Definition
Room temperature	10° - 35° C (50° - 95° F)
Power source	• AC power voltage: 100-127 VAC; 200-240 VAC (4 - 2 A) **Note:** The 4U library requires two separate power sources to implement redundant power. • Line frequency: 50-60 Hz Place the library near an AC outlet. The AC power cord is the product's main AC disconnect device and must be easily accessible at all times.
Air quality	The library should be placed in an area with minimal sources of particulate contamination. Avoid areas near frequently used doors and walkways, stacks of supplies that collect dust, printers, and smoke-filled rooms. Excessive dust and debris can damage tapes and tape drives.
Humidity	15-80 % RH non-condensing
Clearance	• Back: Minimum of 15.4 cm (6 inches) • Front: Minimum of 30.8 cm (12 inches) • Sides: Minimum of 5.08 cm (2 inches)
Rack requirements	Standard 19-inch rack with: • 2U (63.5 mm/3.5 in.) of clearance for a 2U library • 4U (177.8 mm/7 in.) of clearance for a 4U library Rackmounting the library is optional.

Unpacking the Library

Note: If the temperature in the room where the library will be installed varies by 15° C (30° F) from the room where the library was stored, allow the library to acclimate to the surrounding environment for at least 12 hours before unpacking it from the shipping container.

1. Before you begin, clear a work surface to unpack the library.
2. Before opening and removing the library from the shipping container, inspect the container for shipping damage. If you notice any damage, report it to the shipping company immediately.
3. Open the shipping container and carefully remove the shipping materials from the top of the library. Remove the accessory package and set it aside.

Important: Once the drive is unpacked, **save and store** the packaging materials for future moves or shipping. If you discard the original packaging materials, you may need to purchase packaging materials if you wish to move or store your library.

4. Lift the library out of the carton and remove the bag from the library. Remove the foam cushion from the back of the library. Save the packaging materials for future use.

   Important: Do not place the library on the front panel or the rear panel as this may damage the library.

Verifying the Shipment

Verify that the following items are included in your library shipment:

- With every library:
  - Power cord
  - Cleaning cartridge
  - Foot pads (for desktop installation)
  - Documentation CD:
    - Setup, Operator, and Service Guide
    - Translated Safety Notices
    - Statement of Limited Warranty (in 29 languages)
  - IBM License Agreement for Machine Code
  - Setup. Operator, and Service Guide
  - Warranty information (in 9 languages)
  - Quality Hotline card
- With every library containing a SCSI drive:
  - SCSI terminator (one per SCSI drive)
  - SCSI library-to-host cable (if ordered by customer)
  - SCSI Wrap plug (one for each library)
- With every library containing a Fibre Channel drive:
  - Fibre wrap tool (one per library)
  - Fibre Channel library-to-host/switch cable (if ordered by customer)
- With every library containing a SAS drive:
  - SAS library-to-host cable (if ordered by customer)
- Optional item that is included in your shipment, if ordered:
  - Rack Mount Kit

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

Installing the Library Foot Pads (for Desktop Installation ONLY)

Important: Foot pads are required for a desktop installation.

Six foot pads must be installed on the bottom of the library before the library can be used as a desktop unit. If you intend to install your library in a rack, skip this step and proceed to “Removing and Storing the Shipping Lock” on page 2-3.

To install the library foot pads:

1. Being very careful, lay the library on its side.
2. Peel the adhesive from the back of each foot pad.
3. Install the foot pads on the bottom of the library chassis by pressing each foot into one of the six areas (**1**) as shown in the figure below.

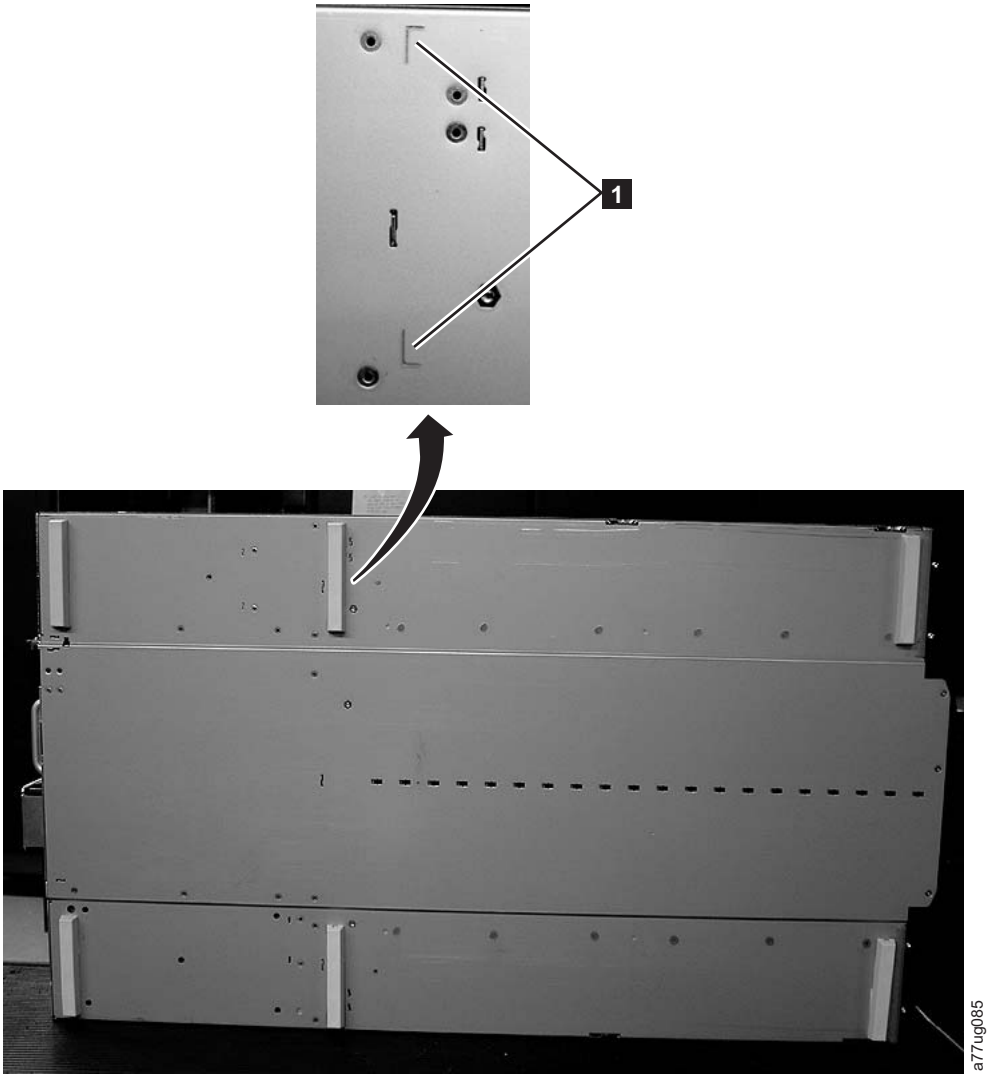


Figure 2-1. Installing foot pads on the bottom of the library enclosure

4. Carefully return the library to an upright position.

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

Removing and Storing the Shipping Lock

Important: The shipping lock, which prevents the library accessor from moving during shipment, **must be removed before the library is powered ON**.

The shipping lock is held in place with a label and is located in the top center of the library. After the shipping lock is removed, it should be stored on the right side of the back panel of the library for future use.

To remove and store the shipping lock:

1. Remove the blue label (2) that is securing the lock (1) to the top of the library, then remove the lock (see Figure 2-2).

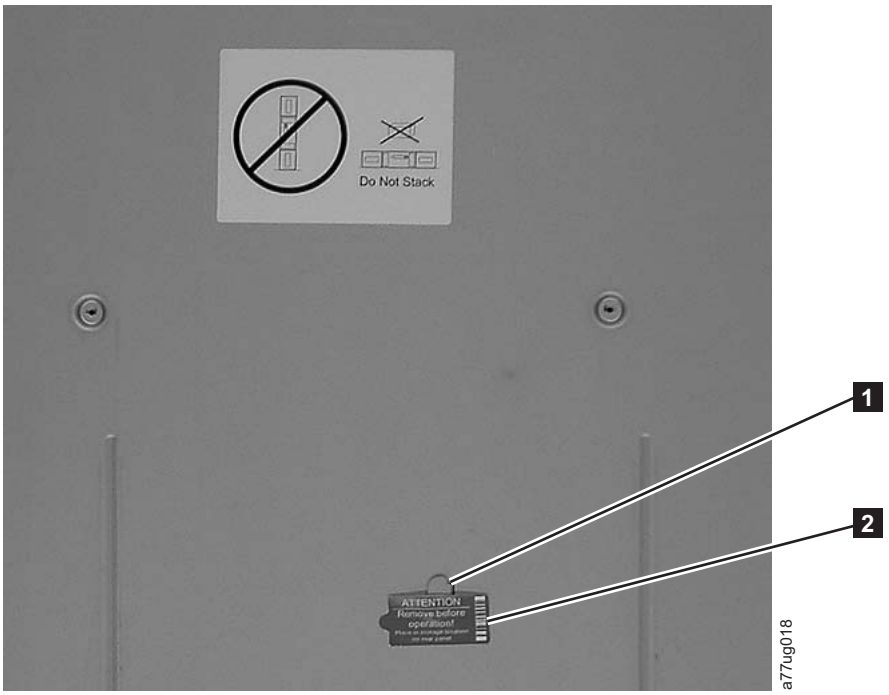


Figure 2-2. Shipping lock and label

2. Store the lock (1) and label (2) on the rear panel of the library as shown in Figure 2-3.

Figure 2-3. Library shipping lock and label storage location

Rackmounting the Library (for Rack Installation ONLY)

Attention: If you haven't removed the shipping lock, complete this first before rackmounting your library. See "Removing and Storing the Shipping Lock" on page 2-3.

The 2U library and the 4U library are easily installed into a standard 19-inch rack system. A standard 19-inch rack system contains multiple mounting locations called EIA units as defined by the Electronics Industries Association. Each EIA unit contains three square or round holes used to mount rack designed equipment. These units are often referred to as ″U″s, thus the 2U library requires 2 EIA units (or 6 holes) of space; the 4U library takes 4 EIA units (or 12 holes) of space. Each unit is separated by a very small space. See Figure 2-5 for an example of how to count EIA units. The 2U library requires 2U (3.5 in.) of space. The 4U library requires 4U (7 in.) of space.

If you are not rackmounting your library, skip this procedure and go to "Attaching the Library to a Server" on page 2-10.

Important: A 2U library weighs 15.59 kg (34.37 lbs.) with one drive and without media. A 4U library weighs 21.32 kg (47 lbs.) with one drive and without media.

To reduce the risk of personal injury or damage to the library:

1. observe local health and safety requirements and guidelines for manual material handling,
2. obtain adequate assistance to lift and stabilize the library during installation or removal, and
3. always remove all cartridges to reduce the overall weight of the library.

To install your library in a rack, perform the following steps.

1. Verify that your rack kit includes the following contents (see Figure 2-4 on page 2-6):
   - Packaged in plastic material:
     - 2 rails (not shown)
     - 2 mounting brackets (**1**)
   - Packaged in the small bag with no label:
     - 1 Torx wrench (**5**)
     - 2 anchors (**4**)
     - 2 countersunk screws for securing the anchors (**6**)
     - 2 smaller screws for securing the tops of the mounting brackets (**7**
     - 2 large screws to secure the mounting brackets to the rack (**8**)
   - Packaged in the small bag with ″Round Hole″ on the label: 9 screws to be used on racks with round holes. (**2**)
   - Packaged in the small bag with ″Square Hole″ on the label: 9 screws to be used on racks with square holes. (**3**)

     Note: Eight screws are needed for the installation. One additional screw is provided for security.

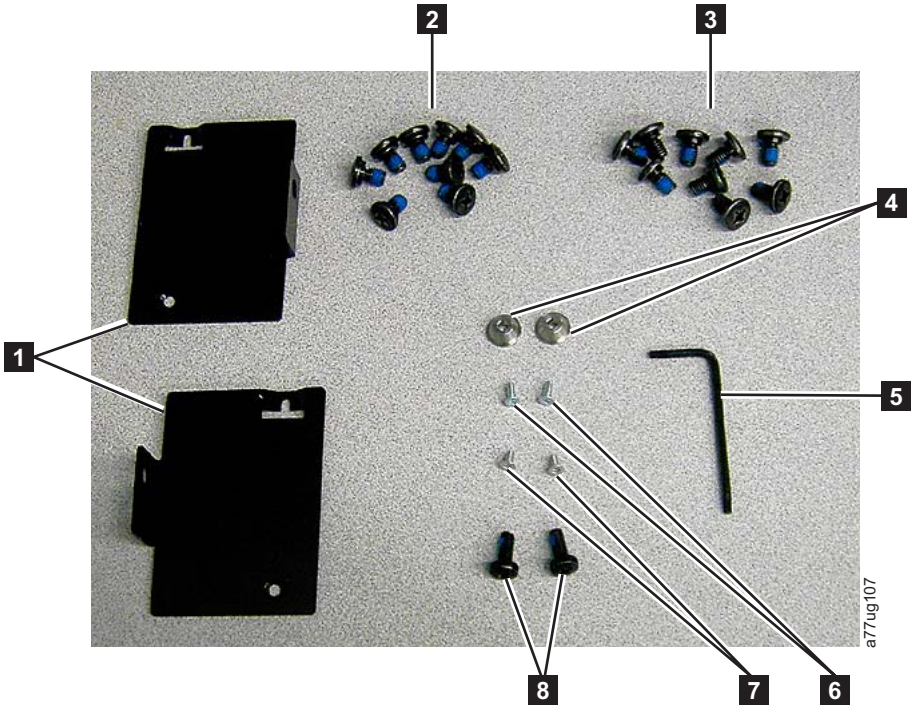


Figure 2-4. Rack Kit mounting hardware

2. Determine the location in your rack for your library to be installed and, using a pencil, mark the location on each vertical rail in your rack.

   Note: A 2U library requires 2U (3.5 in.= two EIA) of rack space. A 4U library requires 4U (7 in. = four EIA) of rack space

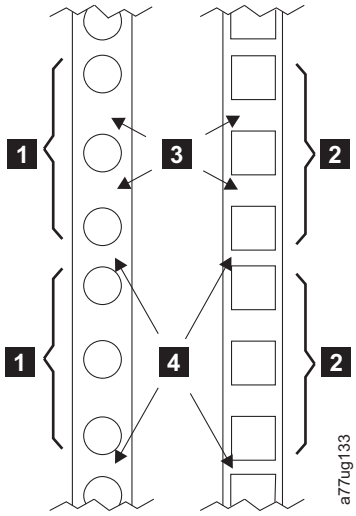


Figure 2-5. Examples of EIA units for round hole and square hole installations

1	Two EIA units for round hole and square hole installation	3	Wide Gaps **within** the EIA unit
2		4	Narrow Gaps **between** EIA units

3. Remove the adhesive security tape on the backside of the rails. Using the screws for your rack type (round holes or square holes) and a #2 Phillips

screwdriver and ensuring that the flange on each rail points toward each other to form a shelf, secure one rail to each side of the rack in your chosen rack location. Secure both the front and back of each rail to the rack, then tighten all 8 screws. The narrow end of each rail goes to the rear of the rack. The rails extend to fit a variety of rack depths. Each rail requires 2 EIA units of rack space (**1** in Figure 2-6).

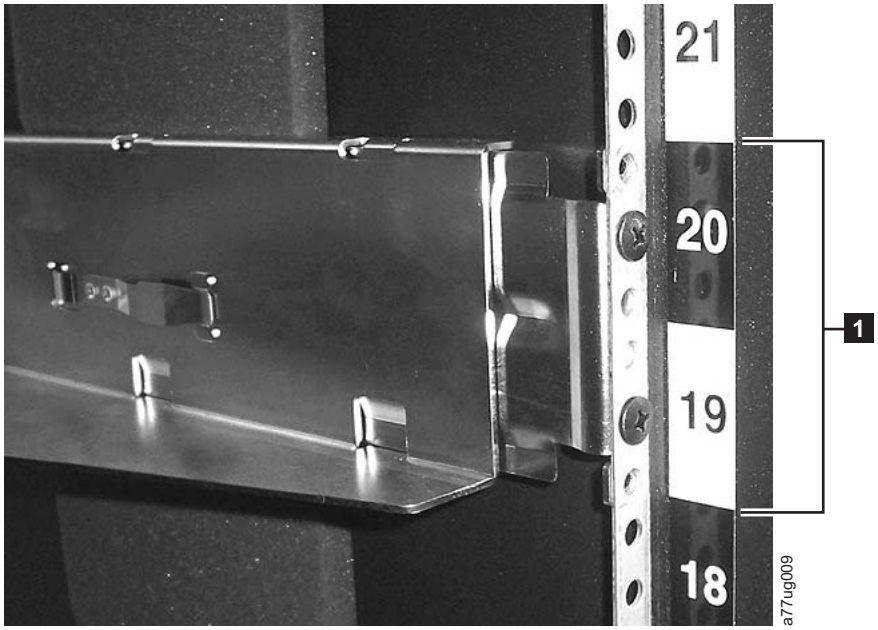


Figure 2-6. Rear view of a rack showing the narrow part of the rail

4. Using the Torx wrench included in your shipment, remove the screws (**1**) as shown in Figure 2-7. Screw locations on the 4U library are similar.

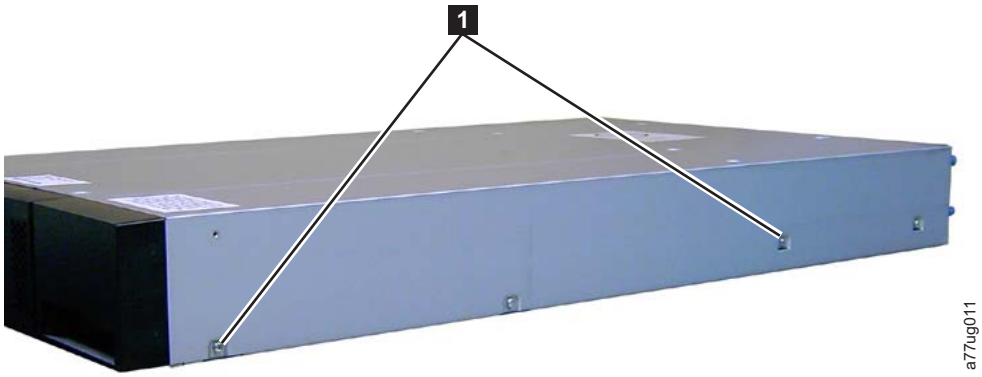


Figure 2-7. 2U library side screws to remove

5. Install the library rack anchors (**2**) as shown in Figure 2-8 on page 2-8 on each side of your library using the longer counter-sunk screws included in the rack kit.

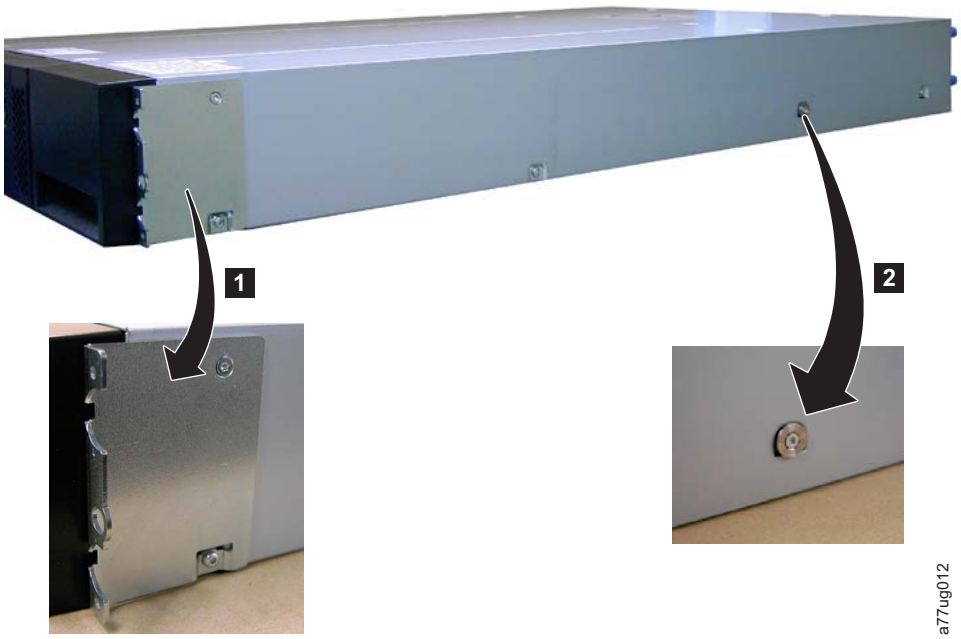


Figure 2-8. 2U library rack anchors and mounting brackets

6. Install the library mounting brackets (**1**) as shown on the 2U library on each side of the library using the screw that was removed from your library and an additional short, counter-sunk screw included in the rack kit. (The 4U rack anchors and mounting brackets are similar.)
7. With library rack anchors and mounting brackets installed, slide the library onto the rails (as shown in Figure 2-9 and Figure 2-10 on page 2-9). When the library stops, gently push the library to lock the anchors installed on each side of the library to the rails and until the mounting brackets are flush with the vertical rack rails.

Figure 2-9. Sliding the 2U library into the rack

Figure 2-10. Sliding the 4U library into the rack

8. Using a #2 Phillips screwdriver, secure the library to the rack (see Figure 2-11 for a 2U library; see Figure 2-12 on page 2-10 for a 4U library) by placing a screw in the center hole of each mounting bracket and tightening them (**1**).

Figure 2-11. Securing the 2U library to the rack

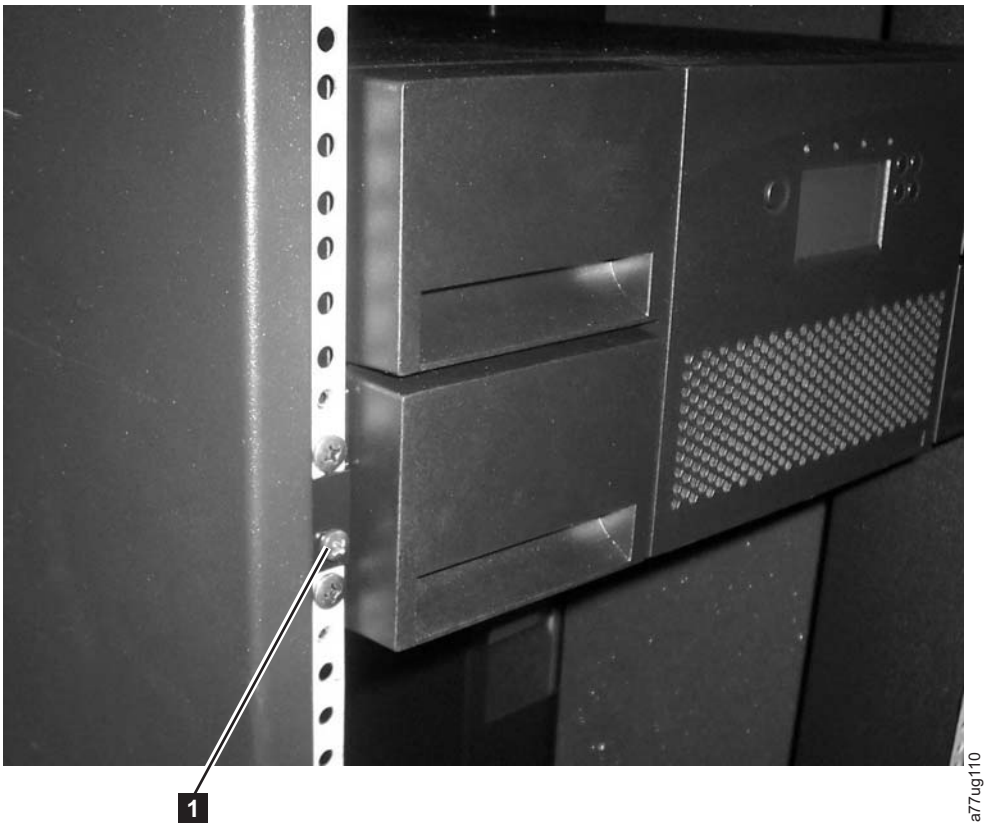


Figure 2-12. Securing the 4U library to the rack

Attaching the Library to a Server

The 2U library and the 4U library can be attached to servers using the following interfaces:

- SCSI (LVD Ultra 160)
- Fibre Channel
- Serial Attached SCSI (SAS)

Connecting the Host Interface Cable

To connect the host interface cables to the library:

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

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

2. For a SCSI library, attach one end of the host interface cable to one of the connectors on the back panel of the library (see **1** in Figure 2-13 on page 2-11). For a Fibre Channel library, attach one end of the host interface cable to the connector on the back panel of the library (see **5** in Figure 2-14 on page 2-11). For a Serial Attached SCSI (SAS) connected library, attach the host end of

the SAS cable to the SAS or Mini-SAS (SFF-8088) HBA (see **2** in Figure 2-15). Full high drives will have dual SAS or Mini-SAS connectors. Half high drives will have one SAS connector. Unused SAS connectors do not need to be terminated.

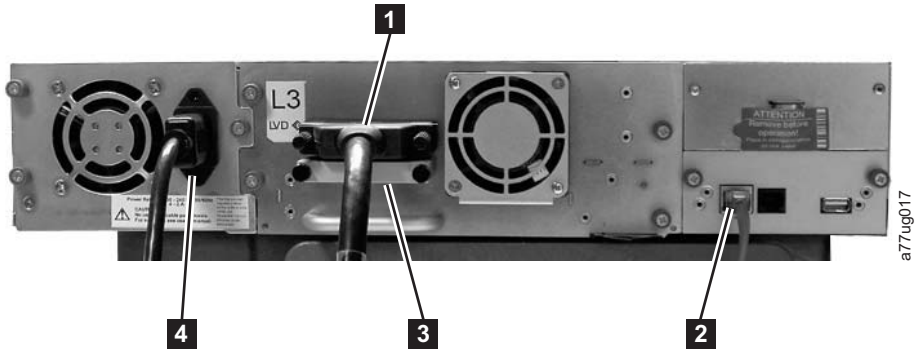


Figure 2-13. Attaching a SCSI host interface cable to the 2U library

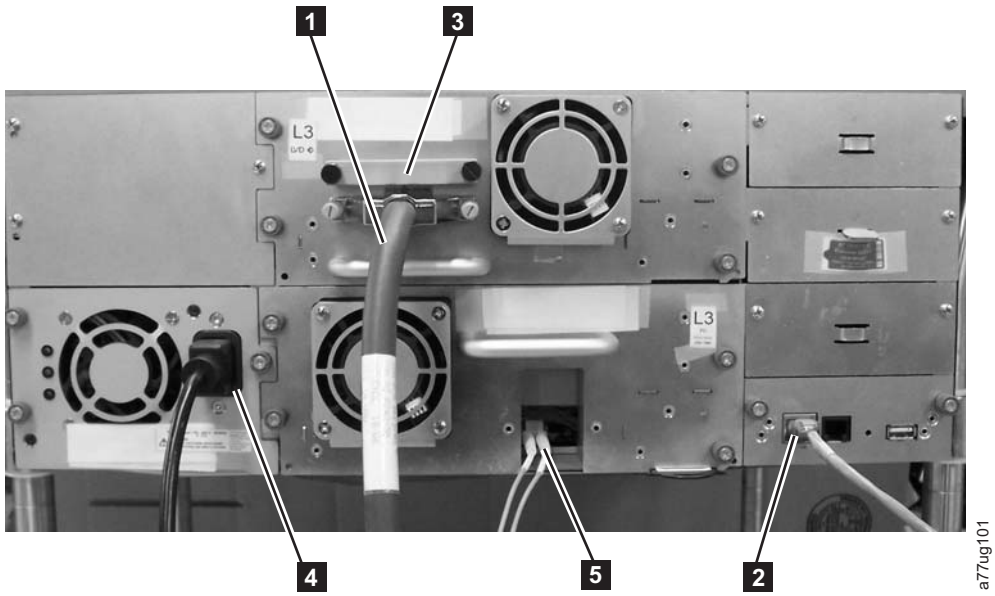


Figure 2-14. Attaching host interface cables to the 4U library.

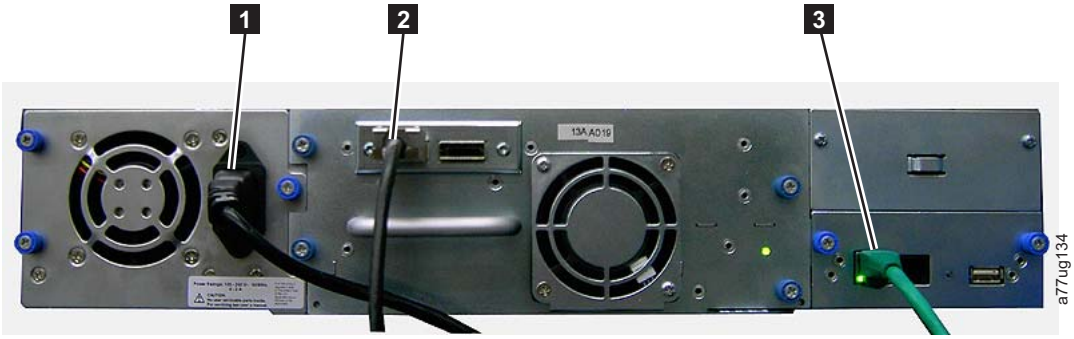


Figure 2-15. Attaching a SAS interface cable to the 2U library

3. Attach the other end of the host interface cable as follows:

- For a SCSI library, connect the host interface cable to the connector on the SCSI host bus adapter or to the connector on the previous device on the SCSI bus. Attach the terminator (3 in Figure 2-13 on page 2-11) to the remaining SCSI connector on the back panel of the library, if the library is the last or only device on the SCSI bus. Otherwise, attach one end of a SCSI cable to the remaining port and the other end to the next device on the SCSI bus. Make sure that the last device on the SCSI bus is properly terminated.

  Note: Cables and terminators supporting Ultra160 should be used.

  Note: The host bus adapter should be LVD SCSI. A single-ended (SE) SCSI host bus adapter will work, but will severely degrade performance, and limit cable length. If there are any SE devices on the same SCSI bus, the entire SCSI bus will negotiate down to SE speed and severely degrade performance.
- For a Fibre Channel library, connect the host interface cable to the host or to a switch. If an SC-to-LC interposer is required, refer to "Installing a Fibre Channel Interposer (Feature Code 5096)."
- For a SAS library, connect the drive using a host interface cable to the host HBA, or to an interposer as required. You can connect to either ports if you have a dual port configuration. Unused SAS connectors do not need termination.

4. Plug the network ethernet cable (2 in Figure 2-13 on page 2-11, Figure 2-14 on page 2-11, or 3 in Figure 2-15 on page 2-11) into the ethernet port on the back panel of the library. If the ethernet connection is directly attached to a server or laptop, a crossover ethernet cable may be required.

   Note: It is the customer's responsibility to supply the crossover ethernet cable if one is required.

Installing a Fibre Channel Interposer (Feature Code 5096)

For a list of supported adapters and required interposers, go to the Technical Support section on the web at http://www.ibm.com/storage/lto.

To install the interposer, refer to the procedure below.

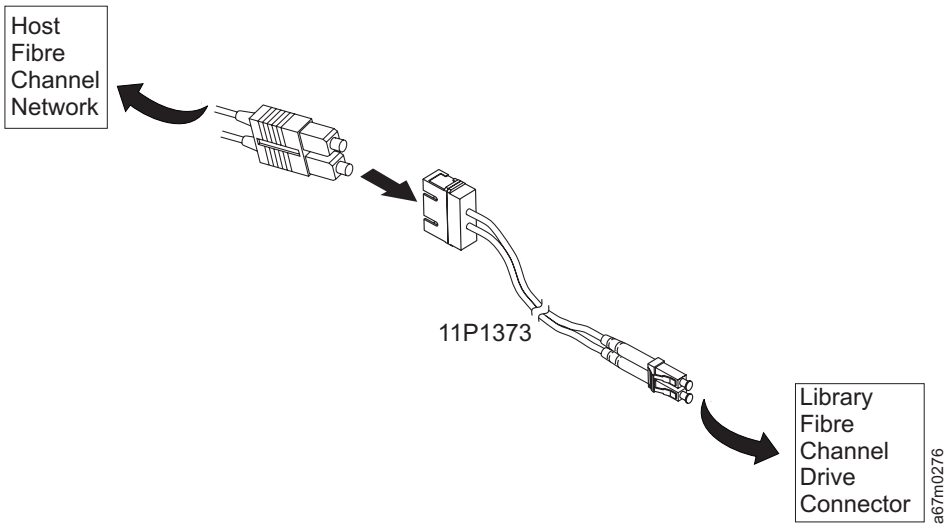


Figure 2-16. Interposer installation

1. Connect the host SC fibre cable to the matching side of the interposer.
2. Connect the drive LC fibre side of the interposer to the drive/library.

Connecting a Power Cord

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

- not meeting individual country specific safety requirements;
- overheating with potential personal injury and/or property damage; and
- a fracture resulting in the internal contacts being exposed, which potentially could subject the user to a shock hazard.

For every power supply in the library, complete the following steps.

1. Plug one end of the power cord (**4** in Figure 2-13 on page 2-11, Figure 2-14 on page 2-11, or **1** in Figure 2-15 on page 2-11) into each power supply connector on the back panel of the library.
2. Plug the other end of each power cord into the nearest properly grounded power outlet. Use separate power sources for each power supply for redundant power.

   Attention: To disconnect all power from the library, remove the power cord from each outlet. The power button removes power from portions of the library and the drives, but the power supplies still have AC power at their inputs.
3. Remove the protective plastic on the exterior surfaces of the library.
4. Turn ON the library using the power button. Check the Operator Control Panel display to make sure the library is receiving power. If it is not, check the power connections and your power source. During the Power-On Self Test (POST), all four LEDs are illuminated briefly, followed by a flashing Ready LED. When the initialization sequence is complete, the Home screen (see "Power-ON Display" on page 3-2) will be displayed.

Configuring Your Library

The library can be configured using the Operator Control Panel and/or the Web User Interface. The recommended method for configuring your library is using the Web User Interface.

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

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

Choosing your Configuration Method

If you choose to use the Operator Control Panel for configuring your library, go to “Configure Your Library using the Operator Control Panel” on page 2-25.

If you choose to use the Web User Interface for configuring your library, enter your library network settings using the Operator Control Panel (see “Accessing the Configure Menu using the Operator Control Panel” and “Entering Network Settings using the Operator Control Panel”), then go to “Configure Your Library using the Web User Interface” on page 2-15,.

Accessing the Configure Menu using the Operator Control Panel

1. From the screen that shows the library logo (Home screen), press either the UP(+) or DOWN(-) button to get to the Main Menu.
2. Press the DOWN(-) button to select **Configure**.
3. Press the ENTER button to display the **Configure** menu.

Entering Network Settings using the Operator Control Panel

If you would like to use DHCP (Dynamic Host Configuration Protocol) as your library network setting, complete Steps 1, 2, 4, and 8. If you do **not** want to use DHCP as your library network setting, complete Steps 1, 2, 5, 6, 7, and 8.

1. Press the DOWN button to highlight the **Network** menu.
2. Press the SELECT button to display the **Network** screen.
3. Select IP STACK to change Internet Protocols. Choose **IPv4 only**, **IPv6 only**, or **IPv4 & IPv6**.
4. If you do **not** want to select DHCP as your library network setting, skip this step and proceed to the next step. If you want to select DHCP as your library network setting, complete the following steps:
   a. Press the SELECT button to highlight the **DHCP** field.
   b. Press the DOWN button to select **ON**.
   c. Press the SELECT button to apply your selection.
   d. Skip to Step 7.
5. Press the DOWN button to select **IP Address**.

a. Press the SELECT button to highlight the **IP Address** field.
b. Press the UP or DOWN button to select the digit(s) of your library's IP Address.
c. Press the SELECT button to highlight the next digit(s) in your IP Address.
d. After entering the final digits, press the SELECT button to apply your entries.

6. Press the DOWN button to select **Netmask**.
   a. Press the SELECT button to highlight the **Netmask** field.
   b. Press the UP or DOWN button to select the digit(s) in your library's Netmask address.
   c. Press the SELECT button to highlight the next digit(s) in your library's Netmask address.
   d. After entering the final digit(s) in your Netmask address, press the SELECT button to apply your entries.
7. Press the DOWN button to select **Gateway**.
   a. Press the SELECT button to highlight the **Gateway** field.
   b. Press the UP or DOWN button to select the digit(s) in your library's Gateway address.
   c. Press the SELECT button to highlight the digit(s) in your library's Gateway address.
   d. After entering the final digits in your Gateway address, press the DOWN button and select one of the following:
      - **Save** - to save your network settings.
      - **Cancel** - to cancel all of your entries and leave the settings as they were.
8. Press the SELECT button to return to the **Configure** menu.
9. Press the CANCEL button to return to the **Main** menu.
10. Press the CANCEL button to return to the home screen.
11. Power cycle the library to initialize your configuration.

Configure Your Library using the Web User Interface

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

1. "Choosing the Number of Logical Libraries for Your Library" on page 2-16
2. "Choosing Library Settings" on page 2-17
3. "Choosing Drive(s) Interface Identification/Settings" on page 2-18
4. "Configure Library: Network" on page 2-19
5. "Entering User Access Information using the Web User Interface" on page 2-21
6. "Entering Date and Time using the Web User Interface" on page 2-22
7. "Entering Encryption Feature Activation Key" on page 2-22
8. "Entering Path Failover Feature Activation Key" on page 2-23
9. "Configuring Logs and Traces using the Web User Interface" on page 2-24
10. "Entering Event Notification Information using the Web User Interface" on page 2-24
11. "Restoring Factory Default Settings using the Web User Interface" on page 2-25

Logging on to the Web User Interface

To complete the configuration of your library using the Web User Interface, follow the steps below.

1. On your host computer, open Internet Explorer.
2. In the browser address field, enter your library's IP Address.
3. When the login screen appears, enter the following:
   - Username: **admin**
   - Password: **secure**

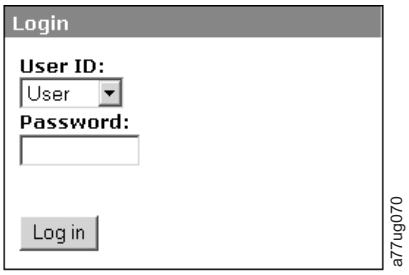


Figure 2-17. Log in screen on the Web User Interface

If you have a library with only one drive, proceed to the section, "Choosing Library Settings" on page 2-17

Choosing the Number of Logical Libraries for Your Library

If you have a 2U or 4U library with only one drive, or do not wish to partition your library, proceed to the next section, "Choosing Library Settings" on page 2-17.

One cartridge magazine cannot be assigned to two logical libraries. If you partition a multi-drive library, each of the magazines must be assigned to a logical library on a magazine boundary. The entire magazine must be part of one logical library only.

Note: If you have a 2U library with two drives, you have the capability to have two logical libraries.

In a fully populated 4U library with full high drives and two logical libraries, resource assignments will be as follows:

- Logical Library 1 will contain Drive 1 and the left cartridge magazines.
- Logical Library 2 will contain Drive 2 and the right cartridge magazines.

Note: For more information about various configurations, see "Library Partitioning and Element Addressing" on page 1-15.

The I/O Station and slots reserved for cleaning cartridges, if any, are shared among all logical libraries.

1. Navigate to **Configure Library** → **Logical Libraries** using the Web User Interface.

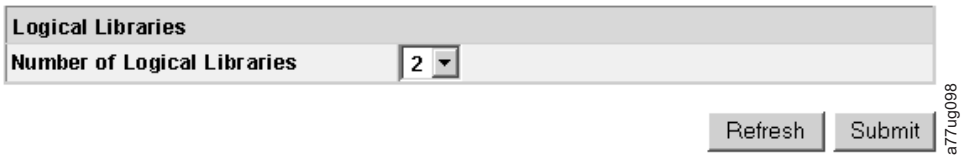


Figure 2-18. The 4U library Configure Library: Logical Libraries page

2. Select the number of logical libraries you would like to create in your library.
3. Click **Submit** to create the logical libraries.

Choosing Library Settings

If your library contains only one logical library, both general and specific settings will be combined into one table (see Figure 2-19 on page 2-18).

1. Expand **Configure Library** in the left navigation pane of the Web User Interface.
2. Click **General** and enter the following:
   - **Library Name** - Enter a name for your library.
   - **Library Mode** (per logical library):
     - **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 I/O Station through the last slot in your library) for loading into the drive.
       - **Autoload**: Sequential mode with autoload mode ON loads the first available cartridge (slot with the lowest numerical value that contains a cartridge) automatically if the library powers ON with an empty drive.
       - **Loop**: Sequential mode with loop mode ON loads the cartridge in the lowest numerical slot after the cartridge in the highest numerical slot has been filled and sent back to its home slot. This allows endless backup operations without user interaction.
   - **Active Slots** - Select the number of active slots you would like to assign in your library. This item will affect the number of **Res.** (Reserved) **Slots** in your library.

     Note: Slots can be reserved so that they are invisible to the host. It may be necessary to reserve slots in order to match the number of available slots to the ISV software licensing. Slots will be reserved starting with the highest element address. If your library does not have a dedicated cleaning cartridge slot, and you desire to enable Auto Clean, you must designate a reserved slot which can be used to hold the cleaning cartridge.
   - **I/O Enabled** - If checked, the I/O Station is enabled. If not, the first 3 slots (in a 4U library or the 1st slot in a 2U library) are configured as storage. See "Configure Library: General" on page 4-35.
   - **Auto Clean Enabled** - Automatically cleans drive when drive requests cleaning **and** cleaning cartridge is present in a reserved slot. All cleaning cartridges must have **CLN** as part of the bar code. The Universal Cleaning Cartridge has the bar code label CLNUxxLx.
   - Click one of the following:

– **Refresh** - Click this button to update the current screen.
– **Apply Selections** - Click this button to submit the changes made to the screen.

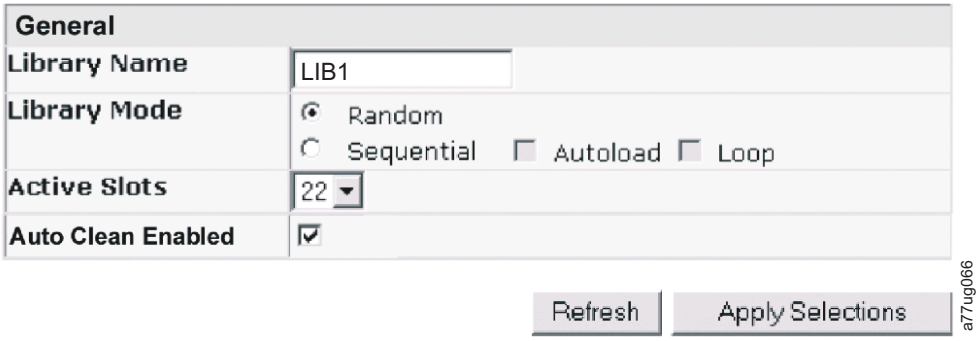


Figure 2-19. The 2U library Configure Library: General screen

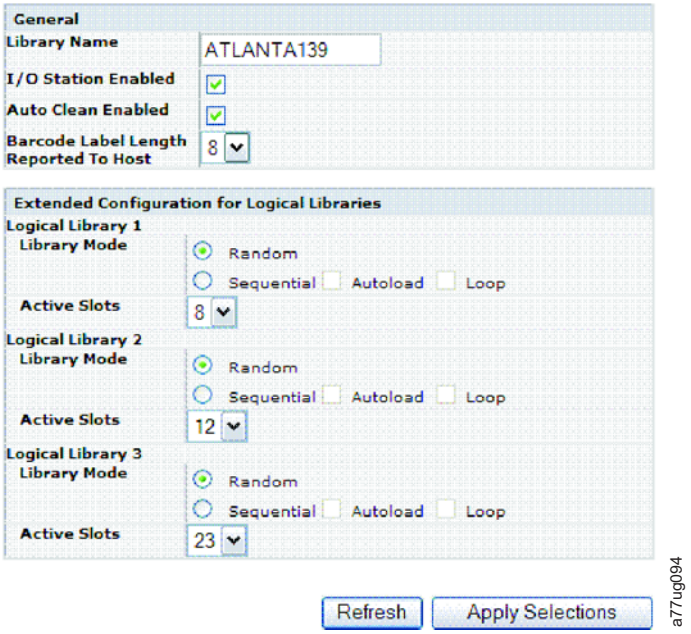


Figure 2-20. Example: The 4U library Configure Library: General screen

Choosing Drive(s) Interface Identification/Settings

1. Click **Drives** in the left navigation pane.
2. Select the desired settings for each drive listed (either SCSI, SAS, or Fibre Channel). Refer to Figure 2-21 on page 2-19.
3. Click one of the following:
   - **Refresh** - to update the current screen
   - **Submit** - to apply the changes made to the screen

   Note: If you have a Fiber Channel Drive connected to a AS/400 Host, direct attached to the Fiber HBA, set the Port Type to L-Port.

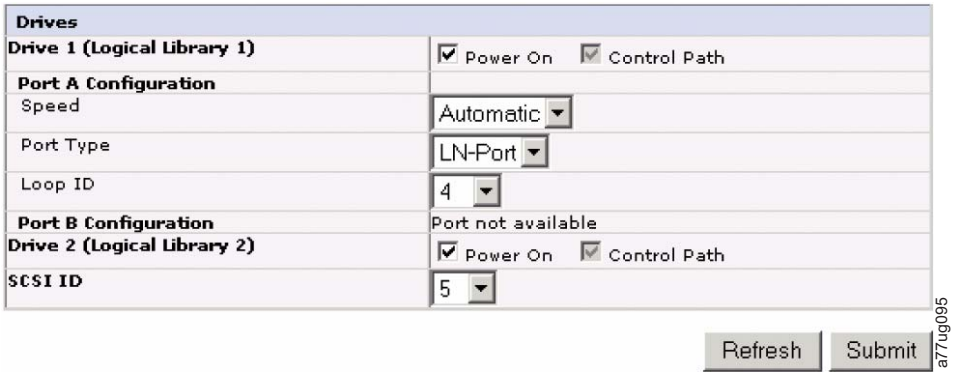


Figure 2-21. The Configure Library: Drive screen

Configure Library: Network

This page shows the current network configuration of the library and allows modification to the configuration. When a change is requested, a pop-up box will ask to confirm the changes.

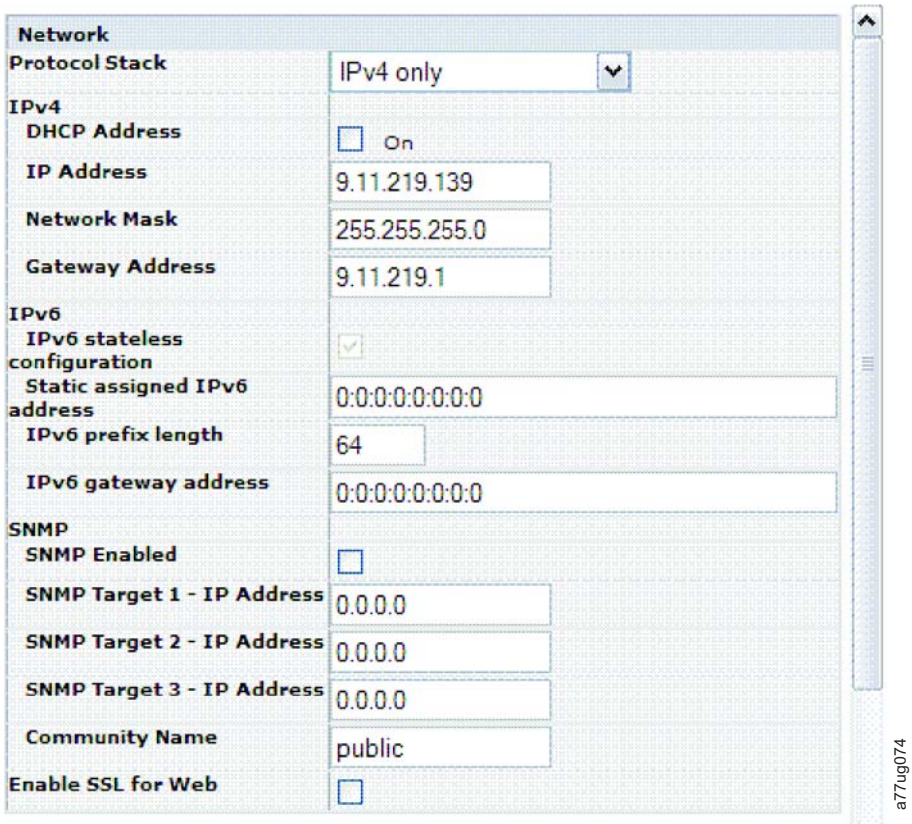


Figure 2-22. Configure Library: Network page

The following elements are displayed on the **Network** page.

Network

Protocol Stack

Choose **IPv4 only**, **IPv6 only**, or **IPv4 & IPv6**.

Note: When changes are made, a Warning message will appear when the Submit button is clicked.

Figure 2-23. Warning screen

The library **must be rebooted** or the changes will not take place.

IPv4

DHCP Address

Click this item ON to have the IP Address of your library automatically set by the library host computer. Leave unchecked and enter the appropriate information for the IP Address, Network Mask, and Gateway Address.

IP Address

An identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255. For example, 1.160.10.240 could be an IP address.

Network Mask

This address defines and limits users within a local network.

Gateway Address

This address allows access outside the local network.

IPv6

IPv6 stateless auto config

Click this item ON to have the IP Address of your library automatically set by the library host computer. Leave unchecked and enter the appropriate information for the static assigned IP Address, prefix length, and Gateway Address.

Static assigned IPv6 address

Enter the assigned IPv6 address. The format of an IPv6 IP address is a 128-bit numeric address written as 8 groups of four numbers separated by colons.

IPv6 prefix length

The default prefix length is set to 64, but can be set to any length, depending upon the address used.

IPv6 gateway address

This address allows access outside the local network.

SNMP

SNMP Enabled

If you desire to have SNMP Traps sent to an IP address of your choosing, place a check in this box.

SNMP Target 1-IP Address
If SNMP Traps are enabled, enter an IP address where SNMP Traps are to be sent.

SNMP Target 2-IP Address
Enter an optional 2nd IP address where SNMP Traps are to be sent, or leave as 0.0.0.0.

SNMP Target 3-IP Address
Enter an optional 3rd IP address where SNMP Traps are to be sent, or leave as 0.0.0.0.

Community Name
Enter your preferred name, or leave as "public".

Enable SSL for Web
If you desire to have SSL enabled, place a check in this box.

Entering User Access Information using the Web User Interface

This function, other than the Access PIN, is not available on the Operator Control Panel.

1. Click **User Access** in the left navigation pane.
2. Choose an **Access Level**. The **Access Level Name** associated with the **Access Level** chosen
   - **1** - User
   - **2** - Admin
   - **3** - Service
3. Enter the **New Password**.
4. In **Repeat Password**, enter the new password again.
5. In **Support Name**, enter the name of the person that will be able to offer the user help with the library.
6. In **Support Phone**, enter the phone number of the person that will be able to offer the user help with the library.
7. In **Support Email**, enter the email address of the person that will be able to offer the user help with the library.
8. Click one of the following:
   - **Refresh** - to update the current screen.
   - **Submit** - to apply the changes made to the screen.

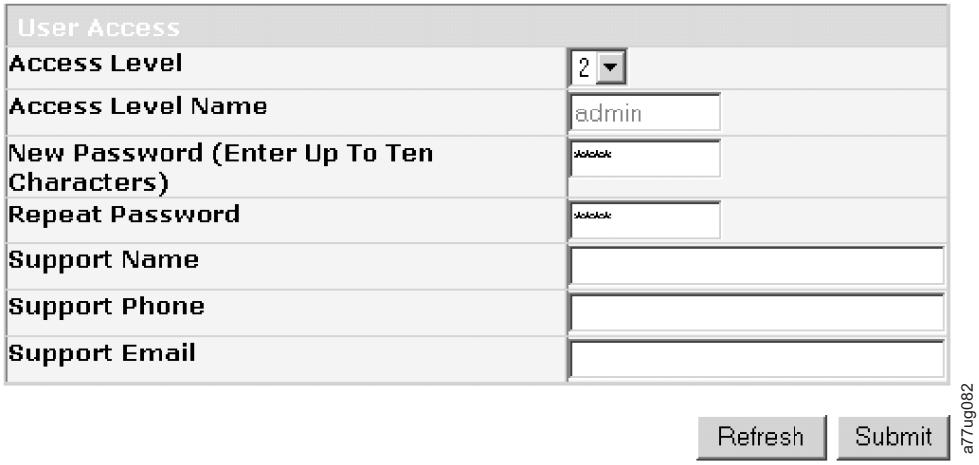


Figure 2-24. The Configure Library: User Access screen

Entering Date and Time using the Web User Interface

1. Click **Date & Time** in the left navigation pane.
2. Enter the current **Time** using the HH:MM:SS format.
3. Enter the current **Date** using the MMDDYYYY format.
4. Click one of the following:
   - **Refresh** - to update the current screen
   - **Submit** - to apply changes made to the current screen

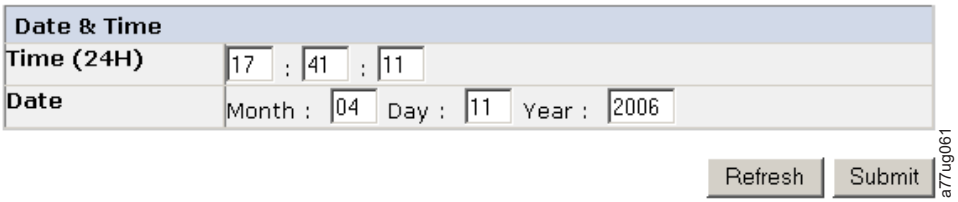


Figure 2-25. The Configure Library: Date and Time screen

Entering Encryption Feature Activation Key

1. Navigate to **Configure Library** → **Encryption**.
2. Enter the 12-digit feature key in the spaces provided.

   Note: Application Managed Encryption (AME) does not require a key.

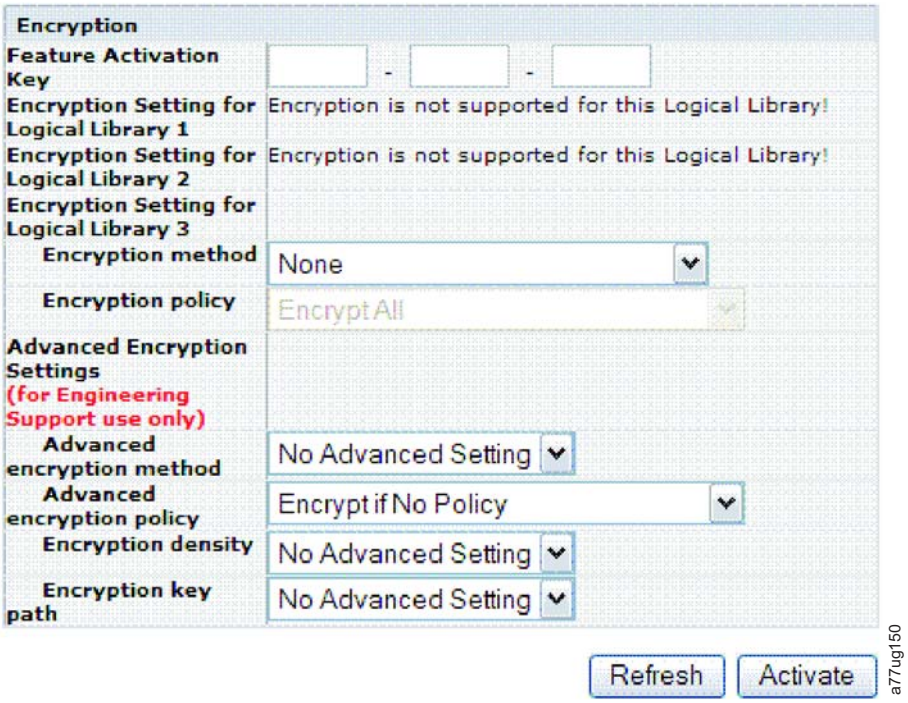


Figure 2-26. Configure Library: Encryption Activation screen

3. Click **Activate** to save the feature key.

Note: The Advanced Encryption Settings are for Engineering Support only.

Entering Path Failover Feature Activation Key

1. Navigate to **Configure Library** → **Path Failover**.
2. Enter the Control Path Failover 12-digit feature key in the spaces provided.

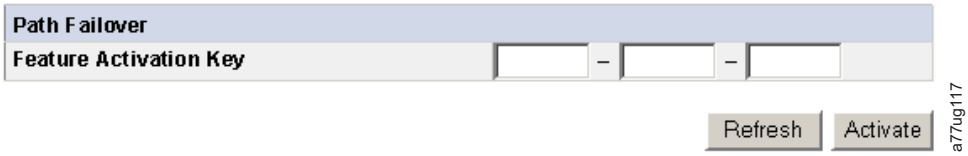


Figure 2-27. The Configure Library: Path Failover Feature Activation screen

3. Click **Activate** to save the feature key. The following screen will display if you have correctly entered the feature key.

Figure 2-28. Feature Key verification screen

Note: Path Failover is a combination of two previous features: Control Path Failover (key entered at the library user interface) and Data Path Failover (key entered at the device driver interface). A single activation key entered at the library user interface now activates both features unless the LTO-3 drive firmware level is equal to or lower than 69U2 and/or

the library firmware is equal to or lower than 1.95. For either or both of these two cases, the device driver interface Data Path Failover key activation will still be required. The Path Failover feature is available for select LTO 4 tape drives. Path Failover is not supported for half high drives.

Configuring Logs and Traces using the Web User Interface

This function is not available on the Operator Control Panel.

1. Click **Logs & Traces** in the left navigation pane.
2. It is recommended that you select **Continuous** so all information for logs and traces will be captured.
3. Leave all options under **Trace Level** and **Trace Filters** selected. These options can be changed by Service personnel only.
4. Click **Submit** to apply any changes.

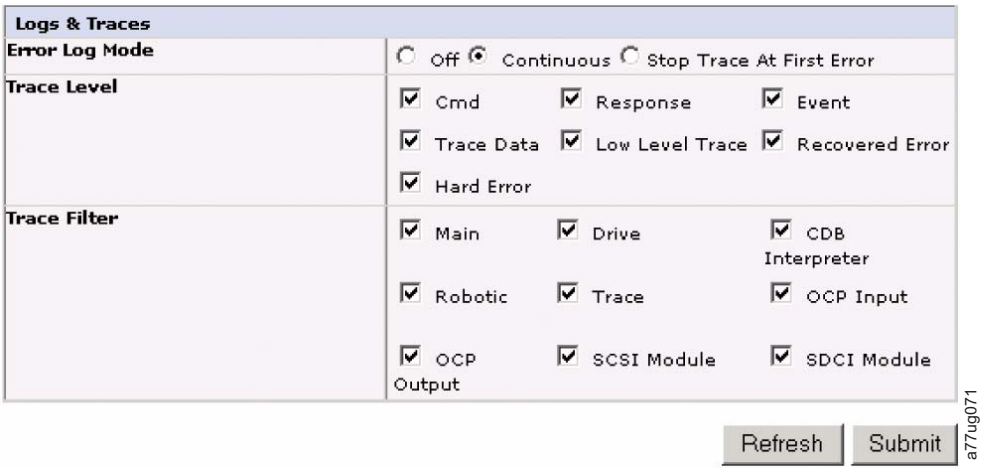


Figure 2-29. The Configure Library: Logs and Traces screen

Entering Event Notification Information using the Web User Interface

This function is not available on the Operator Control Panel.

Use this menu item to set up email notification of library errors and warnings.

1. If you would like to be notified when an error occurs, select **Notify Errors**.
2. If you would like to be notified when a warning occurs, select **Notify Warnings**.
3. In **To Email Address**, enter the email address to which the information will be sent.
4. In **Email Domain**, enter the domain name for the email address.
5. In **SMTP Server Address**, enter the IP Address of the SMTP server associated with the email address.

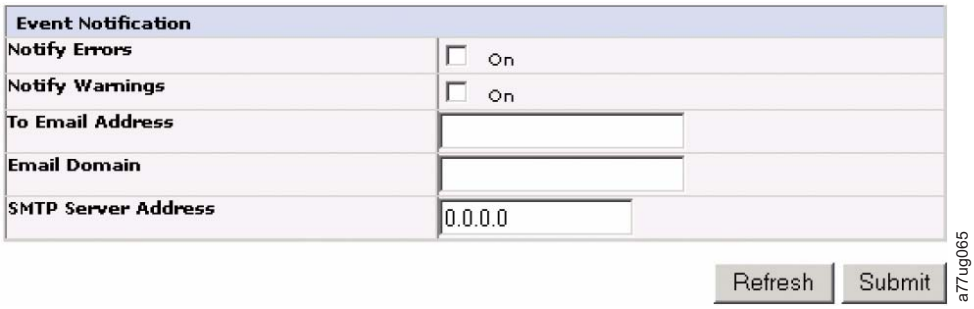


Figure 2-30. The Configure Library: Event Notification screen

Restoring Factory Default Settings using the Web User Interface

This function is also available on the Operator Control Panel. If you do not have the capability of accessing your library using the Web User Interface, you should write down all library configuration settings for future reference.

Navigate to **Configure Library** → **Restore Defaults**

Configure Your Library using the Operator Control Panel

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

1. "Choosing the Number of Logical Libraries"
2. "Choosing Library Settings"
3. "Choosing Drive Interface Identification/Settings" on page 2-26
4. "Entering Network Settings using the Operator Control Panel" on page 2-14
5. "Setting the Operator Control Panel Access PIN" on page 2-27
6. "Entering Date and Time using the Operator Control Panel" on page 2-27
7. "Entering Path Failover Feature Activation Key using the Operator Control Panel" on page 2-28
8. "Restoring Factory Default Settings using the Operator Control Panel" on page 2-28

Choosing the Number of Logical Libraries

1. Navigate to **Configure** → **Logical Libraries**.
2. Press the DOWN button to select **Number of Logical Libraries**.
3. Press the SELECT button to highlight the selection field.
4. Press the UP or DOWN button to select the number of logical libraries to be assigned in your library.
5. Click **Save** to apply your selections.

Choosing Library Settings

For each logical library, complete the following steps.

1. Choose the **Mode** for your logical library (Random or Sequential).
2. If Sequential Mode was chosen, you may select **Autoload** and/or **Loop** or neither. Autoload automatically loads the cartridge in the lowest number storage slot **after** the library is powered on.

3. Choose the number of **Reserved Slots** in your logical library. This number will affect the number of **Active Slots** shown on the Web User Interface menu under the **Configure Library** menu.

   Note: Slots can be reserved so that they are invisible to the host. It may be necessary to reserve slots in order to match the number of available slots to the ISV software licensing.
4. Check Auto Clean to enable automatic cleaning of the drive(s) in your library. A cleaning cartridge must reside in a reserved slot. You will need to ″reserve″ a data slot for that purpose, then move a cleaning cartridge into that slot. See “Inserting the Cleaning Cartridge” on page 2-33 for instructions on libraries containing a Dedicated Cleaning Slot (DCS).
5. Check **I/O Station** to enable the I/O Station (1 slot in a 2U library, 3 slots in a 4U library). If left unchecked, the I/O station slot or slots are configured for storage.
6. Click **Save**.

Choosing Drive Interface Identification/Settings

1. Navigate to **Configure** → **Drive**.
2. Select a drive.
3. If the selected drive is to be designated as a control path drive, check **Control Path**. All drives in a logical library may be designated as a control path drive.
4. Select a SCSI ID for each SCSI drive. Refer to Element Address drive configurations in “Library Partitioning and Element Addressing” on page 1-15 for assistance in defining drive element addresses.
5. Select a Port Speed, Port Type, and Loop ID for each Fibre Channel drive. SAS drives require no Port settings.
6. Click **Save**.

Entering Network Settings using the Operator Control Panel

If you would like to use DHCP (Dynamic Host Configuration Protocol) as your library network setting, complete Steps 1, 2, 4, and 8. If you do **not** want to use DHCP as your library network setting, complete Steps 1, 2, 5, 6, 7, and 8.

1. Press the DOWN button to highlight the **Network** menu.
2. Press the SELECT button to display the **Network** screen.
3. Select IP STACK to change Internet Protocols. Choose **IPv4 only**, **IPv6 only**, or **IPv4 & IPv6**.
4. If you do **not** want to select DHCP as your library network setting, skip this step and proceed to the next step. If you want to select DHCP as your library network setting, complete the following steps:
   a. Press the SELECT button to highlight the **DHCP** field.
   b. Press the DOWN button to select **ON**.
   c. Press the SELECT button to apply your selection.
   d. Skip to Step 7.
5. Press the DOWN button to select **IP Address**.
   a. Press the SELECT button to highlight the **IP Address** field.
   b. Press the UP or DOWN button to select the digit(s) of your library’s IP Address.
   c. Press the SELECT button to highlight the next digit(s) in your IP Address.

d. After entering the final digits, press the SELECT button to apply your entries.

6. Press the DOWN button to select **Netmask**.
   a. Press the SELECT button to highlight the **Netmask** field.
   b. Press the UP or DOWN button to select the digit(s) in your library's Netmask address.
   c. Press the SELECT button to highlight the next digit(s) in your library's Netmask address.
   d. After entering the final digit(s) in your Netmask address, press the SELECT button to apply your entries.
7. Press the DOWN button to select **Gateway**.
   a. Press the SELECT button to highlight the **Gateway** field.
   b. Press the UP or DOWN button to select the digit(s) in your library's Gateway address.
   c. Press the SELECT button to highlight the digit(s) in your library's Gateway address.
   d. After entering the final digits in your Gateway address, press the DOWN button and select one of the following:
      - **Save** - to save your network settings.
      - **Cancel** - to cancel all of your entries and leave the settings as they were.
8. Press the SELECT button to return to the **Configure** menu.
9. Press the CANCEL button to return to the **Main** menu.
10. Press the CANCEL button to return to the home screen.

Setting the Operator Control Panel Access PIN

1. Navigate to **Configure** → **Set Access PIN**.
2. Press the SELECT button to highlight the first digit of the 4-digit Access PIN.
3. Use the UP and DOWN buttons to select each digit.
4. Press the SELECT button to move to the next digit.
5. Repeat these steps for repeating the Access PIN.
6. After entering the final digit, press the DOWN button and select one of the following:
   - **Save** - to apply your settings.
   - **Cancel** - to delete your settings.

Entering Date and Time using the Operator Control Panel

1. Navigate to **Configure** → **Date and Time**.
2. Use the UP and DOWN buttons to select Time.
3. Press the SELECT button to highlight the first time field.
4. Using the UP and DOWN buttons, enter each digit of the time (HHMM). After selecting each digit, press SELECT to move to the next field.
5. After you have correctly entered the time, press SELECT to select Time.
6. Press the DOWN button to select Date.
7. Press the SELECT button to highlight the first date field.
8. Using the UP and DOWN buttons, enter each digit of the DATE (MMDDYYYY). After selecting each digit, press SELECT to move to the next field.
9. After you have correctly entered the date, press SELECT to select Date.

10. Press the DOWN button to select SUBMIT.
11. Press SELECT to apply your changes.

Note: If you wish to enter an Encryption Activation key, you must use the Remote Web interface.

Entering Path Failover Feature Activation Key using the Operator Control Panel

1. Navigate to **Configure** → **Path Failover**.
2. Press the SELECT button to highlight the first digit of the 12-digit feature key.
3. Use the UP and DOWN buttons to select each digit.
4. Press the SELECT button to move to the next digit.
5. After entering the final digit, press the DOWN button and select one of the following:
   - **Save** - to apply your settings.
   - **Cancel** - to delete your settings.

   Note: Path Failover is a combination of two previous features: Control Path Failover (key entered at the library user interface) and Data Path Failover (key entered at the device driver interface). A single activation key entered at the library user interface now activates both features unless the LTO-3 drive firmware level is equal to or lower than 69U2 and/or the library firmware is equal to or lower than 1.95. For either or both of these two cases, the device driver interface Data Path Failover key activation will still be required. The Path Failover feature is available for select LTO 4 tape drives. Path Failover is not supported for half high drives.

Restoring Factory Default Settings using the Operator Control Panel

DO NOT USE THIS ITEM UNLESS YOU WOULD LIKE TO ERASE ALL LIBRARY SETTINGS AND RESTORE FACTORY DEFAULT SETTINGS.

For more information about this menu item, see “Configure: Restore Defaults” on page 4-22.

Preparing the Host

Follow these general guidelines:

1. Ensure that your backup application supports the SCSI, SAS, or Fibre Channel host bus adapter (HBA).
2. Ensure that all the required or latest available Operating System files and/or updates (dll’s, PTF’s, etc.) have been installed and applied.
3. If the host server is connected to a network, check with the system administrator before turning host power OFF.
4. Install a suitably rated HBA. Remember that if there are any single-ended (SE) devices on the same SCSI bus, the entire SCSI bus will negotiate down to SE speed and severely degrade performance and limit cable length.
5. Ensure that LUN scanning is enabled on the SCSI host adapter.
6. Ensure that Fibre Channel Tape Support is enabled on the Fibre Channel HBA if installing a library with a Fibre Channel drive.

7. Ensure that SAS support is enabled on the SAS HBA if installing a library with a SAS drive.

Verifying the Connection

1. Depending on the server configuration, you may need to change the SCSI ID or Fibre Channel Loop ID of the library, if the current ID is the same as another device on the bus.
2. When the host server is powered ON, install the software and/or driver(s) that are compatible with the library. Backup software packages may require additional software or licensing to communicate with the library accessor.
3. If this is a SCSI attachment, ensure the library is properly terminated. If the library is the only SCSI device, other than the SCSI host adapter on the selected SCSI bus, it must be terminated. Likewise, if the library is physically the last SCSI device on the SCSI bus, it must be terminated. Only the devices physically located at the beginning and end of the SCSI bus should be terminated.
4. Confirm that the host server operating system recognized the library. In Microsoft® Windows XP, Windows Server 2003, or in Windows 2000 you can verify this by going to: **Settings** → **Control Panel** → **System** → **Hardware** → **Device Manager** → **Tape Drive and/or Medium Changer** .

For more information on verifying the connection of SCSI devices, see the operating system documentation.

Cartridge Magazines

The library has removable magazines. Magazine access is password protected. For safety reasons, the accessor motion is stopped when a magazine is removed.

The magazines can be released using the Operator Control Panel or the Web User Interface. In case the Operator Control Panel or Web User Interface initiated process has failed or the library no longer has power, a manual emergency release is available.

Important: To manually release a magazine, see “Releasing the Magazines Manually” on page 8-1. This manual process should only be used if the magazine cannot be released using the Operator Control Panel or the Web User Interface.

2U Library Cartridge Magazines

The 2U library has two cartridge magazines. The left cartridge magazine (see Figure 2-31 on page 2-30) has eleven storage slots and houses the 1-slot I/O Station. The right magazine (see Figure 2-32 on page 2-30) has twelve storage slots. For information about Element Addressing, see “2U Library I/O Slot, Storage Slots and Drive Slot Element Addresses and Physical Locations” on page 1-19.

Note: On some 2U Libraries prior to Library Microcode Level 1.9, slot 11 may be labelled a ″Not Used″ slot which contained a ″Slot Blocker″. With Library Microcode level 1.9 or higher, there is an option to remove the ″Slot Blocker″ and place that slot into use. See “Removing the Slot Blocker - 2U Library” on page 9-4.

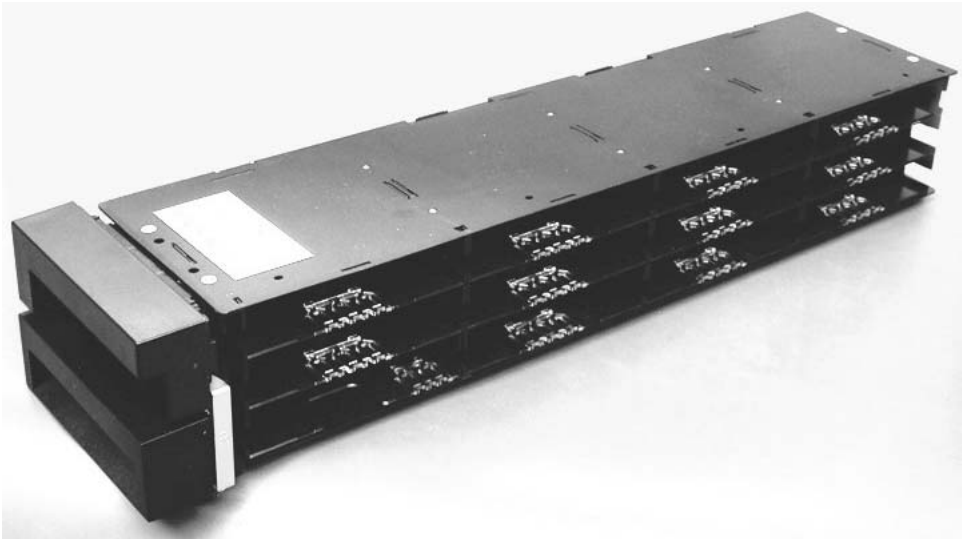


Figure 2-31. 2U library left magazine

Figure 2-32. 2U library right magazine

2U Library I/O Station

The I/O (Input/Output) Station (see Figure 2-33 on page 2-31) in a 2U library is part of the left magazine. To open the I/O Station, select **Control → Open I/O Station**. The I/O Station will pop open. To close the I/O Station, gently push it back into the left magazine.

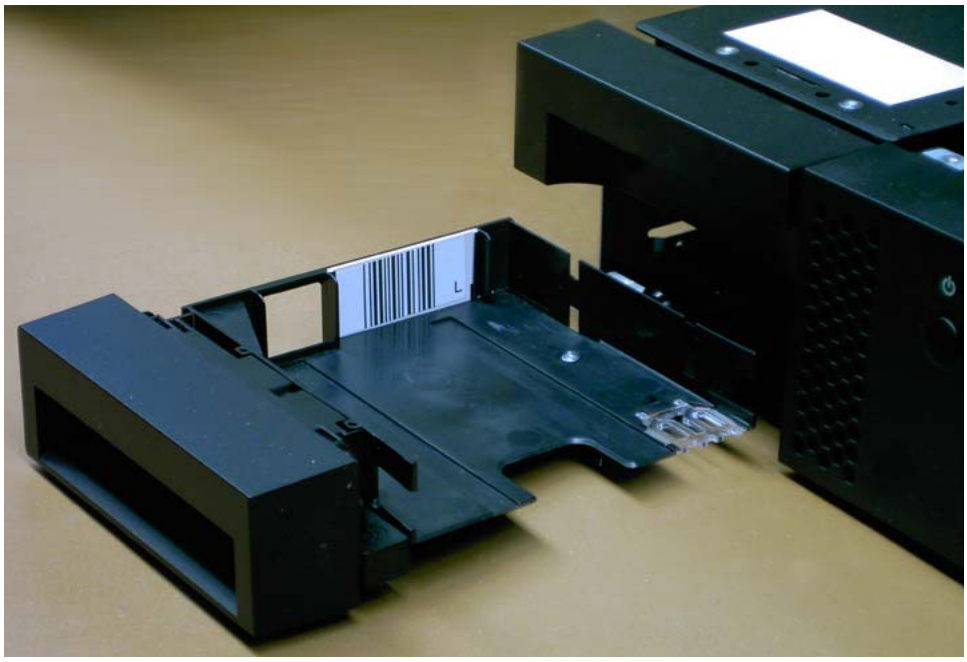


Figure 2-33. 2U library I/O Station in the left magazine

4U Library Cartridge Magazines

The 4U library has four cartridge magazines, two on each side (see Figure 2-34 and Figure 2-35 on page 2-32). The upper left magazine has twelve storage slots. The lower left magazine has nine storage slots and houses the 3-slot I/O Station (**1** in Figure 2-34). The upper right magazine has twelve storage slots. The lower right magazine has twelve storage slots. For information on Element Addressing, see "4U Library I/O Slots, Storage Slots, and Drive Slots Element Addresses and Physical Locations" on page 1-19.

Figure 2-34. 4U library left magazines

Figure 2-35. 4U library right magazines

4U Library I/O Station

The I/O Station in a 4U library (see Figure 2-36) is part of the lower left magazine. To open the I/O Station, select **Control** → **Open I/O Station**. The I/O Station will pop open. To close the I/O Station, gently push it back into the lower left magazine.

Figure 2-36. 4U library I/O Station in the lower left magazine

There are finger holes on the back side of the I/O Station (see **1** in Figure 2-37 on page 2-33) that allow the user to push the cartridges out of the I/O station.

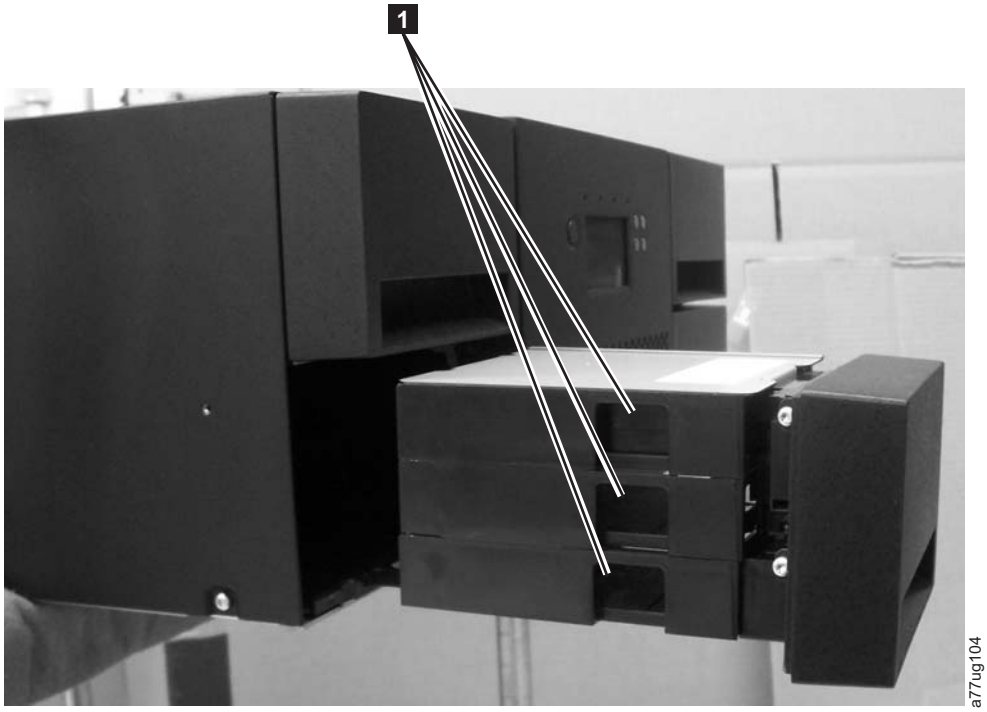


Figure 2-37. Finger Holes on back side of 4U Library I/O Station

Populating the Library with Data Cartridges

For information on working with the cartridge magazines, see "Cartridge Magazines" on page 2-29.

1. Unlock the cartridge magazines.
   - Using the Operator Control Panel: **Control → Magazines**
   - Using the Web User Interface: **Manage Library → Release Magazine**
2. Remove all magazines from the library.
3. Insert cartridges in the left magazine(s). Do not store cartridges in the I/O Station or in the dedicated cleaning cartridge slot. See "2U Library I/O Slot, Storage Slots and Drive Slot Element Addresses and Physical Locations" on page 1-19 or "4U Library I/O Slots, Storage Slots, and Drive Slots Element Addresses and Physical Locations" on page 1-19 for determining slot location.
4. Insert cartridges in the right magazine(s).
5. Put all magazines back into the library. The library will automatically start up and perform an inventory check.

Inserting the Cleaning Cartridge

See the **Note** below for 4U libraries with a Dedicated Cleaning Slot (DCS).

The following criteria must be followed for **Auto Clean** to function:

1. The **Auto Clean** function must be configured ″**On**″ or ″**Enabled**″.
   - OCP: **Configure->Library Settings->Enabled**
   - Web Interface: **Configure Library->General->Auto Clean->checkmark**

Note: Earlier versions of the 4U library contained a **Dedicated Cleaning Slot** (**DCS**). This DCS can be retained and is supported by future library firmware updates. However, library firmware later than 1.95 will allow removal of the DCS, thus enabling this slot to be used as a storage slot. Once the DCS is removed, the Auto Clean cleaning cartridge slot must be configured as described below. To remove the DCS, perform the following procedure using the Operator Control Panel (OCP): **OCP->Configure->Library Settings->General->Remove DCS->No/Yes->Save**.

2. A storage slot must be reserved (Res or RSVD).
   - Reserving a slot is accomplished by reducing the **Active Slot** count in any particular logical library. A reserved slot (or slots) is always the last slot in the last magazine of any particular logical library. A cleaning cartridge that is in a reserved slot is available to any logical library drive even if the reserved slot is not in that particular logical library. If the library contains multiple logical libraries, typically, the last logical library is chosen to be the reserved slot containing the cleaning cartridge. As with a library with a single logical library, this slot is the last physical slot in the library (top right magazine, uppermost rear slot).
3. A cleaning cartridge **(CLNxxxLx)** must be placed or moved to a reserved slot.
   - A cleaning cartridge must be replaced after 50 uses. Click on the remote web interface, **Monitor Library->Inventory** .
   - Find the magazine that contains the cleaning cartridge.
   - Click on the **(+)** located under that magazine presentation to expand the detail of resident cartridges.
   - Observe the cleaning cartridge location displayed. The number of Media Loads represent how many times the cleaning cartridge has been used. The number 50, minus that Media Load number represents the number of uses left.
4. To install a cleaning cartridge in the 2U or 4U library:
   a. Use the **OCP** → **Control** → **Move Cartridge** or the Web Interface **Manage Library** → **Move Media** to insert the cleaning cartridge into the reserved slot or the DCS (if one exists, 4U only).
   b. An alternate method is to use the Release Magazine option:
      - Operator Control Panel: **Control** → **Magazine (Left/Right)**
      - Web User Interface: **Manage Library** → **Release Magazines (Left/Right)**
   c. Place a cleaning cartridge into the reserved slot or the DCS (if one exists, 4U only).

Chapter 3. User Interfaces

This library has two user interfaces.

- Operator Control Panel - located on the front panel of the library
- Web User Interface - accessed via a web browser

Operator Control Panel

The Operator Control Panel operates in two basic modes.

- **User Interaction mode** - This mode is employed when a user is pushing buttons on the Operator Control Panel.
- **System Driven mode** - This is the normal mode of operation. In this mode, the Operator Control Panel displays status associated with the actions that were caused from commands issued via the drive's internal (drive to library) serial interface.

When an Operator Control Panel button is pressed and released, the Operator Control Panel automatically transitions to User Interaction mode. User Interaction mode will continue until 3 minutes after a user stops pushing buttons, or the requested accessor action stops - whichever is longer. At which time, the Operator Control Panel will return to System Driven mode.

If necessary, the Operator Control Panel will automatically transition to the System Driven mode. When this occurs, the library must remember what the user was doing before the display mode changed. Therefore the next button pressed will only transition the Operator Control Panel to the User Interaction mode from the System Driven mode.

In case of the activated user security feature, the User Interaction mode is restricted to **Login** and **Monitor** menu items, until a user logs in with a correct password.

Operator Control Panel Philosophy

Operator Control Panel operation must obey some basic rules. These rules of operation constitute a philosophy.

- Any operational conflict between commands received over the host interface or the Web User Interface and those entered via the Operator Control Panel will be avoided with a reservation mechanism on a first-come, first-served basis. Any reservation by the Operator Control Panel is canceled by an Operator Control Panel logout or a timeout, which cancels the User Interaction Mode.
- Library firmware will not allow a user to select an impossible request. Those situations will include, but are not limited to:
  - Moving a cartridge from any source to a full slot
  - Moving a cartridge from an empty slot
  - Loading a cartridge from any source to a full drive
  - Unloading a cartridge from an empty drive
- Any error detected by the library or drive controller and not recoverable through predetermined firmware algorithms will be considered as fatal. An error code will be displayed on the Operator Control Panel display and the error LED will

become illuminated. The error code will remain on the Operator Control Panel until a push button is pressed, which will cause the Operator Control Panel to return to the Home Screen.

- Numeric error codes are only used for unrecoverable, fatal errors, otherwise text status messages are displayed.

Power-ON Display

When the library powers ON or resets, it goes through several internally controlled processes that allow it to get initialized and running. These processes are called Power-On-Self-Test (POST). During the POST the Operator Control Panel will display information that may be meaningless until POST is complete. When the POST is finished, the library will display the current library status in the Home Screen.

The example below shows that the Accessor and Drives 1 through 3 are OK as shown by the check marks in the Home Screen, but that drive 4 either has a problem, or is missing. The exclamation mark (!), which shows that there is something wrong with drive 4 will not go away until the drive is either fixed, or is replaced. At that time, the explanation mark will become a check mark.

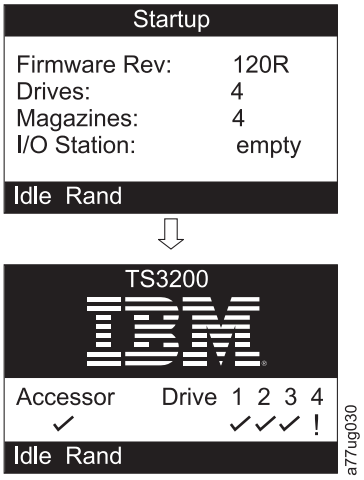


Figure 3-1. Power-ON Screens

Note about the LEDs

All LEDs are updated during power ON and reset sequences. Upon power ON or software reset, the library will illuminate all LEDs as soon as POST allows. When initialization starts, all LEDs will be extinguished and the Ready/Activity LED will flash at a rate of approximately one second per cycle. When the mechanical initialization is complete, the Ready/Activity LED will stop flashing and be constantly illuminated.

If a library failure occurs, the Ready/Activity LED will turn OFF and the Error LED will illuminate. The Operator Control Panel will also display an appropriate error code to help identify the failure.

The following are additional operational details of LEDs:

- The **Ready/Activity** LED will be lit any time the unit is powered ON and functional. The Ready/Activity LED will blink whenever there is library or drive activity. This LED will also blink when the unit is OFFLINE.

- The **Clean** LED will only be lit when a cleaning REQUIRED has been issued by the drive. The LED will be turned OFF after a successful drive cleaning operation.
- The **Attention** LED will indicate that there is a piece of media which is bad/marginal, or invalid. The LED will also be lit if the power supply or the power supply fan is failing. The LED will turn OFF when all marginal and invalid cartridges have been exported from the library, or the power supply/power supply fan is replaced. See "Identifying a Suspect Cartridge" on page 8-1 or "Isolating a Power Supply Problem" on page 6-5.
- The **Error** LED will be lit when there is an unrecoverable (i.e. hard) drive or library failure. This will happen at the same time the hard error message is displayed on the screen and the LED will remain lit until the error state is resolved.

Input Modes

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

Selecting Predefined Values

1. To set the predefined values, press the ENTER button to select the menu item.
2. Using the UP and DOWN buttons, select one of the various predefined values for that item.
3. As soon as the Operator Control Panel display shows the correct value, press the ENTER button to apply the value.

Toggling Values

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

1. After navigating to the menu item, press the ENTER button to select the menu item.
2. Using the UP and DOWN buttons, select one of the various predefined states for that item.
3. Press the ENTER button to apply the new state.

Entering Numerical Values

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

1. After navigating to the menu item, the current value is displayed and the cursor highlights the first digit of the value that can be changed.
2. For each digit to be changed in the value:
   a. Use the UP and DOWN buttons to increment / decrement the digit.
   b. Press the ENTER button to highlight the next editable digit.
3. Press the ENTER button at the last digit to apply the complete entry, or press the CANCEL button to cancel the whole edit process and maintain the original value.

Power ON/OFF

Part of the Operator Control Panel is the Power ON/OFF button. If the library is powered ON, pressing this button for 4 seconds will initiate a controlled power down of the library (soft landing). The following operations will take place before the library shuts down completely:

- The display indicates with an appropriate message that the shutdown is in progress.
- The library controller finishes all ongoing library and drive activities.
- The accessor is moved to its home position.
- The library controller switches OFF the power supply's secondary side.

Note: The shutdown process may be aborted by releasing the button before 4 seconds has passed.

Web User Interface

Many of the same operations performed from the Operator Control Panel can also be performed remotely using the Web User Interface.

The Web User Interface lets you monitor and control your library from any terminal connected to your network or through the World Wide Web (WWW). The Web User Interface hosts a dedicated, protected Internet site that displays a graphical representation of your library.

For static IP Addresses only: After establishing a connection to the library, open any HTML browser and enter the IP address of the library. To configure the Web User Interface, you must first set the IP address using the Operator Control Panel.

Login

Important: Some options of the Web User Interface take the library OFFLINE. This inactive mode can interfere with host-based application software, causing data loss. Make sure the library is idle before attempting to perform any remote operations that will take the library OFFLINE.

To login, select the access type and enter the correct password. There are three levels of access:

- User - Normal user level
- Admin - Admin user level
- Service - Service personnel user level. Access to this level is for Service personnel only.

Use the following password for logging in as an Admin user: **secure**

Each level affects which areas you have access to and what actions you can initiate from those areas.

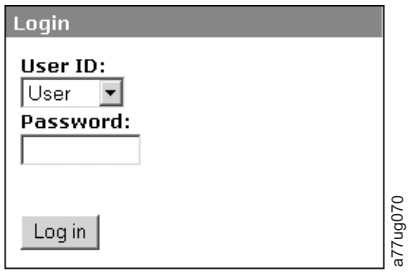


Figure 3-2. Web User Interface login page

System Status

The **System Status** screen is always present after login giving current status of the library.

Figure 3-3. 2U library System Status screen

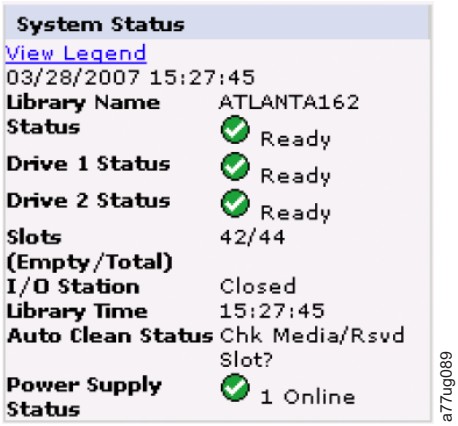


Figure 3-4. 4U library System Status screen

Status icons indicate the following conditions.

- The green check mark indicates that the library is fully operational and that no user intervention is required.
- The yellow exclamation point indicates that user intervention is necessary, but that the library is still capable of performing operations. This condition can be caused by a media, library, or drive problem. To determine which, click on "Monitor" and review "Library Status", "Drive Status", and "Inventory".
- The red X indicates that user intervention is required and that the library is not capable of performing operations.

- If Auto Clean is enabled and a cleaning cartridge is **not** present, or if a cleaning cartridge is present, but not in a reserved slot, Auto Clean status will show **Chk Media/Rsvd Slot?**

SNMP Messaging

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

In summary, each trap provides the following information:

- **Product Identification** such as product name, description, manufacturer, model number, firmware level, and the URL that the trap is designated for.
- **Product Status** such as the severity of the trap, status (current and previous) and the time the trap occurred.
- **Library state** (physical device status) such as identification and status of devices that are monitored. In the case of the library, it would include enclosure, power supply, controller, magazine status, drive count, cartridge slot count, I/O station count and temperature sensor status if any. Also included would be certain library statistics and where appropriate, the fault FSC (fault symptom code) including the severity and description of that fault.
- **Drive Status** such as the identification of each drive in the library, firmware level, serial number and other address and status information.
- **Trap Definitions** such as library status change, open magazine, I/O accessed, hard fault information, drive cleaning requests, excessive retries and library returning to normal operations.

Chapter 4. Operations

The following table lists menu navigation shortcuts to activities that can be performed via the Operator Control Panel and/or the Web User Interface.

Before using the Operator Control Panel or the Web user Interface, please review the information in Chapter 3: **User Interfaces**.

Table 4-1. Menu navigation shortcuts

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	For More Info	Web User Interface	For More Info
Access PIN, create new	**Configure → Set Access PIN**	"Configure: Set Access PIN" on page 4-22	**Configure Library → User Access**	"Configure Library: User Access" on page 4-40
Access PIN, modify existing	**Configure → Set Access PIN**	"Configure: Set Access PIN" on page 4-22	**Configure Library → User Access**	"Configure Library: User Access" on page 4-40
Accessor, number of cartridge moves	**Monitor → Library → Status → Cycles**	"Monitor: Library" on page 4-10	**Monitor Library → Library Status**	"Monitor Library: Library Status" on page 4-30
Auto Clean, enable	**Configure → Library Settings → Auto Clean**	"Configure: Library" on page 4-19	**Configure Library → General**	"Configure Library: General" on page 4-35
Cartridge, currently active/moving	**Monitor → Library → Status → Act. Cart**	"Monitor: Library" on page 4-10	**Monitor Library → Library Status**	"Monitor Library: Library Status" on page 4-30
Cartridge, Inventory	**Monitor → Inventory → Magazines**	"Monitor: Inventory" on page 4-14	**Manage Library → Perform Inventory**	"Manage Library: Perform Inventory" on page 4-44
Cartridge, Move	**Control → Move Cartridges**	"Control: Move Cartridges" on page 4-15	**Manage Library → Move Media**	"Manage Library: Move Media" on page 4-43
Cartridge currently in drive (n), serial number	**Monitor → Inventory → Drive (n)**	"Monitor: Inventory" on page 4-14	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31
Cartridge in drive (n), serial number	**Monitor → Drive → Status → Drive (n)/Source**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31

Table 4-1. Menu navigation shortcuts (continued)

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	**For More Info**	**Web User Interface**	**For More Info**
Configuration, save and restore	**Configure → Restore Defaults**	"Configure: Restore Defaults" on page 4-22	**Configure Library → Restore Defaults**	"Configure Library: Restore Defaults" on page 4-43
Control path, enable	**Configure → Drive → Control Paths**	"Configure: Drive" on page 4-21	**Configure Library → Drive**	"Configure Library: Drives" on page 4-38
Date and time, current setting	**Monitor → Library → Identity → Date/Time**	"Monitor: Library" on page 4-10	**Monitor Library → Library Identity**	"Monitor Library: Library Identity" on page 4-28
Date and time, set	**Configure → Set Date and Time**	"Configure: Set Date and Time" on page 4-23	**Configure Library → Date & Time**	"Configure Library: Date & Time" on page 4-41
DHCP, current status	**Monitor → Library → Network → DHCP**	"Configure: Network" on page 4-22	**Configure Library → Network**	"Configure Library: Network" on page 2-19
DHCP, modify	**Configure → Network → DHCP**	"Configure: Network" on page 4-22	**Configure Library → Network**	"Configure Library: Network" on page 2-19
Diagnostics, run drive Head test	**Service → Service → Drive Tests**	"Service: Run Tests" on page 4-25	**Service Library → Perform Diagnostics**	"Service Library: Perform Diagnostics" on page 4-46
Diagnostics, run drive Media test	**Service → Service → Drive Tests**	"Service: Run Tests" on page 4-25	**Service Library → Perform Diagnostics**	"Service Library: Perform Diagnostics" on page 4-46
Diagnostics, run drive Normal Read/Write test	**Service → Service → Drive Tests**	"Service: Run Tests" on page 4-25	**Service Library → Perform Diagnostics**	"Service Library: Perform Diagnostics" on page 4-46
Diagnostics, run drive POST	**Service → Service → Drive Tests**	"Service: Run Tests" on page 4-25	**Service Library → Perform Diagnostics**	"Service Library: Perform Diagnostics" on page 4-46
Diagnostics, run drive wrap test	**Service → Service → Drive Tests**	"Service: Run Tests" on page 4-25	**Service Library → Perform Diagnostics**	"Service Library: Perform Diagnostics" on page 4-46

Table 4-1. Menu navigation shortcuts (continued)

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	For More Info	Web User Interface	For More Info
Diagnostics, run Library Verify test	**Service → Library Verify**	"Service: Library Verify" on page 4-24	Not available with this interface.	
Diagnostics, run Slot to Slot test	**Service → Run Tests**	"Service: Run Tests" on page 4-25	**Service Library → Perform Diagnostics**	"Service Library: Perform Diagnostics" on page 4-46
Diagnostics, run System Test	**Service → Run Tests**	"Service: Run Tests" on page 4-25	**Service Library → Perform Diagnostics**	"Service Library: Perform Diagnostics" on page 4-46
Display Contrast	**Service → Display Contrast**	"Service: Display Contrast" on page 4-26	Not available with this interface.	
Drive, change interface configuration	**Configure → Drive → Drive Interface**	"Configure: Drive" on page 4-21	**Configure Library → Drives**	"Configure Library: Drives" on page 4-38
Drive, clean	**Service → Service → Clean Drive**	"Service: Service (Drives)" on page 4-25	**Service Library → Clean Drive**	"Service Library: Clean Drive" on page 4-44
Drive, current SCSI/Loop ID	**Monitor → Drive → Identity**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Identity**	"Monitor Library: Drive Identity" on page 4-29
Drive, current status	**Monitor → Drive → Status**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31
Drive, data compression ON/OFF	Not available with this interface.		**Monitor Library → Drive Identity → Data Compression**	"Monitor Library: Drive Identity" on page 4-29
Drive, Fibre, Worldwide Node Name	**Monitor → Drive → Identity → Drive (n)/WWNN**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31
Drive, Hashed SAS Address	Not available with this interface.		**Monitor Library → Drive Status → Hashed SAS Address**	"Monitor Library: Drive Status" on page 4-31

Table 4-1. Menu navigation shortcuts (continued)

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	**For More Info**	**Web User Interface**	**For More Info**
Drive, Interface type	**Configure → Drive → Drive Interface**	"Configure: Drive" on page 4-21	**Configure Library → Drive**	"Configure Library: Drives" on page 4-38
Drive, SCSI Inquiry string	**Monitor → Drive → Identity → Drive (n)/Product ID**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Identity**	"Monitor Library: Drive Identity" on page 4-29
Drive, turn power ON/OFF	**Service → Service → Drive Power**	"Service: Service (Drives)" on page 4-25	**Configure Library → Drive**	"Configure Library: Drives" on page 4-38
Drive activity, current	**Monitor → Drive → Status → Drive (n)/Activity**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31
Drive fan, status	**Monitor → Drive → Status → Drive (n)/Cooling**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31
Drive Dump, save	Not available with this interface.		**Service Library → Save Drive Dump**	"Save Drive Dump" on page 4-46
Encryption, modify settings	Not available with this interface.		**Configure Library → Encryption**	"Configure Library: Encryption" on page 4-37
Event notifications: add, modify, and delete	Not available with this interface.		**Configure Library → Event Notification**	"Configure Library: Event Notification" on page 4-42
Error log, view	**Monitor → Library → Error log**	"Monitor: Library" on page 4-10	**Service Library → View logs**	"Service Library: View Logs" on page 4-45
Error logs and traces, set mode	Not available with this interface		**Configure Library → Logs & Traces**	"Configure Library: Logs & Traces" on page 4-42
Factory Default settings, restore	**Configure → Restore Default**	"Configure: Restore Defaults" on page 4-22	**Configure Library → Restore Defaults**	"Configure Library: Restore Defaults" on page 4-43
Fibre Channel, speed	**Monitor → Drive → Status → Drive (n)/Speed**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31

Table 4-1. Menu navigation shortcuts (continued)

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	For More Info	Web User Interface	For More Info
Fibre Channel, topology	**Monitor → Drive → Status → Drive (n)/Topology**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31
Fibre Channel link, status	**Monitor → Drive → Status → Drive (n)/Link**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Status**	"Monitor Library: Drive Status" on page 4-31
Firmware, drive, current level	**Monitor → Drive → Identity**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Identity**	"Monitor Library: Drive Identity" on page 4-29
Firmware, drive, upgrade	**Service → Service → Drive FW Upgrade**	"Service: Service (Drives)" on page 4-25	**Service Library → Upgrade Firmware**	"Service Library: Upgrade Firmware" on page 4-47
Firmware, library, identify current level	**Monitor → Library → Identity**	"Monitor: Library" on page 4-10	**Monitor Library → Library Identity**	"Monitor Library: Library Identity" on page 4-28
Firmware, library, update	Not available with this interface.		**Service Library → Upgrade Firmware**	"Service Library: Upgrade Firmware" on page 4-47
Gateway, current address	**Monitor → Library → Network → Gateway**	"Monitor: Library" on page 4-10	**Configure Library → Network**	"Configure Library: Network" on page 2-19
Gateway Address, modify	**Configure → Network → Gateway**	"Configure: Network" on page 4-22	**Configure Library → Network**	"Configure Library: Network" on page 2-19
Inventory, perform	**Control → Re-Inventory**	"Control: Re-Inventory" on page 4-17	**Manage Library → Perform Inventory**	"Manage Library: Perform Inventory" on page 4-44
I/O Station, current status	**Monitor → Library → Status**	"Monitor: Library" on page 4-10	**Monitor Library → Library Status**	"Monitor Library: Library Status" on page 4-30
I/O Station, open	**Control → Open I/O Station**	"Control: I/O Station" on page 4-15	Not available with this interface	

Table 4-1. Menu navigation shortcuts (continued)

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	For More Info	Web User Interface	For More Info
IP Address, current	**Monitor → Library → Identity**	"Monitor: Library" on page 4-10	**Monitor Library → Library Identity**	"Monitor Library: Library Identity" on page 4-28
IP Address, modify	**Configure → Network → IP Address**	"Configure: Network" on page 4-22	**Configure Library → Network**	"Configure Library: Network" on page 2-19
Library, current status	**Monitor → Library → Status**	"Monitor: Library" on page 4-10	**Monitor Library → Library Status**	"Monitor Library: Library Status" on page 4-30
Logical libraries, configure	**Configure → Logical Libraries**	"Configure: Logical Libraries" on page 4-17	**Configure Library → Logical Libraries**	"Configure Library: Logical Libraries" on page 4-36
Logs, library, view	**Monitor → Library → Error Log**	"Monitor: Library" on page 4-10	**Service Library → View Logs**	"Service Library: View Logs" on page 4-45
Magazines, graphical representation	**Monitor → Inventory → Magazines**	"Monitor: Inventory" on page 4-14	**Monitor Library → Inventory**	"Monitor Library: Inventory" on page 4-33
Magazines, Unlock	**Control → Magazines**	"Control: Magazine" on page 4-16	**Manage Library → Release Magazine**	"Manage Library: Release Magazine" on page 4-44
Mode, library, change	**Configure → Library Settings → Mode**	"Configure: Library" on page 4-19	**Configure Library → General**	"Configure Library: General" on page 4-35
Mode, library, current	**Monitor → Library → Identity**	"Monitor: Library" on page 4-10	**Monitor Library → Library Identity**	"Monitor Library: Library Identity" on page 4-28
Netmask, current address	**Monitor → Library → Network → Netmask**	"Monitor: Library" on page 4-10	**Configure Library → Network**	"Configure Library: Network" on page 2-19
Netmask Address, modify	**Configure → Network → Netmask**	"Configure: Network" on page 4-22	**Configure Library → Network**	"Configure Library: Network" on page 2-19

Table 4-1. Menu navigation shortcuts (continued)

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	For More Info	Web User Interface	For More Info
Network configuration, change	**Configure → Network**	"Configure: Network" on page 4-22	**Configure Library → Network**	"Configure Library: Network" on page 2-19
Network configuration, view	**Monitor → Library → Network**	"Monitor: Library" on page 4-10	**Configure Library → Network**	"Configure Library: Network" on page 2-19
Path Failover, enter activation key	**Configure → Path Failover**	"Configure: Path Failover" on page 4-24	**Configure Library → Path Failover**	"Configure Library: Path Failover" on page 4-36
Power cycles	**Monitor → Library → Status**	"Monitor: Library" on page 4-10	**Monitor Library → Library Status**	"Monitor Library: Library Status" on page 4-30
Restart, library,	Not available with this interface.		**Service Library → Reboot**	"Service Library: Reboot" on page 4-48
SCSI Inquiry string, library	**Monitor → Library → Identity**	"Monitor: Library" on page 4-10	**Monitor Library → Library Identity**	"Monitor Library: Library Identity" on page 4-28
Serial Number, drive	**Monitor → Drive → Identity**	"Monitor: Drive" on page 4-12	**Monitor Library → Drive Identity**	"Monitor Library: Drive Identity" on page 4-29
Serial Number, library	**Monitor → Library → Identity**	"Monitor: Library" on page 4-10	**Monitor Library → Library Identity**	"Monitor Library: Library Identity" on page 4-28
Slots, number active	**Monitor → Library → Identity → Active Slots**	"Monitor: Library" on page 4-10	**Monitor Library → Library Identity**	"Monitor Library: Library Identity" on page 4-28
Slots, number empty	**Monitor → Library → Status → Slots Empty**	"Monitor: Library" on page 4-10	**Monitor Library → Library Status**	"Monitor Library: Library Status" on page 4-30
Slots, reassign number of active	**Configure → Library Settings → Active Slots**	"Configure: Library" on page 4-19	**Configure Library → General**	"Configure Library: General" on page 4-35

Table 4-1. Menu navigation shortcuts (continued)

Information/ Activity	Menu Navigation Shortcuts			
	Operator Control Panel	For More Info	Web User Interface	For More Info
SNMP, modify settings	Not available with this interface.		**Configure Library → Network**	"Configure Library: Network" on page 2-19
Time elapsed since power ON	**Monitor → Library → Status**	"Monitor: Library" on page 4-10	**Monitor Library → Library Status**	"Monitor Library: Library Status" on page 4-30
Web UI, access PIN, enable/disable	**Configure → Set Access PIN**	"Configure: Set Access PIN" on page 4-22	**Configure Library → User Access**	"Configure Library: User Access" on page 4-40
Web UI, user access, create or modify	Not available with this interface.		**Configure Library → User Access**	"Configure Library: User Access" on page 4-40

Operator Control Panel Navigation

The four control keys on the front of a 2U or 4U library enable the user to navigate through the library settings and make changes as needed to configure the library.

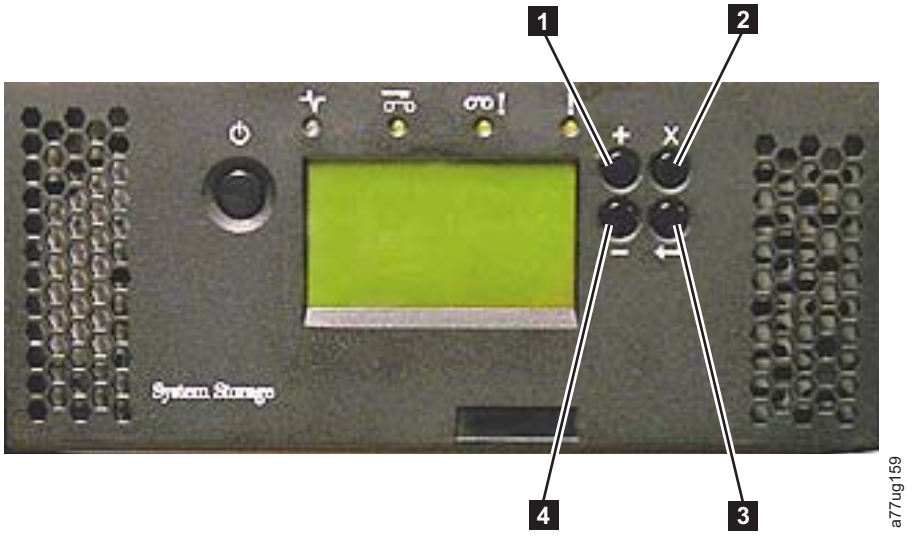


Figure 4-1. 2U Library Control Keys

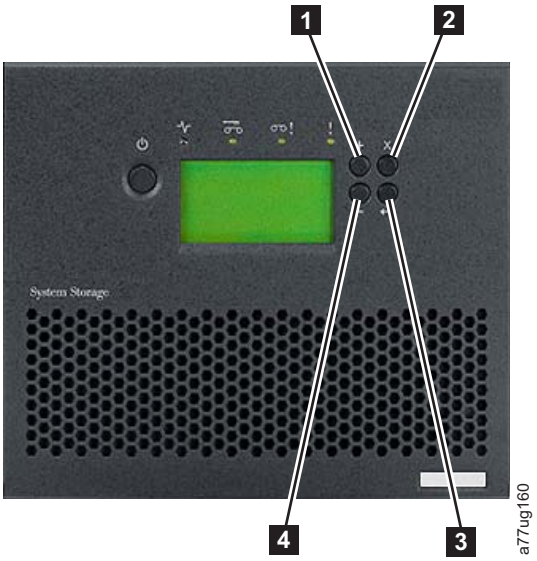


Figure 4-2. 4U Library Control Keys

Table 4-2. Library Control Keys

Control Keys	Description
1	**Up (+)** - Upper left button Used to scroll upward through menu items.
2	**Cancel** - Upper right button Used to cancel a user action and return to the previous menu screen.
3	**Enter** - Lower right button Used to display a sub-menu or force an accessor action.
4	**Down (-)** - Lower left button Used to scroll downward through menu items.

1. Press the UP (1) or DOWN(4) keys to enter Interaction Mode. The Main Selection Menu will appear. The Main Selection screen shows Monitor, Control, Configure, and Service.
2. Scroll to your selection, then press the ENTER (3) key. The sub-menu for the selected menu item will appear.
3. Use the UP (1) or DOWN(4) and ENTER (3) keys to scroll until you get to the area/screen you wish to configure.
4. Use the CANCEL (2) key if you wish to move backwards through the menu selections.

Operator Control Panel Menu Tree

The Operator Control Panel Main menu is made up of the following items:

- Monitor
- Control
- Configure
- Service

The table below shows each Main menu item and the associated sub menu items.

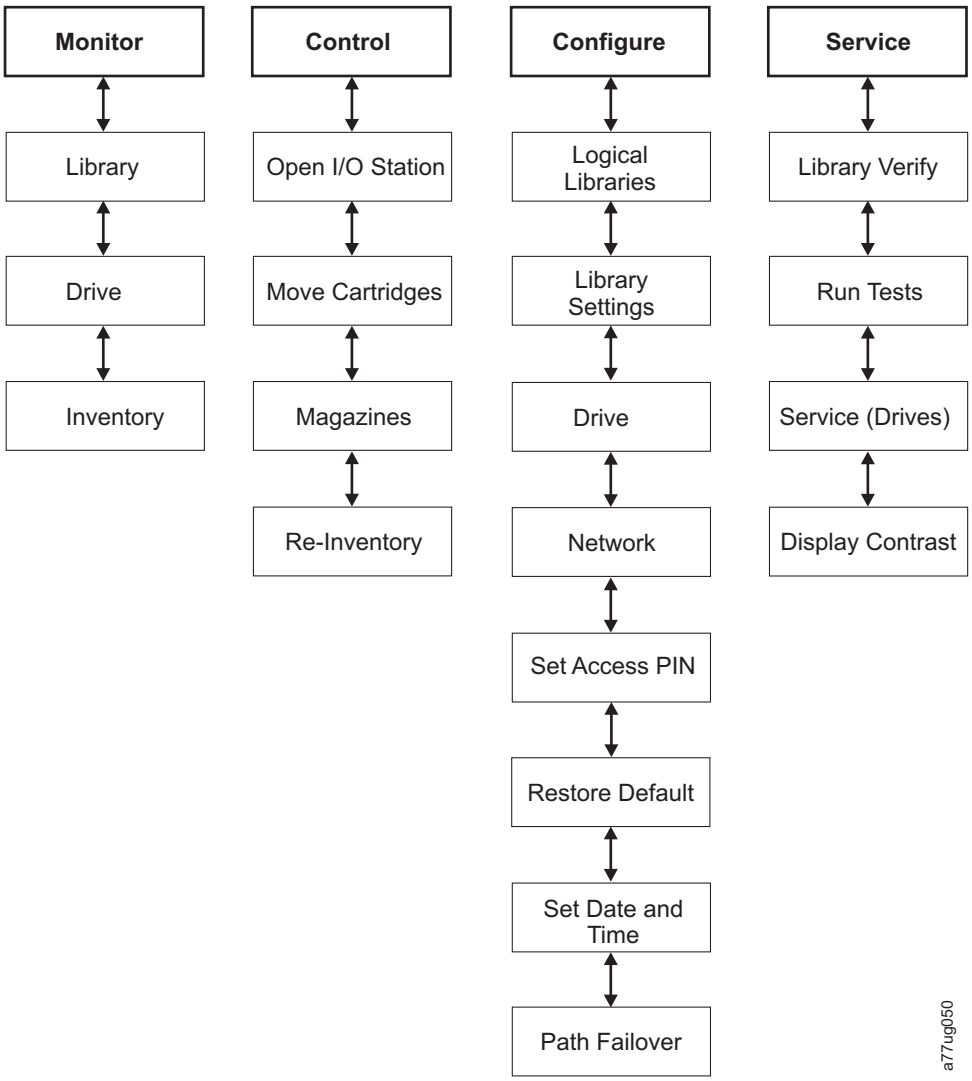


Figure 4-3. Operator Control Panel Menu Tree

Monitor Menu

The Monitor menu contains information about the following sub menu items:

- Library
- Drive
- Inventory

Monitor: Library

This menu item displays current library information and settings.

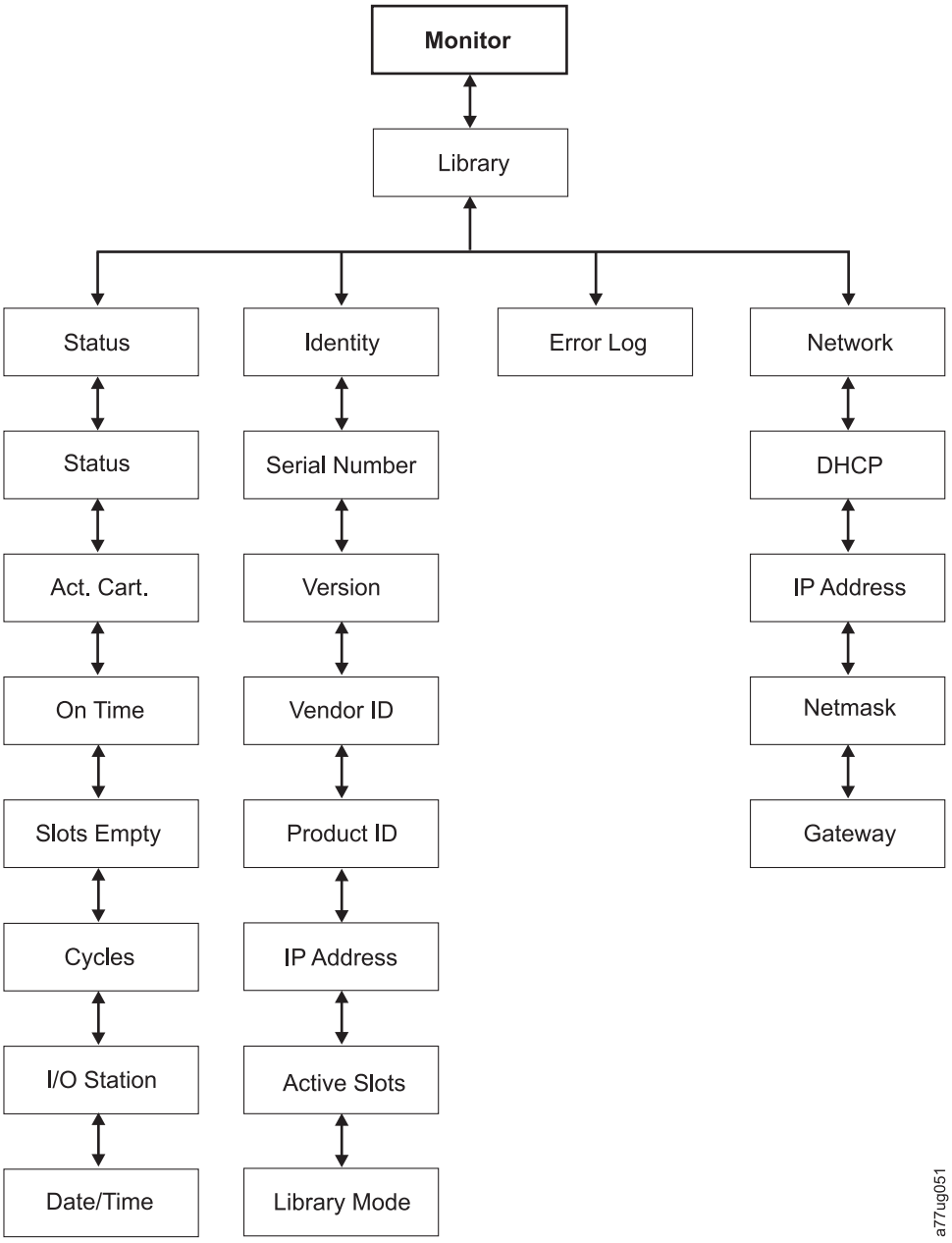


Figure 4-4. Monitor: Library menu

Under **Monitor** → **Library** are the following items:

- **Status**
- **Identity**
- **Error Log**
- **Network**

Under **Monitor** → **Library** → **Status** are the following items:

- Status - current status of the library
- Act. Cart - the serial number of the cartridge currently active in the library
- On Time - the amount of time the library has been powered ON
- Slots Empty - the number of empty slots in the library

- Cycles - the total number of cartridge moves carried out by the library accessor
- I/O Station - indicates whether the I/O Station holds a cartridge or is empty
- Date/Time - gives the current date and time set in the library

Under **Monitor** → **Library** → **Identity** are the following items:
- Serial Number - the serial number of the library
- Version - the current level of library firmware installed
- Vendor - IBM
- Product ID - library inquiry string
- IP Address - current library IP address
- Active Slots - number of active slots in the library
- Library Mode - current library mode (Random or Sequential)

Under **Monitor** → **Library** → **Error Log**, you will have a list of errors logged by the library. The errors will be displayed beginning with the most recent error.

Under **Monitor** → **Library** → **Network** are the following items:
- DHCP - Dynamic Host Configuration Protocol
- IP Address
- Netmask
- Gateway

Monitor: Drive

This menu item displays drive information and settings.

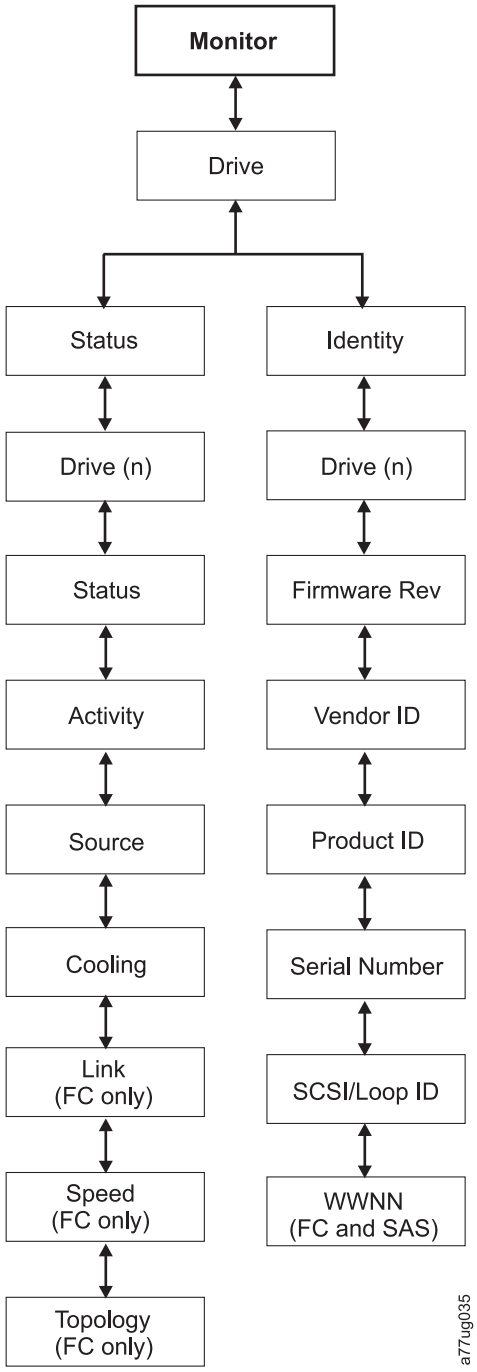


Figure 4-5. Monitor: Drive menu for a SCSI library

Under **Status** and **Drive (n)** are the following items:

- Status - the current status of the drive
- Activity - the current action being performed by the drive
- Source - the serial number of the cartridge currently in the drive
- Cooling - indicates whether or not the drive fan is running
- Link - indicates the status of the fibre channel (fibre library)
- Speed - indicates the speed of the fibre channel (fibre library)

- Topology - the topology chosen for a fibre library (see "Fibre Channel Interface" on page 1-13)

Under **Identity** and **Drive (n)** are the following items:

- Firmware Rev - the current level of drive firmware
- Vendor ID - IBM
- Product ID - drive inquiry string
- Serial Number - the drive serial number
- SCSI ID or Fibre Loop ID- the unique identifier assigned to a SCSI, SAS, or Fibre Channel drive
- WWNN - the fibre library's World Wide Node Name

Monitor: Inventory

This menu item displays the current library inventory of a 4U library.

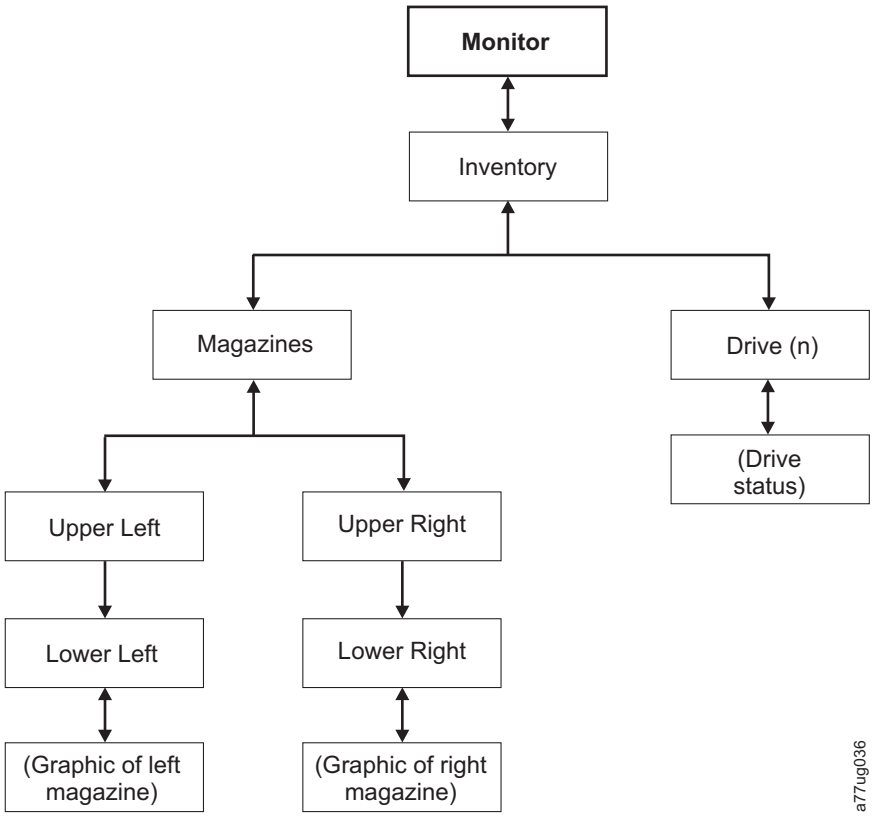


Figure 4-6. Example of a 4U Monitor: Inventory menu

Under **Magazine** choose one of the following to see a graphical representation of the cartridge magazine(s). Slots containing cartridges will be highlighted.

- Upper Left - choose this option to see the upper left magazine
- Upper Right - choose this option to see the upper right magazine
- Lower Left - choose this option to see the lower left magazine
- Lower Right - choose this option to see the lower right magazine

Press **Enter** to display all empty slots and cartridge serial numbers in the associated magazine.

Under **Drive (n)** will be displayed the serial number of the cartridge currently in the drive or "Empty".

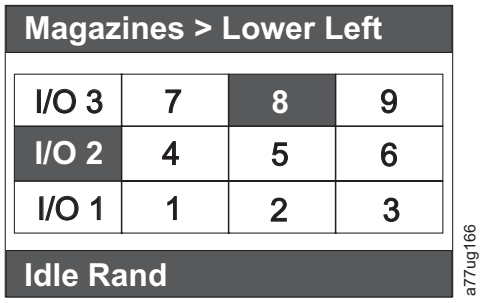


Figure 4-7. Overview of inventoried cartridges: Lower Left Magazine

The black boxes are inventoried cartridges. Press the up and down keys to scroll. Note that this magazine has a 3-slot I/O Station. These slots can be changed to storage slots if needed. See "Configuring I/O Stations and Reserving Slots" on page 1-7.

Control Menu

The Control Menu contains the following items:

- Open I/O Station
- Move Cartridges
- Magazine
- Re-Inventory

Control: I/O Station

Use this menu item to open the I/O Station.

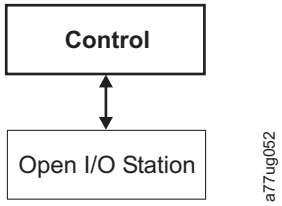


Figure 4-8. Control: I/O Station menu

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

Control: Move Cartridges

Use this menu item to move cartridges in the library.

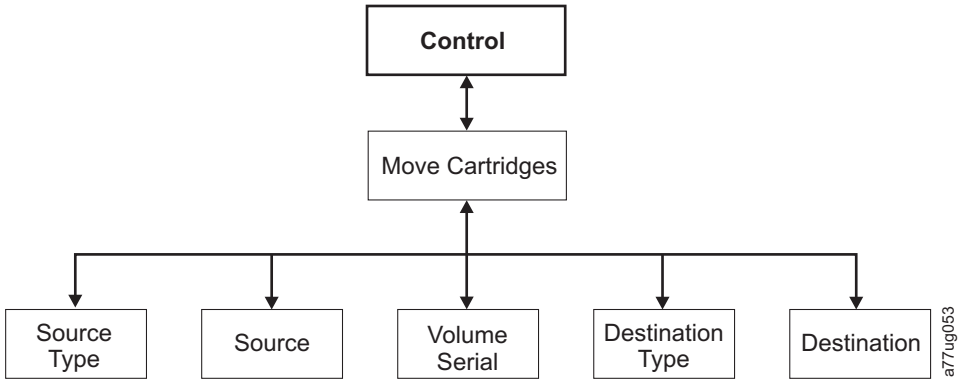


Figure 4-9. Control: Move Cartridges menu

To move a cartridge from point A to point B, you must make the following choices:

- Source Type - Drive, I/O station, magazine. Only the source type(s) that contain cartridges will be listed.
- Source - the choices start with the choice made in the preceding item and then advances through all available choices.

  Note: If the Attention LED is ON due to a suspect cartridge, that cartridge will be identified by an exclamation point (!) when scrolling through the source cartridges.
- Volume Serial - the serial number of the cartridge
- Dest Type - the destination Drive, I/O station, magazine
- Dest - the choices start with the choice made in the preceding item and then advances through all available choices.

Control: Magazine

Use this menu item to unlock the cartridge magazines.

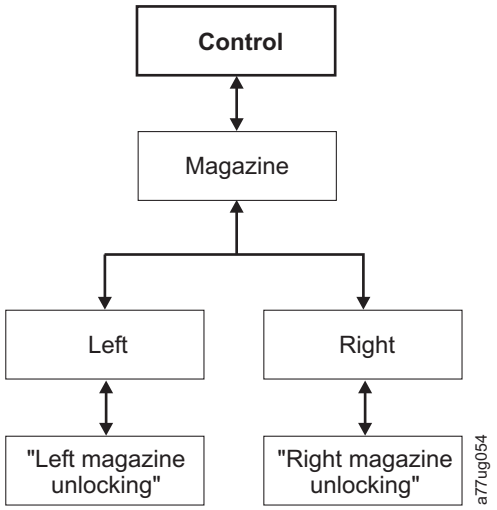


Figure 4-10. Control: Magazine menu

Choose ″Left″ or ″Right″ to unlock the corresponding cartridge magazine(s). The magazines can now be removed from the library by gently pulling each magazine

out of the library. To replace a magazine, insert the back of the magazine into the front of the library and gently push the magazine into the library. The magazine will lock when inserted into the library.

If the magazines are not pulled out of the library within 15 seconds after they are unlocked, the command will cancel and you will have to repeat the process to unlock the magazines.

Control: Re-Inventory

Use this menu item to initiate a scan of the cartridges currently in the library.

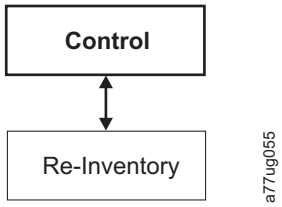


Figure 4-11. Control: Re-Inventory menu

Note: It may take up to five minutes to complete the library inventory.

Configure Menu

The Configure Menu is used during the initial setup of your library and when changes need to be made to your library's configuration. This menu contains the following items:

- Logical Libraries
- Library Settings
- Drive
- Network
- Set Access PIN
- Set Date and Time
- Path Failover
- Restore Defaults

Configure: Logical Libraries

Use this menu item to select the number of logical libraries.

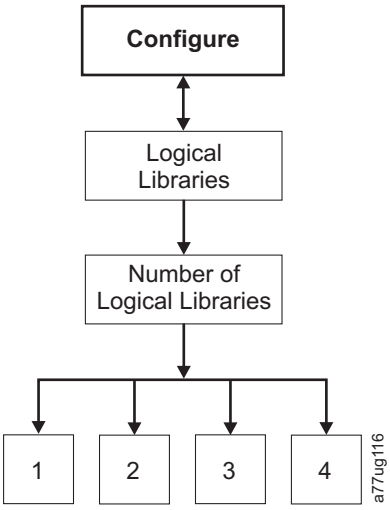


Figure 4-12. Configure: Logical Libraries menu

Note: This menu is only available on libraries with multiple drives.

Configure: Library

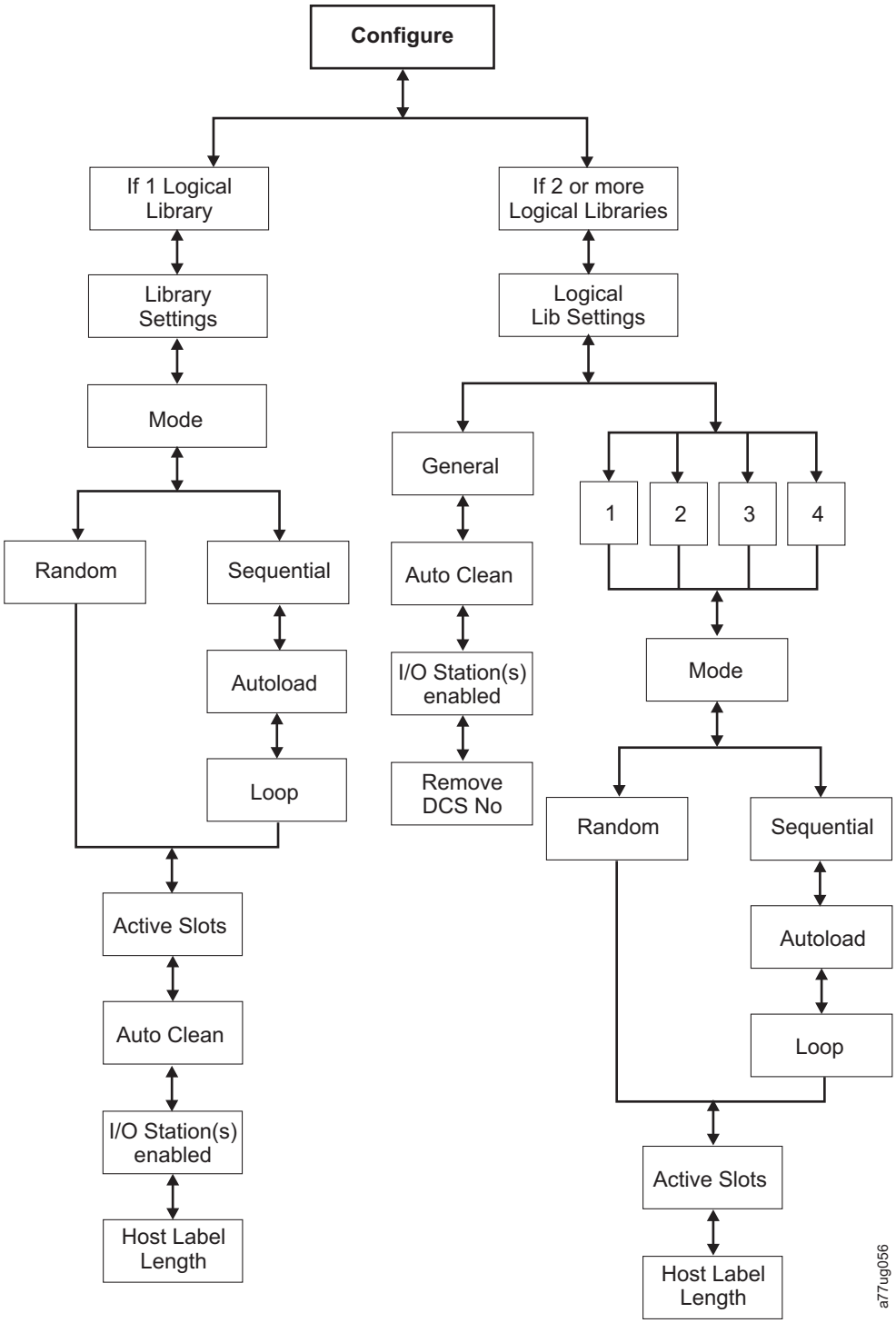


Figure 4-13. Configure: Library menu

The following library configuration items are in this menu:

- **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 I/O Station through slot 23) for loading into the drive.
  - **Autoload**: Sequential mode with autoload mode ON loads the first available cartridge (slot with the lowest numerical value that contains a cartridge) automatically if the library powers ON with an empty drive.
  - **Loop**: Sequential mode with loop mode ON loads the cartridge in the lowest numerical slot after the cartridge in the highest numerical slot has been filled and sent back to its home slot. This allows endless backup operations without user interaction.
  - **Starting Sequential Mode**
    - Autoload Option:
      – If the Autoload option is set to **ON** (**Configure** → **Library** → **Autoload**), the accessor will load the first cartridge (cartridge located in the slot with the lowest numeric value) found in the storage inventory area into the drive upon power ON of the library. If the library powers on with a cartridge already in the drive, sequential mode will start with that cartridge unless the host issues a rewind and unload command to the drive. In that case, the next cartridge in sequence will be loaded into the drive.
      – If the Autoload Option if **OFF**, sequential mode must be started by selecting the Move Cartridges option (**Control** → **Move Cartridges**) to load the first cartridge (or any cartridge) into the drive. Whatever cartridge is loaded into the drive, that is where the sequence starts from. For example, if a cartridge from the fifth lowest numeric storage slot containing a cartridge is loaded using the Move Cartridges option, after the host issues a rewind/unload command, the next cartridge loaded will be the cartridge from the next higher numeric slot. Cartridges need not be in contiguous slots.
    - Loop Option:

      If the Loop option is set to **ON** (**Configure** → **Library** → → **Loop**), when the last cartridge (cartridge in the highest numeric slot) is unloaded and placed back into storage, the accessor will immediately start over again loading the first cartridge into the drive.
  - **Stopping Sequential Mode**: To stop sequential mode, use the Move Cartridges option from the Control menu (**Control** → **Move Cartridges**) to unload the drive. the next sequential cartridge will NOT be loaded. To restart sequential mode, use the same Control menu command to load a cartridge. The loading sequence will resume from that numeric slot in the cartridge inventory.

- **Active Slots** - the number of active slots you want to assign to each logical library.

  Note: Slots can be reserved so that they are invisible to the host. It may be necessary to set the number of **Active Slots** to match the number of slots that are available to the ISV software.

- **Auto Clean** - Use this menu item to enable the Auto Clean function. All cleaning cartridges must have ″CLNxxxLx″ as part of the bar code.

  The cleaning cartridge can be stored in any data cartridge slot.

  Note: The universal cleaning cartridge has a bar code CLNUxxLx. This cleaning cartridge is used to clean all LTO generation tape drives.

For Auto Clean to function, the following criteria must be met:

- On 4U libraries with library firmware of 1.95 or lower that still contain a Dedicated Cleaning Slot (DCS), or 4U libraries with library firmware higher than 1.95 that chose to retain the DCS in their library, a CLN cartridge must be present in that slot.
- On libraries that don't have a DCS, a storage slot must be reserved (RSVD) by reducing the active slot count by one.
- A cleaning cartridge (CLNxxxLx) must be placed or moved to the reserved slot.
- Auto Clean must be enabled.

Note: Cleaning cartridges must be replaced after 50 cleanings. The web inventory screen will show the number of cleaning sessions remaining.

- **I/O Station(s) enabled** - The I/O Station(s) can be enabled (the default), or disabled so the stations can be utilized as storage slots.
- **Remove DCS No** - If the DCS has been removed, it cannot be reinstated. This option will no longer appear in the Operator Panel.
- **Host Label Length** - The Host Label Length is related to the Bar Code Labels appearing on the media being used. The default value is **8**, but **6** can also be chosen.

Configure: Drive

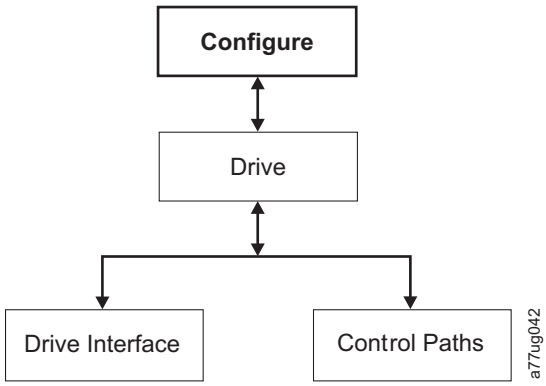


Figure 4-14. Configure: Drive menu

The following items are in this menu:

- **Drive Interface** - use this to assign a SCSI ID to a SCSI drive or to assign a Port Speed, Port Type, and Loop ID to a Fibre Channel or SAS drive. For more information on drive interfaces, refer to "Host Interfaces" on page 1-11.
- **Control Paths** - use this to enable the drive as a control path drive. Each logical library must have a control path drive; however, all drives in a logical library can be designated as control path drives.

Configure: Network

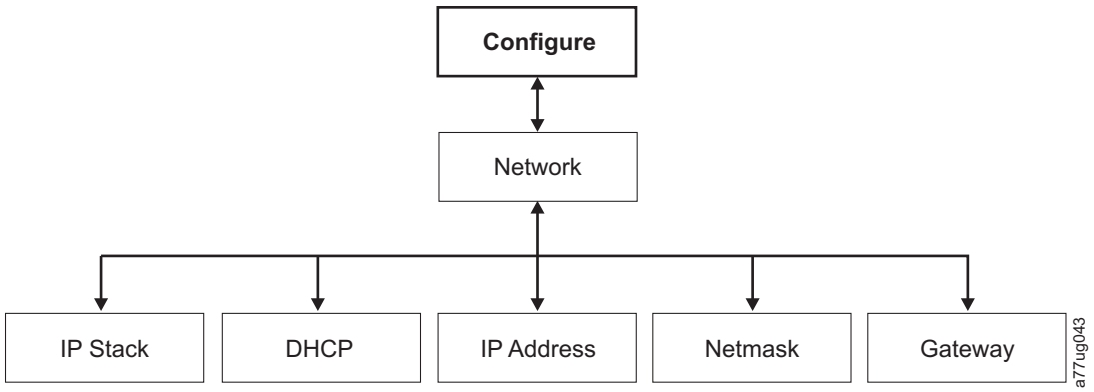


Figure 4-15. Configure: Network menu

Use these menu items to change the current network settings which allow you to access the library remotely via a web browser.

- **IP Stack** - Choose **IPv4 only**, **IPv6 only**, or **IPv4 & IPv6**.
- **DHCP** - (Dynamic Host Configuration Protocol) If this is enabled, your library host will negotiate the connection with the library. If DHCP is disabled, the following information is necessary to establish the remote access.
- **IP Address**
- **Netmask**
- **Gateway**

Configure: Set Access PIN

Use this menu item to enable/disable, set or change the Access PIN (personal identification number) which is used to restrict access to the Control, Configure, and Service menus.

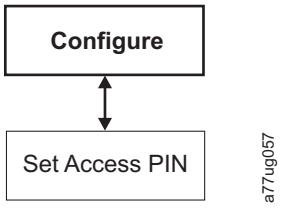


Figure 4-16. Configure: Set Access PIN menu

Configure: Restore Defaults

Use this menu item to restore the factory default settings.

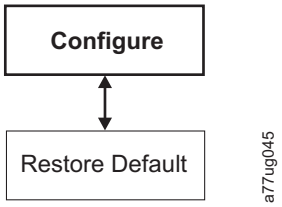


Figure 4-17. Configure: Restore Defaults menu

Important: Restoring factory defaults will wipe out all the previous configuration data.

Table 4-3. Factory Default Settings

Restored Item	Default Setting*	Comments
Autoclean	Disabled	
Logical Libraries	1	
Active Slots	Maximum	
I/O Slots	Enabled	
Encryption	None	
DHCP	Enabled	
IPv4/IPv6 Default Setting	IPv4 Only	
Bar Code Label Length	8	
SNMP	Disabled	
Event Notification	Disabled	
User Access		Restore from OCP or RMU
Admin	secure	(default)
User	std001	(default)
Library Mode	Random	
Library Name	Default	(Depends on MAC Address)
Logs & Traces	Continuous	
Path Failover Key	No change	Key is protected
Drives		
Power	Power On	(All drives)
Drive 1 SCSI-ID	4	SCSI Drives
Drive 2 SCSI-ID	5	SCSI Drives
Drive 3 SCSI-ID	6	SCSI Drives
Drive 4 SCSI-ID	8	SCSI Drives
Drive 1 Loop-ID	4	FC Drives Arbitrated Loop
Drive 2 Loop-ID	5	FC Drives Arbitrated Loop
Control Path Drive	Drive 1 only	
Speed	Auto	FC Drives (all)
Topology	LN-Port	FC Drives (all)
Note: * = all settings at library firmware level 4.xx and greater		

In some cases, (such as Library Mode), the entry of one option precludes any other options from being selected. In such cases, the details of the non-applicable options are not shown.

Configure: Set Date and Time

Use this menu item to set the current date and time in your library.

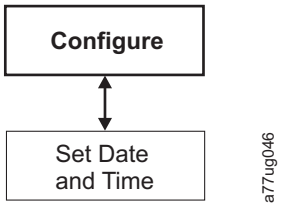


Figure 4-18. Configure: Set Date and Time menu

Configure: Path Failover

Use this menu item to enter the Path Failover Feature Activation key (4U library only).

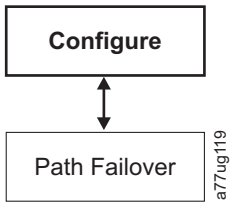


Figure 4-19. Configure: Path Failover

Note: Path Failover is a combination of two previous features: Control Path Failover (key entered at the library user interface) and Data Path Failover (key entered at the device driver interface). A single activation key entered at the library user interface now activates both features unless the LTO-3 drive firmware level is equal to or lower than 69U2 and/or the library firmware is equal to or lower than 1.95. For either or both of these two cases, the device driver interface Data Path Failover key activation will still be required. The Path Failover feature is available for select LTO 4 tape drives. Path Failover is not supported for half high drives.

Service Menu

The 2U/4U library is always online, except for when the user enters the Service Library area. A warning message appears stating that the library should be taken offline from the host before performing any Service functions. It is up to the operator to ensure that it is taken offline by phoning the host operator or other means of communication. Before performing any service functions, ensure the host is not performing any data writing or retrieval.

The **Service Menu** contains the following items:

- Library Verify - an overall library diagnostic
- Run Tests - other library diagnostics
- Service - diagnostics and procedures for servicing the drive
- Display Contrast - setting the display from light to dark

Service: Library Verify

This is an overall diagnostic that exercises all library components. To run the Library Verify test, complete the following procedure.

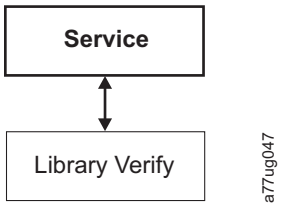


Figure 4-20. Service: Library Verify menu

1. When prompted by the Operator Control Panel display and the I/O Station opens, insert a blank or scratch data cartridge.
2. Close the I/O Station by pushing it back into the library.
3. While the test is running, the Operator Control Panel will display library status.
   - If the test PASSES, resume normal library operations.
   - If the test FAILS, an error code will be displayed. Make note of the error, then refer to Chapter 6, "Troubleshooting," on page 6-1.
   - When prompted by the Operator Control Panel display and the I/O Station opens, remove the cartridge used in the test.
   - Close the I/O Station by pushing it back into the library.
   - Press **Cancel** to exit the Library Verify screen.

Service: Run Tests

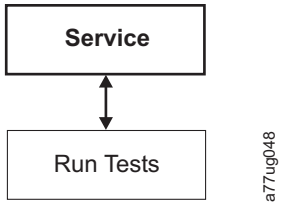


Figure 4-21. Service: Run Tests menu

The following library diagnostics are available in this menu:

- **System Test** - this test exercises library components by moving customer data cartridges from slots to drives and back to slots. No data is written or read from the customer tapes. To run this test successfully, the library must contain at least one data cartridge for every drive present in the library.
- **Slot to Slot Test** - The Slot To Slot test will move each resident data cartridge from one slot to another, for each test cycle requested. When completing the Slot To Slot test, you will need to **Inventory** your library before placing it back online, since this test scrambles the cartridge slot locations.

  Note: After running the Slot to Slot Test, the library will need to be re-inventoried.

Service: Service (Drives)

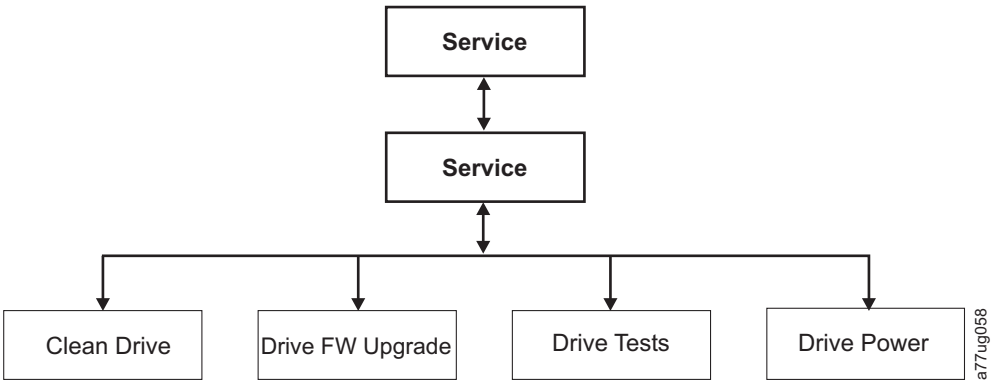


Figure 4-22. Service: Service menu

The following drive diagnostics and service procedures are available in this menu:

- **Clean Drive** - The accessor takes the cleaning cartridge from the dedicated cleaning cartridge slot (DCS), or previously reserved slot if no DCS is available, and inserts it into the drive. After the cleaning is complete, the accessor removes the cleaning cartridge from the drive and returns it to the dedicated cleaning cartridge slot or reserved slot.
- **Drive FW Upgrade** - allows drive firmware to be upgraded using a customer-supplied FMR (firmware) cartridge
- **Drive Tests** - Power On Self Test (POST), Wrap Test, Normal Read/Write Test, Head Test, Media Test
  1. Navigate to the desired test (**Service** → **Service** → **Drive Tests**). Choose the drive if more than one is installed.
  2. Follow the instructions, and, if required, insert a blank or scratch cartridge into the I/O Station when requested.
  3. The test will execute.
     - If the test PASSES, resume normal library operations.
     - If the test FAILS, an error will be displayed. Make note of the error, then refer to "Isolating Drive Sled Problems" on page 6-6.
  4. Remove the cartridge from the I/O Station, if needed, then close the I/O Station.
  5. Press **Cancel** to exit the screen.
- **Drive Power** - use this item to turn drive power ON and OFF

Service: Display Contrast

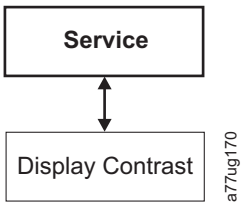


Figure 4-23. Service: Display Contrast menu

The following display contrast settings are available in this menu:

- The numbers **1** through **10** will display, with **10** being the lightest shade and **1** being the brightest.

Web User Interface Menus

The following menus are available on the Web User Interface.

Table 4-4. Web User Interface Menus

- **Monitor Library**
  - Library Identity
  - Drives Identity
  - Library Status
  - Drives Status
  - Inventory
- **Configure Library**
  - General
  - Logical Libraries
  - Path Failover
  - Encryption
  - Drives
  - Network
  - User Access
  - Date & Time
  - Logs & Traces
  - Event Notification
  - Restore Defaults
- **Manage Library**
  - Move Media
  - Perform Inventory
  - Release Magazine
- **Service Library**
  - Clean Drive
  - Advanced Diagnostics (for Service Personnel only)
  - View Logs
  - View Drive Logs
  - Save Drive Dump
  - Perform Diagnostics
  - Upgrade Firmware
  - Reboot

Monitor Library Menu

The **Monitor Library** menu contains the following sub-menu items.

- "Monitor Library: Library Identity" on page 4-28
- "Monitor Library: Drive Identity" on page 4-29
- "Monitor Library: Library Status" on page 4-30
- "Monitor Library: Drive Status" on page 4-31

- "Monitor Library: Inventory" on page 4-33

Monitor Library: Library Identity

This page provides access to the static information about the library. No changes can be made from this page. Table 4-5 lists all available elements on the Library Identity page. An "X" indicates that the element displays for the specified library type.

Table 4-5. Library Identity page elements

Menu Item	Description	2U	4U
Serial Number	This is the unique identification number assigned by the manufacturer.	X	X
Product ID	This is the SCSI inquiry string of the library	X	X
Currently Installed Library Firmware	This is the current level of firmware installed on the library. To ensure you are running the latest version of firmware, visit http://www.ibm.com. For information on updating your firmware, refer to "Service Library: Upgrade Firmware" on page 4-47.	X	X
Bootcode Firmware Revision	This is the level of bootcode firmware currently installed on the library. Bootcode is the firmware that allows the library to begin initialization when it is powered ON.	X	X
IP Address	This is Internet Protocol Address assigned to your library.	X	X
MAC Address	This is the machine's access code assigned to your library.	X	X
WWide Node Name	This is the Worldwide Node Name assigned to your library.	X	X
Logical Library *x* Library Mode	The **Extended Logical Libraries Information** table displays information about the logical libraries currently assigned in your library. For each logical library in your library, either Random or Sequential will be displayed.	X	X

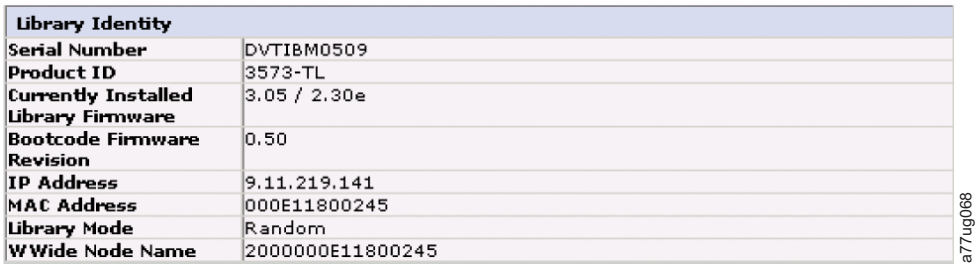


Figure 4-24. The 2U library Monitor Library: Library Identity page

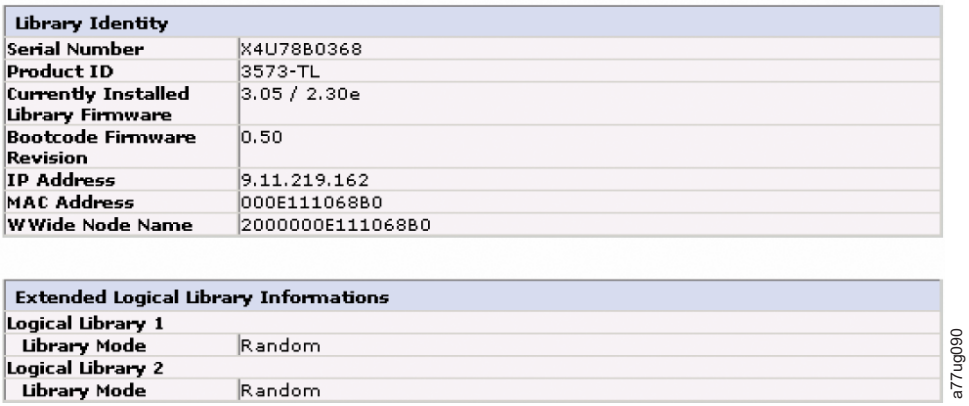


Figure 4-25. The 4U library Monitor Library: Library Identity page

Monitor Library: Drive Identity

This page provides the following detailed information about the drive. No changes can be made from this page. The displayed information will vary depending on the library model and drive type (SCSI, SAS, or Fibre Channel). Table 4-6 lists all available elements on the Drive Identity page. An ″X″ indicates that the element displays for the specified drive type.

Table 4-6. Drive Identity page elements

Menu Item	Description	2U Library			4U Library		
		SCSI	Fibre	SAS	SCSI	Fibre	SAS
Vendor ID	This identifies the manufacturer of the tape drive.	X	X	X	X	X	X
Product ID	This is the SCSI inquiry string of the tape drive.	X	X	X	X	X	X
Serial Number	This is the unique identification number of the tape drive that was assigned by the manufacturer.	X	X	X	X	X	X
Firmware Revision	This is the current level of firmware installed on the drive. To ensure you are running the latest version of firmware, visit http://www.ibm.com. For information on updating your firmware, refer to “Service Library: Upgrade Firmware” on page 4-47.	X	X	X	X	X	X
SCSI ID	This is the unique identifier assigned to the SCSI drive to enable it to receive communications from the host computer.	X			X		
Element Address	This is the unique identifier assigned to the drive that allows the host to recognize and communicate with the drive.	X	X	X	X	X	X
Control Path Drive	If the drive communicates all messages from the host to the library, then it is considered the control path drive. If the drive is the control path drive, this element displays ″Yes.″ If not, this element displays ″No.″ All drives in a logical library may be a control path drive.	X	X	X	X	X	X
Data Compression	If the drive is compressing data, this element displays ″Yes.″ If not, this element displays ″No.″	X	X	X	X	X	X
Interface Type	This identifies Fibre Channel drives.		X			X	

Table 4-6. Drive Identity page elements (continued)

Menu Item	Description	2U Library			4U Library		
		SCSI	Fibre	SAS	SCSI	Fibre	SAS
Node Name	This is the Worldwide node Name assigned to a Fibre drive.		X			X	
Worldwide ID	This is the Worldwide ID assigned to a SAS drive.			X			X
Port A	This port is always ″enabled.″		X	X		X	X
Port Name	This is the name assigned to Port A on the drive.		X	X		X	X
Topology	This is the type of connection to the host.		X			X	
FC-AL Loop ID	This is the Fibre Channel - Arbitrated Loop ID of the drive.		X			X	
Speed	This is the current speed setting of the drive. Choices are Auto (where the drive will automatically negotiate the speed of the drive to match that of the server), 1Gb/s, 2Gb/s or 4 Gb/s.		X			X	
Port B	This port is enabled for full high SAS drives only.			X			X

Figure 4-26. The 4U library Monitor Library: Drive Identity page showing one Fibre Channel drive (#1) and one SCSI drive (#2)

Monitor Library: Library Status

This page displays the dynamic information about the library, such as the current status of the components. No changes can be made from this page. Table 4-7 on page 4-31 lists all available elements on the Library Identity page. An ″X″ indicates that the element displays for the specified library type.

Table 4-7. Library Status page elements

Menu Item	Description	2U	4U
Status	Library status is displayed using icons with text. A checkmark with the word ″Ready″ indicates the library is functioning properly. An exclamation point with the word ″Caution″ indicates the library can function, but is experiencing a problems. An X with the word ″Error″ indicates the library is not functioning because of a serious problem.	X	X
Cartridge in Transport	This identifies a cartridge that is currently being moved by the accessor. ″None″ is displayed if no cartridge is being moved.	X	X
Number of Moves	This is the number of times the accessor has moved a cartridge from Point A to Point B (for example, from a storage slot to a drive).	X	X
Total Power On Time	This is the total amount of time that the library has been powered ON.	X	X
Robotic Status	This is the current status of the accessor.	X	X
Left Magazine	This displays whether the left magazine is ″Present″ or ″Not Present″.	X	
Right Magazine	This displays whether the right magazine is ″Present″ or ″Not Present″.	X	
1. Left Magazine	This displays whether the lower left magazine is ″Present″ or ″Not Present″.		X
1. Right Magazine	This displays whether the lower right magazine is ″Present″ or ″Not Present″.		X
2. Left Magazine	This displays whether the upper left magazine is ″Present″ or ″Not Present″.		X
2. Right Magazine	This displays whether the upper right magazine is ″Present″ or ″Not Present″.		X

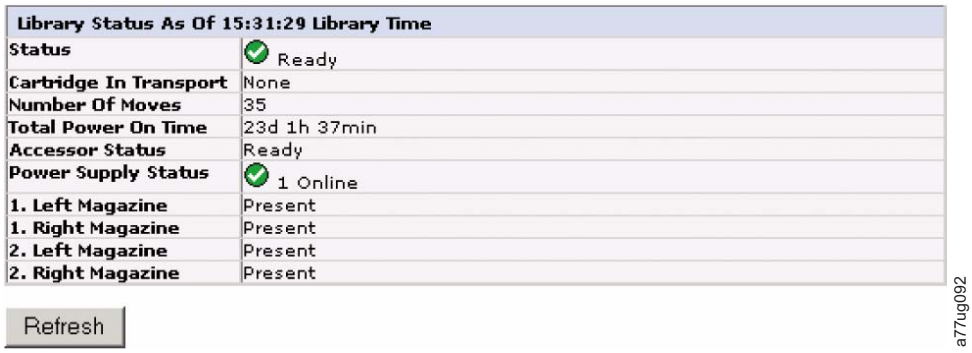


Figure 4-27. The 4U library Monitor Library: Library Status page

Monitor Library: Drive Status

This page provides the following detailed dynamic information about the drive in the library. No changes can be made from this page. The displayed information will vary depending on the library model and drive type (SCSI, SAS, or Fibre Channel). Table 4-8 on page 4-32 lists all available elements on the Drive Status page. An ″X″ indicates that the element displays for the specified drive type.

Table 4-8. Drive Status page elements

Menu Item	Description	2U Library			4U Library		
		SCSI	Fibre	SAS	SCSI	Fibre	SAS
Status	This is the current status of the drive. A checkmark indicates that the drive is operating properly. An exclamation point indicates that the drive is operating but has a problem. An X indicates that the drive is not operational because of a serious problem.	X	X	X	X	X	X
Cartridge in Drive	This is the serial number of the cartridge currently in the drive. If the drive does not contain a cartridge, ″None″ is displayed.	X	X	X	X	X	X
Drive Error Code	If the drive has generated an error code, it is displayed here. If the drive has not generated an error, ″No Error″ will be displayed.	X	X	X	X	X	X
Cooling Fan Active	This indicates whether the drive cooling fan is ″On″ or ″Off″.	X	X	X	X	X	X
Drive Activity	This indicates whether or not the drive is operating.	X	X	X	X	X	X
Port A Status	This indicates whether Port A is logged on or out.		X	X		X	X
Port Name	This is the name assigned to Port A on the drive.		X			X	
Speed	This is the current speed setting of the drive. Choices are Auto (where the drive will automatically negotiate the speed of the drive to match that of the server), 1Gb/s, 2Gb/s, or 4Gb/s.		X			X	
Topology	This is the type of connection to the host.		X			X	
FC-AL Loop ID	This is the Fibre Channel - Arbitrated Loop ID of the drive.		X			X	
Hashed SAS Address	The Hashed SAS address is a value which is calculated from the WWID for use on the SAS interface			X			X

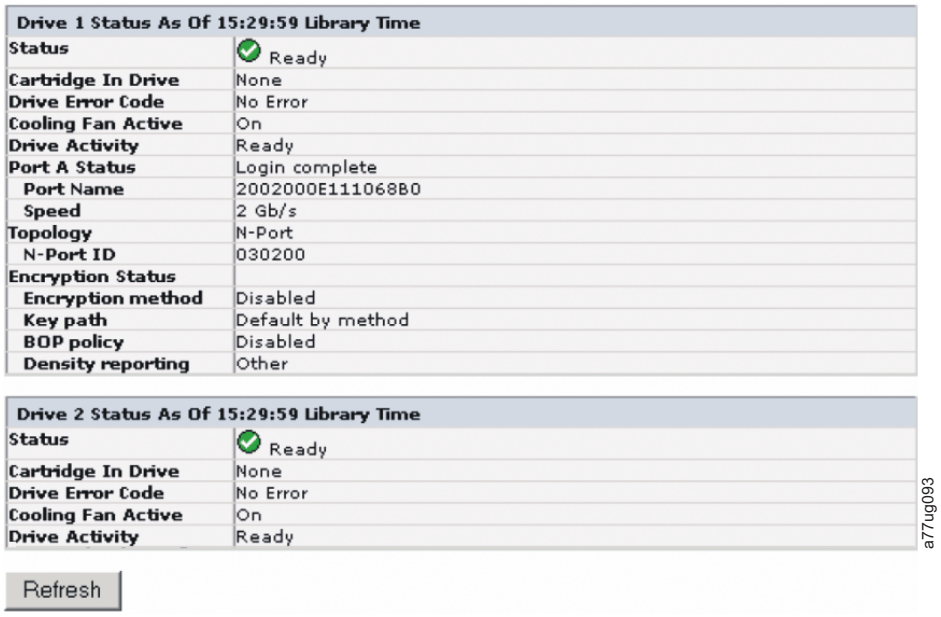


Figure 4-28. The 4U library Monitor Library: Drive Status page

Monitor Library: Inventory

This page provides detailed information about the tape inventory in the library. A summary of each magazine is shown. To get detailed information, click on the + button. This will expand the display for the magazine.

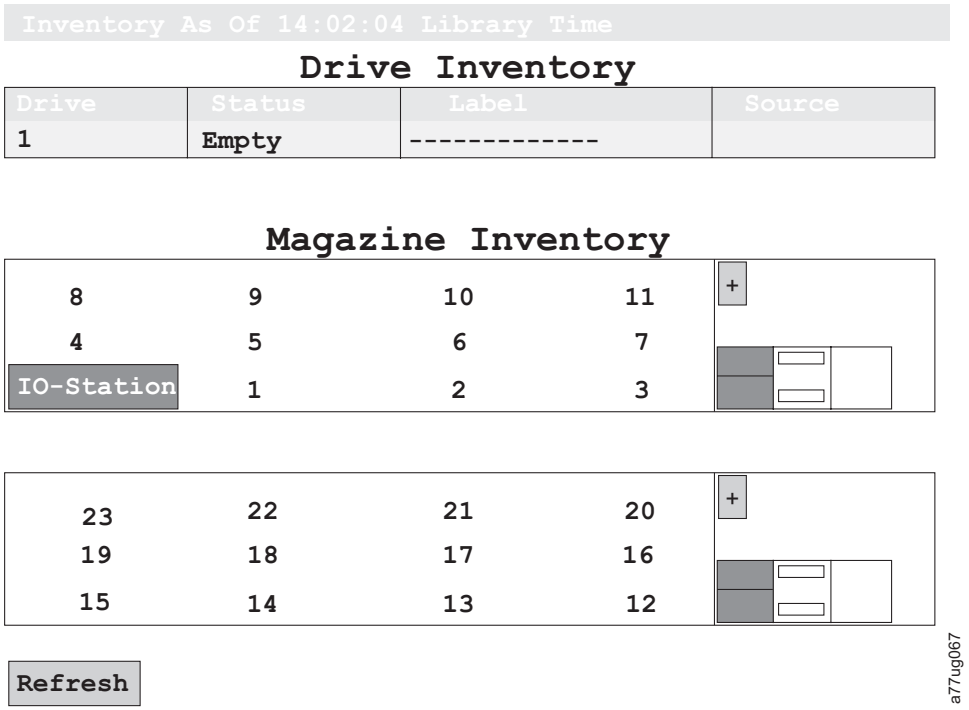
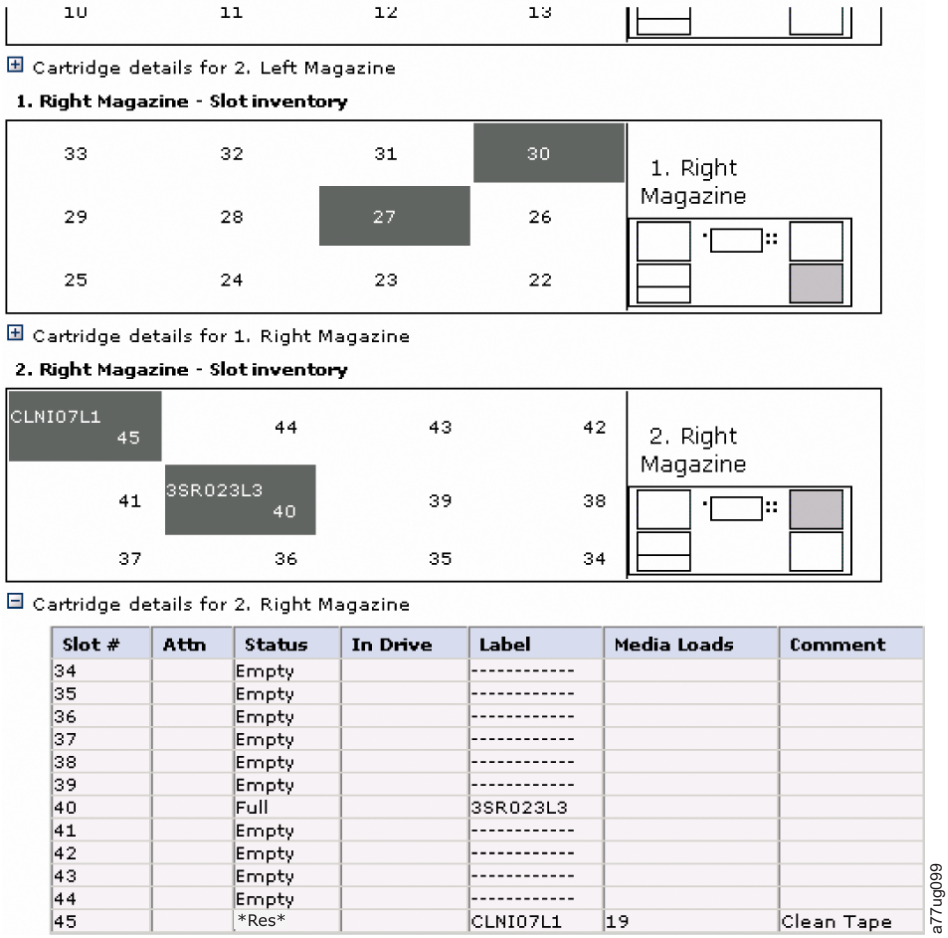


Figure 4-29. The 2U library Monitor Library: Inventory page

Note: On some 2U Libraries prior to Library Microcode Level 1.9, slot 11 may be labelled a "Not Used" slot which contained a "Slot Blocker". With Library Microcode level 1.9 or higher, there is an option to remove the "Slot Blocker" and place that slot into use. See "Removing the Slot Blocker - 2U Library" on page 9-4.



Slot #	Attn	Status	In Drive	Label	Media Loads	Comment
34		Empty		----------		
35		Empty		----------		
36		Empty		----------		
37		Empty		----------		
38		Empty		----------		
39		Empty		----------		
40		Full		3SR023L3		
41		Empty		----------		
42		Empty		----------		
43		Empty		----------		
44		Empty		----------		
45		*Res*		CLNI07L1	19	Clean Tape

Figure 4-30. The 4U library Monitor Library: Inventory page

Configure Library Menu

The **Configure Library** menu contains the following sub-menu items:

- "Configure Library: General" on page 4-35
- "Configure Library: Logical Libraries" on page 4-36
- "Configure Library: Path Failover" on page 4-36
- "Configure Library: Encryption" on page 4-37
- "Configure Library: Drives" on page 4-38
- "Configure Library: Network" on page 2-19
- "Configure Library: User Access" on page 4-40
- "Configure Library: Date & Time" on page 4-41
- "Configure Library: Logs & Traces" on page 4-42
- "Configure Library: Event Notification" on page 4-42
- "Configure Library: Restore Defaults" on page 4-43

Configure Library: General

This page allows you to make changes to general library configuration elements. As changes are made, they will only be applied after the **Apply Selections** or the **Submit** button is selected. After making the selection, a warning page will inform you of the impact of the proposed change. In some cases a pop-up screen will ask for confirmation. Many changes will also require a library reboot.

Table 4-9. Configure Library: General page elements

Menu Item	Description	2U	4U
Library Name	This is a name that is assigned to your library for ease of identification.	X	X
I/O Station	The I/O Station defaults to **I/O Station Enabled**. Choosing **Disabled** (no checkmark) adds one more storage slot to the 2U library, and 3 more storage slots to the 4U library. When the I/O Station is disabled, removing or adding media to the library must be performed by releasing the left and/or right magazine(s).	X	X
Auto Clean	Auto Clean defaults to **Disabled**. For Auto Clean to function, a cleaning cartridge (CLNxxxLx) must be resident in a reserved library slot and Auto Clean must be enabled (turned on).	X	X
Bar Code Label Length Reported To Host	The default bar code label length is **8**, but can be set to 6. The bar code label length is a ″reported″ length. This setting will cause the host computer to only see the first 6 characters of the label or all 8 characters. This setting does not affect the bar code label that is shown on any of the library user interfaces (always shows all 8 characters).	X	X

Table 4-10. Configure Library: Specific page elements

Menu Item	Description	2U	4U
Library Mode	Choices are Random and Sequential. If you choose Sequential, you may also activate Autoload and/or Loop. If there is more than one logical library, there is a Library Mode entry for each logical library.	X	X
Active Slots	It may be necessary to modify the number of active slots to agree with the number of slots allowed by your host software. To modify the number of active slots in your library, click on the drop down list and select the number of slots you want active in your library. Also, the Auto Clean function requires the cleaning cartridge to be in a DCS or reserved slot. Reserved slots are created by reducing the number of active slots.	X	X

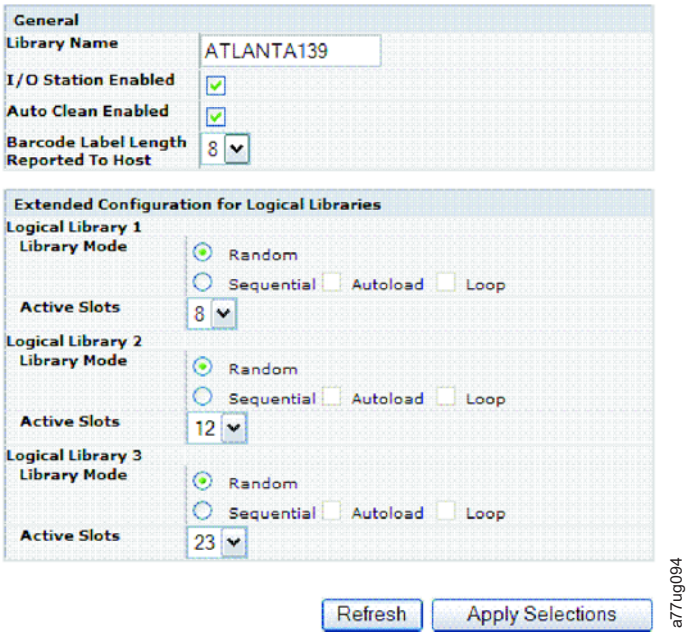


Figure 4-31. The 4U library Configure Library: General and Extended page

Configure Library: Logical Libraries

To partition your multi-drive library, select the number of logical libraries you would like to create in your library, then click **Submit**.

One cartridge magazine cannot be assigned to two logical libraries. If you partition a multi-drive library, each of the magazines must be assigned to a logical library on a magazine boundary. The entire magazine must be part of one logical library only. In a fully populated 4U library with two logical libraries, resource assignments will be as follows:

- Logical Library 1 will contain Drive 1 and the left cartridge magazines.
- Logical Library 2 will contain Drive 2 and the right cartridge magazines.

The I/O Station and the reserved slot (or dedicated cleaning slot (DCS) if one is assigned) are shared among all logical libraries.

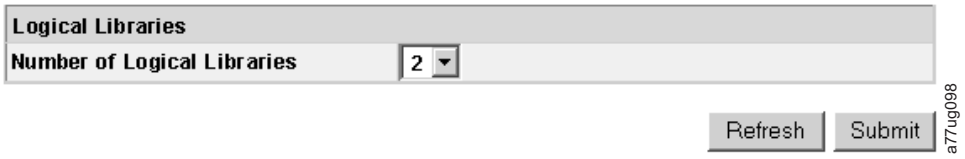


Figure 4-32. The 4U library Configure Library: Logical Libraries page

Configure Library: Path Failover

This page allows the user to enter the Path Failover feature activation key.

Note: Path Failover feature now covers what used to be two features; Control Path Failover and Data Path Failover. The Control Path Failover Activation key is entered at the Library. The Data Path Failover Activation key is not entered at the Library. Data Path Failover is a host implementation, available for

select LTO 4 tape drives. Path Failover is not supported for half high drives.

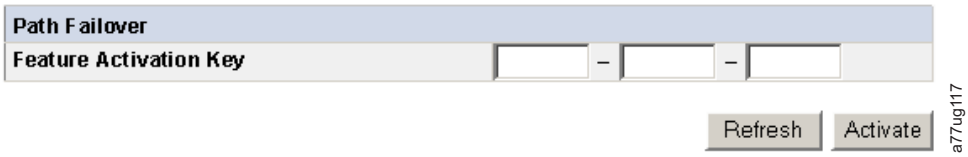


Figure 4-33. The 4U library Configure Library: Path Failover page

After clicking **Activate**, this page will display if you have entered the feature key correctly.

Figure 4-34. Path Failover license verification page

Configure Library: Encryption

This page shows the current encryption configuration of the library and allows modification to the configuration.

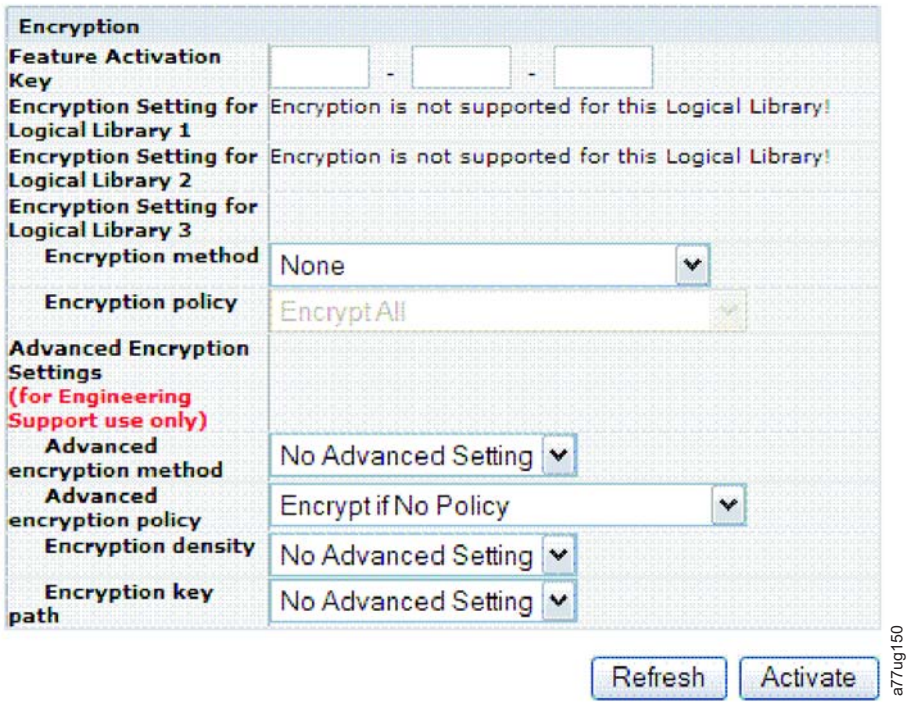


Figure 4-35. Configure Library: Encryption Feature Activation screen

The library firmware should always allow the user to select ″None″ or ″Application Managed Encryption″ from the web user interface, as long as there is at least one encryption capable drive in the logical library. If a valid Transparent Encryption license key has been previously entered, ″System Managed Encryption″ or ″Library Managed Encryption″ can be selected. The factory default should be ″None.″

The Advanced Encryption Settings are for Engineering Support use only.

Configure Library: Drives

This page allows you to modify the current ID assigned to the drive. You can also select **Power ON** through this page for a SCSI library. The displayed information will vary depending on the library model and drive type (SCSI, SAS, or Fibre Channel). Table 4-11 lists all available elements on this page. An "X" indicates that the element displays for the specified drive type.

Table 4-11. Drive Identity page elements

Menu Item	Description	2U Library			4U Library		
		SCSI	Fibre	SAS	SCSI	Fibre	SAS
SCSI ID	For each SCSI drive, click on the drop down list and select the number of the slot in which the drive is located.	X			X		
Power On	For each drive, click in the box to power ON the selected drive.	X	X	X	X	X	X
Control Path	The control path drive communicates messages from the host to the library. Select this option for each drive that you want to be a control path drive. At least one drive in each logical library must be designated as a control path drive.	X	X	X	X	X	X
Port A Configuration:							
Speed	For each Fibre Channel drive, click on the drop down list and select Automatic, 1Gb/s, 2Gb/s, or 4 Gb/s. Selecting Automatic will allow library speed to automatically negotiate to the current server speed.		X			X	
Port Type	For each Fibre Channel drive, click LN-Port, L-Port, or N-Port.		X			X	
Loop ID	This is the loop position number if the drive is in an arbitrated loop configuration.		X			X	
Port B Configuration:							
	Port B is supported for SAS full high drives only.			X			X

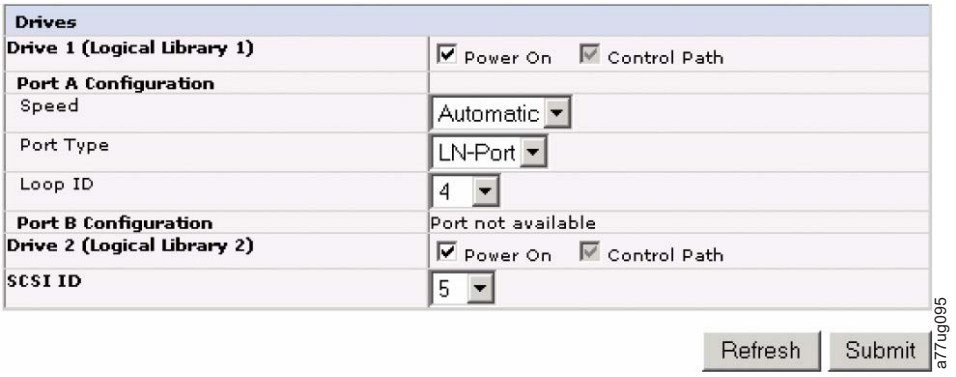


Figure 4-36. The Configure Library: Drive page for a 4U library

Configure Library: Network

This page shows the current network configuration of the library and allows modification to the configuration. When a change is requested, a pop-up box will

ask to confirm the changes.

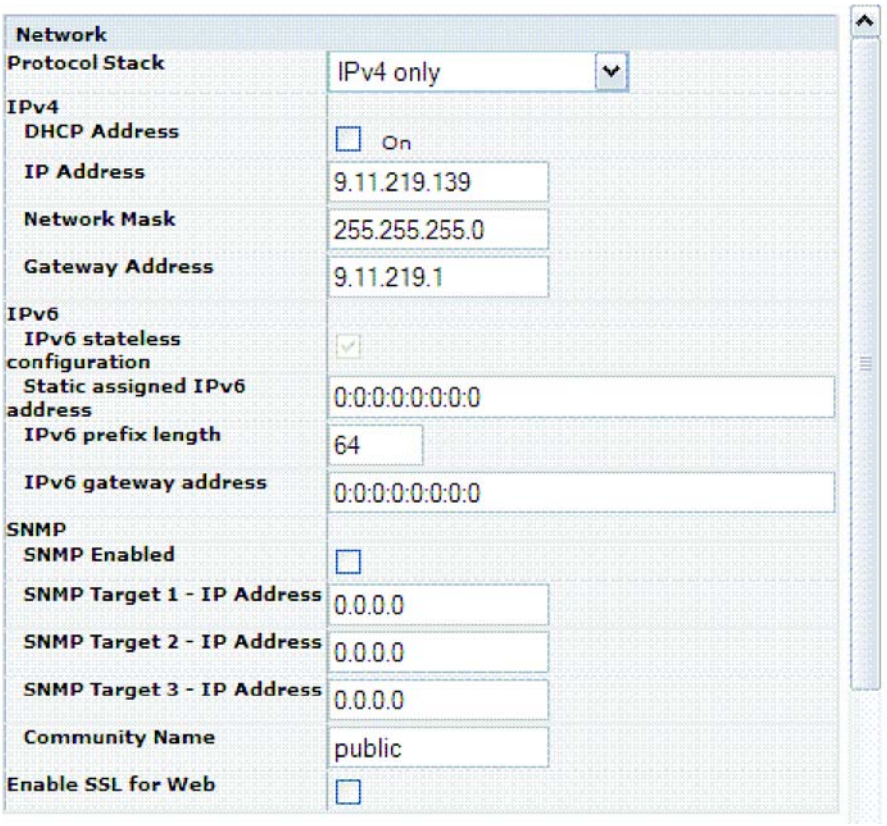


Figure 4-37. Configure Library: Network page

The following elements are displayed on the **Network** page.

Network

Protocol Stack

Choose **IPv4 only**, **IPv6 only**, or **IPv4 & IPv6**.

Note: When changes are made, a Warning message will appear when the Submit button is clicked.

Figure 4-38. Warning screen

The library **must be rebooted** or the changes will not take place.

IPv4

DHCP Address

Click this item ON to have the IP Address of your library automatically set by the library host computer. Leave unchecked and enter the appropriate information for the IP Address, Network Mask, and Gateway Address.

IP Address
An identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255. For example, 1.160.10.240 could be an IP address.

Network Mask
This address defines and limits users within a local network.

Gateway Address
This address allows access outside the local network.

IPv6

IPv6 stateless auto config
Click this item ON to have the IP Address of your library automatically set by the library host computer. Leave unchecked and enter the appropriate information for the static assigned IP Address, prefix length, and Gateway Address.

Static assigned IPv6 address
Enter the assigned IPv6 address. The format of an IPv6 IP address is a 128-bit numeric address written as 8 groups of four numbers separated by colons.

IPv6 prefix length
The default prefix length is set to 64, but can be set to any length, depending upon the address used.

IPv6 gateway address
This address allows access outside the local network.

SNMP

SNMP Enabled
If you desire to have SNMP Traps sent to an IP address of your choosing, place a check in this box.

SNMP Target 1-IP Address
If SNMP Traps are enabled, enter an IP address where SNMP Traps are to be sent.

SNMP Target 2-IP Address
Enter an optional 2nd IP address where SNMP Traps are to be sent, or leave as 0.0.0.0.

SNMP Target 3-IP Address
Enter an optional 3rd IP address where SNMP Traps are to be sent, or leave as 0.0.0.0.

Community Name
Enter your preferred name, or leave as “public”.

Enable SSL for Web
If you desire to have SSL enabled, place a check in this box.

Configure Library: User Access

This page allows the user to add and modify user accounts.

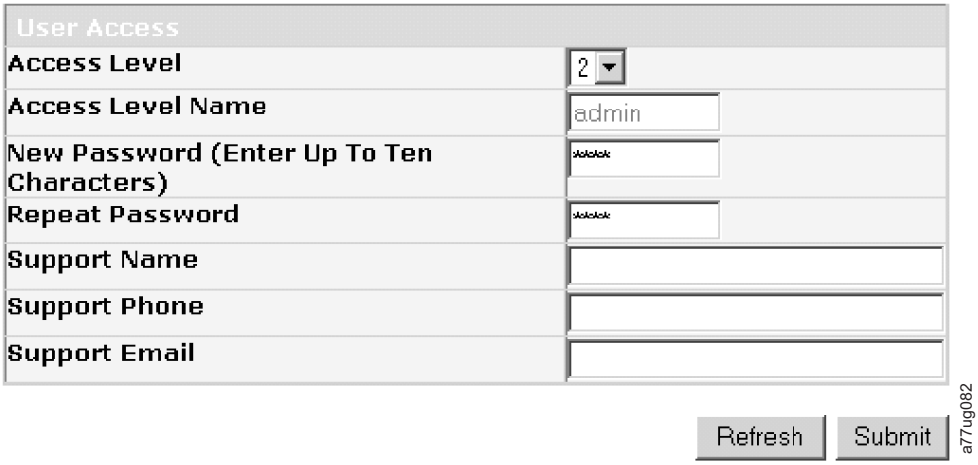


Figure 4-39. Configure Library: User Access page

The following elements are displayed on the **User Access** page.

Access Level
Choose from 1 (User), 2 (Admin), or 3 (Service).

Access Level Name
The name associated with the chosen Access Level.

New Password
The password must be a maximum of ten characters.

Repeat Password
Enter the New Password again.

Support name
The name of the individual within your company to contact for Web User Interface or library support.

Support phone
The phone number of the individual within your company to contact for Web User Interface or library support.

Support email
The email address of the individual within your company to contact for Web User Interface or library support.

Configure Library: Date & Time

This page allows the user to set the time and date, and how it will be displayed.

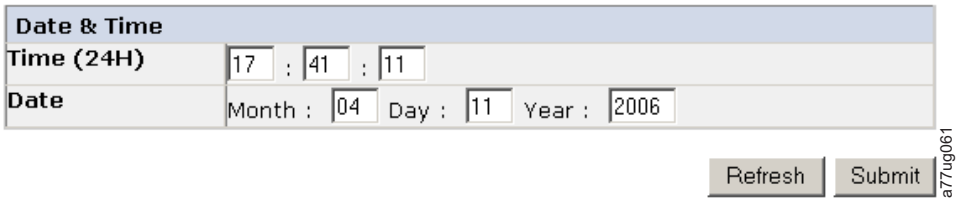


Figure 4-40. The Configure Library: Date & Time page

Time (24H)
Using a 24-hour format, enter the current hour, minutes, and seconds.

Date Enter the current month, day, and year.

Configure Library: Logs & Traces

This page allows service personnel to set the error log mode to **Off**, **Continuous**, or to **Stop trace at first error**.

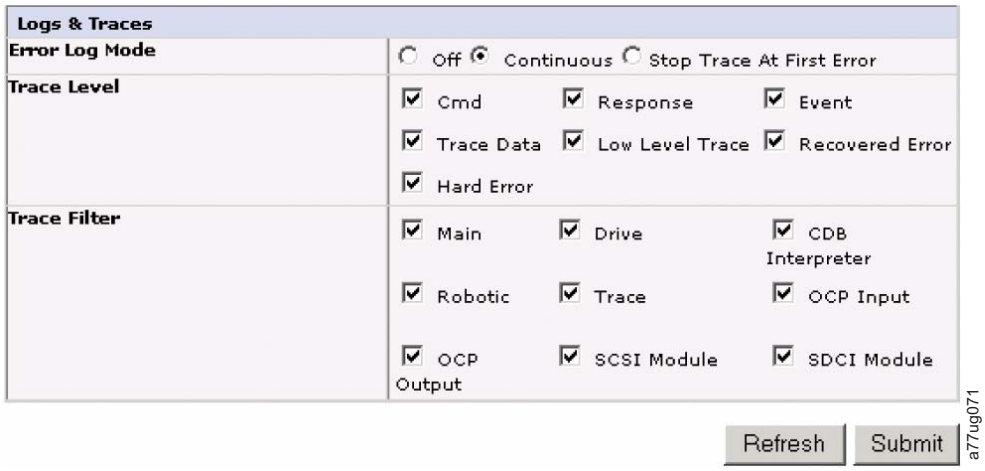


Figure 4-41. Configure Library: Logs & Traces page

It is recommended that you select **Continuous** for the **Error Log Mode** so that all information for logs and traces will be captured.

Note: The trace level and trace filter selection options are only changeable by Service personnel.

Configure Library: Event Notification

This page allows the user to enter information for event notification. When set up correctly, **Event Notification** allows the library to send an email to a designation individual when the library is experiencing a problem.

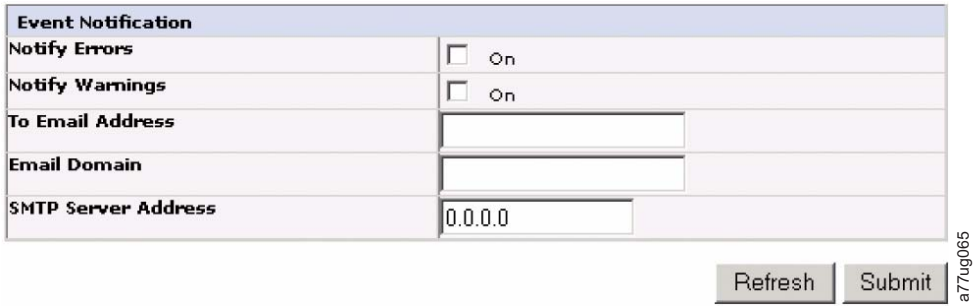


Figure 4-42. Configure Library: Event Notification page

The following elements are displayed on the **Event Notification** page.

Notify Errors
Select this item to be notified of library errors via email.

Notify Warnings
Select this item to be notified of library warnings via email.

To E-mail Address
Enter the email address of the individual you would like to receive the errors and/or warnings.

E-mail Domain
Enter the email domain name of the individual you would like to receive the errors and/or warnings.

SMTP Server Address
Enter the address of the email server of the individual you would like to receive the errors and/or warnings.

Configure Library: Restore Defaults

This page allows the user to reset the configuration to the factory defaults.

For information on factory default settings, see "Configure: Restore Defaults" on page 4-22. Be aware that when you restore your library to factory defaults, all configuration data in the library will be lost and will need to be reestablished.

Figure 4-43. Configure Library: Restore Defaults page

Manage Library Menu

Manage Library: Move Media

This page allows the user to move tape cartridges within the library. The source and destination are selected and then the MOVE button in the center of the screen is clicked to activate the move.

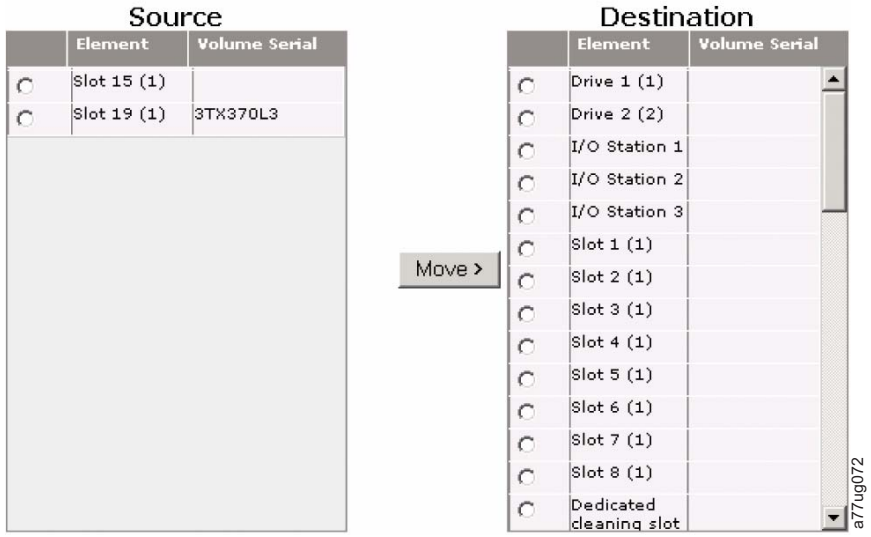


Figure 4-44. Manage Library: Move Media page

The following elements appear in the **Source** and **Destination** screens.

Element

In the **Source** screen, this identifies the library element that contains a cartridge. In the **Destination** screen, this identifies the library element that is empty and can receive a cartridge.

Volume Serial

In the **Source** screen, this element displays the serial number of the cartridge. In the **Destination** screen, this element contains no information.

Manage Library: Perform Inventory

This page provides the user to re-scan the library to determine the current media inventory.

Figure 4-45. Manage Library: Perform Inventory page

Manage Library: Release Magazine

This page allows the user to release the right or left magazine from the library.

Figure 4-46. Manage Library: Release Magazine page

Note: To manually release a magazine, see "Releasing the Magazines Manually" on page 8-1. However, this manual process should only be used if the magazine cannot be released using the Operator Control Panel or the Web User Interface.

Service Library Menu

The 2U/4U library is always online, except for when the user enters the Service Library area. A warning message appears stating that the library should be taken offline from the host before performing any Service functions. It is up to the operator to ensure that it is taken offline by phoning the host operator or other means of communication. Before performing any service functions, ensure the host is not performing any data writing or retrieval.

Service Library: Clean Drive

This page allows the user to clean the tape drive. After the requested drive is cleaned, the screen will be greyed out. If you want to clean another drive, click on the Navigation bar ″Service Library: Clean Drive″ in the left column of your screen to activate the ″Clean Drive″ screen and select another drive. Click on ″Clean″.

Figure 4-47. Service Library: Clean Drive page

Advanced Diagnostics (for Service Personnel Only)

This menu is for use by Service Personnel only.

Service Library: View Logs

This page allows the user to view the library logs after entering the following:

- Log Type
  - **Error Trace:** Logs all the error messages
  - **Informational Trace:** Logs all the informational messages created as the library operates
  - **Warning Trace:** Logs all warning messages created by the library. Warning messages will not stop a library's operation but does remind the user of issues that may become a problem. Example: Invalid Media.
  - **Configuration Change Trace:** Logs any configuration changes made, such as changing/adding partitions, changing SCSI addresses, removing a DCS, etc.
  - **Standard Trace:** Logs all library operations
- Total Number of Entries
- Start Entry
- Number of Entries per Page

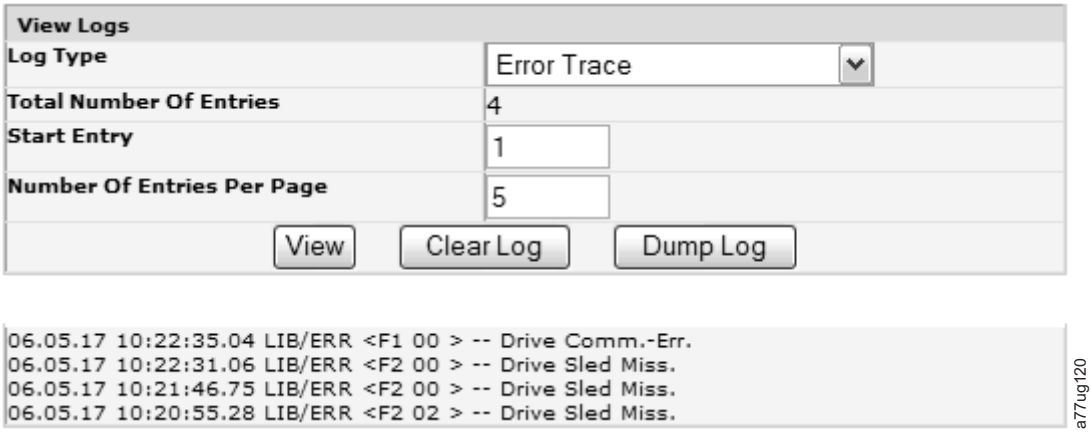


Figure 4-48. Service Library: View Logs page

View Drive Logs

This menu item allows the user to view a drive log.

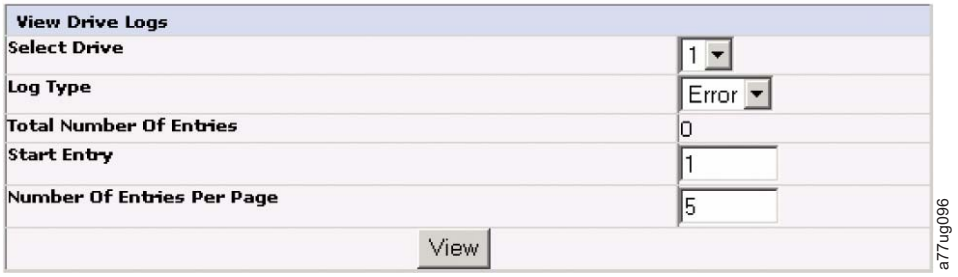


Figure 4-49. Service Library: View Drive Logs screen

Save Drive Dump

This menu item allows a drive dump to be saved to the host computer. Once the **Save Drive Dump** button is clicked, the user will have the option of saving the drive dump to their hard drive. The progress status for the drive dump is shown on the System Status screen to the right of the main web interface.

Note: Ensure that all the pop-up facilities on the web browser are set to enable pop-up boxes to appear. For example on the Microsoft Internet Explorer, under **Tools**, ensure that the Pop-up Blocker is turned OFF and **Internet Options -> Security -> Custom Level -> Downloads -> Automatic Prompting** for file **Downloads and File Downloads** are both Enabled.

Once saved on the hard drive, it can be e-mailed to Tech Support for analysis, if needed.

Note: The dump may take as long as 20 minutes to complete.

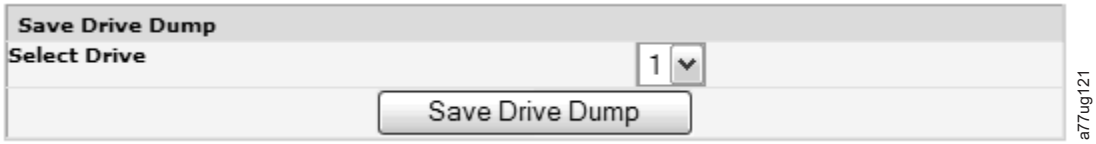


Figure 4-50. Service: Save Drive Dump

Service Library: Perform Diagnostics

Note: When running the “System Test”, the library must contain at least the same number of data cartridges as there are drives in that library. For example, if your library has 4 drives installed, you must have 4 or more data cartridges in the library prior to the start of the test. If there are fewer data cartridges than drives in the library, an error message ”Slot Empty” will occur, and the test will not complete successfully.

This page provides the system administrator with general tests to verify the usability and reliability of the library. The “System Test” will use resident data cartridges to test the load and unload capability of the drives, and ensure that the library mechanics are working satisfactorily. No data will be written to the cartridges and the cartridges will be returned to their normal slot location. The “Slot To Slot” test will move each resident data cartridge from one slot to another,

for each test cycle requested. When completing the “Slot To Slot” test, you will need to Inventory your library before placing it back online, since this test scrambles the cartridge slot locations.

The user selects the number of test cycles before starting the test from the EXECUTE button. To cancel the test before it completes the cycles, select the STOP button.

Figure 4-51. Service Library: Perform Diagnostics page

Service Library: Upgrade Firmware

This page displays the current library and drive firmware versions. Firmware can be downloaded to the host then uploaded to the drive in the library by using this page.

In the first line you can see the actual loaded firmware revision or level installed on the drive. Click **Browse...** to choose the firmware file you have downloaded from the web site (the web site is http://www.ibm.com/storage/support/lto) on the first drive you want to update (You can not update 2 drives at the same time). Be sure you choose the correct firmware for your drive type. After pressing the **Update** button the file will be sent to the drive and the drive will be upgraded.

Note: During the update no host drive action is possible. The drive update takes approximately 5 minutes. The system status panel (in the right of the browser window) will change from ″update″ to ″ready″.

Figure 4-52. The 2U library Service Library: Upgrade Firmware page

Figure 4-53. The 4U library Service Library: Upgrade Firmware page

Service Library: Reboot

Important: Some options of the Web User Interface take the library OFFLINE. This inactive mode can interfere with host-based application software, causing data loss. Ensure that the library is idle before attempting to perform any remote operations that will take the library OFFLINE.

This page is used to perform a library reboot. There is a default time delay when the Web User Interface page refreshes itself. This time should be sufficient to reload the page. However, during a reboot, the connection to the library may be lost. If the connection is lost, the user will have to reload the page manually.

Figure 4-54. Service Library: Reboot page

Import and Export Media during Normal Library Operation

Import Media

Data cartridges can be inserted and taken out of a magazine while the library is in operation. If the library contains an I/O Station, and you wish to import media, follow these steps:

1. Go to **Main** → **Control** → **Open I/O Station**. The I/O Station will unlock itself.
2. Pull out the magazine and insert a data cartridge(s) into the I/O Station. On a 2U library, only 1 cartridge can be inserted at a time. On the 4U library, 3 cartridges can be inserted at one time.

3. Close the door of the I/O Station. The library will automatically start an inventory. The cartridges in the I/O Station will be counted but unassigned until they are moved into storage slots.
4. Go to **Main** → **Control** → **Move Cartridges** and move the data cartridges into the desired data slots. See "Control: Move Cartridges" on page 4-15 or "Manage Library: Move Media" on page 4-43 for more information.

If the library does not have an I/O Station (all slots are assigned to storage), and you wish to import media, you will need to release a magazine and insert the cartridges manually following these steps:

1. Go to **Main** → **Control** → **Magazine**. Choose the desired magazine to unlock/remove.
2. Pull out the magazine and insert a data cartridge(s) into the empty slots.
3. Push the magazine back into the library. The library will automatically start an inventory.
4. To move cartridges in the magazine once they are inserted, go to **Main** → **Control** → **Move Cartridges** and move the data cartridges into the desired slots. See "Control: Move Cartridges" on page 4-15 or "Manage Library: Move Media" on page 4-43 for more information.

   Note: If you run a library configuration backup program on your host computer, use the program to run an audit of the library after new cartridges have been added to update the backup program.

Export Media

To remove cartridges from your library using your I/O Station, follow these steps:

1. Go to **Main** → **Control** → **Move Cartridges** and move the data cartridges into the I/O Station. See "Control: Move Cartridges" on page 4-15 or "Manage Library: Move Media" on page 4-43 for more information.
2. Go to **Main** → **Control** → **Open I/O Station**. The I/O Station will unlock itself
3. Pull out the magazine and take the data cartridge(s) out of the I/O Station
4. Push the magazine back into the library. The library will automatically start an inventory of the I/O station.

If you do not have an I/O Station (all slots are assigned to storage), and wish to export media, you will need to release a magazine and take out the cartridges manually following these steps:

1. Go to **Main** → **Control** → **Magazine**. Choose the magazine you wish to unlock/remove.
2. Pull out the magazine and remove the desired data cartridge(s).
3. Push the magazine back into the library. The library will automatically start an inventory.

   Note: If you run a library configuration backup program on your host computer, use the program to run an audit of the library after cartridges have been removed to update the backup program.

Chapter 5. Using Ultrium Media

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

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

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

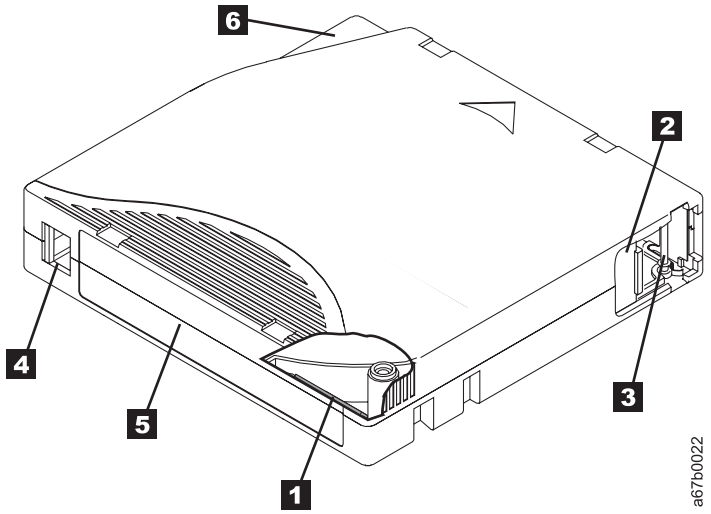


Figure 5-1. The IBM LTO Ultrium 800 GB Data Cartridge

Data Cartridges

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

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

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

You can order tape cartridges with the bar code labels included, or you can order custom labels. To obtain tape cartridges and bar code labels, see “Ordering Media Supplies” on page 5-18.

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

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

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

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

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

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

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

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

Cartridge Compatibility

Table 5-1. Ultrium data and cleaning cartridge compatibility with Ultrium tape drive

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

Table 5-1. Ultrium data and cleaning cartridge compatibility with Ultrium tape drive (continued)

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

Capacity Scaling

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

WORM (Write Once, Read Many)

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

WORM Media

Because standard read/write media are incompatible with the WORM feature, a specially formatted WORM tape cartridge (see Figure 5-2) is required. Each WORM cartridge has a unique, worldwide cartridge identifier (WWCID), which comprises the unique CM chip serial number and the unique tape media serial number. Ultrium 4 WORM cartridges are two-tone green and silvery-gray. See "Ordering Media Supplies" on page 5-18 for information on how to choose and purchase the appropriate WORM tape cartridges for your library.

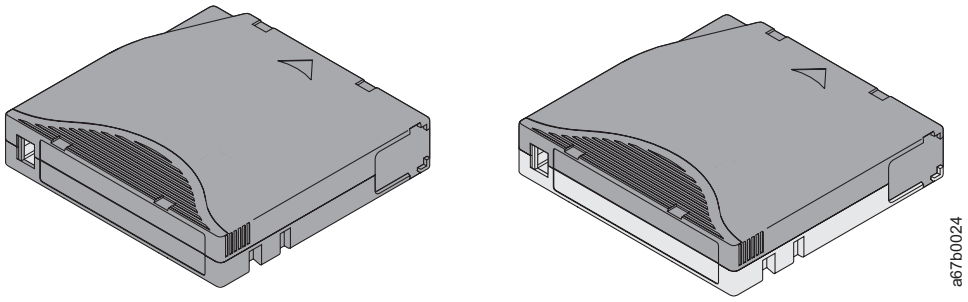


Figure 5-2. Ultrium WORM Tape Cartridge

Data Security on WORM Media

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

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

WORM Media Errors

The following conditions cause WORM media errors to occur:

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

Requirements for WORM Capability

To add WORM capability to your LTO Ultrium generation 4 drive(s), you need to have the drive firmware to the correct code level, and use either Ultrium 4 800 GB WORM tape cartridges or Ultrium 3 400 GB WORM tape cartridges (see "Ordering Media Supplies" on page 5-18).

Cleaning Cartridge

With each library, a specially labeled IBM LTO Ultrium Cleaning Cartridge is supplied to clean the drive head. The drive itself determines when a head needs to be cleaned. It alerts you by lighting the "Clean Drive" (amber LED) above the library OCP. To clean the head, insert the cleaning cartridge into the tape load compartment (see "Inserting the Cleaning Cartridge" on page 2-33). The drive performs the cleaning automatically. When the cleaning is finished, the drive ejects the cartridge, and the library turns the "Clean Drive" LED off.

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

The IBM Cleaning Cartridges are valid for 50 uses. The cartridge's LTO-CM chip tracks the number of times that the cartridge is used.

Cartridge Memory Chip (LTO-CM)

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

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

Bar Code Label

A bar code label contains:

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

Note: The tape drive does not require bar code labels, but you may choose to use labels for tape cartridge identification purposes.

Table 5-2. Bar code label requirements for Ultrium tape drives and libraries

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

When read by a library's bar code reader, the bar code identifies the cartridge's VOLSER to the library. The bar code also tells the library whether the cartridge is a data cartridge or cleaning cartridge. In addition, the bar code includes the two-character media-type identifier Lx, where x equals 1, 2, 3, or 4. L identifies the cartridge as an LTO cartridge and the number represents the generation of cartridge for that cartridge type. Figure 5-3 on page 5-6 shows a sample bar code label for the LTO Ultrium Tape Cartridge.

Tape cartridges can be ordered with the labels included or with custom labels. To order tape cartridges and bar code labels, see "Ordering Media Supplies" on page 5-18. 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 two characters must be L4, L3, L2, or L1
- Label and printing to be non-glossy
- Nominal narrow line or space width of 0.423 mm (0.017 in.)
- Wide to narrow ratio of 2.75:1
- Minimum bar length of 11.1 mm (0.44 in.)

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

Cartridges	VOLSER
Ultrium 4 Data Cartridge	xxxxxxL4
Ultrium 4 WORM Cartridge	xxxxxxLU
Ultrium 3 Data Cartridge	xxxxxxL3
Ultrium 3 WORM Cartridge	xxxxxxLT
Ultrium 2 Data Cartridge	xxxxxxL2
Ultrium 1 Data Cartridge (READ ONLY)	xxxxxxL1
IBM LTO Ultrium Cleaning Cartridge	CLNxxxLx

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

Cartridges	VOLSER
*An Ultrium 3 Tape Drive must have a minimum firmware level of 54xx for it to be compatible with the WORM cartridge.	

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

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

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

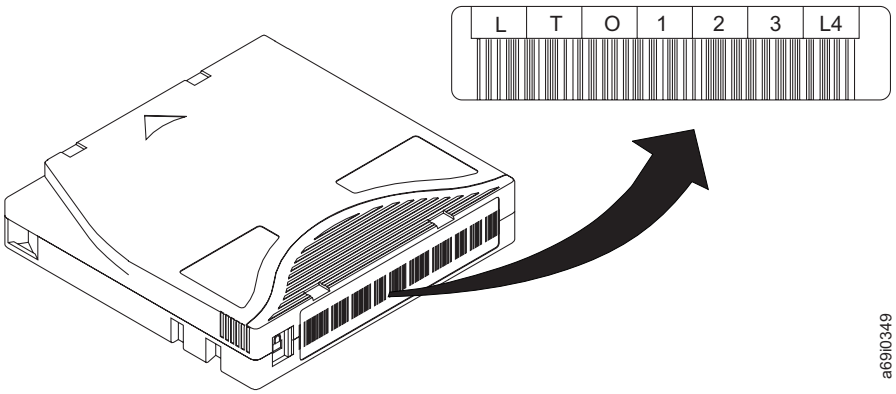


Figure 5-3. Sample bar code label on the LTO Ultrium 4 Tape Cartridge. The volume serial number (LTO123), cartridge type (L4), and bar code are printed on the label.

Guidelines for Using Bar Code Labels

Apply the following guidelines whenever using bar code labels:

- Use only IBM-approved bar code labels on cartridges to be used in an IBM tape library.
- Do not reuse a label or reapply a used label over an existing label.
- Before you apply a new label, remove the old label by slowly pulling it at a right angle to the cartridge case.
- Use peel-clean labels that do not leave a residue after being removed. If there is glue residue on the cartridge, remove it by gently rubbing it with your finger. Do not use a sharp object, water, or a chemical to clean the label area.
- Examine the label before applying it to the cartridge. Do not use the label if it has voids or smears in the printed characters or bar code (a library's inventory operation will take much longer if the bar code label is not readable).
- Remove the label from the label sheet carefully. Do not stretch the label or cause the edges to curl.
- Position the label within the recessed label area (see **5** in Figure 5-1 on page 5-1).
- With light finger pressure, smooth the label so that no wrinkles or bubbles exist on its surface.

- Verify that the label is smooth and parallel, and has no roll-up or roll-over. The label must be flat to within 0.5 mm (0.02 in.) over the length of the label and have no folds, missing pieces, or smudges.
- Do not place other machine-readable labels on other surfaces of the cartridge. They may interfere with the ability of the drive to load the cartridge.

Write-Protect Switch

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

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

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

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

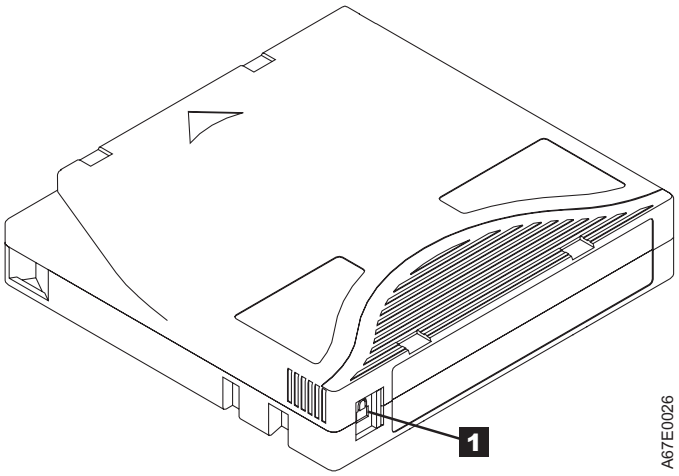


Figure 5-4. Setting the write-protect switch

Handling the Cartridges

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

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

Provide Training

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

Ensure Proper Packaging

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

Figure 5-5. Tape cartridges in a Turtlecase

- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.
- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure the following:
  - Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.
  - Pack the cartridge snugly; do not allow it to move around.
  - Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes (see Figure 5-6 on page 5-9).

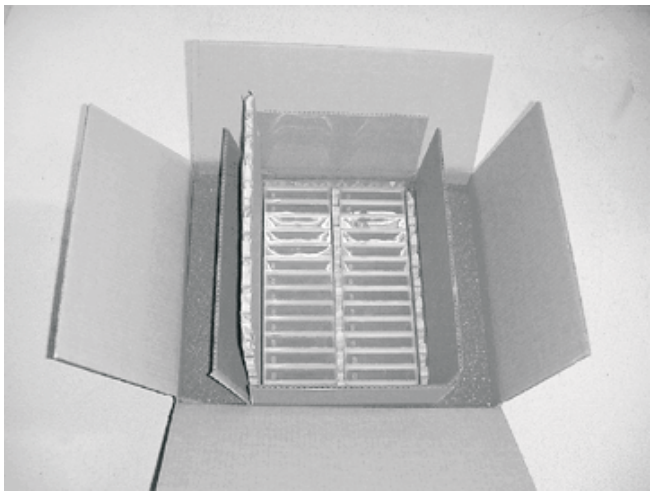


Figure 5-6. Double-boxing tape cartridges for shipping

Provide Proper Acclimation and Environmental Conditions

- Before using a cartridge, let it acclimate to the normal operating environment for 1 hour. If condensation is visible on the cartridge, wait an additional hour.
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields of greater than 100 oersteds (for example, terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies). Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the conditions that are described in "Environmental and Shipping Specifications for Tape Cartridges" on page 5-17.

Perform a Thorough Inspection

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

- Inspect the cartridge's packaging to determine potential rough handling.
- When inspecting a cartridge, open only the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are held together with screws; separating them destroys the usefulness of the cartridge.
- Inspect the cartridge for damage before using or storing it.
- Inspect the rear of the cartridge (the part that loads first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case (see **1** in Figure 5-7 on page 5-10 and **4** in Figure 5-9 on page 5-12). If there are gaps in the seam (see Figure 5-7 on page 5-10), the leader pin may be dislodged. Go to "Repositioning or Reattaching a Leader Pin" on page 5-11.

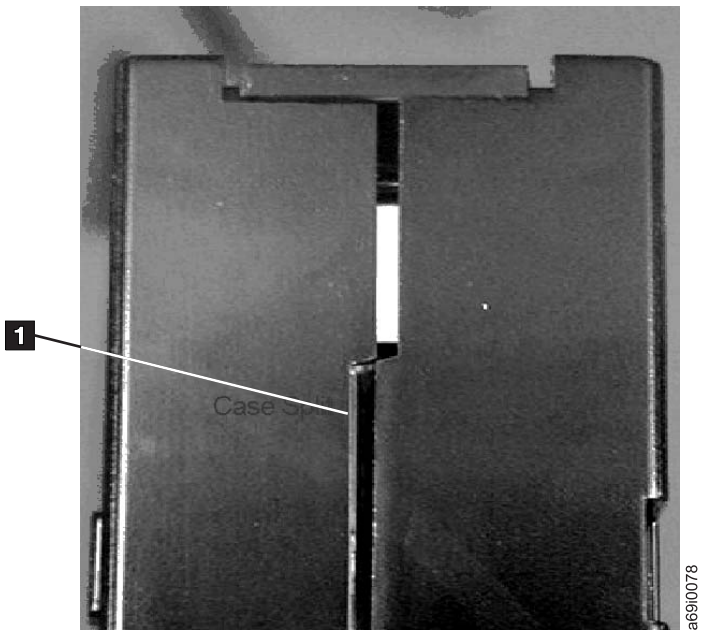


Figure 5-7. Checking for gaps in the seams of a cartridge

- Check that the leader pin is properly seated (see **2** in Figure 5-8 on page 5-12).
- If you suspect that the cartridge has been mishandled but it appears usable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.
- Review handling and shipping procedures.

Handle the Cartridge Carefully

- Do not drop the cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly seated in the pin-retaining spring clips (see **2** in Figure 5-8 on page 5-12). If the leader pin has become dislodged, go to "Repositioning or Reattaching a Leader Pin" on page 5-11.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.
- Do not stack more than six cartridges.
- Do not degauss a cartridge that you intend to reuse. Degaussing makes the tape unusable.

Examples of Cartridge Problems

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

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

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

3. Review media-handling procedures.

Example: Improper Placement of Leader Pin (see Figure 5-8 on page 5-12)

The leader pin is misaligned. Perform the following steps:

1. Look for cartridge damage.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning or Reattaching a Leader Pin"). 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 may void the warranties of the drive and the cartridge.

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

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

Repositioning a Leader Pin

A leader pin that is improperly seated inside a cartridge can interfere with the operation of the drive. Figure 5-8 on page 5-12 shows a leader pin in the incorrect **1** and correct **2** positions.

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

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

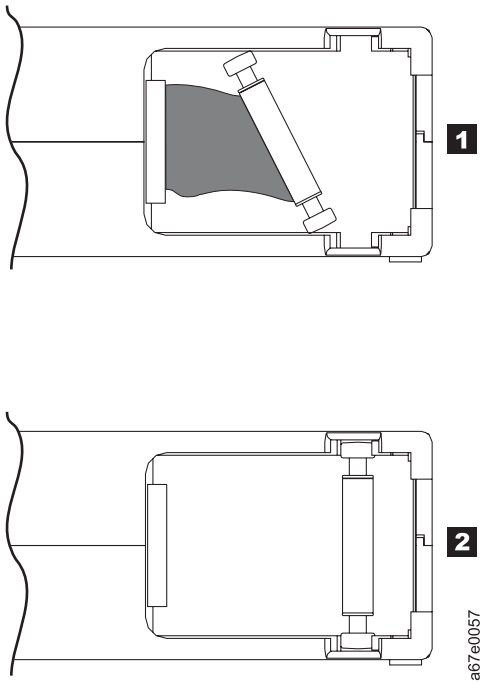


Figure 5-8. Leader pin in the incorrect and correct positions. The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

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

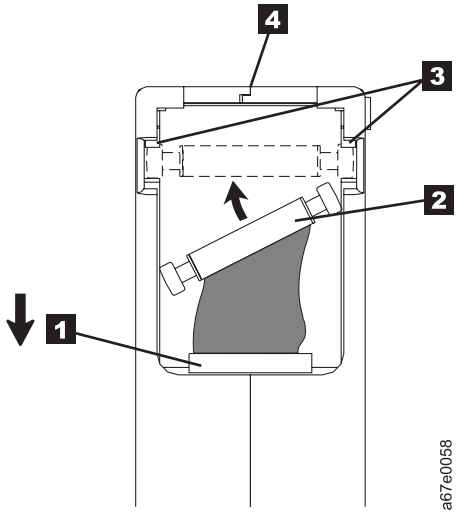


Figure 5-9. Placing the dislodged leader pin into the correct position. The cartridge door is open to show the leader pin.

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

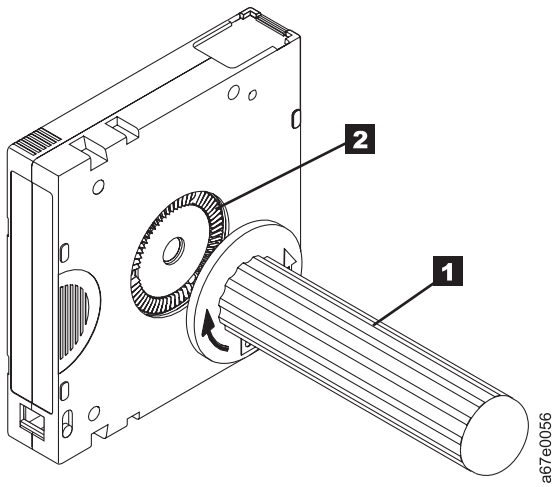


Figure 5-10. Rewinding the tape into the cartridge

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

Reattaching a Leader Pin

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

The Leader Pin Reattachment Kit contains three parts:

- **Leader pin attach tool** (see **1** in Figure 5-11 on page 5-14). A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** (see **2** in Figure 5-11 on page 5-14). A device that fits into the cartridge's hub and lets you wind the tape into and out of the cartridge.
- **Pin supplies** (see **3** in Figure 5-11 on page 5-14). Leader pins and C-clips.

Attention:

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

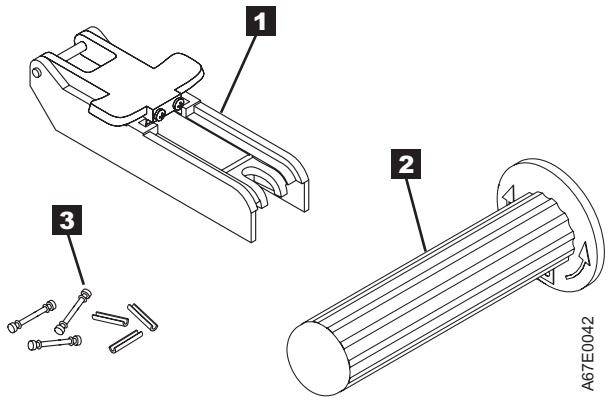


Figure 5-11. Leader Pin Reattachment Kit

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 5-12 on page 5-15) to the cartridge **2** so that the tool's hook **3** latches into the cartridge's door **4** . Pull the tool back to hold the door open, then slide the tool onto the cartridge. Open the tool's pivot arm **5** .

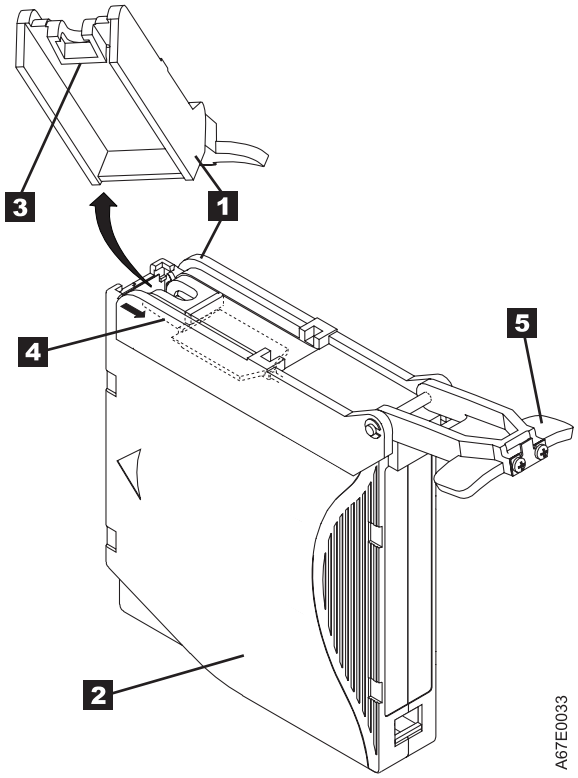


Figure 5-12. Attaching the leader pin attach tool to the cartridge. To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool (**1** in Figure 5-13 on page 5-16) to the cartridge's hub **2** by fitting the tool's teeth between the teeth of the hub. Turn the tool clockwise until you see the end of the tape inside the cartridge. Then, slowly turn the rewind tool counterclockwise to bring the tape edge toward the cartridge door **3** .
3. Continue to turn the rewind tool counterclockwise until approximately 13 cm (5 in.) of tape hangs from the cartridge door. If necessary, grasp the tape and pull gently to unwind it from the cartridge.
4. Remove the rewind tool by pulling it away from the cartridge. Set the tool and the cartridge aside.

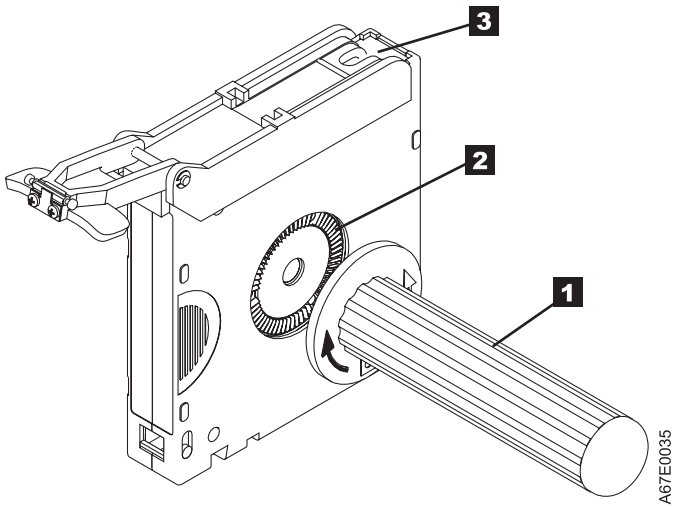


Figure 5-13. Winding the tape out of the cartridge. Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the cartridge door.

5. On the leader pin (**1** in Figure 5-14), locate the open side of the C-clip **2** . The C-clip is a small black part that secures the tape **3** to the pin.
6. Remove the C-clip from the leader pin by using your fingers to push the clip away from the pin. Set the pin aside and discard the clip.

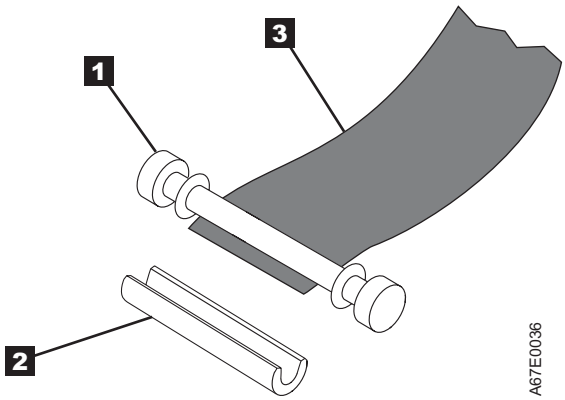


Figure 5-14. Removing the C-clip from the leader pin. Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool (see **1** in Figure 5-15 on page 5-17).
8. Place a new C-clip into the retention groove **2** (Figure 5-15 on page 5-17) 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 5-15 on page 5-17) of the leader pin attach tool.

   Attention: To prevent the leader pin from rolling into the cartridge, in the following step use care when folding the tape over the pin.
10. Fold the tape over the leader pin and hold it with your fingers (see Figure 5-15 on page 5-17).

    Note: Use care to ensure that the tape is centered over the leader pin. Failure to properly center the tape on the pin will cause the repaired cartridge to fail. When the tape is properly centered, a 0.25-mm (0.01-in.) gap

exists on both sides of the pin.

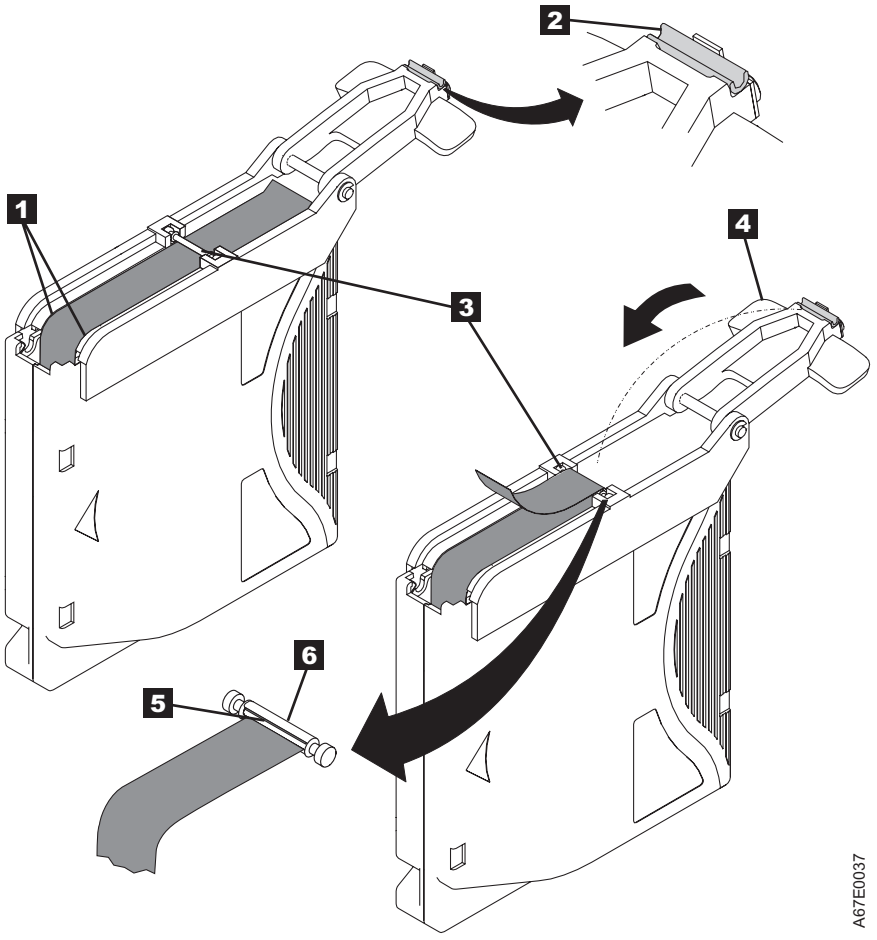


Figure 5-15. Attaching the leader pin to the tape

11. Close the pivot arm **4** of the leader pin attach tool by swinging it over the leader pin so that the C-clip snaps onto the pin and the tape.
12. Swing the pivot arm open and trim the excess tape **5** so that it is flush with the reattached leader pin **6** .
13. Use your fingers to remove the leader pin from the cavity **3** in the leader pin attach tool.
14. Use the cartridge manual rewind tool to wind the tape back into the cartridge (wind the tape clockwise). Ensure that the leader pin is latched by the pin-retaining spring clips on each end of the leader pin.
15. Remove the rewind tool.
16. Remove the leader pin attach tool by lifting its end up and away from the cartridge.

Environmental and Shipping Specifications for Tape Cartridges

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

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

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

Table 5-4 gives the environment for operating, storing, and shipping LTO Ultrium Tape Cartridges.

Table 5-4. 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 to 45°C(50 to 113°F)	16 to 32°C(61 to 90°F)	16 to 25°C(61 to 77°F)	-23 to 49°C(-9 to 120°F)
Relative humidity (non-condensing)	10 to 80%	20 to 80%	20 to 50%	5 to 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 ten years.

Disposing of Tape Cartridges

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

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

If a tape cartridge must be disposed of in a secure manner, you can erase the data on the cartridge by using a high-energy ac degausser (use a minimum of 4000 oersted peak field over the entire space that the cartridge occupies). The tape should make two passes through the field at 90 degree orientation change for each pass to achieve complete erasure. Some commercial degaussers have two magnetic field regions offset 90 degrees from each other to accomplish complete erasure in one pass for higher throughput. Degaussing makes the cartridge unusable.

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

Ordering Media Supplies

Table 5-5 on page 5-19 lists the cartridges and media supplies that you can order for the drive.

Table 5-5. Media supplies

Supply Item	Methods of Ordering
20-PACK IBM LTO Ultrium 800 GB Data Cartridge (with attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 010. Specify the VOLSER characters that you want. Order as part number 95P4443 (color label) or 95P4445 (black and white label) through an IBM-authorized distributor. Specify the VOLSER characters that you want.
20-PACK IBM LTO Ultrium 800 GB Data Cartridge (without attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 011. Order as part number 95P4447 through an IBM-authorized distributor.
5-PACK IBM LTO Ultrium 800 GB Data Cartridge	Order as part number 95P4278 through an IBM-authorized distributor.
20-PACK IBM Ultrium 4 800 GB WORM Tape Cartridge (with attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 032. Order as part number 95P4457 (color label) or 95P4459 (black and white label) through an IBM-authorized distributor. Specify the VOLSER characters that you want.
20-PACK IBM Ultrium 4 800 GB WORM Tape Cartridge (without attached labels)	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 033. Order as part number 95P4461 through an IBM-authorized distributor. Specify the VOLSER characters that you want.
IBM LTO Ultrium 400 GB Data Cartridge Bar code labels are pre-applied to cartridges.	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 008. Specify the VOLSER characters that you want. Order as part number 96P1470 (color label) or 96P1471 (black and white label) through an IBM-authorized distributor. Specify the VOLSER characters that you want.
IBM LTO Ultrium 400 GB Data Cartridge Order VOLSER labels separately.	Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 009. Order as part number 24R1922 through an IBM-authorized distributor. Specify the VOLSER characters that you want.
5-PACK IBM LTO Ultrium 400 GB Data Cartridge	Order as part number 95P2020 through an IBM-authorized distributor. Specify the VOLSER characters that you want.

Table 5-5. Media supplies (continued)

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

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

Ordering Bar Code Labels

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

You can order bar code labels directly from the authorized label suppliers in Table 5-6.

Table 5-6. Authorized suppliers of custom bar code labels

In America	In Europe and Asia
EDP/Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U. S. A. Telephone: 888-438-8362 http://www.tri-optic.com/	EDP Europe, Ltd. 43 Redhills Road South Woodham Ferrers Chelmsford, Essex CM3 5UL U. K. Telephone: 44 (0) 1245-322380 http://www.tri-optic.com/
Dataware P.O. Box 740947 Houston, TX 77274 U. S. A. Telephone: 800-426-4844 http://www.datawarelabels.com/	Dataware Labels Europe Heubergstrasse 9 D-83052 Bruckmuhl-Gotting Germany Telephone: 49 8062-9455 http://www.datawarelabels.com/
NetC P. O. Box 1067 Fairfield, CT 06825 U. S. A. Telephone: 203-372-6382 http://www.netcllc.com/	NetC Europe Ltd Town Farm Bungalow The Pavement North Curry TA3 6LX Somerset U. K. Telephone: 44 (0) 1823 49 1439 http://www.netclabels.co.uk
	NetC Asia Pacific Pty Ltd Locked Bag 1 Kenthurst NSW 2156 Australia Telephone: 61 (0) 2 4573 6556 http://www.netclabels.com.uk

Chapter 6. Troubleshooting

Installation Problems

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

- **Picker Ship Lock Key:**

  Ensure that the Picker Ship Lock Key on the top cover has been removed **before** powering on the library.
- **Drive SCSI or Loop ID:**

  Ensure that the SCSI ID of the Drive (or Fibre Channel Loop ID) is correct and not the same as other devices that may be on the same bus or loop.
- **Host Bus Adapter (HBA) Compatibility:**

  Ensure that the library is compatible with the HBA. For best performance, the HBA used for this library should be SCSI-3 LVDS. Pay particular attention to any steps describing settings of various jumpers and/or switches.
- **HBA LUN 0/1 Support:**

  A single ID will address both drive and library since the drive is LUN 0 and the library is LUN 1. These models require an HBA that supports LUN scanning which must be enabled at the HBA.
- **Cable Connections:**

  Ensure that there are no bent pins on cables and that all connections are securely fastened.
- **Fibre Channel Tape Support:**

  Ensure that Fibre Channel Tape Support is enabled on the HBA if you are installing a library with a Fibre Channel drive.
- **SCSI Cable Length:**

  Ensure that the maximum cable length is not over 25 meters (82 ft.) for a single device on the bus or 12 meters (40 ft.) for multiple devices. Internal SCSI length within the library accounts for 2 ft.
- **SCSI Termination:**

  Verify proper termination on both ends of the SCSI bus.
- **SAS Cables and Interposers**

  Ensure that SAS Cables and Interposers (if any) are properly attached.
- **Backup Application Installation:**

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

  Ensure that the proper device driver, if applicable, is installed for the library.

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

Maintenance Problems

Many problems can be resolved by a firmware upgrade. Ensure that both the library and drive firmware are at the latest levels available. Compare the firmware levels on the Operator Control Panel Information Menu panel with the latest levels on the web site http://www.ibm.com/storage/lto/.

Most library or drive errors will result in an error code or error message on the Operator Control Panel display. An error code history is maintained in the library or drive error log. See "View Drive Logs" on page 4-45 for how to get the error log over the operator panel and "Service Library: View Logs" on page 4-45 to view logs using the web interface.

- **CRUs (Customer Replaceable Units):**

  The library consists of the following CRUs:
  - Control Card (electronics, processor, memory, etc.)
  - Power Supply
  - Drive Sled (drive plus drive-to-library connectivity)
  - Library Enclosure (accessor, Operator Control Panel display, etc.)
  - Cartridge Magazines
- **Other Possible Replacement Parts:**
  - Data Cartridges
  - Cables/Terminator

Important: Before replacing any CRU and after finding the problem and performing any listed actions listed in the Troubleshooting Table below, be sure to review the "Procedures for Isolating CRU Problems" on page 6-5 to help confirm the failing CRU.

The following table is the starting point for all service issues. Find the reason which closest resembles the problem you are experiencing and perform the listed action. Prior to contacting Technical Support, be sure to also see the "Pre-Call Checklist" on page 8-5.

Table 6-1. Troubleshooting table

Problem	Solution
Power	
Library does not power ON	1. Perform "Isolating a Power Supply Problem" on page 6-5.
The Operator Control Panel is blank or frozen	1. If possible, log on to the Web User Interface and check the error log. 2. Record and note any error code and sub code found. If an error code is found, look up the error code and try to resolve (see Chapter 7, "Error Codes," on page 7-1). 3. Power cycle the library. 4. Download the latest library firmware by visiting http://www.ibm.com/support. 5. If the problem still exists, refer to "Contacting IBM Technical Support" on page 8-6.
Error Codes	
There is an error code in the error log.	Look up the error code and try to resolve (see Chapter 7, "Error Codes," on page 7-1 and/or Appendix C, "Sense Data," on page C-1).
Attention LEDs	

Table 6-1. Troubleshooting table (continued)

Attention LED	Avoid contamination by ensuring that the library is installed in a clean, contamination-free environment. Continue cleaning the tape drive as needed. A cartridge should be acclimated for at least 24 hours before being used, particularly if it has been stored at a substantially different temperature or level of humidity than the library. Any cartridge that is suspected of being defective or contaminated should NOT be reused, in any drive. Check the power supply (or redundant power supply) for failure, and also check any power supply fans. Replace any defective units.
Clean Drive LED	• Ensure that you are using an Ultrium universal cleaning cartridge (see "Cleaning Cartridge" on page 5-4). • Ensure that the cleaning cartridge has not expired. A cleaning cartridge is good for 50 cleans. • If the problem still exists, refer to "Contacting IBM Technical Support" on page 8-6.
Error LED	Make a note of the error and sub error code, then refer to Chapter 7, "Error Codes," on page 7-1
Firmware	
Update library firmware	Refer to "Service Library: Upgrade Firmware" on page 4-47.
Update drive firmware	Refer to "Service: Service (Drives)" on page 4-25 or "Service Library: Upgrade Firmware" on page 4-47.
Cartridge Movement Problems	
Cartridge placement problems	Magazine slot prism fiducials NOT seated properly can result in gripper or slider error codes due to the fiducial interfering with the back edge of the cartridge. Release and pull magazines out of the library for inspection. Inspect the light pipe fiducials on each slot of the magazine for proper seating. See "Replacing Magazine Fiducials" on page 9-8.
Cartridge will not eject from drive	1. Power cycle the library, allow it to complete initialization, which in rare cases can take as long as 10 minutes, and then retry unloading the cartridge using the library Operator Control Panel. 2. Allow the drive to complete all operations. This may take as long as 10 minutes if you reset or cycle power on the library while the cartridge is positioned at the physical end of the media. 3. Ensure that the backup software is not reserving the slot or preventing the drive from ejecting the cartridge. The backup software needs to cancel the reservation and any hold it has on the drive. Temporarily disconnecting the library from the host server and power cycling eliminates the host and its software as a problem source. 4. If the problem still exists, refer to "Contacting IBM Technical Support" on page 8-6.
Cartridge can not be removed from storage slot	See "Removing Cartridges from Magazine Slots" on page 8-1.
Slot Blocker blocking a storage slot	See "Removing the Slot Blocker - 2U Library" on page 9-4
Media	

Table 6-1. Troubleshooting table (continued)

Cleaning or data cartridge incompatible with drive.	Ensure that you are using data and cleaning cartridges that are compatible with the drive and model of your library. The library automatically unloads incompatible cartridges and the Media Attention LED flashes. Export the media in order to clear the state.
Cannot write to or read from tape.	1. Ensure that the cartridge write-protect switch is in the write enabled position (see "Write-Protect Switch" on page 5-7). 2. Ensure that you have the appropriate data cartridge for your library model (see "Cartridge Compatibility" on page 5-2). 3. Ensure that you are using an Ultrium cartridge that has not been degaussed. Do not degauss Ultrium cartridges. 4. Ensure that the cartridge has not been exposed to harsh environmental or electrical conditions and is not physically damaged in any way. 5. Many backup applications do not read or write to cartridges that were created using a different backup application. In this case, you may have to perform an erase, reformat, or label replacement operation on the cartridge. 6. Ensure that you understand any data protection or overwrite protection schemes that your backup application may be using, which could prevent you from writing to a given cartridge. 7. Retry the operation with a different, known good cartridge. 8. Clean the drive. See "Service Library: Clean Drive" on page 4-44.
Drive ID (SCSI, SAS, or Fibre Channel Loop)	
Changed drive ID, but the host server does not recognize the new ID	1. Ensure that all devices on the same bus/network have unique ID numbers. 2. Ensure that you cycle power on the library after changing the ID. 3. Reboot the host server.
Tape library performance: The library is not efficiently backing up data	1. Check the network bandwidth from the host computer. If you are backing up data over a network, consider comparing to a local-only backup. 2. Ensure that the library and tape drive are on their own SCSI bus and not daisy-chained to another tape drive or to the hard drive being backed up. 3. Ensure that the library is connected to a LVDS SCSI bus and there are no single-ended (SE) devices on the same bus, because this will cause the entire bus to negotiate down to SE speed. 4. Use an Ultra160 SCSI bus and high-quality cabling with the library.
Customer Replaceable Units (CRU)	
Drive Sled	See "Isolating Drive Sled Problems" on page 6-6.
Power Supply	See "Isolating a Power Supply Problem" on page 6-5.
Library Controller Card	See "Isolating a Library Controller Card vs. Accessor Enclosure Problem" on page 6-7.
Library Enclosure	See "Isolating a Library Controller Card vs. Accessor Enclosure Problem" on page 6-7.
Other Problems	
Web User Interface problems	See "Isolating Web User Interface Problems" on page 6-7.
Bar code scanner problems	See "Isolating Accessor Scanner Problems" on page 6-8.
Host Attachment Interface problems	See "Isolating Host Attachment Interface Problems" on page 6-8
Need help with a library password	Refer to "Contacting IBM Technical Support" on page 8-6.

Procedures for Isolating CRU Problems

Isolating a Power Supply Problem

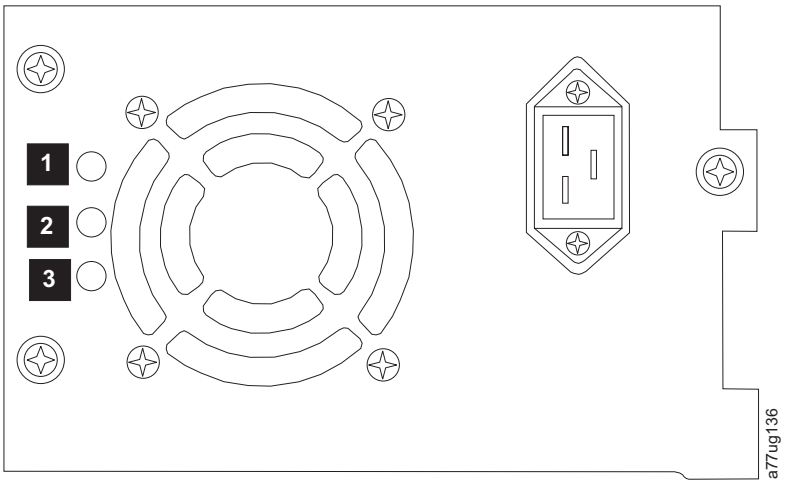


Figure 6-1. Power LEDs on the back of a power supply

Table 6-2. Power Supply LED Meanings

1	If the blue LED is lit, AC voltage is available.
2	If the amber LED is lit, there is a possible fan problem or other power supply issue. The power supply will need replacement.
3	If the green LED is lit, DC power is OK and active.

Note: Not all power supplies have LEDs. The original power supply for the 2U library did not have LEDs though any power supplies replaced will likely have LEDs. The 4U library has power supplies with LEDs.

If the Library does not power on:

1. 1. With library power OFF and the power cord unplugged, loosen the three thumb screws, pull the power supply out half way and then reseat the power supply and tighten the three thumb screws.
2. 2. Ensure the power cord is plugged in at the power supply and at the electrical outlet, then turn library power ON.
   a. For power supplies with LED's, the "Blue" LED will be lit if AC power is good.
   b. If your power supply does not have LED's, feel for air flowing out of the cooling fan grill on the rear of the library. AC is good if air is flowing from the fan.
3. 3. If AC appears to be missing
   a. Try another electrical outlet or plug another device into the outlet to test.
   b. If the outlet tests OK, try another power cord.
4. For power supplies with LED's, if the "Amber" LED is lit, replace the power supply (refer to "Replacing a Power Supply" on page 9-5).
5. If your power supply has no LED's, AC seems to be getting to the supply, but it is still failing, replace it (refer to "Replacing a Power Supply" on page 9-5).

6. If the power supply seems to be delivering power to the library (OCP and front panel LED's may be functioning); however, air does not flow from the power supply cooling fan grill on the rear of the library, replace the power supply (refer to "Replacing a Power Supply" on page 9-5).
7. If the power supply seems to be delivering power to the library (OCP and front panel LED's may be functioning), and air is flowing from the power supply cooling fan grill on the rear of the library, observe the "Green" LED (lowest of the three). If it is lit, the power supply is OK.

   Note: If your library has redundant power supplies, it is normal for the one in "Standby" mode to turn its "Green" LED off. You can test this power supply by pulling the power connector from the other "Active" power supply. The power supply that was in "Standby" mode will now become "Active", and its "Green" LED should light. If it doesn't, replace it (refer to "Replacing a Power Supply" on page 9-5).
8. If the "Green" LED is not lit, and it is the only one in the Library, replace it (refer to "Replacing a Power Supply" on page 9-5).

Isolating Drive Sled Problems

Prior to replacing a drive sled CRU, verify that the following activities have been performed:

1. Ensure that the drive firmware is at the latest level (visit http://www.ibm.com/storage/lto/).
2. Prior to powering OFF the library, if possible, use the host interface support tool, ITDT (available on http://www.ibm.com/storage/lto/), to collect a drive dump and save it on the host console for possible future use by Technical Support.Drive dumps can also be saved using the web interface. See chapter 4, **Operations**, for instructions on using the "Save Drive Dump" on page 4-46 option under the Service Library menu selection.
3. Try reseating the drive sled.

   Note: The drive sled is hot-pluggable so it is not necessary to power off the library. See "Replacing a Tape Drive" on page 9-1.
4. Cycle power to the library.
5. If air does not flow from the drive sled cooling fan grill on the rear of the library, replace the drive sled CRU. Several library error codes also point to cooling problems.
6. If the drive is experiencing permanent or temporary errors or if the amber Clean LED is lit on the front panel of the library, select Clean Drive from the Operator Control Panel Service Menu and clean the drive. Use only an approved cleaning cartridge (see "Cleaning Cartridge" on page 5-4).
7. Run the **Library Verify Diagnostic** which includes a drive performance Read/Write test (other drive diagnostics are also available) available on the Operator Control Panel or Web User Interface. Be sure to use a known good scratch or blank data cartridge.
   - If the drive test fails, replace the drive sled CRU (refer to "Replacing a Tape Drive" on page 9-1).
   - If the drive diagnostic(s) pass, run the drive wrap test (when available). If the wrap test fails, replace the drive sled CRU (refer to "Replacing a Tape Drive" on page 9-1).

     Note: If a SCSI drive wrap test fails, run the test again, with a different SCSI terminator prior to exchanging the drive sled.

8. Using the host interface test tool, ITDT, run the Scan function (s) to verify that the host application interface (SCSI, SAS, or Fibre Channel) can detect the drive (LUN 0) and the library (LUN 1). To further test the interface communication path, run the Test Device function (t), if available, after selecting the drive. This function will write/read data across the interface as well as sending a command to the drive to run the internal performance Read/Write test.
9. 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 a Library Controller Card vs. Accessor Enclosure Problem

1. If possible, ensure that the library firmware is at the latest level (visit http://www.ibm.com/storage/lto/).
2. With library power OFF, loosen the two thumb screws which secure the controller card to the library enclosure and slide it out.
   - Inspect the card for any broken components or other anomalies.
   - If the card appears to have no abnormalities, reseat the card back in the library, tighten the thumb screws, and turn library power ON.
3. If both the Operator Control Panel and Web User interfaces are inoperable or frozen and the latest firmware has been installed, the controller card CRU electronics is the most likely failure. If only the Web User Interface has failed, please see "Isolating Web User Interface Problems"before replacing any CRUs.
4. If a control card error code has been obtained and reseating, power cycling, and updating the library firmware did not fix the problem, the controller card CRU is the most likely failing CRU (refer to "Replacing a Library Controller Card" on page 9-6).
5. If the error code indicates an accessor type error (slider, elevator, sled, etc.), release and remove both magazines (see "Control: Magazine" on page 4-16, "Manage Library: Release Magazine" on page 4-44, or "Releasing the Magazines Manually" on page 8-1) and observe the accessor path for any obvious obstruction or problems. Resolve any observed problem if possible, Otherwise, replace the library enclosure CRU (refer to "Replacing the Library Enclosure" on page 9-9).
6. If the problem is intermittent or if a particular electronic or mechanical function of the library is not working properly as evidenced through observation or by error code, the library enclosure CRU is the most likely failing component (refer to "Replacing the Library Enclosure" on page 9-9).

Isolating Web User Interface Problems

If the Web User Interface is not functioning at all or if it is intermittently functioning, review the following steps to ensure that it is properly configured, or, to help determine which CRU or part needs to be replaced. The complete Web User Interface electronics reside on the control card CRU.

1. Ensure that the ethernet cable is securely plugged in the rear of the library at the ethernet port. See **7** on the "Rear Panel" on page 1-4.
2. Ensure that the correct IP, Netmask, and Gateway addresses are keyed into the network parameters. From the Operator Control Panel, navigate to **Configure** → **Network**.
3. Ensure that the correct IP address is being used on the web browser.
4. If the ethernet connection is a direct connection between the PC and the library, a special "crossover" ethernet cable needs to be used.

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

5. 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.
6. If the Web User Interface is still malfunctioning, replace the Library Controller Card CRU (refer to "Replacing a Library Controller Card" on page 9-6).

Isolating Accessor Scanner Problems

If the server has reported inventory problems relating to inability to read bar code labels, or, if some or all of the cartridge labels are not being displayed on the Web User Interface, use the following procedure to determine if the scanner (library enclosure CRU) needs to be replaced.

1. Ensure that a supported bar code label (or labels) are being used. Also, check for damaged labels (see "Bar Code Label" on page 5-5).
2. With library power OFF, reseat the control card CRU and then switch library power ON.
3. Perform a re-inventory via the Operator Control Panel and view the inventory via the Web User Interface to determine if the labels are now being read.
4. If the labels are still not being read properly, replace the library enclosure CRU (refer to "Replacing the Library Enclosure" on page 9-9).

Isolating Host Attachment Interface Problems

After successfully exercising "Isolating Drive Sled Problems", and more specifically the "Library Verify" diagnostic (**OCP → Service → Library Verify**) which includes a drive (or drives) read/write diagnostic, the following procedures are suggested to help isolate the failure to properly establish connectivity to the Host Bus Adapter (HBA).

1. If not already performed, exercise the drive interface wrap test **OCP → Service → Service → Drive Tests**. The test will require that a proper Wrap Test Tool be installed at some point during the test procedure. If the wrap test fails, replace the drive sled, and skip steps 2 and 3. Proceed to step 2 if the wrap test passes.

   Note: If a SCSI wrap test fails, run the test one more time with a different SCSI terminator prior to replacing the drive sled.
2. Use the utility, ITDT, to evaluate connectivity from the HBA through the cabling to the drive (or drives). ITDT does not require separate device drivers, thus the Operating System has the ability to scan and find all the LTO devices that are attached. If ITDT cannot successfully locate the LTO drive, suspect cabling or HBA problems, and skip step 3. If ITDT successfully located the LTO drive, proceed to step 3. See "Using the ITDT Firmware Update, Dump Retrieval and Drive Test Tool" on page 8-5 for a brief description of ITDT and instructions on how to download the tool from the web.
3. If ITDT successfully locates the LTO device(s), verify that the correct application device drivers and backup application software is properly installed.
4. Ensure that all the required or latest available Operating System files and/or updates (dll's, PTF's, etc.) have been installed and applied.

Chapter 7. Error Codes

If an error occurs during operation of the library, the library stops the current operation and displays an error code on the LCD screen. Unless otherwise noted in Table 7-1 on page 7-2, try to resolve the error by cycling power to the library and retrying the last operation. If the error persists, contact technical support.

Example Error Code

```
EVENT -6

8D 07
```

Where:

- `-6` indicates the position in sequence list, `0` being the most recent.
- 8D 07 indicates the error. (code 8D = sled blocked, ...).

The event log with the library also includes a date stamp for each event. Press ENTER to display the associated time stamp in the following format:

```
yy.mm.dd hh:mm:ss:HH
```

Where:

- `yy` is the year
- `mm` is the month
- `dd` is the current day
- `hh` is hours
- `mm` is minutes
- `ss` is seconds
- `HH` is 1/100 second

The time stamp is set to zero at system start.

A description of each error code and possible solution is provided in Table 7-1 on page 7-2.

Preparing to Resolve an Error Code

1. Record the error information that is displayed on the Operator Control Panel display or Web User Interface screen.
2. If possible, cycle library power and retry operation.
   - If the error reoccurs, refer to Table 7-1 on page 7-2 for information on resolving the error.
   - If the error does not reoccur, continue with normal library operation.

Complete the steps in "Preparing to Resolve an Error Code" before completing the User Action listed in Table 7-1 on page 7-2.

Table 7-1. Error Codes

Error Code	Description	User Action
30	SCSI: transport element full	Check the application software.
31	SCSI: all slots empty	
32	SCSI: invalid opcode	
33	SCSI: invalid element address	
34	SCSI: invalid field in CDB	
35	SCSI: Invalid drive specified	
36	SCSI: SEND DIAGNOSTIC command: invalid test number	
37	SCSI: invalid LUN	
38	SCSI: parameter list length error	
39	SCSI: parameter list error: invalid field	
3A	SCSI: parameter list error: parameter not supported	
3B	SCSI: parameter value invalid	
3C	SCSI: saving parameters not supported	
3D	SCSI: invalid ID message	
3E	SCSI: destination element full	
3F	SCSI: source slot or drive empty	
40	SCSI: wrong checksum	
41	SCSI: command sequence error	
42	SCSI: drive disabled	Check your configuration settings.
43	SCSI: mailslot disabled	
44	SCSI: flash image does not fit bootcode	Check the application software.
45	SCSI: media removal prevented by drive	Check the application software.
46	SCSI: media removal prevented by library	
47	SCSI: flash image does not fit personality	Check the version of code used for the upgrade.
48	SCSI: drive type not supported in this library	Check if a version of code is available which supports this drive type.
49	SCSI: incompatible magazine, magazine not accessible	Check your configuration settings.
60	Cleaning tape installed	Complete the cleaning process and retry the operation.
61	Cleaning failure Cleaning process could not be performed	Check cleaning tape and exchange if necessary. Retry operation
62	Cleaning tape expired	Exchange cleaning tape
63	Invalid cartridge Drive has rejected the data tape as invalid	Check cartridge regarding tape and drive technology and retry operation. After further occurrence exchange data cartridge.
64	Invalid cleaning cartridge Drive has rejected the cleaning tape as invalid	Check cleaning cartridge and retry operation. After further occurrence exchange cleaning tape.
65	Invalid upgrade cartridge Drive has rejected the upgrade tape as invalid	Retry operation, after further occurrence contact technical support for new upgrade tape
70	Currently not used	

Table 7-1. Error Codes (continued)

Error Code	Description	User Action
71	Currently not used	
72	Currently not used	
73	SCSI: overlapped command attempt	Check the application software.
74	SCSI: echo buffer overwritten	
80	Bar code reader Error, cannot initialize BCR	Refer to "Contacting IBM Technical Support" on page 8-6.
81	Bar code reader Error, no response from BCR	
82	EEPROM (Electrically Erasable Programmable Read-Only Memory) Error, no response from EEPROM (located on accessor controller)	
83	Accessor controller generic problem	
84	Setting of gripper motor parameters failed	
85	Setting of slider motor parameters failed	
86	Setting of elevator motor parameters failed	
87	Setting of rotation motor parameters failed	
88	Setting of sled motor parameters failed	
89	Gripper blocked	1. If this is the first time the library has been powered ON or if it has been moved to a new location, ensure that the shipping lock has been removed. The lock is located on the top of the library (see "Removing and Storing the Shipping Lock" on page 2-3). 2. Remove the left and right cartridge magazines (refer to "Cartridge Magazines" on page 2-29). 3. Look inside the library and remove any obvious obstruction that may be preventing the accessor from functioning properly. 4. Cycle library power and retry operation. • If the error reoccurs, refer to "Contacting IBM Technical Support" on page 8-6. • If the error does not reoccur, continue with normal library operation.
8A	Slider blocked	
8B	Elevator blocked	
8C	Rotation blocked	
8D	Sled blocked	

Table 7-1. Error Codes (continued)

Error Code	Description	User Action
8E	Cannot find gripper block within the expected range	1. Run the Library Verify Test, then retry the operation. 2. If the error recurs, refer to "Contacting IBM Technical Support" on page 8-6.
8F	Cannot find slider block within the expected range	
90	Cannot find elevator block within the expected range	
91	Cannot find rotation block within the expected range	
92	Cannot find sled block within the expected range	
93	Gripper outside range, Gripper has reached a position beyond the expected range	
94	Slider outside range, Slider has reached a position beyond the expected range	
95	Elevator outside range, Elevator has reached a position beyond the expected range	
96	Rotation outside range, Rotation has reached a position beyond the expected range	
97	Sled outside range, Sled has reached a position beyond the expected range	
98	Cartridge present sensor not found	
99	Slider home sensor not found	
9A	Rotation home sensor not found	
9B	Sled position sensor not found	
9C	Gripper range out of specification	
9D	Slider range out of specification	
9E	Elevator range out of specification	
9F	Rotation range out of specification	
A0	Sled range out of specification	
A1	Open I/O Station (Import/Export Element) failed	Refer to "Contacting IBM Technical Support" on page 8-6.
B0	Robotic controller response timeout. A command did not complete in the required amount of time.	
B1	NACK (not acknowledged) received from robotic controller	
B2	Accessor controller communication failed	

Table 7-1. Error Codes (continued)

Error Code	Description	User Action
B3	Accessor controller urgent stop due to a released magazine	1. Verify that the left and right magazines are completely inserted, then retry operation. 2. If the problem still exists, refer to "Contacting IBM Technical Support" on page 8-6.
B4	Cartridge did not transport completely Gripper could not pick cartridge and CP sensor not present After pushing the cartridge, CP sensor still not present	Refer to "Contacting IBM Technical Support" on page 8-6.
B5	Accessor controller does not respond on command	
C0	Network initialization failed	1. Check network cable and network configuration, then retry operation. 2. If the error recurs, refer to "Contacting IBM Technical Support" on page 8-6.
C1	Telnet Interface initialization failed	
C2	Webserver initialization failed	
C6	Ping command did not reach target	
C7	Cannot Upgrade from USB	Refer to "Contacting IBM Technical Support" on page 8-6.
D0	ROM error. ROM checksum incorrect	
D1	RAM error. Power on Self Test (POST) has failed,	
D2	NVRAM (Non-Volatile Random Access Memory) error. R/W operation to NVRAM has failed	
D3	CTC (Channel to Channel) Error. Timer unit has failed during POST.	
D4	UART (Universal Asynchronous Receiver Transmitter) Error. Frame overrun or Parity Error on serial Interface.	
D5	Display Error Communication to display failed	
D6	Memory Error, Stack and heap overflow.	
D7	Fatal system error	
D8	Data base error	
D9	No SCSI IC detected	
DA	While running the Library Verify Test, the bar code reader read different bar code data for the same customer-supplied scratch cartridge label.	1. Check the barcode label on the customer-supplied scratch cartridge, then run the Library Verify Test again. 2. If the error recurs, refer to "Contacting IBM Technical Support" on page 8-6.

Table 7-1. Error Codes (continued)

Error Code	Description	User Action
DB	External cooling fan error (fan motion has stopped). The subcode indicates which drive sled fan is affected Subcode 01: drive sled #1(bottom) Subcode 02: drive sled #2	1. Verify that the indicated fan is operational and not obstructed. 2. If fan is not working, replace the drive sled that is failing.If the error recurs, refer to "Contacting IBM Technical Support" on page 8-6
DC	I^2C Bus Failure	Refer to "Contacting IBM Technical Support" on page 8-6
DD	Power Supply x fan has failed, Redundancy may be at risk The subcode indicates which power supply fan is affected Subcode 01: 1st PS fan from bottom Subcode 02: 2nd PS fan from bottom	Check if the indicated fan is operational and not obstructed. Check ambient temperature conditions. Power cycle the unit If the error persists, contact technical support and replace power supply x.
DE	Power supply x has failed, Redundancy is not available The subcode indicates which power supply is affected Subcode 01: 1st PS from bottom Subcode 02: 2nd PS from bottom	Ensure the power supply is inserted correctly and that the thumbscrews are adjusted. Power cycle the unit. If the error persists, contact technical support and replace power supply x.
F0	Drive Over temperature Condition The subcode indicates which drive is affected. Example: Subcode 02: drive #2	1. Check the ambient temperature conditions, and check all fans. 2. If the error recurs, refer to "Contacting IBM Technical Support" on page 8-6
F1	Drive Communication Error Library controller has lost communication to drive The subcode indicates which drive is affected. Example: Subcode 02: drive #2	Refer to "Contacting IBM Technical Support" on page 8-6
F2	Drive Sled not present The subcode indicates which drive sled is affected. Example: Subcode 02: drive sled #2	1. Verify that the drive sled is properly installed in the library and that all associated cables are properly connected, then retry the operation. 2. If the error recurs, refer to "Contacting IBM Technical Support" on page 8-6

Table 7-1. Error Codes (continued)

Error Code	Description	User Action
F3	Drive Hardware Error The subcode indicates which drive is affected. Example: Subcode 02: drive #2	Refer to "Contacting IBM Technical Support" on page 8-6.
F4	Drive Load Timeout Drive has run in a timeout while loading a tape. The subcode indicates which drive is affected. Example: Subcode 02: drive #2	
F5	Drive Unload Timeout Drive has run in a timeout while unloading a tape The subcode indicates which drive is affected. Example: subcode 02: drive #2	

Table 7-2. Sub error codes

Error Code	Description
Robotics	
00	No sub error code
01	Mechanical initialization failure
02	Connection to slave robotic failed
03	Error motor initialization
04	Error during gripper close
05	Error slider home positioning
06	Error elevator home movement
07	Error during sled movement to rotation position
08	Error during rotation initialization, get range failed
09	Error elevator init
0A	Error during rotation to far position

Table 7-2. Sub error codes (continued)

0B	Error first sled init, move to sensor failed
0C	Error during sled movement to rotation position
0D	Error during rotation to drive position
0E	Error slider init, get range failed
0F	Error during slider forward movement
10	Error gripper init, get range failed
11	Error during slider home movement
12	Error during rotation to FAR position
13	Error sled init, move to sensor failed
20	Error Inventory scan
21	Error during gripper close
22	Error slider home movement
23	Error during move gripper to scan pos
24	Error reading barcode label
28	Error Extra inventory scan
29	Error during closing gripper
2A	Error slider preposition movement
2B	Error during opening gripper
2C	Error during sled movement up to sensor
2D	Error slider preposition backwards movement
30	Error slot preposition
31	Error during sled movement in FLMoveRotation function
32	Command sending to robotic failed
33	Error during elevator movement in FLMoveRotation function
34	Error during rotation in FLMoveRotation function
35	Error during elevator movement in FLMoveSled function

Table 7-2. Sub error codes (continued)

36	Error during sled movement in FLMoveSled function
37	Error during sled positioning to sensor in FLMoveSled function
38	Error during sled positioning to mail slot in FLMoveSled function
39	Error during sled positioning without sensor
40	Movement to/from slot failed
41	Error during first slider movement
42	Error during first gripper movement
43	Error during second slider movement
44	Error during second gripper movement, get range failed
45	Error during third slider movement, move home failed
50	Preposition to drive failed
51	Elevator movement to home sensor failed.
52	Sled movement to home sensor failed.
53	Error during sled movement to drive position.
54	Error during rotation to drive position.
55	Error during elevator movement in drive position.
56	Error during sled movement to rotation position.
57	Error during rotation to end position.
60	Move from/to drive failed.
61	Error during first slider movement.
62	Error during first gripper movement.
63	Error during second slider movement.
64	Error during second gripper movement, get range failed.
65	Error during third slider movement, move home failed.
70	Release magazine failed.
71	Error during sled movement to rotation position.
72	Error during rotation to unlock position.
73	Error during move sled to block.
80	Opening I/O slot failed.
81	Error during movement to I/O slot open position.
82	Error during moving back - sensor was found.
90	Movement to home position failed.
91	Elevator movement to home position failed.
92	Error during sled movement to rotation position.
93	Error during rotation to home or far position.

Table 7-2. Sub error codes (continued)

94	Sled movement to home sensor position failed.
95	Sled movement to transport position failed.
A0	Movement of I/O slot failed.
A1	Sled movement to sensor failed.
A2	Sled movement to rotation position failed.
A3	Elevator movement to home position failed.
A4	Error during rotation to far position.
A5	Sled movement to I/O slot position failed.
Library	
81	Drive wake up failed
88	Error accessing slot status
90	Accessor load not reached Cartridge Present sensor
91	No activity after Load command
92	Timeout while loading tape
93	No activity after load command
94	Timeout drive Unload
95	Drive terminated unsuccessfully
96	Tape not ejected at robot unload
97	Slot not free at robot unload

Chapter 8. Service Procedures

Removing Cartridges from Magazine Slots

In the event of a severe mechanical problem with the library or if circumstances require you to remove tape cartridges, do the following. If the Operator Control Panel or the Web User Interface is still operational:

1. Move the tapes from the drive(s) to the magazines using the **Move Media** command. See "Manage Library: Move Media" on page 4-43.

   Note: Refer to "Contacting IBM Technical Support" on page 8-6 if a cartridge will not eject from the drive.
2. Use the magazine removal process to release the magazine and remove it from the library. To use the Operator Control Panel, see "Control: Magazine" on page 4-16. To use the Web User Interface, see "Manage Library: Release Magazine" on page 4-44. If neither one of these processes works, see "Releasing the Magazines Manually."

Identifying a Suspect Cartridge

The amber **Attention** LED will be lit on the front panel of a library when there has been a failure that indicates a piece of media is bad, marginal, or invalid. It will be cleared when all invalid cartridges have been exported from the library. The amber LED may also be lit because a power supply, or a power supply fan is failing.

To identify a suspect cartridge

1. Navigate to **Move Cartridges** using the Operator Control Panel (**Control** → **Move Cartridges**).
2. Select **Source**.
3. Scroll through the different slots containing cartridges, and look for an exclamation point (!). The exclamation point indicates that the cartridge is bad or was rejected due to wrong format, write protected, etc..
4. Select the marked cartridge as the **Source** and the I/O Station as the **Destination** (**Dest**.).
5. Select **Move**.
6. Open the I/O Station (**Control** → **I/O Station**).
7. Remove the marked cartridge from the I/O Station and dispose of properly.
8. Close the I/O Station. If the amber LED was lit because of bad media, the **Attention** LED will turn OFF. If the amber LED is still on, check the power supply or the power supply fans. See "Isolating a Power Supply Problem" on page 6-5.

Releasing the Magazines Manually

If the directions in steps 1 and 2 above do not allow you to remove the tapes, do the following:

1. Unplug the power cord from the library.
2. Find the access holes for the right and left magazines.

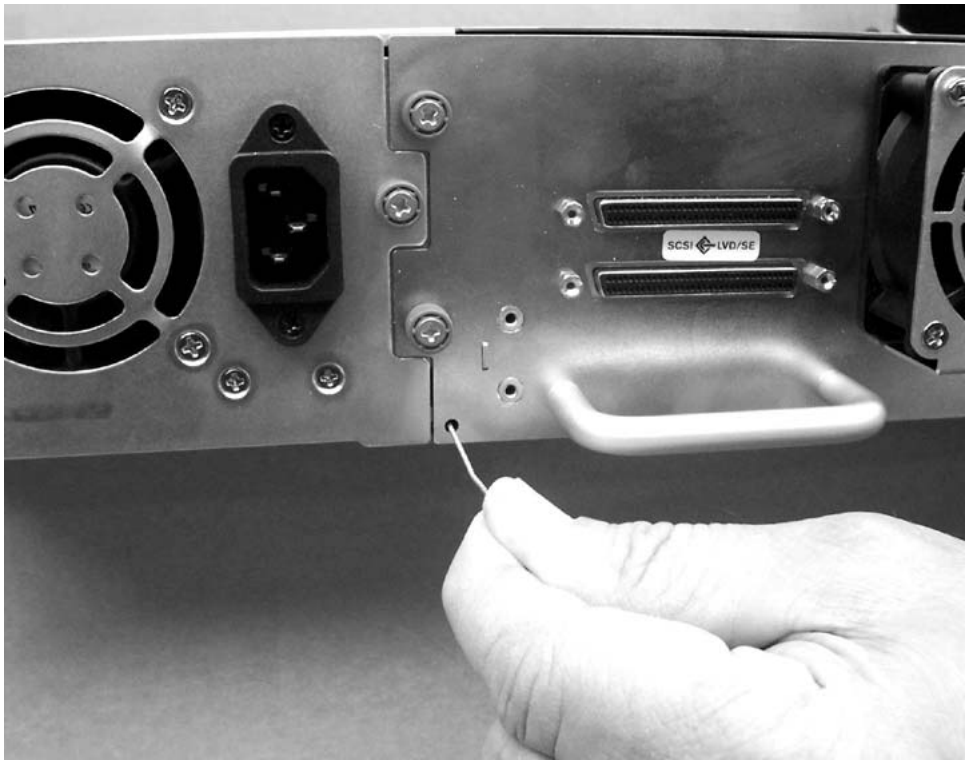


Figure 8-1. Access holes for the left magazine

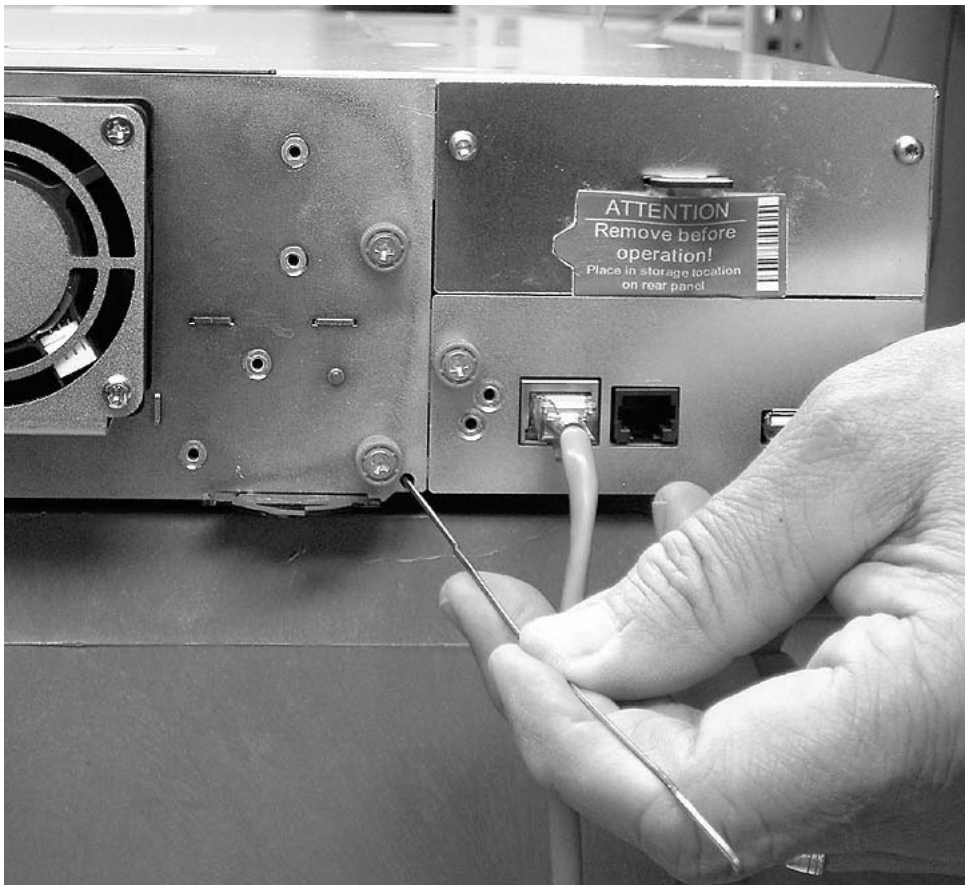


Figure 8-2. Access holes for the right magazine

3. To manually release the magazines, push the end of a straightened paper clip into the access hole for each magazine at the back of the library. While holding the paper clip, have a second person pull the magazine out of the front of the unit. DO NOT push the paper clip in more than 1/2 inch.

Figure 8-3. Left magazine pulled out of the 2U library

Figure 8-4. Left Magazines pulled out of the 4U Library

4. If there are additional tapes still in the library, or if you were unable to manually remove the magazines and drive, contact technical support for further instructions.

Using the ITDT Firmware Update, Dump Retrieval and Drive Test Tool

A newly designed tool, ITDT, has multiple functional capability and is a very quick, convenient and efficient method for drive firmware updates. As a note, drive dump retrievals can be performed by the tool as well.

Below are some of the capabilities of this tool:

- Firmware update capability via host interface to all IBM LTO Tape Drive products.
- Does not require any special device drivers.
- Available for most major platforms (Windows, AIX®, SUN, Linux™, NetWare).
- Capable of uploading drive dump files.
- Primary function is thoroughly testing a drive. However, if the library is online to the server/host where the tool resides, ITDT will communicate with the drive through the library to load and unload a test cartridge thereby exercising some library functions.
- Scans the host interface and will find and display for selection all IBM LTO devices. The tool will not display and allow for selection of any non-IBM device.
- Each function has a ″Help″ selection which explains the required syntax as well as a brief explanation of the particular function.
- A Readme text file will be posted with the .exe for a thorough explanation of initial tool download information from the web as well as explanation of tool capabilities.
- Currently a ″command line″ tool with a simple entry by keying in the executable name, **itdt**, from the directory where the tool is located.

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

Pre-Call Checklist

If you have questions or problems concerning the library, perform the following steps before placing a call to IBM Technical Support.

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

1. Verify that you have exhausted all troubleshooting options.
2. 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.
3. Verify that your device drivers are at the most recent level (see your server (host) manual for instructions).
   - For the latest release of IBM device drivers, visit the web.
   - For the latest release of device drivers by Independent Software Vendors (ISVs), visit the appropriate third-party web site.
4. Verify whether your hardware and software configuration is supported. To determine the latest supported attachments, visit the web.
5. Perform a general checkup of the hardware and connections:
   - Ensure that you are using the correct SCSI terminator and that you are not mistakenly using a SCSI wrap plug.
   - Ensure that the SCSI cable connector does not contain bent or recessed pins.

- Ensure that all retention screws for the SCSI cable and terminator are securely tightened.
- Ensure that all Fibre Channel cables are in good condition and all connections are secure.
- Ensure that all Serial Attached SCSI (SAS) cables are in good condition and all connections are secure.

6. If you still have a problem after completing the above steps, see "Contacting IBM Technical Support."

Contacting IBM Technical Support

- Perform the steps in "Pre-Call Checklist" on page 8-5 before placing a call to IBM Technical Support.
- Prior to calling IBM Technical Support, the customer is responsible for following IBM's published LTO diagnostic procedures including any needed update to the latest level of firmware. For details, visit **http://www.ibm.com/storage/support/lto**.
- The IBM Support Center will assist with problem determination and initiate shipment of a replacement part, if needed, to the customer's location. transportation costs, both ways, are paid by IBM. The replacement part becomes the property of the customer in exchange for the failed part, which becomes the property of IBM. The customer is responsible for packing the failed part into the shipping carton that contained the replacement part. Failure to return the failed part to IBM within 30 days will result in the customer being billed for the new list price. The customer is responsible for installing and setting up the CRU replacement part. All FRU replacement parts will be installed by an authorized IBM Service Representative.
- Failure to use the carton in which the replacement part was received, or failure to otherwise properly pack the returned part, could result in charges being incurred by the customer for damage to the failed part during shipment.
- Before calling support, follow these steps which will help you take full advantage of your call:
  1. Be prepared to provide library and drive firmware levels currently installed.
  2. Review all documentation carefully. (Experience has demonstrated that most questions are answered in your documentation.)
  3. Be prepared to explain whether the software or hardware has worked properly at anytime in the past. Have you changed anything recently?
  4. 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?
  5. Note any error messages displayed on your PC monitor or file server. Write down the exact error message.
  6. If at all possible, call while at your computer, with the library installed and turned on.
  7. If running on a network, have all relevant information available (that is, type, version number, network hardware, and so on).
  8. Be prepared to provide:
     - Machine type and Model name(s)
     - Serial number of the library (front of the control module on the label underneath the power button)
     - Software version numbers

- Device driver information
- Host application name and version
- Hardware configuration, including firmware versions, date, and number
- Type of host, operating system version, clock speed, RAM, network type, network version, and any special boards installed
- A brief description of the problem

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

- To contact IBM Technical Support:
  - In the USA: 1-800-IBM_SERV (1-800-426-7378)
  - All other Countries/Regions: **http://www.ibm.com/us/**
  - To open a Service Request online: Under **Get Support**, click **Open a Service Request**.

Chapter 9. Check, Adjust, Remove, and Replace

Tools Required

To service a library you may need one or more of the following tools:

- #2 Phillips screwdriver
- Ground strap (recommended, if available)

Electrostatic Discharge

Important: A discharge of static electricity can damage static-sensitive devices or microcircuitry. Proper packaging and grounding techniques are necessary precautions to prevent damage.

To prevent electrostatic damage, observe the following precautions:

- Transport products in static-safe containers such as conductive tubes, bags, or boxes.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free stations.
- Cover the unit with approved static-dissipating material. If available, provide a ground strap connected to the work surface and properly grounded tools and equipment. If a ground strap is not available, touch a metal surface to discharge any static electricity in your body.
- Keep the work area free of no conducting materials, such as ordinary plastic assembly aids and foam packing.
- Make sure you are always properly grounded when touching a static-sensitive component or assembly.
- Avoid touching pins, leads, or circuitry.
- Use conductive field service tools.

Replacing a Tape Drive

Tape drives are installed at the back of the library.

Note: This part is hot pluggable. It is not mandatory to power down the library to replace a drive.

The black pull-out tab located underneath the right edge of the drive sled is for manufacturing tracking purposes.

1. Using your Web User Interface or the Operator Control Panel, unload the tape cartridge from the drive to be removed.
2. Remove the host interface cable (**5**) and terminator (**2** for SCSI drive only).

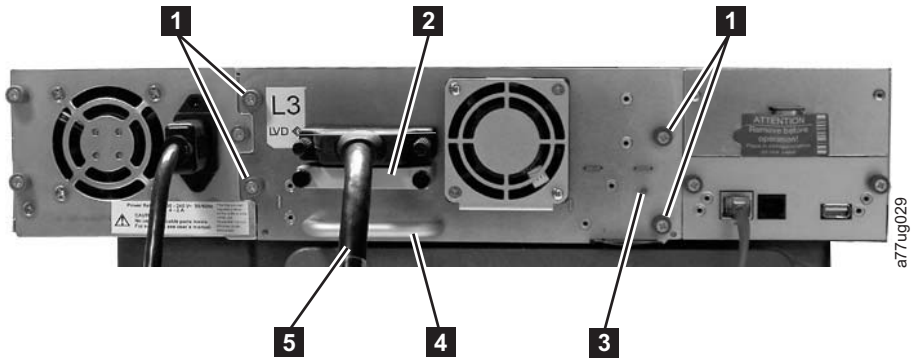


Figure 9-1. Drive sled components on back panel of a 2U library

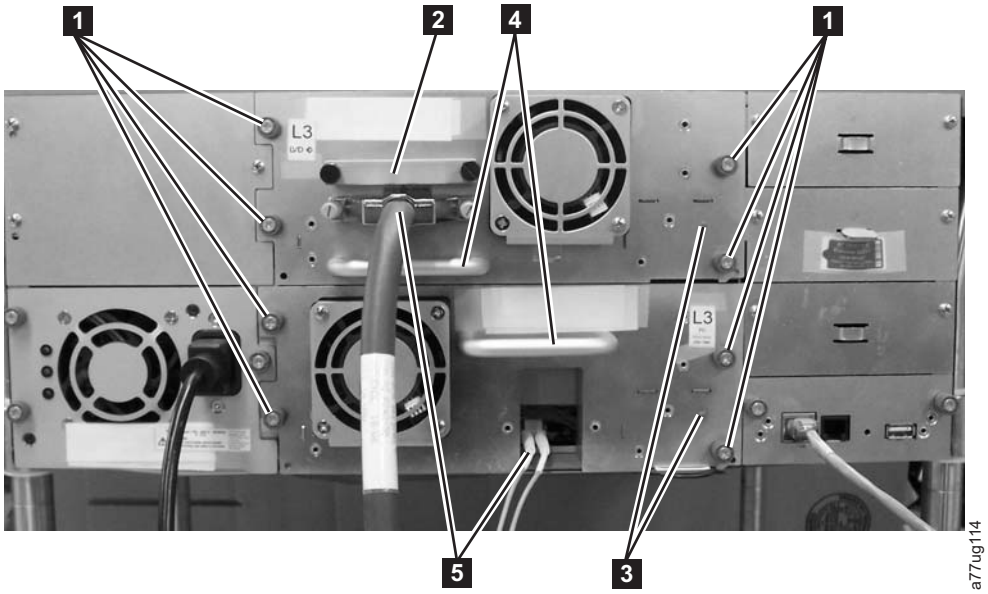


Figure 9-2. Drive Sled Components on back panel of 4U Library (SCSI and FC both shown)

3. Loosen the blue captive thumbscrews (**1**) on the drive.
4. Pull straight back on the tape drive handle (**4**) to remove it from the library.

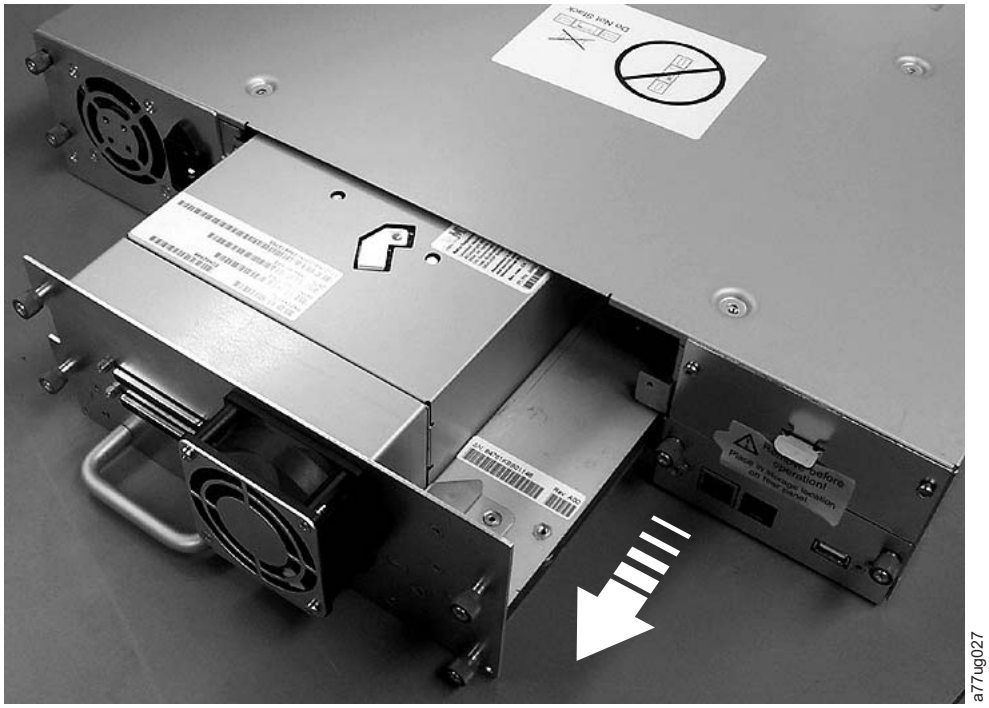


Figure 9-3. Pulling the drive out of the library

5. Before installing the new drive, inspect the connectors on the tape drive. Ensure that the connectors are intact, free of any foreign objects, and have no cracks or deformed or bent contacts.
6. Extend the black pull-out tab located underneath the lower right corner of the drive sled.
7. Slowly insert the new tape drive into the drive slot, and align the connectors on the library while supporting the drive assembly. Ensure that the black tab remains extended.

   Important: Push in on the tape drive handle (**4**) while supporting the bottom of the tape drive until it is properly seated. Damage to the connector pins may occur if this procedure is not followed.
8. Push the tape drive slowly into the drive slot until the drive seats itself against the back of the library.

Figure 9-4. Pushing the drive into the library

9. Tighten the captive thumbscrews (**1**) until the drive is secure.
10. Push the black tab back underneath the drive sled. When inserted properly, only the handle of the tab will be visible.
11. Upgrade the library firmware to the latest version. See "Service Library: Upgrade Firmware" on page 4-47.

    Note: Go to http://www-912.ibm.com/eserver/support/fixes/ to download the latest firmware for your tape drive.
12. Run the Library Verify test (refer to "Service: Library Verify" on page 4-24).

Removing the Slot Blocker - 2U Library

Earlier versions of the 2U library may have a ″slot blocker″ in the upper right cell of the left magazine. A slot blocker is used to close off/restrict a data cell so a data cartridge cannot be placed there. For 2U libraries using library firmware of 1.90 or higher, this blocker can be removed by following the procedure below:

Figure 9-5. 2U Library with Slot Blocker

Completely remove the magazine from the library. The power does not have to be turned off.

1. In the upper right cell, locate the slot blocker (**1**).
2. Remove the slot blocker.
   a. From behind the magazine, push a screwdriver or a pen through the hole.
   b. Pop the slot blocker out of the cell.

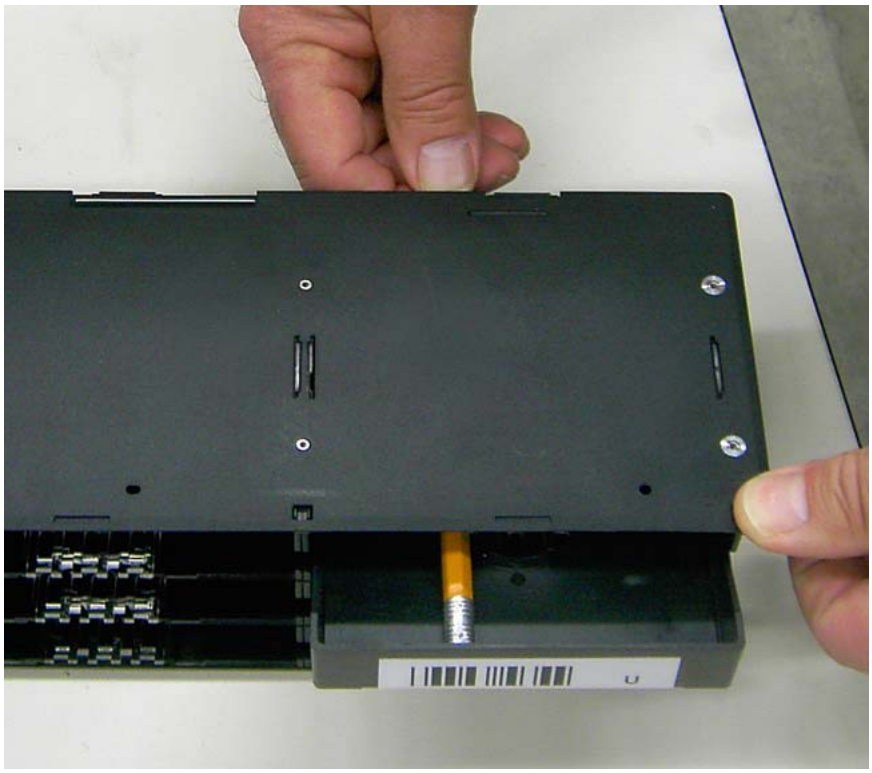


Figure 9-6. Popping the Slot Blocker out of the Cell

3. Slide the magazine back into the rack.
4. After the accessor runs through the inspection, a REMOVE SLOT RESTRICTION? message will appear on the main menu screen.
5. Choose the YES option. You can replace the empty cell with a data cartridge.

Replacing a Power Supply

1. Power OFF the library by pressing and holding down the power button for 4 seconds.
2. Disconnect the power cord from the electrical source, then from the library.
3. Loosen the three blue captive thumbscrews on the power supply located on the back panel of the library.
4. Pull on two of the thumbscrews to pull the unit away from the rear panel of the library, then grasp the top and bottom edge of the power supply and pull it out of the library.

Figure 9-7. A power supply being removed from a 2U library

5. Remove the packaging from the replacement power supply.
6. Grasp the top and bottom edge of the power supply and push it into the library.
7. Tighten the three blue captive thumbscrews on the power supply located on the back panel of the library.
8. Connect the power cord to the library, then to the electrical source.
9. Power ON the library using the power button on the front panel.
10. Run the Library Verify test (refer to "Service: Library Verify" on page 4-24).

Replacing a Library Controller Card

Read Me before Continuing

The Library Controller Card contains a copy of the vital product data (VPD) for your library. The VPD contains your current library configuration. A backup copy of this VPD is contained within the electronics of the Library Enclosure. When the Library Controller Card is replaced, the new replacement card should contain zeros (0's) in key VPD locations. Upon detection of these zeros, the library will automatically attempt to write VPD data to the new Library Controller Card from the backup copy of the VPD contained in the Library Enclosure. In rare occurrences, the new Library Controller Card may contain valid (non-zero) VPD data left over from having been installed previously in another library. If this occurs, the library, which is expecting to see zeros in the VPD area, will instead detect valid VPD data, and will not know which copy of the VPD is the correct one. It will detect a "VPD Mismatch" and display on the OCP a screen entitled "VPD Selection", where it is asking you to determine which copy of VPD should be written to the new Library Controller Card.

If the message "VPD Selection" is displayed at the OCP, carefully highlight the "VPD from Enclosure (Chassis)" option to copy that version of the VPD to the new Library Controller Card. Then continue with the procedure.

Removal and Replacement

1. Power OFF the library by pressing and holding the power button at the front of the library for 4 seconds.
2. Disconnect the power cord from the electrical source, then from the power supply or supplies at the back of the library.
3. Loosen the two blue captive thumbscrews on the Library Controller Card.
4. Grasp the two thumbscrews and pull the defective Library Controller Card out of the library.

Figure 9-8. A Library Controller Card being removed from the library

5. Remove the packaging from the replacement Library Controller Card.
6. Grasp the two thumbscrews and push the replacement Library Controller Card into the library.
7. Tighten the two blue captive thumbscrews on the Library Controller Card.
8. Connect the power cord to the power supply or supplies at the back of the library, then to the electrical source.
9. Power ON the library using the power button on the front panel.
10. After power is restored to the Library Controller Card, the library will automatically restore the VPD on the new Library Controller Card from the Library Enclosure. If a ″VPD Selection″ message is displayed in the OCP, see the ″Read Me before Continuing″ section earlier in this procedure to determine how to respond to the message.
11. Run the Library Verify test (refer to “Service: Library Verify” on page 4-24).

    Note: Use care when selecting the appropriate VPD to restore from/to. An error in selection here could cause a long downtime.
12. Package the failed Library Controller Card in the same packaging in which the new control board was shipped to you and return to IBM. Fill out the Warranty Redemption form and return it in the package with the Library Controller Card.

Replacing Cartridge Magazines

To replace a cartridge magazine, refer to one of the following procedures:

- Using the Web User Interface, refer to “Manage Library: Release Magazine” on page 4-44.
- Using the Operator Control Panel, refer to “Control: Magazine” on page 4-16.
- If your library can not be powered ON, refer to “Releasing the Magazines Manually” on page 8-1.

Replacing Magazine Fiducials

Magazine fiducials are location sensors utilized by the library accessor. Extra magazine fiducials are included in your original library shipment.

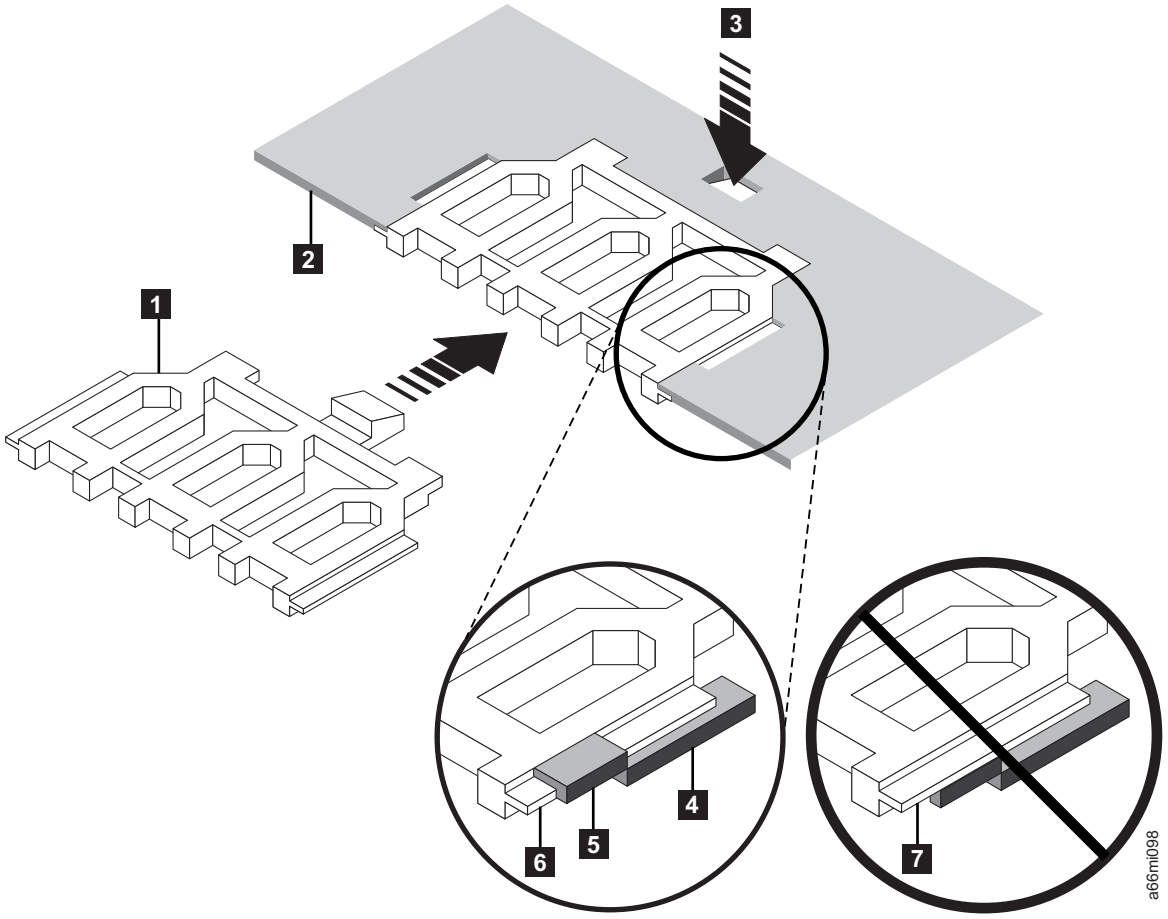


Figure 9-9. Magazine fiducial

1. Remove the cartridge magazine that requires a replacement fiducial (refer to “Cartridge Magazines” on page 2-29.
2. Remove the damaged fiducial by pushing on the fiducial tab (**3**) and pulling the fiducial (**1**) out of the slot in the magazine (**2**).
3. Slide the replacement fiducial (**1**) into the correct magazine slot (**2**) being sure that the fiducial tab (**6**) on each side of the fiducial is underneath the magazine slot at **5** and above the magazine slot at **4** . Ensure that the fiducial is not installed in the magazine slot as indicated by **7** .
4. Slide the cartridge magazine into the library and resume normal library operation.

Replacing the Library Enclosure

Note: The 2U library weighs 17.59 kg (38.8 lbs.) without media, and 21.12 kg (46.6 lbs.) when both magazines are full (21 cartridges). To reduce the risk of personal injury or damage to equipment:

- observe local health and safety requirements and guidelines for manual material handling,
- obtain adequate assistance to lift and stabilize libraries during installation or removal, and
- remove all tapes to reduce the overall weight of the library.

You will need a #2 Phillips screwdriver to replace the library enclosure. Before beginning, be sure the tape drive does not contain a tape cartridge. To remove a cartridge, see "Manage Library: Move Media" on page 4-43.

Read Me before Continuing

The Library Enclosure contains a copy of the vital product data (VPD) for your library. The VPD contains your current library configuration. A backup copy of this VPD is contained within the Library Controller Card. When the Library Enclosure is replaced, the new enclosure electronics should contain zeros (0's) in key VPD locations. Upon detection of these zeros, the library will automatically attempt to write VPD data to the new Library Enclosure from the backup copy of the VPD contained in the Library Controller Card. In rare occurrences, the new Library Enclosure may contain valid (non-zero) VPD data left over from having been installed previously in another library. If this occurs, the library, which is expecting to see zeros in the VPD area, will instead detect valid VPD data, and will not know which copy of the VPD is the correct one. It will detect this "VPD Mismatch" and display a message entitled "VPD Selection" on the OCP. The library will need your input to determine which copy of VPD to write to the new Library Enclosure. Do not try to replace the library enclosure and the Library Controller Card at the same time, otherwise your VPD will be lost!

If the message "VPD Selection" is displayed at the OCP, carefully highlight the "VPD from Controller" option to copy VPD from the controller to the Library Enclosure. Then continue with the procedure.

1. Remove the magazines from your library (see "Cartridge Magazines" on page 2-29).
2. Turn OFF power to your library by using the power button on the front panel (**1** in Figure 1-1 on page 1-2).
3. On the rear panel of the library:
   - Disconnect the power cord (**4** in Figure 9-10 on page 9-10).
   - Disconnect the host interface cable (**3** in Figure 9-10 on page 9-10).
   - Disconnect the Ethernet cable (**5** in Figure 9-10 on page 9-10), if necessary.
   - Loosen the blue thumbscrews on the tape drive (**1** in Figure 9-10 on page 9-10), and pull the tape drive handle (**2** in Figure 9-1 on page 9-2) while supporting the bottom of the drive to remove the drive from your library.

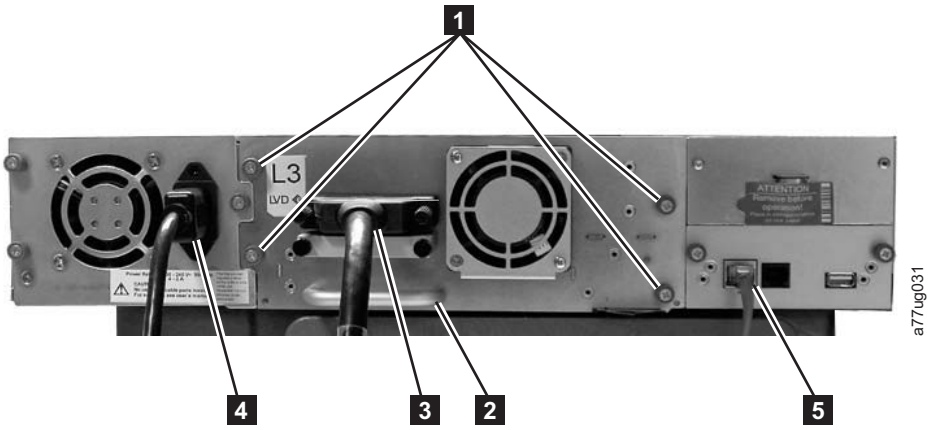


Figure 9-10. Rear panel of 2U library

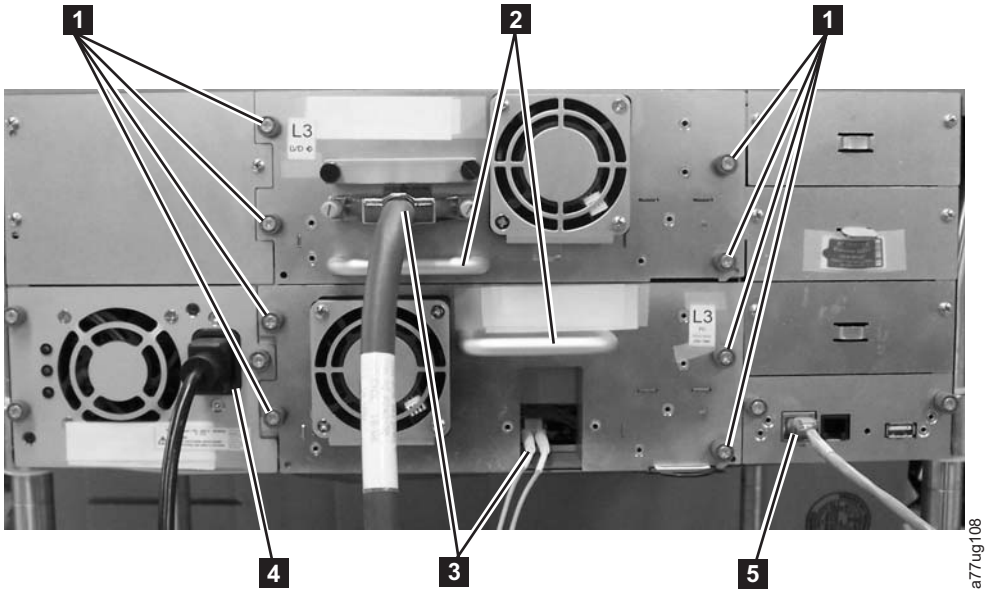


Figure 9-11. Rear Panel of 4U Library

4. If your library is installed in a rack:
   a. From the front of the library remove the two screws (**1** in Figure 9-12 on page 9-11) anchoring the mounting brackets on the library to the rack.

Figure 9-12. Removing the two screws anchoring the library to the rack

b. Remove your library from the rack using assistance.

5. Remove the replacement library enclosure from the packing materials.

   Note: The replacement Library Enclosure includes cartridge magazines, a power supply, and a Library Controller Card. These items are included with the replacement library enclosure due to safety agency requirements. These unused parts will be removed from the new Library Enclosure and sent back with the defective enclosure. The old parts currently in your defective enclosure will be removed, and installed into the new Library Enclosure in a later step.

6. To install the replacement library enclosure in your rack:
   a. Place the replacement library enclosure on a solid surface in preparation for installation into the rack
   b. Remove the mounting brackets and anchors from your library and install them on the replacement library (see Figure 2-8 on page 2-8).
   c. With assistance, slide the replacement library enclosure onto the metal rails that are already in position in the rack.
   d. Tighten the mounting bracket screw to anchor the replacement library enclosure to the rack (see Figure 9-12).
7. Install your drive in the replacement library enclosure.
8. Exchange the library controller board in the replacement library enclosure with the one installed in your library (see “Replacing a Library Controller Card” on page 9-6. Place the unused Library Controller Card in the failing Library Enclosure for return.
9. Exchange the library power supply that came with the replacement Library Enclosure with the old one installed in your library. Place this unused power supply in the failing Library Enclosure for return.
10. Power on the library using the power button on the front panel.
11. After power is restored to the Library Enclosure, the library will automatically restore the VPD on the new Library Enclosure from the Library Controller Card. If a ″VPD Selection″ message is displayed in the OCP, see the ″Read Me before Continuing″ section earlier in this procedure to determine how to respond to the message.
12. Exchange the left and right magazines in the replacement Library Enclosure with those taken out of the defective Library Enclosure being replaced. Put the magazines removed from the replacement Library Enclosure into the Library Enclosure being returned.

13. Properly fill out the Repair Identification (RID) Tag with the serial number of your old library and apply the tag to the front of your new library enclosure (refer to “Applying a RID Tag”).
14. Run the Library Verify test (refer to “Service: Library Verify” on page 4-24).
15. Securely package the library enclosure that was replaced (including the left and right magazines, Library Controller Card, and power supply) and return to IBM. Fill out and return the Warranty Redemption card when you return the library enclosure.

Important: Failure to return all of these components to IBM will result in your being charged for any missing components.

Applying a RID Tag

The RID (Repair Identification) Tag is important in transferring the serial number of the old library enclosure to the new library enclosure. This will ensure that your warranty coverage, if applicable, is not interrupted.

1. Copy the serial number from the label on the front of your old enclosure onto the RID Tag.

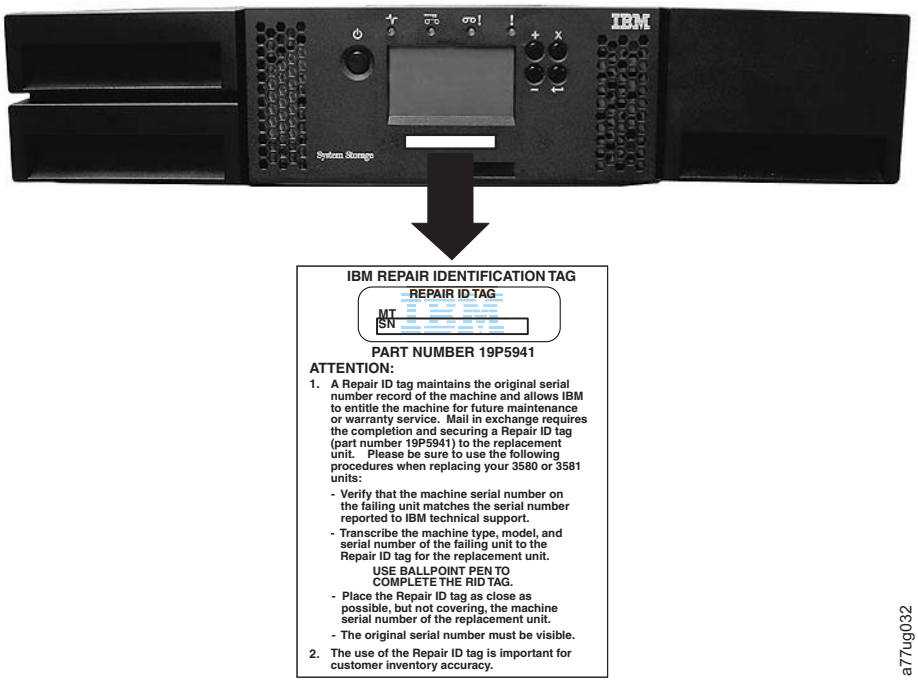


Figure 9-13. RID Tag applied to the front of a 2U library

2. Place the RID Tag on the front of the library.

Chapter 10. Optional Features, Replacement Parts and Power Cords

For information on ordering tape cartridges, refer to “Ordering Media Supplies” on page 5-18. For information on ordering bar code labels, refer to “Ordering Bar Code Labels” on page 5-20

Optional Features

Table 10-1. Optional Features

Feature Code	Description
1682	Path Failover (4U) (Not available on High Volume (HVEC) models)
1901	Additional Power Supply (4U)
5096	LC-SC Fibre Cable Interposer
5402	2.0 M SAS/Mini-SAS 1x Cable
5406	5.5 M SAS/Mini-SAS 1x Cable
5500	Mini-SAS/550x 4x Interposer
5502	2.0 M Mini-SAS/Mini-SAS 1x Cable
5506	5.5 M Mini-SAS/Mini-SAS 1x Cable
5602	2.5 M VHDCI/HD68 SCSI Cable
5604	4.5 M VHDCI/HD68 SCSI Cable
5610	10 M VHDCI/HD68 SCSI Cable
5900	Transparent LTO Encryption (Not available on High Volume (HVEC) models)
6005	5 M LC/LC Fibre Cable
6013	13 M LC/LC Fibre Cable
6025	25 M LC/LC Fibre Cable
7002	Rack Mount Kit
8002	Cleaning Cartridge L1 UCC
8043	Ultrium 3 LVD SCSI Tape Drive
8044	Ultrium 3 4Gb/s Fibre Channel Tape Drive
8046	Ultrium 3 Half-High SCSI Tape Drive
8047	Ultrium 3 Half-High SAS Tape Drive
8106	Right Side Magazine
8143	Ultrium 4 SCSI Tape Drive
8144	Ultrium 4 Fibre Tape Drive
8145	Ultrium 4 SAS Tape Drive
8305	Data Cart (GEN3) 5-Pack
8405	Ultrium 4 Data Cartridges (5 pack)
9848	Rack Power Distribution Unit (PDU) Line Cord
9900	Encryption Configuration (Not available on High Volume (HVEC) models)

Replacement Parts

Note: This library has mandatory CRUs (customer replaceable units). These CRUs are parts of the library that must be added, removed, and replaced by the customer. If a customer chooses to have the CRU added or removed/replaced by an IBM Service Representative, there will be a charge for the service.

Table 10-2. Replacement Parts

Part Number	Description
95P5855	Ultrium 4 Full High LVD SCSI Tape Drive
95P5856	Ultrium 4 Full High Fibre Tape Drive
95P5857	Ultrium 4 Full High SAS Tape Drive
95P5888	Ultrium 3 Half-High LVD SCSI Tape Drive
95P5859	Ultrium 3 Half-High SAS Tape Drive
23R7162	Ultrium 3 LVD SCSI Drive Sled
23R7163	Ultrium 3 Fibre Channel Drive Sled
23R9628	Library Controller Card
23R9627	250 W Power Supply
23R7170	Foot Pads
23R5841	SCSI Terminator
23R5840	SCSI Wrap Tool
12R9314	Fibre Channel Wrap Tool
23R7133	2.5 M VHDCI/HD68 SCSI Cable
23R3594	4.5 M VHDCI/HD68 SCSI Cable
23R3593	10 M VHDCI/HD68 SCSI Cable
95P4587	2 M SAS/Mini-SAS 1x Cable
95P4588	5.5 M SAS/Mini-SAS 1x Cable
95P4488	2 M Mini-SAS/Mini-SAS 1x Cable
95P4498	5.5 M Mini-SAS/Mini-SAS 1x Cable
95P4994	SAS/Mini-SAS 4x Interposer
95P4996	Mini-SAS/Mini-SAS 4x Interposer
23R9679	Library Enclosure (2U)
23R9629	Library Enclosure (4U)
23R6471	Left Cartridge Magazine (2U)
23R6452	Right Cartridge Magazine (2U/4U)
23R7175	Lower Left Cartridge Magazine (4U)
23R7174	Upper Left Cartridge Magazine (4U)
23R7172	Block Out Panel, Power Supply (4U)
23R7173	Block Out Panel, Full High Drive Bay (4U)
95P6720	Half High Drive Filler Plate (2U/4U)

Power Cords

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

Table 10-3 lists the power cord part number, feature code, the country or region where the power cord can be used, and the plug's standard reference. The last column in the table contains an index number that you can match to a specific receptacle type in Figure 10-1 on page 10-7.

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

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

Power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL), are certified by the Canadian Standards Association (CSA), and comply with the plug standards of the National Electrical Manufacturers Association (NEMA). For other worldwide geographies, plug standards are listed in Table 10-3.

Table 10-3. Power Cords

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 10-1 on page 10-7
US/Canada • 2.8 m, 125V • FC 9800 • PN 39M5081	NEMA 5-15P	Aruba, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, South Korea, Suriname, Taiwan, Trinidad Tobago, Venezuela, US	1
Chicago • 1.8 m, 125 V • FC 9986 • PN 39M5080	NEMA 5-15P	Chicago, U.S.A.	1
US/Canada • 2.8 m, 250 V • FC 9833 • PN 39M5095	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

Table 10-3. Power Cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 10-1 on page 10-7
Australia • 2.8 m, 250V • FC 9831 • PN 39M5102	AS 3112 NZS 198	Argentina, Australia, China, Colombia, New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa	3
France, Germany • 2.8 m, 250V • FC 9820 • PN 39M5123	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, Democractic 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 • PN 39M5130	DK2-5A	Denmark	5
South Africa • 2.8 m, 250V • FC 9829 • PN 39M5144	SABS 164	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka	6

Table 10-3. Power Cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 10-1 on page 10-7
United Kingdom • 2.8 m, 250V • FC 9825 • PN 39M5151	BS 1363	Antigua, Bahrain, Bermuda, Brunei, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Fiji, Ghana, Guyana, India, Iraq, Ireland, Jordan, Kenya, Kuwait, Malaysia, Malawi, Malta, Nepal, Nigeria, Oman, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, UK, United Arab Emirate (Dubai), Yemen, Zambia	7
Switzerland • 2.8 m, 250V • FC 9828 • PN 39M5158	SEV SN 416534	Liechtenstein, Switzerland	8
Italy • 2.8 m, 250V • FC 9830 • PN 39M5165	CEI 23- 16	Chile, Ethiopia, Italy, Libya, Somalia	9
Israel • 2.8 m, 250V • FC 9827 • PN 39M5172	S11-32-1971	Israel	10
Argentina • 2.8 m, 250V • FC 9834 • PN 39M5068	IEC 83-A5	Argentina, Brazil, Colombia, Paraguay, Trinidad Tobago, Uruguay	11
China • 2.8 m, 250V • FC 9840 • PN 39M5206	CCEE	People's Republic of China	12
Taiwan LV* • 2.8 m, 125V • FC 9835 • PN 39M5247	CNS 10917-3	Taiwan	13
Taiwan HV** • 2.8 m, 250V • FC 9841 • PN 39M5254	CNS 10917-3	Taiwan	14
Japan LV* • 2.8 m, 125V • FC 9842 • PN 39M5199	JIS C8303, C8306	Japan	15

Table 10-3. Power Cords (continued)

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 10-1 on page 10-7
Japan HV** • 2.8 m, 250V • FC 9843 • PN 39M5186	JIS C8303, C8306	Japan	16
Korea HV** • 2.8 m, 250V • FC 9844 • PN 39M5219	KS C8305, K60884-1	Korea	17
India HV** • 2.8 m, 250V • FC 9845 • PN 39M5226	IS 6538	India	18
Brazil LV* • 2.8 m, 125V • FC 9846 • PN 39M5233	InMetro NBR 6147	Brazil	19
Brazil HV** • 2.8 m, 250V • FC 9847 • PN 39M5240	InMetro NBR 14136	Brazil	20
* Low Voltage ** High Voltage			

Types of Receptacles

Figure 10-1 on page 10-7shows the plugs that are used by the power cords in Table 10-3 on page 10-3. Match the index number that is beside each plug to the index number in the table.

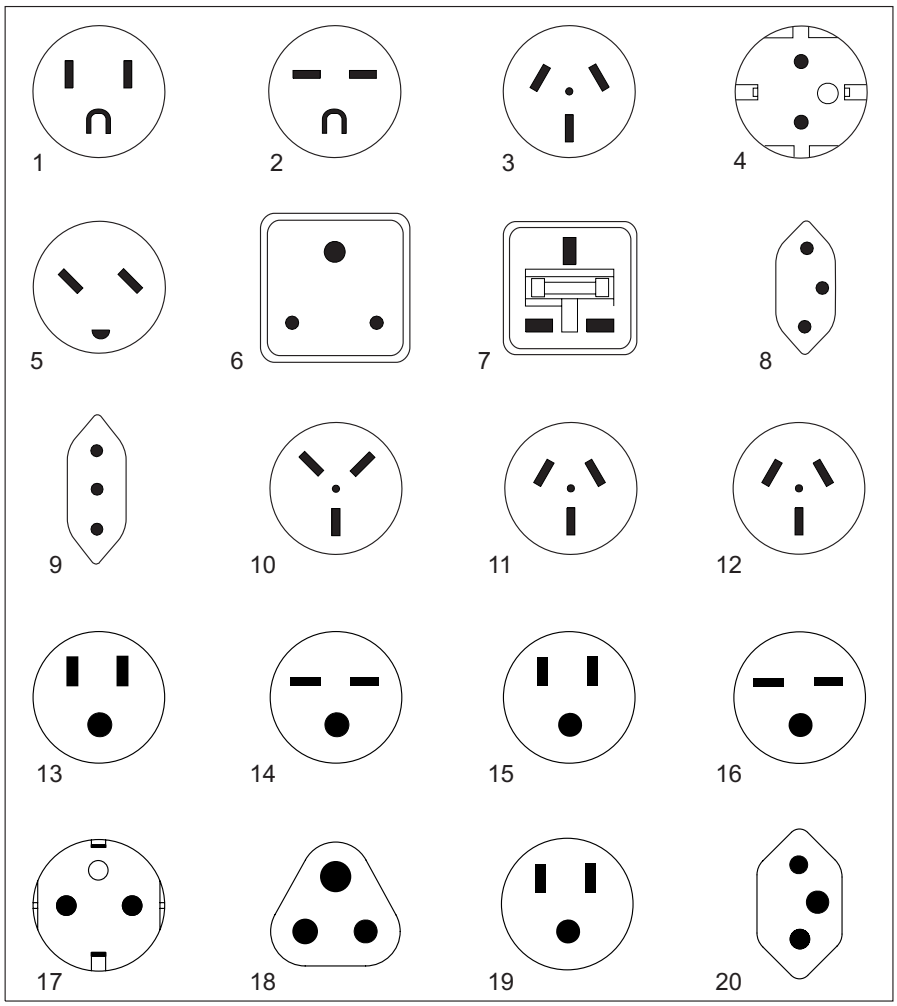


Figure 10-1. Types of Receptacles

Appendix A. Manual Cartridge Removal Procedure for Trained Service Personnel

Attention

- **It is strongly recommended that the drive and tape be returned to IBM for removal and recovery.**
- **If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make no further attempts to unload this tape. Call Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.**
- **These procedures must be performed only by a trained IBM service provider. SSRs should claim their time against service code 33 ECA 013 when performing this procedure.**
- **Inform the customer the following procedure has high risk of damaging the drive and high risk of not being able to recover the data.**

Recommended Tools

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

Before You Begin

1. If you have not already done so, attempt to remove the cartridge with the device power ON and using library manager, a host application, or the unload button. When using the Unload button, press and hold the button for 12 seconds. This will cause the drive to eject the cartridge when it has completed the midtape recovery
2. If you have not already done so, ensure the operator has issued the appropriate application commands to perform a rewind and unload of the cartridge. This is to ensure that the stuck cartridge is not due to a hang condition in the application
3. If you have not already done so, attempt to remove the cartridge by power cycling the drive. Look for the drive to attempt a midtape recovery.

   Note: It can take as long as five minutes for the cartridge to rewind and unload.
4. If the cartridge unloads, inform the operator that the cartridge is unloaded. If the cartridge does not unload, repeat steps 2 and 3 once before continuing with this procedure.

   Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call

Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

Beginning Procedure

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

1. Refer to the enclosure documentation for instructions on removing the drive.
2. Place the drive on a non-slip, sturdy work surface.
3. Ground yourself to the drive by using an ESD Kit.
4. Remove the cover of the 4U drive by performing the following steps:
   a. Using a Phillips screwdriver, remove the three screws and washers (see **1** in Figure A-1) that secure the bezel **2** to the internal drive, then remove the bezel.
   b. Remove the cover of the internal drive by performing the following steps:
      1) Remove the four cover-mounting screws and washers **3** .
      2) Remove the cover by lifting it up.

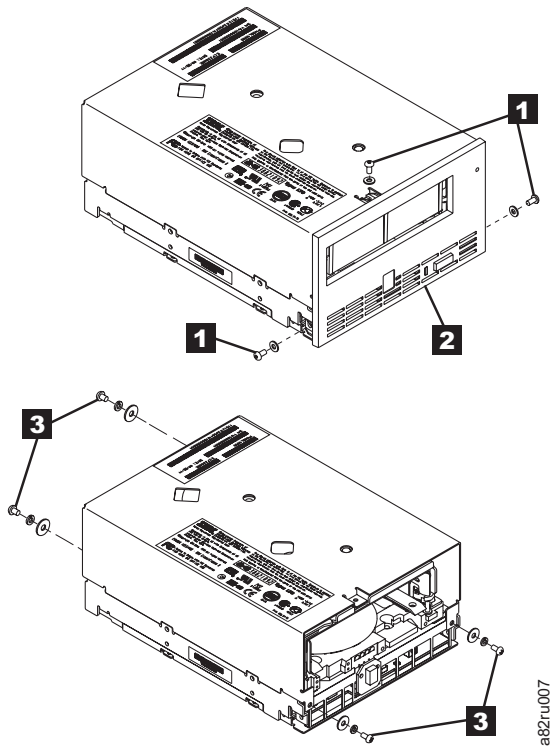


Figure A-1. Removing the bezel and the cover from the 4U internal drive

5. Remove the cover of the 2U drive by performing the following steps:
   a. To remove the drive bezel, pull the right side of the bezel (**1** in a82hd001.eps from the front of the drive, then pull the left side of the bezel out of the frame of the drive.

b. Remove the cover of the internal drive by performing the following steps:
   1) Remove the four cover-mounting screws (**2** in a82hd001.eps. Two screws are located on each side of the drive.
   2) Remove the cover by lifting it up.

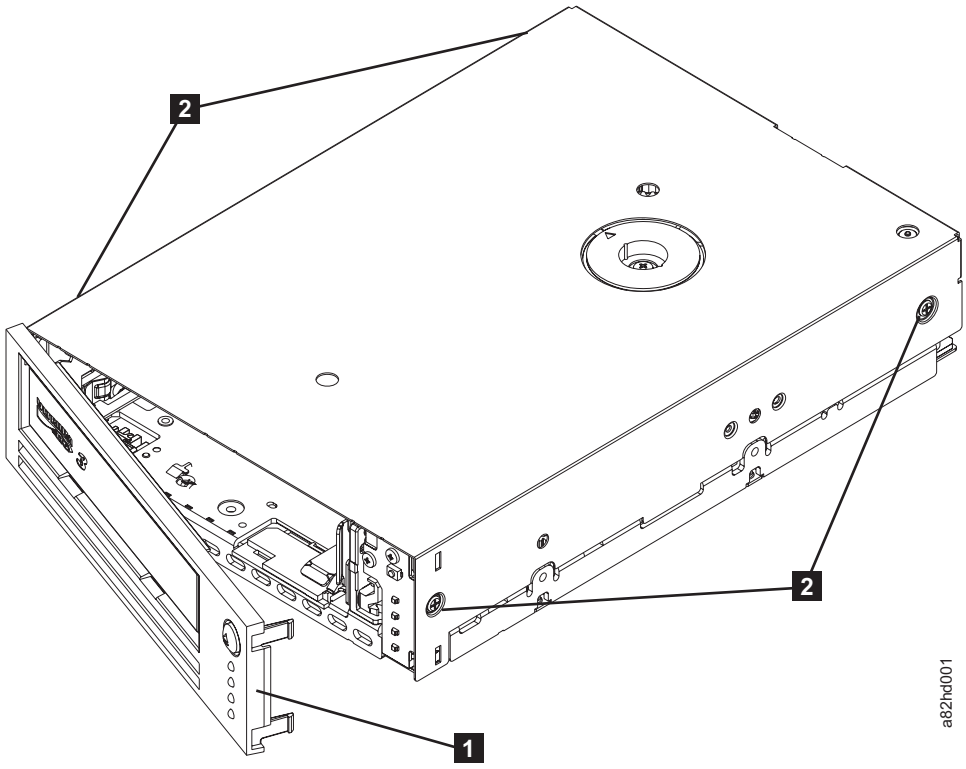


Figure A-2. Removing the bezel and the cover from the 2U internal drive

6. Inspect the drive to decide which of the following conditions most closely matches the symptom on the drive:
   - **Tape spooled off the supply reel** - All the tape appears to be on the take up reel and no tape is on the supply reel (inside the cartridge). Test the drive after the procedure is completed.
   - **Tape pulled from leader pin (or broken at the front end)** - All the tape appears to be on the supply reel (inside the cartridge) and very little or no tape appears to be on the take up reel. The leader block is positioned in the take up reel. Return the drive after the procedure is completed.
   - **Tape broken in mid-tape** - Tape appears to be on both the supply reel (inside the cartridge) and take up reel. Test the drive after the procedure is completed.
   - **Tape tangled along tape path** - Tape appears to be tangled and damaged but intact. Return the drive after the procedure is completed.

     -- OR --

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

Tape Spooled Off Supply Reel

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

1. With the front of the drive facing you, pull an arm's length of tape out of the take up reel from the left side of the drive.
2. From the take up reel, thread tape around the rear of the tape path and over the head and rollers on the left side of the drive.
3. Set the drive on its left side with the head and tape path facing up.
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. From the bottom of the drive, insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle.

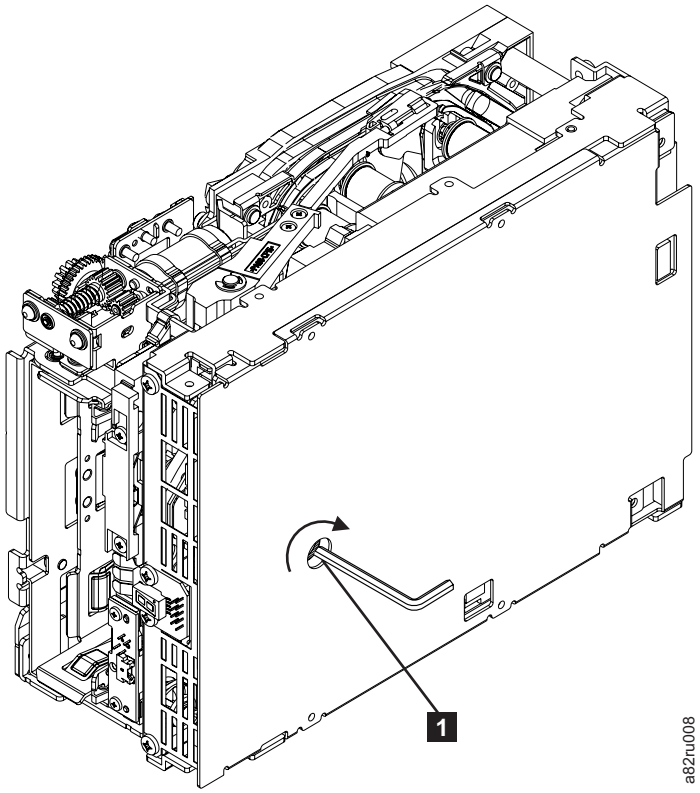


Figure A-3. Using hex wrench to rewind tape into cartridge

6. Turn the supply reel clockwise, allowing the moistened tape to adhere to the hub as it winds around the supply reel (inside the cartridge).
7. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.
8. Reassemble the drive, reversing the steps in "Beginning Procedure" on page A-2.
9. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, the cartridge ejects automatically.

10. Test the drive to determine if it should be replaced.

Ultrium 3 Half-high Drive: Tape Spooled Off Supply

ATTENTION: DO NOT TOUCH THE OUTER GUIDE RAIL (2). THIS RAIL IS VERY DELICATE AND EASILY DAMAGED.

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

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. Ensure that the tape is not twisted. Untwist the 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) clockwise, allowing the moistened tape to adhere to the hub as it winds around the supply reel (inside the cartridge).

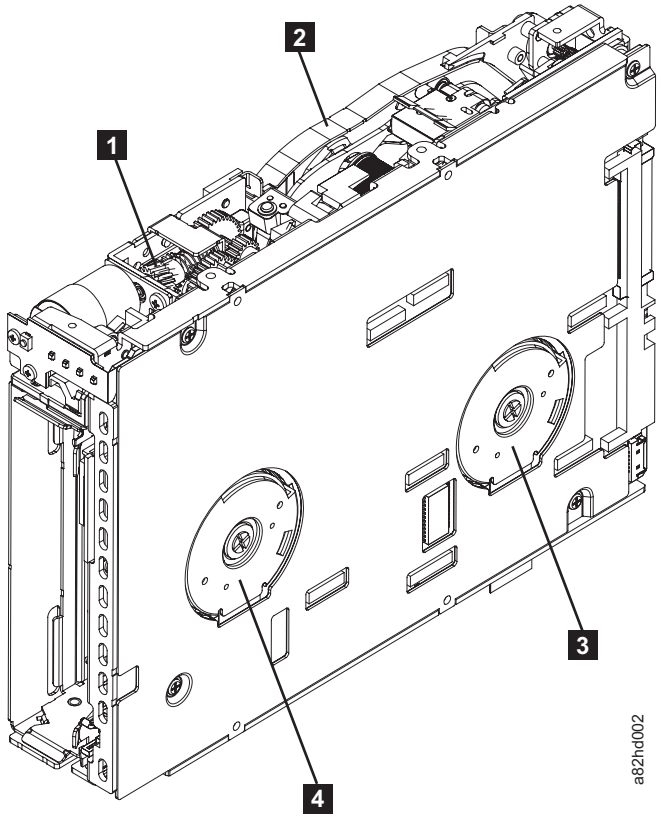


Figure A-4. Rewinding tape into cartridge

1	Loader motor worm gear	3	Takeup reel motor
2	Outer guide rail **(WARNING: Do Not Touch)**	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**) 10 additional turns. Ensure that you do not stretch the tape.
7. Reassemble the drive, reversing the steps in "Beginning Procedure" on page A-2.
8. Reassemble the drive chassis, reversing the steps in "Replacing the Library Enclosure" on page 9-9.
9. Reinstall the drive canister into the cradle assembly. Ensure that the connector on the drive is seated properly into the connector on the cradle.
10. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, push the **Unload** button to eject the cartridge.
11. Test the drive to determine if it should be replaced.

Tape Pulled from or Broken near Leader Pin

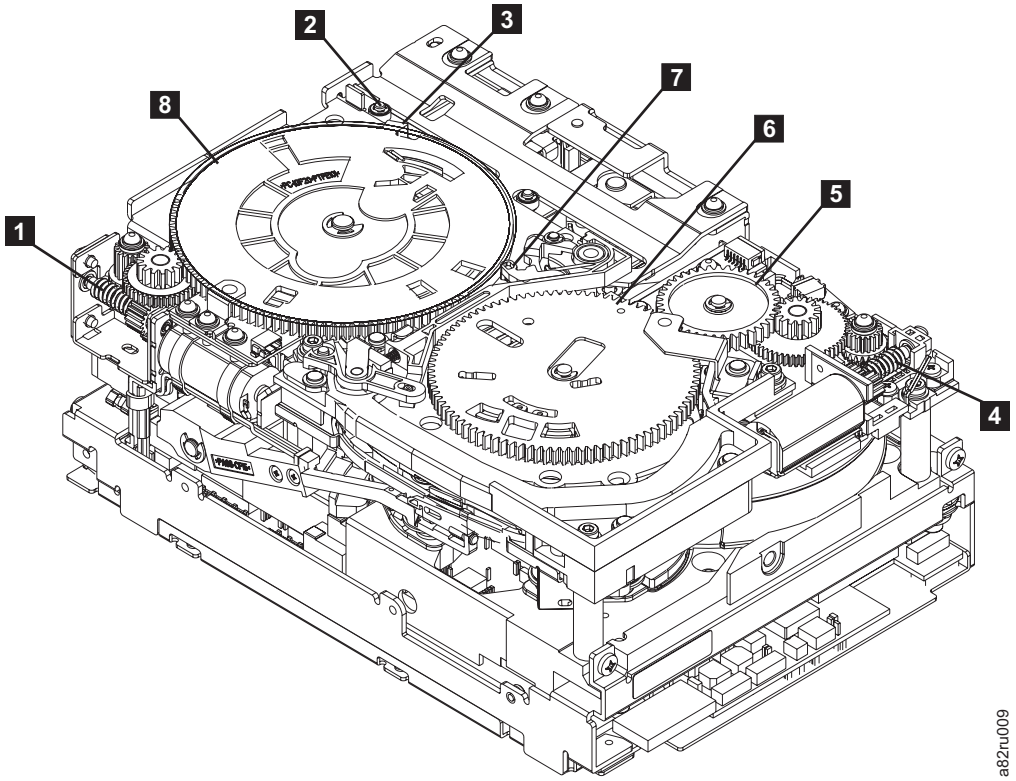


Figure A-5. Drive with cover removed to reveal gear train.

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

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

Note: If there is more than approximately 0.6 m (2 ft.) of tape on the take up reel, go to "Tape Broken in Mid-tape" on page A-9.

2. If there is less than approximately 0.6 m (2 ft.) of tape on the take up reel, cut off the excess tape as close to the leader pin, as possible.
3. Locate the threader motor worm gear (**4**) the rear of the drive. Use your finger to rotate the threader motor worm gear and slowly rotate the threader mechanism gear (**6**) clockwise . This rotates the threader motor worm gear (**4**) clockwise, drawing the tape leader block assembly (LBA) into the cartridge.
4. As the LBA is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear (**4**) stops. The LBA is in the correct position.

   Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench as shown in Figure A-3 on page A-4.
5. Notice the following:
   a. Loader mechanism gear (**8**) nearest the front of the drive that actuates the cartridge loader mechanism
   b. Position of the rotator stub (**3**).
   c. Front loader motor worm gear (**1**). Rotating this gear allows the loader mechanism gear (**8**) to turn.
6. Rotate the loader motor worm gear (**1**) to turn the loader mechanism gear (**6**) counterclockwise. Continue turning until the rotator stub (**3**) loses contact with the lever (**7**). This releases the LBA leader pin.
7. Rotate the threader motor worm gear (**4**) to turn the threader mechanism gear (**6**) counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive (**1**).

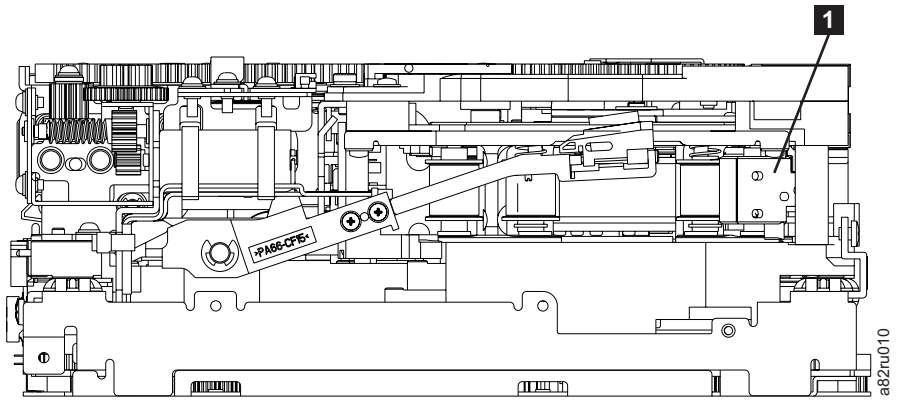


Figure A-6. Leader Block Assembly (LBA)

8. Continue rotating the loader motor worm gear (**1**) until the rotate stub (**3**) is positioned as shown. Notice that the rotator stub (**3**) is nearly aligned with the cartridge loader tray guide bearing (**2**).
9. Remove the cartridge from the cartridge loader tray.
10. Reassemble the drive by reversing the procedure in "Beginning Procedure" on page A-2.
11. Refer to the appropriate procedure to install the new drive and return the failed drive.

Ultrium 3 Half-high Drive: Tape Pulled from or Broken near Leader Pin

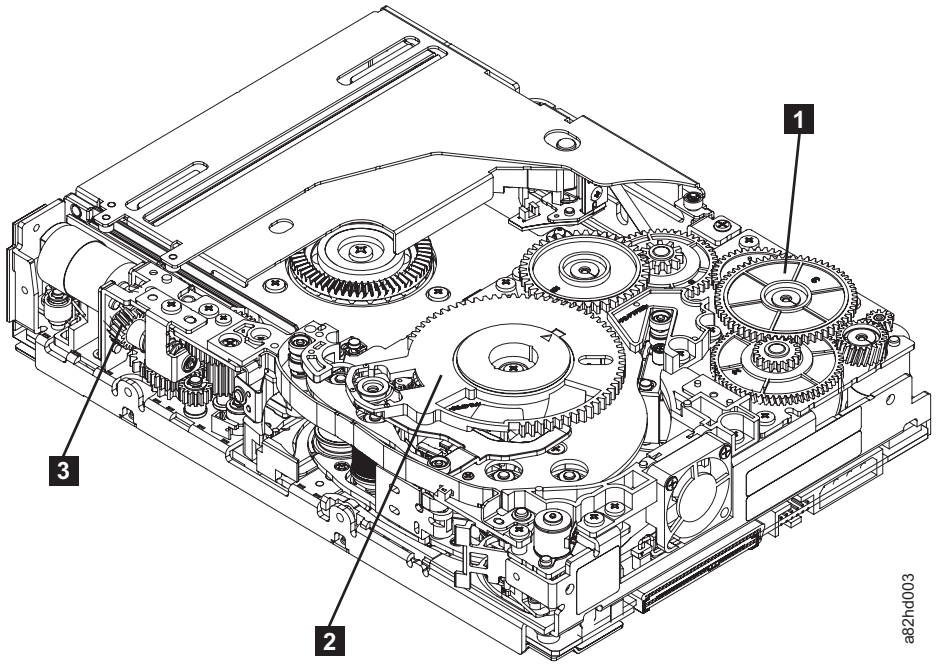


Figure A-7. Drive with cover removed to reveal gear train.

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 "Ultrium 3 Half-high Drive: Tape Broken in Mid-tape" on page A-10
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) near the rear of the drive. You can use your finger to rotate the threader intermediate gear (1) and slowly rotate the threader mechanism gear (2) clockwise. This draws the tape leader block assembly (LBA) into the cartridge.
5. As the leader pin is secured in the cartridge, you should hear the leader pin retention spring clips click into place. If you do not hear the click, continue rolling until the threader intermediate gear(1) stops. The LBA is in the correct position.
6. Rotate the loader motor worm gear (3) clockwise as viewed from the front of the drive until it stops. This releases the LBA leader pin.
7. Rotate the threader intermediate gear (1) counterclockwise until the leader block is in front of the Read/Write head. This moves the LBA out of the cartridge.

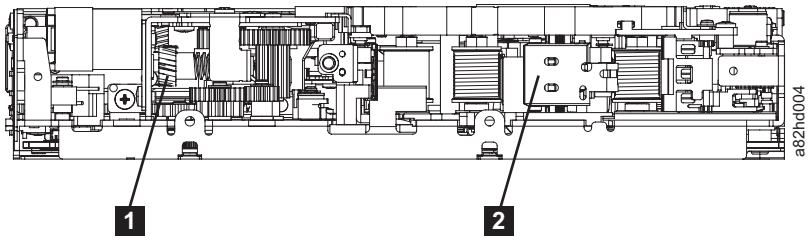


Figure A-8. Leader Block Assembly (LBA)

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

8. Rotate the loader motor worm gear (**3**) 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 "Beginning Procedure" on page A-2.
11. Reassemble the drive chassis.
12. Refer to the appropriate procedure to install the new drive and return the failed drive.

Tape Broken in Mid-tape

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

   Note: If there is less than approximately 5 cm (2 in.) of tape on the take up reel, go to "Tape Pulled from or Broken near Leader Pin" on page A-6.
2. From the supply reel inside the cartridge, pull approximately 0.3 m (1 ft.) of tape.
3. From the take up reel, thread tape around the rear of the tape path and over the head rollers on the left side of the drive.
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. From the bottom of the drive, locate the access hole (**1** in Figure A-9 on page A-10) in the bottom cover. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. begin spooling tape back into the cartridge by turning the hex wrench clockwise.

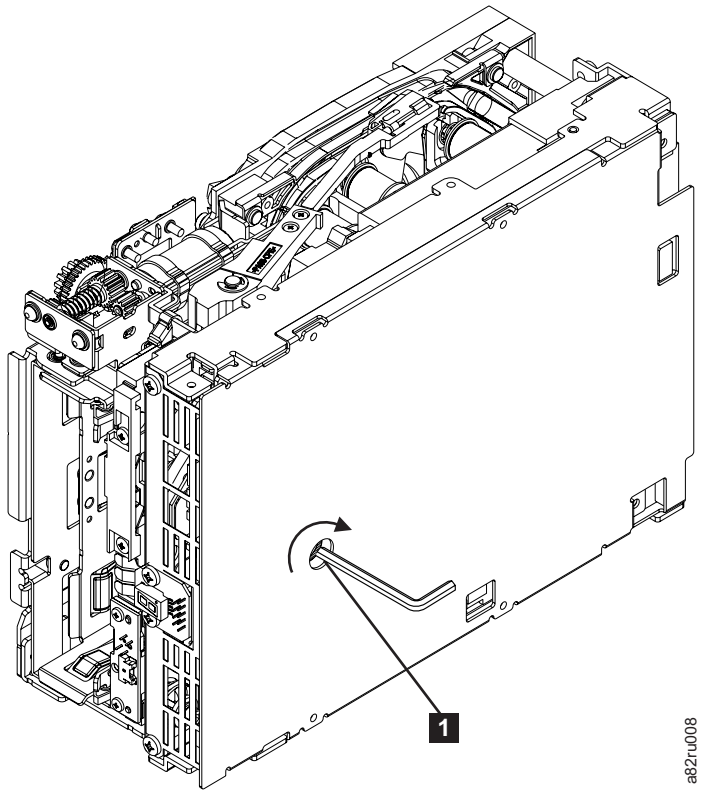


Figure A-9. Using hex wrench to rewind tape into cartridge

7. Turn the supply reel clockwise, carefully guiding the mended portion of the tape to wind around the hub of the supply reel located inside the cartridge. Continue spooling into the cartridge until the tape is taut. The tape must remain within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.
8. Reassemble the drive by reversing the procedure in "Beginning Procedure" on page A-2.
9. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, the cartridge ejects automatically.
10. Test the drive to determine if it should be replaced.

Ultrium 3 Half-high Drive: 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 "Ultrium 3 Half-high Drive: Tape Pulled from or Broken near Leader Pin" on page A-8.
2. From the supply reel inside the cartridge, pull approximately 0.3 m (1 ft.) of tape.
3. Ensure that the tape is not twisted. Untwist the 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**) clockwise, carefully guiding the mended portion of the tape to wind around the hub of the supply reel located inside the cartridge. Continue spooling into the cartridge until the tape is taut. The tape must remain within the flanges of the tape guiding rollers. Turn the supply reel (**4**) 10 additional turns. Ensure that you do not stretch the tape.

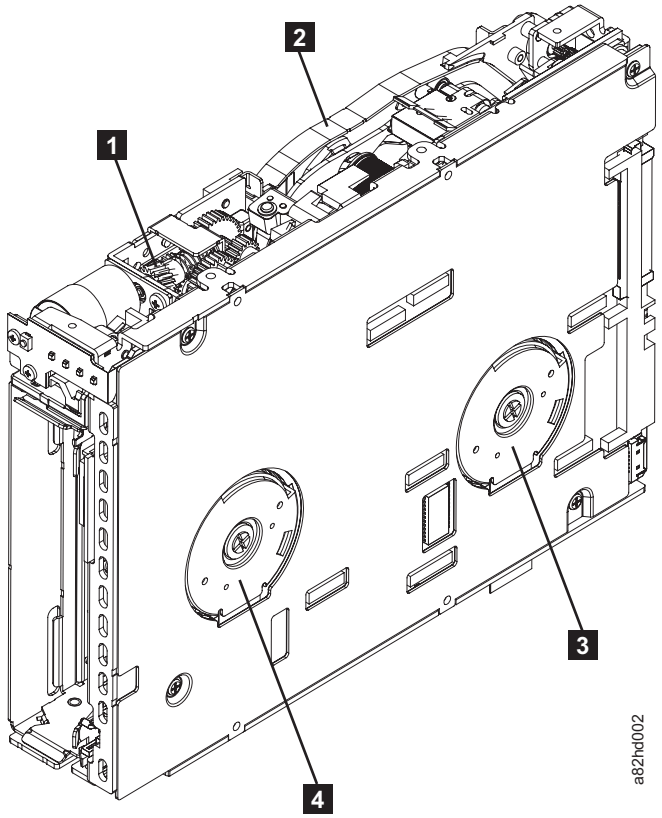


Figure A-10. Rewinding tape into cartridge

1	Loader motor worm gear	**3**	Takeup reel motor
2	Outer guide rail (**WARNING: Do Not Touch)**	**4**	Supply reel motor

7. Reassemble the drive by reversing the procedure in "Beginning Procedure" on page A-2.
8. Reassemble the drive chassis, reversing the steps in "Replacing the Library Enclosure" on page 9-9.
9. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, push the **Unload** button to eject the cartridge.
10. Test the drive to determine if it should be replaced.

Tape Tangled along Tape Path

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call Technical Support and

open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

1. Carefully pull out excess tape and untangle.

   Note: If you find the tape to be broken, go to one of the following appropriate procedures:
   - "Tape Spooled Off Supply Reel" on page A-4
   - "Tape Pulled from or Broken near Leader Pin" on page A-6

     --OR--

     "Tape Broken in Mid-tape" on page A-9
2. Set the drive on its left side with the head and tape path facing up.

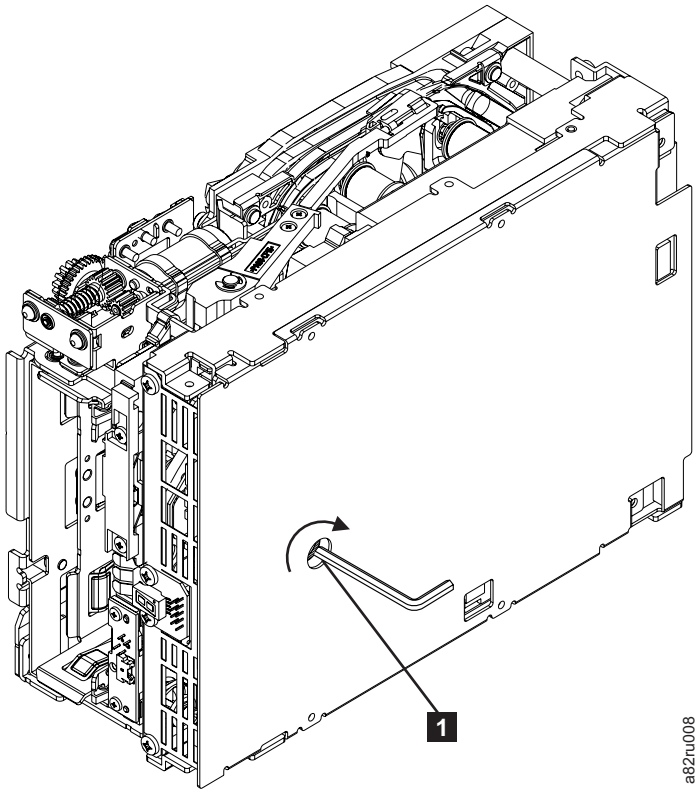


Figure A-11. Using hex wrench to rewind tape into cartridge

3. From the bottom of the drive, locate the access hole (**1** in Figure A-11).
4. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. Begin spooling the tape back into the cartridge by turning the hex wrench clockwise.
5. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.
6. Locate the threader motor worm gear (**4** in Figure A-12 on page A-13) on the rear of the drive. Use your finger to rotate the treader motor worm gear and slowly rotate the threader mechanism gear (**6** in Figure A-12 on page A-13) clockwise. This rotates the threader motor worm gear (**4** in Figure A-12 on page A-13) clockwise, drawing the LBA into the cartridge.

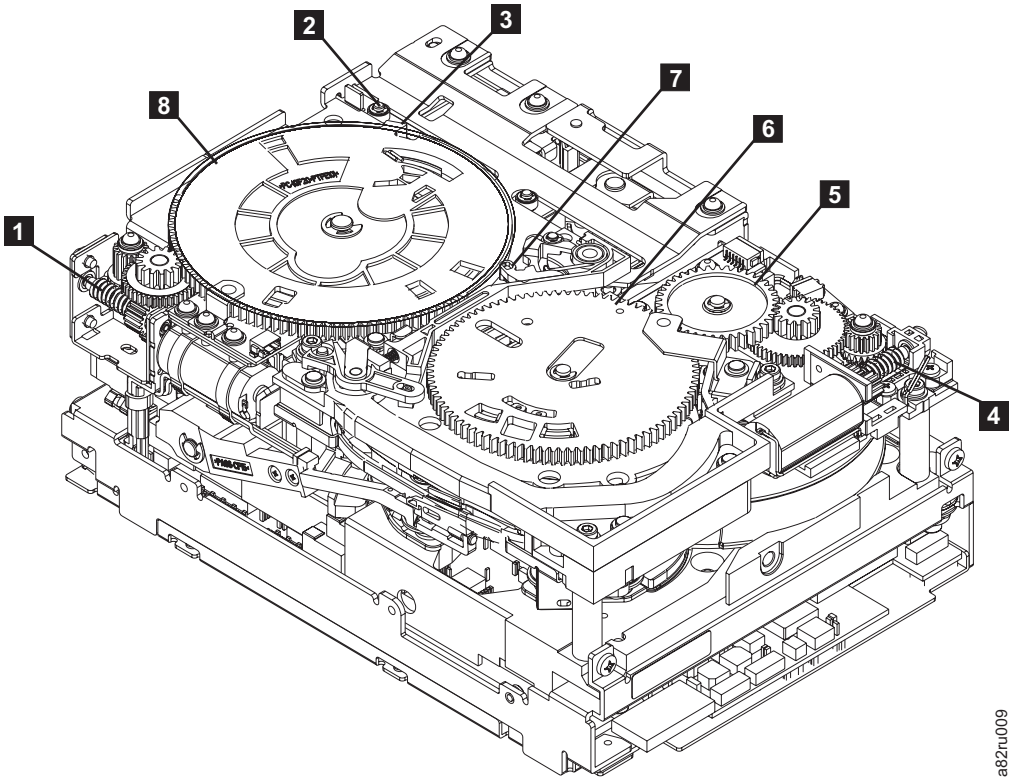


Figure A-12. Drive with cover removed to reveal gear train.

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

7. As the tape leader block assembly (LBA) is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear (4 in Figure A-12) stops. The LBA is in the correct position.

   Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench as shown in Figure A-11 on page A-12.

8. Notice the:
   a. Loader mechanism gear (6 in Figure A-12) nearest the front of the drive that actuates the cartridge loader mechanism.
   b. Position of the rotate stub (3 in Figure A-12).
   c. Front loader motor worm gear (1 in Figure A-12). Rotating this gear allows the loader mechanism gear (8 in Figure A-12) to turn.
9. Rotate the loader motor worm gear (1 in Figure A-12) to turn the threader mechanism gear (6 in Figure A-12) counterclockwise. Continue turning until the rotator stub (3 in Figure A-12) loses contact with the lever (7 in Figure A-12). This releases the LBA leader pin.

10. Rotate the threader motor worm gear (4 in Figure A-12 on page A-13) to turn the threader mechanism gear (6 in Figure A-12 on page A-13) counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive shown as 1 Figure A-13.

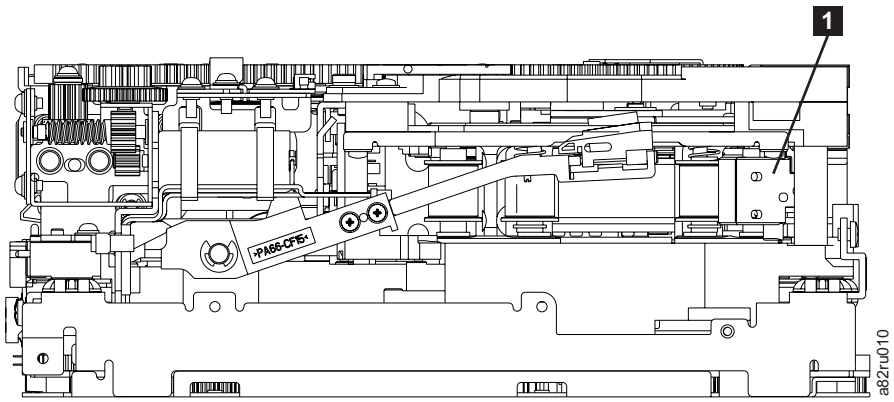


Figure A-13. Leader Block Assembly (LBA)

11. Continue rotating the loader motor worm gear (1 in Figure A-12 on page A-13) until the rotator stub (3 in Figure A-12 on page A-13) is positioned as shown. Notice that the rotator stub (3 in Figure A-12 on page A-13) is nearly aligned with the cartridge loader tray guide bearing (2 in Figure A-12 on page A-13).
12. Remove the cartridge from the cartridge loader tray.
13. Reassemble the drive by reversing the procedure in the "Beginning Procedure" on page A-2.
14. Refer to the appropriate procedure to install the new drive and return the failed drive.

Ultrium 3 Half-high Drive: Tape Tangled along Tape Path

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

1. Carefully pull out excess tape and untangle.

   Note: If you find the tape to be broken, go to one of the following appropriate procedures:
   - "Ultrium 3 Half-high Drive: Tape Spooled Off Supply" on page A-5
   - "Ultrium 3 Half-high Drive: Tape Pulled from or Broken near Leader Pin" on page A-8

     –OR–
   - "Ultrium 3 Half-high Drive: Tape Broken in Mid-tape" on page A-10
2. Set the drive on its left side with the head and tape path facing up.

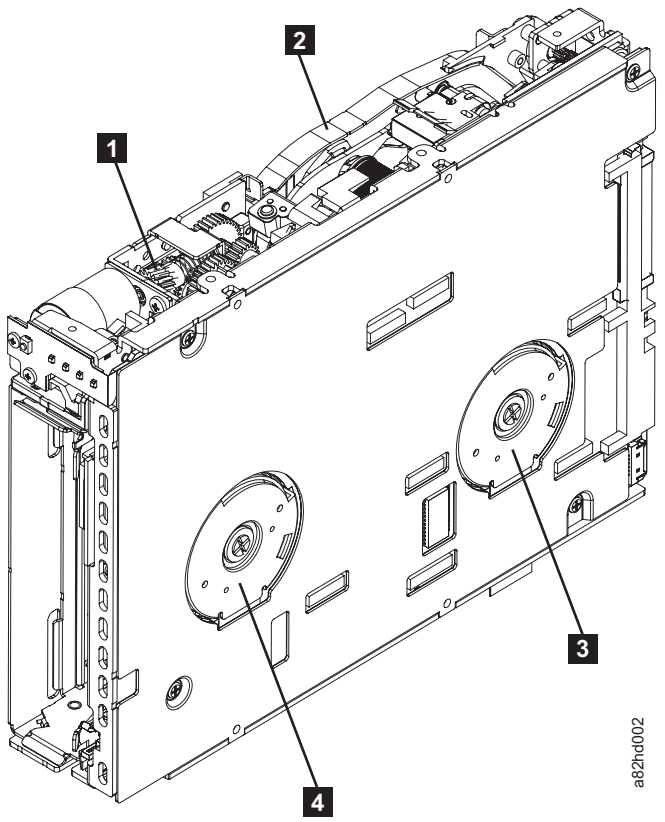


Figure A-14. Rewinding tape into cartridge

1	Loader motor worm gear	3	Takeup reel motor
2	Outer guide rail (**WARNING: Do Not Touch)**	4	Supply reel motor

3. Turn the supply reel (4) 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) 10 turns. Ensure that you do not stretch the tape.
5. Reassemble the drive chassis, reversing the steps in "Replacing the Library Enclosure" on page 9-9.
6. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, push the **Unload** button to eject the cartridge.
7. Test the drive to determine if it should be replaced.

No Apparent Failure or Damage to Tape

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

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

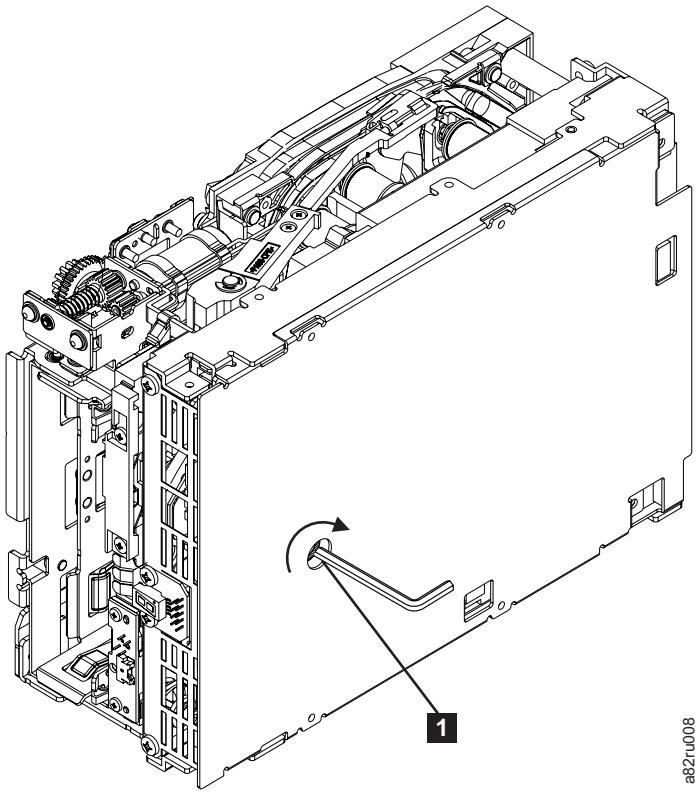


Figure A-15. Using hex wrench to rewind tape into cartridge

2. From the bottom of the drive, locate the access hole (**1** in Figure A-15).
3. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. Begin spooling the tape back into the cartridge by turning the hex wrench clockwise.
4. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.
5. Locate the threader motor worm gear (**4** in Figure A-16 on page A-17) on the rear of the drive. Use your finger to rotate the threader motor worm gear and slowly rotate the threader mechanism gear (**6** in Figure A-16 on page A-17) clockwise. This rotates the threader motor worm gear (**4** in Figure A-16 on page A-17) clockwise, drawing the LBA into the cartridge.

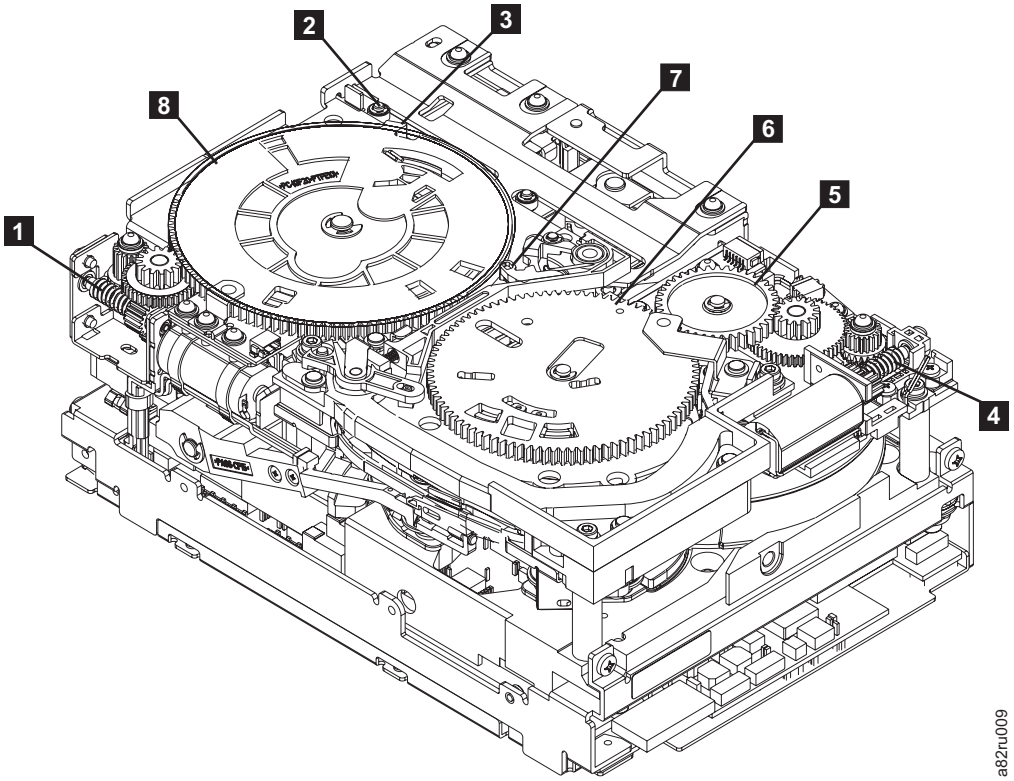


Figure A-16. Drive with cover removed to reveal gear train.

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

6. As the tape leader block assembly (LBA) is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear (4 in Figure A-16) stops. The LBA is in the correct position.

   Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench as shown in Figure A-15 on page A-16.

7. Notice the:
   a. Loader mechanism gear (6 in Figure A-16) nearest the front of the drive that actuates the cartridge loader mechanism.
   b. Position of the rotate stub (3 in Figure A-16).
   c. Front loader motor worm gear (1 in Figure A-16). Rotating this gear allows the loader mechanism gear (8 in Figure A-16) to turn.
8. Rotate the loader motor worm gear (1 in Figure A-16) to turn the loader mechanism gear (6 in Figure A-16) counterclockwise. Continue turning until the rotator stub (3 in Figure A-16) loses contact with the lever (7 in Figure A-16). This releases the LBA leader pin.

9. Rotate the threader motor worm gear (4 in Figure A-16 on page A-17) to turn the threader mechanism gear (6 in Figure A-16 on page A-17) counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive shown as 1 Figure A-17.

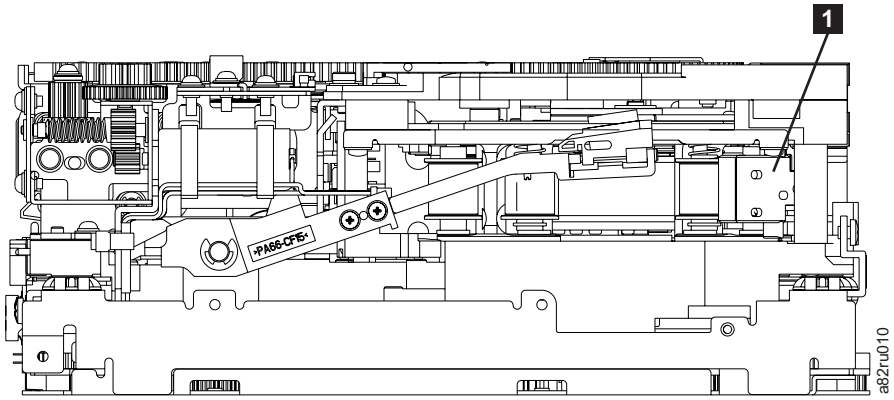


Figure A-17. Leader Block Assembly (LBA)

10. Continue rotating the loader motor worm gear (1 in Figure A-16 on page A-17) until the rotator stub (3 in Figure A-16 on page A-17) is positioned as shown. Notice that the rotator stub (3 in Figure A-16 on page A-17) is nearly aligned with the cartridge loader tray guide bearing (2 in Figure A-16 on page A-17).
11. Remove the cartridge from the cartridge loader tray.
12. Reassemble the drive by reversing the procedure in the "Beginning Procedure" on page A-2.
13. Refer to the appropriate procedure to install the new drive and return the failed drive.

Ultrium 3 Half-high Drive: No Apparent Failure or Damage to Tape

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or 'ONLY COPY' data (i.e., there is no backup), eject commands issued at the host fail to unload the tape, and power-cycling the drive fails to eject the cartridge, make **no further attempts** to unload this tape. Call Technical Support and open a PMR if one isn't already open, to initiate the process of sending the drive with the loaded cartridge in for recovery.

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

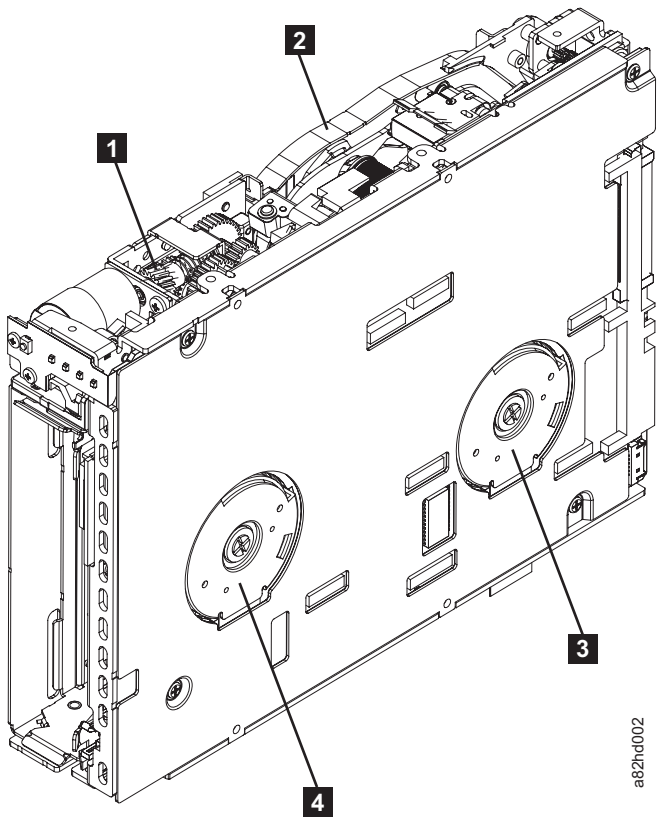


Figure A-18. Rewinding tape into cartridge

1	Loader motor worm gear	3	Takeup reel motor
2	Outer guide rail (**WARNING: Do Not Touch)**	4	Supply reel motor

2. Begin spooling the tape back into the cartridge by turning the supply reel motor (4) 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).
4. Locate the threader intermediate gear (1) near the rear of the drive. You can use your finger to rotate the threader intermediate gear (1) and slowly rotate the threader mechanism gear (2) clockwise. This draws the tape leader block assembly (LBA) into the cartridge.

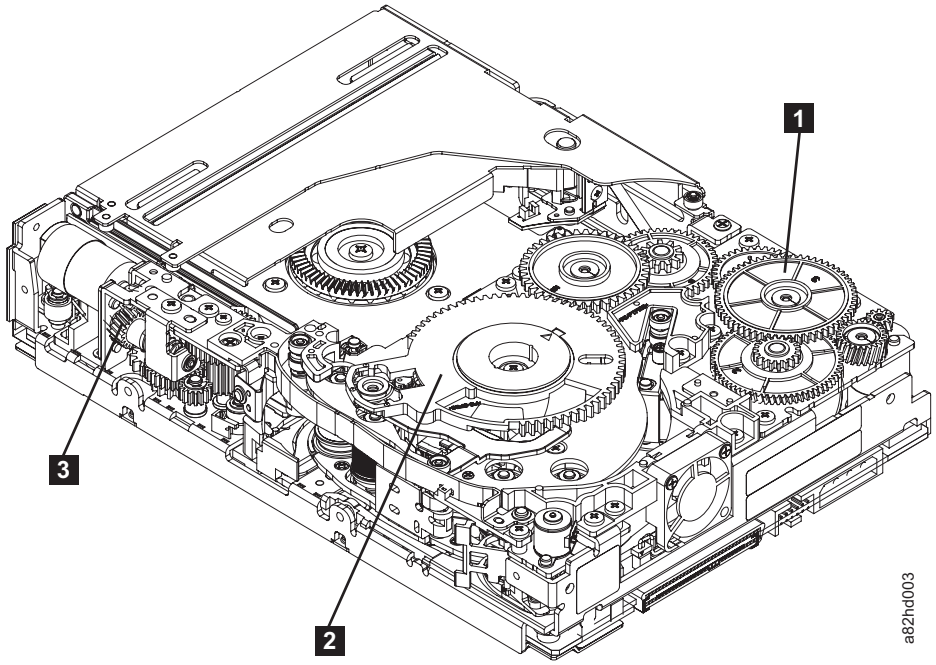


Figure A-19. Drive with cover removed to reveal gear train.

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

5. As the leader pin is secured in the cartridge, you should hear the leader pin retention spring clips click into place. If you do not hear the click, continue rolling until the threader intermediate gear (1) 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 (1) clockwise as viewed from the front of the drive until it stops. This releases the LBA leader pin.
7. Rotate the threader motor worm gear (3) counterclockwise until the leader block is in front of the Read/Write head. This moves the LBA out of the cartridge.

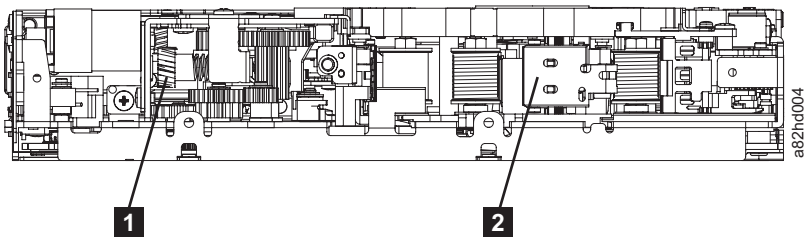


Figure A-20. Leader Block Assembly (LBA)

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

8. Rotate the loader motor worm gear (3) 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 “Beginning Procedure” on page A-2.
11. Reassemble the drive enclosure by following the steps in “Replacing the Library Enclosure” on page 9-9.
12. Refer to the appropriate procedure to install the new drive and return the failed drive.

Appendix B. TapeAlert Flags

This appendix is intended to provide additional information to the reader about the tape drive. All error code and diagnostic information contained in this chapter can be accessed from the Operator Panel of the Library. The drive portion of the Operator Panel Display will contain any drive error codes. Therefore there is no need to open the Library to access the buttons on the drive as described in this chapter. See the Setup and Operator Guide for a complete description of the Operator Panel functions and Displays.

TapeAlert is a standard that defines status conditions and problems experienced by devices such as tape drives, autoloaders, and libraries. The standard enables a server to read TapeAlert messages (called *flags*) from a tape drive via the SCSI bus. The server reads the flags from Log Sense Page 0x2E.

This library is compatible with TapeAlert technology, which provides error and diagnostic information about the drives and the library to the server. Because library and drive firmware may change periodically, the SNMP interface in the library does not require code changes if devices add additional TapeAlerts that are not supported today. However, should this occur the Management Information Block (MIB) is written to minimize impact to the SNMP monitoring station. At the time of this writing, the TapeAlert flags in this appendix correctly represent TapeAlerts that will be sent. The MIB file should not be taken to mean that all traps that are defined in the MIB will be sent by the library or that they will be sent in the future.

This appendix lists TapeAlert flags that are supported by the Ultrium 3 and Ultrium 4 Tape Drives.

TapeAlert Flags Supported by the Library

Parameter Code (d=decimal)	Flag name	Type	Description
01d	Library Hardware A	C	The media changer mechanism is having difficulty communicating with the drive: • Turn the library OFF then ON • Restart the operation If problem persists, contact Technical Support.
02d	Library Hardware B	W	There is a problem with the media changer mechanism. If the problem persists, contact Technical Support.
03d	Library Hardware C	C	The media changer has a hardware fault: • Ensure that the media changer and drives are not being used by any host, then reset the library from the front panel. • If the problem persists, contact Technical Support.
04d	Library Hardware D	C	• Ensure that the media changer and drives are not being used by any host, then reset the library from the front panel. • If the problem persists, contact Technical Support.

13d	Library Pick Retry	W	There is a potential problem with the cartridge loader picking a cartridge from a drive or slot. • No action needs to be taken at this time. • If the problem persists, contact Technical Support This flag is cleared when the next move command is received.
14d	Library Place Retry	W	There is a potential problem with the cartridge loader placing a cartridge into a slot. • No action needs to be taken at this time. • If the problem persists, contact Technical Support. This flag is cleared when the next move command is received.
15d	Drive Load Retry	W	There is a potential problem with the cartridge loader or drive when placing a cartridge into a drive. • No action needs to be taken at this time. • If the problem persists, contact Technical Support. This flag is cleared when the next move command is received.
16d	Library Door	W	The operation has failed because the library door is open. • Clear any obstructions from the library door. • Close the library door. • If the problem persists, contact Technical Support. This flag is cleared when the door is closed.
17d	Library I/O Station	C	There is a mechanical problem with the library media I/O Station.
19d	Library Security	W	Library security has been compromised. The door was opened then closed during operation.
24d	Library Inventory	C	The library has detected an inconsistency in its inventory. • Redo the library inventory to correct inconsistency. • Restart the operation. Check the applications users manual or the hardware users manual for specific instructions on redoing the library inventory.
27d	Cooling FAN Failure	W	One or more fans inside the library have failed. This flag is cleared when all fans are working again.
32d	Unreadable Bar Code Labels	I	The library was unable to read the barcode on a cartridge.

- D = Decimal
- I = Informational suggestion to user
- W = Warning. Remedial action is advised. Performance of data may be at risk.
- C = Critical immediate remedial action is required.

TapeAlert Flags Supported by the Drive

Table B-1. TapeAlert Flags Supported by the Ultrium Tape Drive

Flag Number	Flag	Description	Action Required
3	Hard error	Set for any unrecoverable read, write, or positioning error. (This flag is set in conjunction with flags 4, 5, or 6.)	See the Action Required column for Flag Number 4, 5, or 6 in this table.
4	Media	Set for any unrecoverable read, write, or positioning error that is due to a faulty tape cartridge.	Replace the tape cartridge.
5	Read failure	Set for any unrecoverable read error where isolation is uncertain and failure could be due to a faulty tape cartridge or to faulty drive hardware.	If Flag 4 is also set, the cartridge is defective. Replace the tape cartridge.
6	Write failure	Set for any unrecoverable write or positioning error where isolation is uncertain and failure could be due to a faulty tape cartridge or to faulty drive hardware.	If Flag 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 5-7). If Flag Number 4 is also set, the cartridge is defective. Replace the tape cartridge.
8	Not data grade	Set when the cartridge is not data-grade. Any data that you write to the tape is at risk.	Replace the tape with a data-grade tape.
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 the tape drive can write data to the tape (see “Write-Protect Switch” on page 5-7).
10	No removal	Set when the tape drive receives an UNLOAD command after the server prevented the tape cartridge from being removed.	Refer to the documentation for your server’s operating system.
11	Cleaning media	Set when you load a cleaning cartridge into the drive.	No action required.
12	Unsupported format	Set when you load an unsupported cartridge type into the drive or when the cartridge format has been corrupted.	Use a supported tape cartridge.
14	Unrecoverable snapped tape	Set when the operation failed because the tape in the drive snapped.	Do not attempt to extract the old tape cartridge. Call the tape drive supplier’s help line.
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 you manually unload the tape cartridge while the drive was reading or writing.	No action required.
18	Tape directory corrupted in the cartridge memory	Set when the drive detects that the tape directory in the cartridge memory has been corrupted.	Re-read all data from the tape to rebuild the tape directory.

Table B-1. TapeAlert Flags Supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	Description	Action Required
20	Clean now	Set when the tape drive detects that it needs cleaning.	Clean the tape drive.
21	Clean periodic	Set when the drive detects that it needs routine cleaning.	Clean the tape drive as soon as possible. The drive can continue to operate, but you should clean the drive soon.
22	Expired clean	Set when the tape drive detects a cleaning cartridge that has expired.	Replace the cleaning cartridge.
23	Invalid cleaning tape	Set when the drive expects a cleaning cartridge and the loaded cartridge is not a cleaning cartridge.	Use a valid cleaning cartridge.
30	Hardware A	Set when a hardware failure occurs that requires that you reset the tape drive to recover.	Contact IBM Technical Support.
31	Hardware B	Set when the tape drive fails its internal Power-On Self Tests.	Note the error code on the single-character display, then contact IBM Technical Support.
32	Interface	Set when the tape drive detects a problem with the SCSI, Fibre Channel, or RS-422 interface.	Contact IBM Technical Support.
33	Eject media	Set when a failure occurs that requires you to unload the cartridge from the drive.	Unload the tape cartridge, then reinsert it and restart the operation.
34	Download fail	Set when an FMR image is unsuccessfully downloaded to the tape drive through the SCSI or Fibre Channel interface.	Ensure that it is the correct FMR image. Download the FMR image again.
36	Drive temperature	Set when the drive's temperature sensor indicates that the drive's temperature is exceeding the recommended temperature of the library.	Contact IBM Technical Support.
37	Drive voltage	Set when the drive detects that the externally supplied voltages are either approaching the specified voltage limits or are outside the voltage limits.	Contact IBM Technical Support.
39	Diagnostics required	Set when the drive detects a failure that requires diagnostics for isolation.	Contact IBM Technical Support.
51	Tape directory invalid at unload	Set when the tape directory on the tape cartridge that was previously unloaded is corrupted. The file-search performance is degraded.	Use your backup software to rebuild the tape directory by reading all the data.
52	Tape system area write failure	Set when the tape cartridge that was previously unloaded could not write its system area successfully.	Copy the data to another tape cartridge, then discard the old cartridge.
53	Tape system area read failure	Set when the tape system area could not be read successfully at load time.	Copy the data to another tape cartridge, then discard the old cartridge.

Table B-1. TapeAlert Flags Supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	Description	Action Required
55	Loading Failure	When loading a tape into a drive, a hardware malfunction can prevent the tape from being loaded into the drive, or the tape may actually get stuck in the drive.	Possible Causes: 1. A drive hardware error that prevents the tape from being loaded 2. A damaged tape that cannot be loaded in the drive Take this action if the tape cartridge will not load in the drive: 1. Remove the tape cartridge from the library and inspect it for damage. If damaged, discard it. 2. Try another cartridge in that tape drive. If it still fails, replace the drive sled. See "Replacing a Tape Drive" on page 9-1. Take this action if the tape is stuck in the drive: 1. Attempt to unload the tape from the drive using the host backup application that is currently using the drive, or using the remote or local UI. 2. If the cartridge will not unload, contact Service for assistance.

Table B-1. TapeAlert Flags Supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	Description	Action Required
56	Unload Failure	When attempting to unload a tape cartridge, a drive hardware malfunction can prevent the tape from being ejected. The tape may actually be stuck in the drive.	Possible Causes: 1. A drive hardware error that prevents the tape from being unloaded 2. A damaged tape that cannot be unloaded from the drive Take this action if the tape will not unload from the drive: 1. 1. If possible, manually remove the tape cartridge from the drive and inspect it for damage. If damaged, discard it. 2. Try removing the drive sled and replacing it. This will cause the drive sled to reboot. A reboot should cause the tape cartridge to rewind and unload if possible. If the cartridge unloads, remove it from the library and inspect it. If damaged, discard it. Take this action if the tape is stuck in the drive: 1. Attempt to unload the tape from the drive using the host backup application that is currently using the drive, or via the remote or local UI. 2. If the cartridge will not unload, contact Service for assistance.

Appendix C. Sense Data

When a drive encounters an error, it makes sense data available. You can use IBM device drivers to examine the sense data and determine errors. Instructions for downloading, installing, and properly configuring the IBM device drivers are available in the *IBM Ultrium Device Drivers Installation and User's Guide*. The IBM device drivers may conflict with some commercial software applications unless properly configured. To avoid conflicts on Windows operating systems, refer to your device driver's procedures for setting the driver to manual startup mode. For applications that use Open Systems device drivers that are provided by IBM(for example, AIX, Linux, Sun Solaris, HP-UX, Windows 2003, and Windows 2000), the *Ultrium Device Drivers Installation and User's Guide* contains information about how to obtain sense data after an error has occurred.

If your application uses other device drivers, see the appropriate documentation for those drivers to obtain the sense data.

Raw sense data (as returned from the drive) is documented in the *IBM LTO Ultrium Tape Drive SCSI Reference*.

In addition to device drivers, other methods exist for obtaining sense data and error information. The sections that follow describe alternatives for gathering such information from the IBM AS/400®, eServer iSeries™, RS/6000®, and eServer pSeries® servers.

Library Sense Data

The following table lists the Additional Sense Codes (ASC) and Additional Sense Code Qualifiers (ASCQ) associated with the reported Sense Keys.

A sense key of 00h (no sense) has no ASC/ASCQ associated with it. A few ASC/ASCQs can be associated with more than one sense key. The sense keys that can give a particular ASC/ASCQ are indicated within the Sense Key column. ASC/ASCQs that can indicate an abnormal element state as part of element descriptor.

Table C-1. Library Sense Keys, ASC and ASCQ

Sense Key	ASC	ASCQ	Description
Recovered Error (01)	0Ah	00h	Error log overflow
	47h	00h	SCSI parity error

Table C-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description
Not Ready (02)	00h	17h	Drive cleaning requested
	04h	00h	Cause not reportable
	04h	01h	In progress becoming ready, scanning magazines, etc.
	04h	02h	Initializing command required
	04h	03h	Manual intervention required
	04h	07h	Operation in progress
	04h	12h	Offline
	04h	83h	Door open
	04h	85h	Firmware upgrade in progress
	04h	87h	The drive is not enabled
	04h	88h	The drive is busy
	04h	89h	The drive is not empty
	04h	9Ah	Drive fibre down
	04h	8Eh	The media changer is in sequential mode
	30h	03h	Cleaning in progress
	3Bh	12h	Magazine removed
Medium Error (03)	30h	00h	Incompatible media installed
	30h	03h	Cleaning tape installed
	30h	07h	Cleaning failure

Table C-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description
Hardware Error (04)	81h	80h	Cannot initialize bar code reader
	81h	81h	No response from bar code reader
	81h	82h	No response from EEPROM
	81h	83h	Slave robotic generic problem
	81h	84h	Setting of gripper pic value failed
	81h	85h	Setting of slider pic value failed
	81h	86h	Setting of elevator pic value failed
	81h	87h	Setting of rotation pic value failed
	81h	88h	Setting of sled pic value failed
	81h	89h	Gripper blocked
	81h	8Ah	Slider blocked
	81h	8Bh	Elevator blocked
	81h	8Ch	Rotation blocked
	81h	8Dh	Sled blocked
	81h	8Eh	Cannot find gripper block
	81h	8Fh	Cannot find slider block
	81h	90h	Cannot find elevator block
	81h	91h	Cannot find rotation block
	81h	92h	Cannot find sled block
	81h	93h	Gripper outside range
	81h	94h	Slider outside range
	81h	95h	Elevator outside range
	81h	96h	Rotation outside range
	81h	97h	Sled outside range
	81h	98h	No cartridge present sensor found
	81h	99h	No slider home sensor found
	81h	9Ah	No rotation home sensor found
	81h	9Bh	No sled position sensor found
	81h	9Ch	The range of gripper is wrong
	81h	9Dh	The range of slider is wrong
	81h	9Eh	The range of elevator is wrong
	81h	9Fh	The range of rotation is wrong
	81h	A0h	The range of sled is wrong
	81h	A1h	Open import/export element failed
	81h	B0h	Slave robotic controller response timeout
	81h	B1h	NACK received from slave robotic controller
	81h	B2h	Slave robotic controller communication failed
	81h	B3h	Slave robotic controller urgent stop
	81h	B4h	Cartridge did not transport completely
	81h	B5h	Slave robotic controller does not respond on command

Table C-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description
Hardware Error (04) (continued)	80h	C0h	Network init
	80h	C1h	Telnet interface
	80h	C2h	Webserver
	80h	C3h	EEPROM parameter
	80h	C4h	Cannot init LAN card
	80h	C5h	Write to EEPROM failed
	80h	C6h	Ping command did not reach target
	80h	C7h	Cannot upgrade from USB
	80h	D0h	ROM error
	80h	D1h	RAM error
	80h	D2h	NVRAM error
	80h	D3h	CTC error
	80h	D4h	UART error
	80h	D5h	Display error
	80h	D6h	Memory error
	80h	D7h	Fatal system error
	80h	D8h	dBase error
	80h	D9h	No SCSI IC detected
	80h	DAh	Different bar code labels
	80h	DBh	External cooling fan failure
	80h	DCh	Internal I2C bus error
	82h	F0h	Over temperature problem
	82h	F1h	Drive communication error
	82h	F2h	Drive sled not present
	82h	F3h	Drive broken: needs repair
	82h	F4h	Drive load timeout
	82h	F5h	Drive unload timeout

Table C-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description
Illegal Request (05h)	1Ah	00h	Parameter length error
	20h	00h	Invalid command operation code
	21h	01h	Invalid element address
	24h	00h	Invalid field CDB
	3Dh	00h	SCSI invalid ID message
	25h	00h	Invalid LUN
	2Ch	00h	Command sequence error
	26h	00h	Invalid field in parameter list
	26h	01h	Parameter list error: parameter not supported
	26h	02h	Parameter value invalid
	26h	90h	Wrong firmware image, does not fit boot code
	26h	91h	Wrong personality firmware image
	26h	93h	Wrong firmware image, checksum error
	39h	00h	Saving parameters not supported
	3Bh	0Dh	Medium destination element full
	3Bh	0Eh	Medium source element empty
	3Bh	11h	Medium magazine not accessible
	3Bh	A0h	Medium transfer element full
	53h	02h	Library media removal prevented state set
	53h	03h	Drive media removal prevented state set
	44h	80h	Bad status library controller
	44h	81h	Source not ready
	44h	82h	Destination not ready
	44h	83h	Cannot make reservation
	44h	84h	Wrong drive type
	44h	85h	Invalid slave robotic controller request
	44h	86h	Accessor not initialized
Unit Attention (06h)	28h	00h	Not ready to ready transition
	28h	01h	Import/export element accessed
	29h	01h	Power on occurred
	29h	02h	SCSI Bus reset occurred
	29h	05h	Bus type changed to Single Ended (SE)
	29h	06h	Bus type changed to Low Voltage Differential (LVD)
	2Ah	01h	Mode parameters changed
	2Ah	10h	Time stamp changed
	3Bh	13h	Medium magazine inserted
	3Fh	01h	Microcode has changed
	53h	02h	Media removal prevented

Table C-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description
Command Aborted (0Bh)	3Fh	0Fh	ECHO buffer overwritten
	43h	00h	SCSI message error
	47h	00h	SCSI parity error
	49h	00h	SCSI invalid message
	4Eh	00h	Overlapped command attempt

Drive Sense Data

LTO Ultrium 4 drives contain hardware which performs user data write encryption and read decryption, protecting all user data written to the medium from unauthorized use, provided it is integrated into a secure system design.

Table C-2. LTO Tape Drive Sense Data

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

Table C-2. LTO Tape Drive Sense Data (continued)

Byte	Bit Address or Name							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
12-13	Additional Sense Code (ASC) Additional Sense Code Qualifier (ASCQ) **Byte 12 Byte 13** **ASC ASCQ** 00 00 - No additional sense - The flags in the sense data indicate the reason for the command failure 00 01 - Filemark detected - A Read or Space command terminated early due to an FM The FM flag is set. 00 02 - EOM - A Write or Write File Marks command failed because the physical end of tape was encountered, or a Read or Space command encountered EOM The EOM flag is set 00 04 - BOM - A space command ended at Beginning of Tape The EOM bit is also set 00 05 - EOD - Read or Space command terminated early because End of Data was encountered 04 00 - Cause not reportable - A cartridge is present in the drive, but it is in the process of being unloaded 04 01 - Becoming Ready - A media access command was received during a front panel initiated load or an immediate reported load command 04 02 - Initializing Command Required - A cartridge is present in the drive, but is not logically loaded. A Load command is required 04 03 - Manual Intervention Required - A cartridge is present in the drive but could not be loaded or unloaded without manual intervention 0C 00 - Write Error - A Write operation has failed. This is probably due to bad media, but may be hardware related 11 00 - Unrecovered Read Error - A Read operation failed. This is probably due to bad media, but may be hardware related 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							

Table C-2. LTO Tape Drive Sense Data (continued)

Byte	Bit Address or Name							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
12-13	Additional Sense Code (ASC) - Additional Sense Code Qualifier (ASCQ) (Continued) **Byte 12 Byte 13** **ASC ASCQ** 30 00 - Incompatible Media Installed - A write type operation could not be executed because it is not supported on the cartridge type that is loaded. 30 01 - Unknown Format - An operation could not be carried out because the cartridge in the drive is of a format not supported by the drive 30 02 - Incompatible Format - An operation could not be completed because the Logical Format is not correct 30 03 - Cleaning Cartridge Installed - An operation could not be carried out because the cartridge in the drive is a cleaning cartridge 30 07 - Cleaning Failure - A cleaning operation was attempted, but could not be completed for some reason 30 0C - Data Protect - WORM overwrite attempted. The drive rejected a write operation because it would have resulted in an overwrite. Overwrite is not allowed on WORM media. 30 0D - Medium Error - WORM integrity check. The drive rejected a Read or Write operation because the cartridge is a suspicious WORM cartridge. 31 00 - Media format corrupted - Data could not be read because the format on tape is not valid, but is a known format. A failure occurred attempting to write the FID 37 00 - Rounded parameter - A Mode Select command parameter has been rounded because the drive can not store it with the accuracy of the command. 3A 00 - Media Not Present - A media access command has been received when there is no cartridge loaded 3B 00 - Sequential Positioning Error - A command has failed and left the logical position at an unexpected location 3D 00 - Invalid bits in identify Message - An illegal Identify Message has been received at the drive at the start of a command 3E 00 - Logical Unit has not Self-Configured - The drive has just powered on and has not completed its self test sequence and can not process commands 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							

Table C-2. LTO Tape Drive Sense Data (continued)

Byte	Bit Address or Name							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
12-13	Additional Sense Code (ASC) - Additional Sense Code Qualifier (ASCQ) (Continued) **Byte 12 Byte 13** **ASC ASCQ** 52 00 - Cartridge fault - A command could not be completed due to a fault in the tape cartridge 53 00 - Media Load/Eject Failed - (Sense Key 03) An attempt to load or eject the cartridge failed due to a problem with the cartridge. 53 00 - Media Load/Eject Failed - (Sense Key 04) An attempt to load or eject the cartridge failed due to a problem with the drive 53 02 - Media Removal Prevented - An Unload command has failed to eject the cartridge because media removal has been prevented 5D 00 - Failure Prediction Threshold - Failure Prediction thresholds have been exceeded indicating that a failure may occur soon 5D FF - Failure Prediction False - A Mode Select command has been used to test for Failure Prediction system. 82 82 - Drive requires cleaning - The drive has detected that a cleaning operation is required to maintain good operation 82 83 - Bad Code Detected - The data transferred to the drive during a firmware upgrade is corrupt or incompatible with drive hardware							

Table C-2. LTO Tape Drive Sense Data (continued)

Byte	Bit Address or Name							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
12-13	Additional Sense Code (ASC) - Additional Sense Code Qualifier (ASCQ) (Continued) **Byte 12 Byte 13** **ASC ASCQ** **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 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 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							

Table C-2. LTO Tape Drive Sense Data (continued)

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
12-13	**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 Has Changed 74 00 - Security Error 74 01 - Encryption - Unable to Decrypt Data 74 02 - Encryption - Unencrypted Data Encountered While Decrypting 74 03 - Encryption - Incorrect Data Encryption Key 74 04 - Encryption - Cryptographic Integrity Validation Failed 74 05 - Encryption - Error Decrypting Data							
14	FRU code							
15	SKSV	C/D	Reserved		BPV When set to 1, the bit pointer is 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			

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

Note:

1. The Error Code field (Byte 0) is set to 70h to indicate a current error, that is one associated with the most recently received command. It is set to 71h to indicate a deferred error which is not associated with the current command.
2. The segment number (Byte 1) is zero since the Copy, Compare, and Copy and Verify commands are not supported.
3. The File Mark flag (Byte 2, bit 7) is set if a Space, Read, or Verify command did not complete because a file mark was read.
4. The End of Media (EOM) flag (Byte 2, bit 6) is set if a Write or Write File Marks command completed in the early warning area. Spacing into BOM also causes this flag to be set. It is also set on an attempt to read or space past EOD, or if an attempt is made to space into Beginning of Media.
5. The Illegal Length Indicator (ILI) flag (Byte 2, bit 5) is set if a Read or Verify ended because a block was read from tape that did not have the block length requested in the command.
6. The Information Bytes (Bytes 3-5) are only valid if the Valid flag is set. This occurs only for current errors and not for deferred errors.
7. The Field Replaceable Unit field (Byte 14) is set to either zero or to a non-zero, vendor-specific code indicating which part of the drive is suspected of causing the failure.
8. The Clean (CLN) flag (Byte 21, bit 3) is set if the drive needs cleaning and clear otherwise.
9. The Volume Label Fields Valid (VolValid) bit (Byte 21, bit 0) is set if the Volume Label being reported is valid.
10. The Volume Label field (Bytes 22-28) reports the volume label if a cartridge is loaded in the drive and Volume Label Fields Valid is set.
11. The Current Wrap field (Byte 29) reports the physical wrap of the tape. The least significant bit reflects the current physical direction. A 0 means that the current direction is away from the physical beginning of the tape. A 1 means that the current direction is towards the physical beginning of the tape.
12. Relative LPOS fields (Bytes 30-33) reports the current physical position on the tape.
13. SCSI Address field (Byte 34) reports the SCSI Bus Address for the drive. Values returned range from 00h to 0Fh.
14. This field (Byte 35) contains the frame and drive number, passed across the RS-422 serial interface.

Appendix D. Message Retrieval at the Host

Retrieving message from different hosts are discussed in this appendix.

Obtaining Error Information From an RS/6000

IBM device drivers for the RS/6000 system logs error information when an error occurs on a tape drive or library.

The error information includes the following:

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

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

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

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

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

- For library errors [Resource Name = **smc**n (for example, smc0) and Resource Type = 3573-TL]), refer to "SCSI Sense Data Definition" and Sense Data in Appendix C.
- For drive errors [Resource Name = **rmt**n (for example, rmt0) and Resource Type = LTO], refer to "SCSI Sense Data Definition" and Sense Data in Appendix C.
- For fibre channel errors (not fibre channel adapter errors), determine which host adapter and device are affected, and go to that host documentation to resolve any fibre channel problems. If unsuccessful, call for IBM support.
- For fibre channel adapter errors (not fibre channel bus errors), use the maintenance package for the host.

Note: See Appendix C, "Sense Data," on page C-1 for further details on sense data.

SCSI Sense Data Definition

Following is an example of a tape drive communication failure while attached to an Open Systems host through a fibre channel link, using SCSI protocol. When the host detected the failure, it built the following SCSI Sense Data record. An explanation of the SCSI Sense Data breakout in this example follows.

```
SENSE DATA

aabb  xxxx  ccdd eeee eeee  eeee  eeee  eeee  ffgg  hhxx  ssss  ssss   ssss   ssss   ssss ....

0600 0000 1200 0000 0000 0000 0000 0000 0200 0300 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

Note: The bold area above represents the SCSI Sense Data presented by the host. The regular font data (in this case many bytes of 'zero'), designated by 'ssss' would normally contain device sense data, but with the kind of failure in this example (COMMAND TIMEOUT), the host could not collect valid device sense data, so zeros are the result and should be ignored. If the host had been able to collect valid sense data from the drive, the first byte 'ss' would be '70', '71', 'F0' or 'F1', and valid device sense data would be listed.

```
DETAIL DATA

aabb  xxxx  ccdd eeee eeee  eeee  eeee  eeee  ffgg  hhxx  ssss  ssss   ssss   ssss   ssss ....

aa Length of the Command Descriptor Block (CDB) sent by the host. In this case, '06' bytes.
bb SCSI target address. In this example, SCSI address '00'.
xx Unused or reserved
cc Start of CDB, cc is the operation code (byte 0). In this case, '12' which was an "Inquiry".
```

SCSI Sense Data - Library Error

The following example of SCSI Sense Data was received from a RS/6000 Open System host and shows a Tape Drive Failure and what the sense data would look like. Unlike the previous situation with "SCSI Sense Data Definition", this data contains valid sense data as defined by the hex '70' in the first sense byte position. Therefore, instead of all zeros as in the previous example, we have valid data to rely on. While the data shows that this is a TAPE_ERR2, it could also be caused by a library failure. As described above, the resource name is smc0 indicating a library error. The ASC/ASCQ points to a "Mechanical Positioning Error" while attempting a "Move Medium" command ('A5'). For more information about Sense Data, consult your "IBM System Storage TS3100 Tape Library and TS3200 Tape Library SCSI Reference" document.

```
LABEL:     TAPE_ERR2
IDENTIFIER:      476B351D

Date/Time:       Fri May 04 42:26 DFT
Sequence Number: 1665
Machine ID:      0046083B4C00
Node ID:         risc4
Error Class:     H
Error Type:      PERM
Resource Name:   smc0
Resource Class:  tape
Resource Type:   3573
Location:        P1.1-I3/Q1-W5003013D38321011-L1000000000000
VPD:
        Manufacturer................IBM
        Machine Type and Model......3573-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 a "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
```

Figure D-1. AIX ERRPT Library Error Log Example

Table D-1. AIX ERRPT Library Sense Data

Hex	Description
A5	SCSI Command (in this case Move Medium)
70	Byte 0 of Library Sense Data (Valid Data)
04	Sense Key (in this case Hardware Error)
818F	ASC/ASCQ (additional sense code/additional sense code qualifier), in this case a “Cannot Find Slider Block” error.

SCSI Sense Data - Drive Error

The following example of SCSI Sense Data was received from a RS/6000 Open System host and shows a Tape Drive Failure and what the sense data would look like. Like the SCSI Sense Data in Example 1, this Sense Data example contains valid sense data as defined by the hex ‘71’ in the first sense byte position. Therefore, we have valid data to rely on. While the data shows that this example is a TAPE_ERR2, it could also be caused by a library failure. Further review of the

ASC/ASCQ, (Media load or eject failed), points more to a problem with the media or the drive. Also note that the FSC listed was F402 which is a timeout while attempting to load drive 2. For more information about the Sense Key and ASC/ASCQ fields, refer to the "IBM System Storage TS3100 Tape Library and TS3200 Tape Library SCSI Reference" document.

```
LABEL:     TAPE_ERR2
IDENTIFIER:      476B351D

Date/Time:       Wed May 09 07:51:42 DFT
Sequence Number: 1669
Machine ID:      0046083B4C00
Node ID:         risc4
Error Class:     H
Error 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 0102 0000 7100 0400 0000 0058 0000 0000
5300 0702 F402 0000 0001 0110 0001 0000 0000 0000 0200 0000 0000 0000 0000 00000
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 0000 0000
```

Figure D-2. AIX ERRPT Library Error Log Example

Table D-2. AIX ERRPT Drive Sense Data

Hex	Description
71	Valid Sense Data Follows
04	Sense Key (Hardware Problem)
5300	ASC/ASCQ (additional sense code/additional sense code qualifier)
F401	FSC (fault symptom code) in this case, Drive Load Timeout. Likely a drive problem.

Retrieving from a Sun System

The Sun System provides information when an error occurs on a tape drive or library in `system-errolog /var/adm/messages`. When you have located the error information, go to Chapter 6, "Troubleshooting," on page 6-1.

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

- Tape service program

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

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

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

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

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

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

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

Retrieving from an HP-UX System

The HP-UX system provides information when an error occurs on a tape drive or library in `syslog /var/adm/syslog.log`. When you have located the error information, go to Chapter 6, “Troubleshooting,” on page 6-1.

Appendix E. Library Configuration Form

Use this form when planning your library configuration. Keep this document in a secure location and update it when changes are made to the library configuration.

General Information				
Library type	TS3100	TS3200		
Library Serial Number				
Library name				
I/O Station	Enabled	Disabled		
AutoClean	Enabled	Disabled		
Encryption key				
Path Failover key				
Library Network Settings				
DHCP	Enabled	Disabled		
IP Address				
Netmask Address				
Gateway Address				
Logical Libraries				
Number in library	1	2	3	4
Mode	Random: ON/OFF Sequential: ON/OFF Autoload: ON/OFF Loop: ON/OFF	Random: ON/OFF Sequential: ON/OFF Autoload: ON/OFF Loop: ON/OFF	Random: ON/OFF Sequential: ON/OFF Autoload: ON/OFF Loop: ON/OFF	Random: ON/OFF Sequential: ON/OFF Autoload: ON/OFF Loop: ON/OFF
Magazine Assignment	☐ Upper Left ☐ Lower Left ☐ Upper Right ☐ Lower Right	☐ Upper Left ☐ Lower Left ☐ Upper Right ☐ Lower Right	☐ Upper Left ☐ Lower Left ☐ Upper Right ☐ Lower Right	☐ Upper Left ☐ Lower Left ☐ Upper Right ☐ Lower Right
Number of Active Slots				
Drive Serial Numbers	4U Position 4: 4U Position 3: 2U/4U Position 2: 2U/4U Position 1:	4U Position 4: 4U Position 3: 2U/4U Position 2: 2U/4U Position 1:	4U Position 4: 4U Position 3: 2U/4U Position 2: 2U/4U Position 1:	4U Position 4: 4U Position 3: 2U/4U Position 2: 2U/4U Position 1:
Drive types	4U Position 4: 4U Position 3: 2U/4U Position 2: 2U/4U Position 1:	4U Position 4: 4U Position 3: 2U/4U Position 2: 2U/4U Position 1:	4U Position 4: 4U Position 4: 4U Position 3: 2U/4U Position 2: 2U/4U Position 1:4U Position 3: 2U/4U Position 2: 2U/4U Position 1:	4U Position 4:4U Position 3:2U/4U Position 2:2U/4U Position 1:

Fibre Channel Drive settings	Logical Library: Position: Speed: Port type: Loop ID:	Logical Library: Position: Speed: Port type: Loop ID:	Logical Library: Position: Speed: Port type: Loop ID:	Logical Library: Position: Speed: Port type: Loop ID:
SAS Drive settings	Logical Library: Position: ID:	Logical Library: Position: ID:	Logical Library: Position: ID:	Logical Library: Position: ID:
SCSI Drive settings	Logical Library: Position: ID:	Logical Library: Position: ID:	Logical Library: Position: ID:	Logical Library: Position: ID:

User Accounts	
User Name: Access Level: Password:	User Name: Access Level: Password:
User Name: Access Level: Password:	User Name: Access Level: Password:
User Name: Access Level: Password:	User Name: Access Level: Password:
User Name: Access Level: Password:	User Name: Access Level: Password:
User Name: Access Level: Password:	User Name: Access Level: Password:
User Name: Access Level: Password:	User Name: Access Level: Password:

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Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication. If you do not find the term you are looking for, refer to the index or to the *Dictionary of Computing*, 1994.

Numbers

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

A

A. Ampere.

ac. Alternating current.

access method. A technique for moving data between main storage and input or output devices.

accessor. This component contains the library robot and bar code reader. The accessor moves cartridges to and from the I/O Station, storage slots, and tape drives.

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

adj. Adjustment.

AH. The Authentication Header (AH) is intended to guarantee connectionless integrity and data origin authentication of IP datagrams. Further, it can optionally protect against replay attacks by using the sliding window technique and discarding old packets.

AIX. Advanced Interactive Executive. IBM's implementation of the UNIX® operating system. The RS/6000 system, among others, uses AIX as it's operating system.

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

alter. To change.

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

AME. Application Managed Encryption

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

ANSI. American National Standards Institute.

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

ASCII. American National Standard Code for Information Interchange. A 7 bit coded character set (8 bits including parity check) that consists of control characters and graphic characters.

assigning a device . The establishing of the relationship of a device to a running task, process, job, or program.

assignment. The naming of a specific device to perform a function.

asynchronous. Pertaining to two or more processes that do not depend upon the occurrence of specific events such as common timing signals.

attention (notice). A word for calling attention to the possibility of danger to a program, device, or system, or to data. Contrast with *caution* and *danger*.

ATTN. Attention.

B

backup. To make additional copies of documents or software for safekeeping.

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

bar code label. Paper bearing a bar code and having an adhesive backing. The bar code label must be affixed to a tape cartridge to enable the library to identify the cartridge and its volume serial number.

bar code reader. A laser device specialized for scanning and reading bar codes and converting them into either the ASCII or EBCDIC digital character code.

bezel. Decorative and safety cover.

bicolored. Having two colors.

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

BOM or bill of materials. A list of specific types and amounts of direct materials expected to be used to produce a given job or quantity of output.

Border Gateway Protocol (BGP). BGP is the core routing protocol of the Internet. It works by maintaining a table of IP networks or 'prefixes' which designate network reachability among autonomous systems (AS).

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

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

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

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

C

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 storage slot. Individual slot located within a magazine that is used to house tape cartridges.

caution (notice). A word to call attention to possible personal harm to people. Contrast with *attention* and *danger*.

CE. Customer engineer; field engineer; service representative.

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

channel command. An instruction that directs a data channel, control unit, or device to perform an operation or set of operations.

char. Character.

CHK. Check.

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

command. A control signal that initiates an action or the start of a sequence of actions.

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

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

concurrent. Refers to diagnostic procedures that can be run on one control unit while the rest of the subsystem remains available for customer applications.

contingent connection. A connection between a channel path and a drive caused when a unit check occurs during an I/O operation.

controller. A device that provides the interface between a system and one or more tape drives.

control path drive. A drive that communicates messages from the host computer to the library in which the drive is installed.

CP. Circuit protector.

ctrl. Control.

CU. Control unit.

D

danger (notice). A word to call attention to possible lethal harm to people. Contrast with *attention* and *caution*.

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

data buffer. The storage buffer in the control unit. This buffer is used to increase the data transfer rate between the control unit and the channel.

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

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

dc. Direct current.

DCS. Designated Cleaning Slot

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

degausser. A device that makes magnetic tape nonmagnetic.

degradation. A decrease in quality of output or throughput or an increase in machine error rate.

degraded. Decreased in quality of output or throughput or increased machine error rate.

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

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

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

device driver. A file that contains the code needed to use an attached device.

DHCPv6. The Dynamic Host Configuration Protocol for IPv6. Although IPv6's stateless address autoconfiguration removes the primary motivation for DHCP in IPv4, DHCPv6 can still be used to statefully assign addresses if the network administrator desires more control over addressing.

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. On the Operator Control Panel (OCP), the brightness of the display can be set by setting the contrast from **1** (the brightest) to **10** (the lightest).

dll. Dynamic link library: Microsoft's implementation of the shared library concept. These libraries usually have the file extension DLL, OCX (for libraries containing ActiveX controls), or DRV (for legacy system drivers).

download. (1) To transfer programs or data from a computer to a connected device, typically a personal computer. (2) To transfer data from a computer to a connected device, such as a workstation or microcomputer.

DRAM. Dynamic random-access memory.

drive, magnetic tape. A mechanism for moving magnetic tape and controlling its movement.

Drive Not Configured. This message occurs during the first boot after a factory settings restore is executed. This is not a real issue since it takes the library a while to configure.

DRV. Drive.

DSE. Data security erase.

DSP. Digital signal processor.

E

EBCDIC. Extended binary-coded decimal interchange code.

EC. Edge connector. Engineering change.

ECC. Error correction code.

EEPROM. Electrically erasable programmable read-only memory.

EIA. Electronics Industries Association.

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

eject. To remove or force out from within.

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

e-mail. See *electronic mail*.

encryption. To alter (a file, for example) using a secret code so as to be unintelligible to unauthorized parties. 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.

EPO. Emergency power off.

EPROM. Erasable programmable read only memory.

EQC . Equipment check.

equipment check. An asynchronous indication of a malfunction.

Error log. A dataset or file in a product or system where error information is stored for later access.

ESD. Electrostatic discharge.

ESP. The Encapsulating Security Payload (ESP) protocol provides origin authenticity, integrity, and confidentiality protection of a packet. ESP also supports encryption-only and authentication-only configurations, but using encryption without authentication is strongly discouraged because it is insecure.

F

fault symptom code (FSC). A hexadecimal code generated by the drive or the control unit microcode in response to a detected subsystem error.

FC. Feature code.

FCC. Federal communications commission.

FE. Field engineer, customer engineer, or service representative.

fiducial. A target used for teaching a physical location to a robot.

field replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails.

file. A named set of records stored or processed as a unit. Also referred to as a dataset.

file protection. The processes and procedures established in an information system that are designed to inhibit unauthorized access to, contamination of, or deletion of a file.

file transfer protocol (FTP). In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or hosts.

firmware. Proprietary code that is usually delivered as microcode as part of an operating system. Firmware is more efficient than software loaded from an alterable medium and more adaptable to change than pure hardware circuitry. An example of firmware is the Basic Input/Output System (BIOS) in read-only memory (ROM) on a PC motherboard.

FLASH EEPROM. An electrically erasable programmable read-only memory (EEPROM) that can be updated.

FMR. Field microcode replacement.

format. The arrangement or layout of data on a data medium.

formatter. Part of a magnetic tape subsystem that performs data conversion, speed matching, encoding, first level error recovery, and interfaces to one or more tape drives.

FP. File protect.

frayed. Damaged as if by an abrasive substance.

FRU. Field replaceable unit.

FSC. Fault symptom code.

FSI. Fault symptom index.

FTSS. Field Technical Sales Support

functional microcode. Microcode that is resident in the machine during normal customer operation.

G

g. Gram.

GB. gigabyte.

GBIC. Gigabit Interface Converter.

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

hertz (Hz). Unit of frequency. One hertz equals one cycle per second.

hex. Hexadecimal.

High Voltage Differential (HVD). A logic signaling system that enables data communication between a supported host and the library. HVD signaling uses a paired plus and minus signal level to reduce the effects of noise on the SCSI bus. Any noise injected into the signal is present in both a plus and minus state, and is thereby canceled. Synonymous with *differential*.

HVD. SCSI Bus High Voltage Differential

Hz. Hertz (cycles per second).

I

IBM Ultrium Tape Drive. Located within the library, a data-storage device that controls the movement of the magnetic tape in an IBM LTO Ultrium Tape Cartridge. The drive houses the mechanism (drive head) that reads and writes data to the tape.

ID. Identifier.

identifier (ID). (1) In programming languages, a lexical unit that names a language object; for example, the names of variables, arrays, records, labels, or procedures. An identifier usually consists of a letter optionally followed by letters, digits, or other characters. (2) One or more characters used to identify or name data element and possibly to indicate certain properties of that data element. (3) A sequence of bits or characters that identifies a program, device, or system to another program, device, or system.

IML. Initial microprogram load.

Incomp. Mag.. Incompatible Magazine: This message appears on the Operator Control Panel during library initializing. It occurs during factory restore or VPD. This is not a real issue since it takes the library a while to configure.

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

initiator. The component that executes a command. The initiator can be the host system or the tape control unit.

INST. Installation.

interface. A shared boundary. An interface might be a hardware component to link two devices or it might be a portion of storage or registers accessed by two or more computer programs.

| **Internet Protocol version 4 (IPv4).** A network layer
| protocol for packet-switched internetworks. IPv4
| supports 2^{32} (about 4.3 billion) addresses.

| **Internet Protocol version 6 (IPv6).** A network layer
| protocol for packet-switched internetworks. It is
| designated as the successor of IPv4, the current version
| of the Internet Protocol, for general use on the Internet.
| The main improvement brought by IPv6 is the increase
| in the number of addresses available for networked
| devices, allowing, for example, each mobile phone and
| mobile electronic device to have its own address.

interposer. The part used to convert a 68-pin connector to a 50-pin D-shell connector.

intervention required. Manual action is needed.

INTRO. Introduction.

I/O. Input/output.

IOP. Input/output processor.

| **IP address.** An identifier for a computer or device on
| a TCP/IP network. Networks using the TCP/IP
| protocol route messages based on the IP address of the
| destination. The format of an IP address is a 32-bit
| numeric address written as four numbers separated by
| periods. Each number can be zero to 255. For example,
| 1.160.10.240 could be an IP address.

IPL. Initial program load.

| **IP Stack.** The IP Stack manages static IP addresses.

| **IPv4.** A network layer protocol for packet-switched
| internetworks. IPv4 supports 2^{32} (about 4.3 billion)
| addresses.

| **IPv6.** A network layer protocol for packet-switched
| internetworks. It is designated as the successor of IPv4,
| the current version of the Internet Protocol, for general
| use on the Internet. IPv6 supports approximately 5×10^{28}
| addresses for each of the roughly 6.5 billion people
| alive today.

ISV. Independent software vendor.

ITST. Idle-time self-test.

K

kilogram (kg). One thousand grams (approximately 2.2 pounds).

km. kilometer. 1000 Meters, Approximately 5/8 mile.

L

LAN. Local area network. A computer network within a limited area.

LCD. See *liquid crystal display*.

LED. Light-emitting diode.

Linear Tape-Open (LTO). A type of tape storage technology developed by the IBM Corporation, Hewlett-Packard, and Certance. LTO technology is an "open format" technology, which means that its users will have multiple sources of product and media. The "open" nature of LTO technology enables compatibility between different vendors' offerings by ensuring that vendors comply with verification standards. The LTO technology is implemented in two formats: the Accelis format focuses on fast access; the Ultrium format focuses on high capacity. The Ultrium format is the preferred format when capacity (rather than fast access) is the key storage consideration. An Ultrium cartridge has a compressed data capacity of up to 800 GB (2:1 compression) and a native data capacity of up to 400 GB.

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

loadable. Having the ability to be loaded.

| **LME.** Library Managed Encryption

LTO 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.

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 magnetical surface layer on which data can be stored by magnetic recording.

MAP. Maintenance analysis procedure.

mask. A pattern of characters that controls the retention or elimination of portions of another pattern of characters. To use a pattern of characters to control the retention or elimination of portions of another pattern of characters.

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

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

MB. Mega Byte (usually expressed as data rate in MB/s or MB/second).

media capacity. The amount of data that can be contained on a storage medium, expressed in bytes of data.

media-type identifier. 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 which 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 file. Management Information Block

micro. One millionth of.

microcode. (1) One or more micro instructions. (2) A code, representing the instructions of an instruction set, implemented in a part of storage that is not program-addressable. (3) To design, write, and test one or more micro instructions. (4) See also *microprogram*.

microdiagnostic routine. A program that runs under the control of a supervisor, usually to identify field replaceable units.

microdiagnostic utility. A program that is run by the customer engineer to test the machine.

microinstruction. A basic or elementary machine instruction.

microprogram. A group of microinstructions that when executed performs a preplanned function.

The term microprogram represents a dynamic arrangement or selection of one or more groups of microinstructions for execution to perform a particular function. The term microcode represents microinstructions used in a product as an alternative to hard-wired circuitry to implement certain functions of a processor or other system component.

MIM. Media information message.

mm. Millimeter.

modifier. That which changes the meaning.

mount a device. To assign an I/O device with a request to the operator.

MP. Microprocessor.

ms. Millisecond.

MSG. Message.

multipath. Pertaining to using more than one path.

N

N/A. Not applicable.

Network Address Translation (NAT). NAT involves rewriting the source and/or destination addresses of IP packets as they pass through a Router or firewall. Most systems using NAT do so in order to enable multiple hosts on a private network to access the Internet using a single public IP address.

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

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 one abampere per 4π centimeters of axial length.

offline. Pertaining to the operation of a functional unit without the continual control of a computer. Contrast with *online*.

online. Pertaining to the operation of a functional unit that is under the continual control of a computer. Contrast with *offline*.

OPER. Operation.

ov. Over voltage.

overrun. Loss of data because a receiving device is unable to accept data at the rate it is transmitted.

overtightening. To tighten too much.

P

parameter. A variable that is given a constant value for a specified application and that may denote the application.

p bit. Parity bit.

PC. Parity check.

PCC. Power control compartment.

PDF. Portable Document Format.

PE. Parity error. Product engineer.

pick. Pertaining to the library, to remove, by means of a robotic device, a tape cartridge from a storage slot or drive.

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

PM. Preventive maintenance.

POR. Power-on reset.

port. A physical connection for communication between the drive/library and the host processor.

Portable Document Format (PDF). A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact, can be distributed globally (via e-mail, the Web, intranets, or CD-ROM), and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

PROM. Programmable read only memory.

PS. Power supply.

PTF. Program temporary fix: a single bugfix or group of bugfixes distributed in a form ready to install for customers.

PWR. Power.

R

rack. A unit that houses the components of a storage subsystem, such as the library.

rackmount kit. A packaged collection of articles used to install the rack mounted version of the library.

RAM. Random access memory.

Random access memory. A storage device into which data is entered and from which data is retrieved in a nonsequential manner.

RAS. Reliability, availability, and serviceability.

record. A collection of related data or words, treated as a unit.

recording density. The number of bits in a single linear track measured per unit of length of the recording medium.

recoverable error. An error condition that allows continued execution of a program.

ref. Reference.

reg. Register.

re-inventory. To inventory again.

retention. The process or function of tightening the tape onto the cartridge, if it is sensed that the tape has a loose wrap on the cartridge.

RFC (Request for Comments). Request for Comments (RFC) documents are a series of memoranda encompassing new research, innovations, and methodologies applicable to Internet technologies.

RH. Relative humidity.

robot. Picker.

robotics. Picker assembly.

RPQ. Request for price quotation.

R/W. Read/write.

S

s. Seconds of time.

SAC. Service Action Code. Code developed to indicate possible FRU or FRU's to replace to repair the hardware.

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

SCSI. Small computer system interface.

SE. Single-ended.

segment. A part.

sel. Select.

Serial Attached SCSI (SAS). A drive sled 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; its full-duplex signal transmission supports 3.0 Gb/s. In addition, SAS drives can be hot-plugged.

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

serializer. A device that converts a space distribution of simultaneous states representing data into a corresponding time sequence of states.

servo, servos. An adjective for use in qualifying some part or aspect of a servomechanism.

servomechanism. A feedback control system in which at least one of the system signals represents mechanical motion.

Simple Network Management Protocol. SNMP, a standard TCP/IP protocol to send alerts about conditions (such as need for operator intervention) over a TCP/IP LAN network to an SNMP monitoring station.

Slot Blocker. A slot blocker is used to restrict/close off a data cell so a data cartridge cannot be placed there. This blocker can easily be removed.

Small Computer Systems Interface (SCSI). A standard used by computer manufacturers for attaching peripheral devices (such as tape drives, hard disks, CD-ROM players, printers, and scanners) to computers (servers). Pronounced "scuzzy". Variations of the SCSI interface provide for faster data transmission rates than standard serial and parallel ports (up to 160 megabytes per second). The variations include:

- Fast/Wide SCSI: Uses a 16-bit bus, and supports data rates of up to 20 MBps.
- SCSI-1: Uses an 8-bit bus, and supports data rates of 4 MBps.
- SCSI-2: Same as SCSI-1, but uses a 50-pin connector instead of a 25-pin connector, and supports multiple devices.
- Ultra SCSI: Uses an 8- or 16-bit bus, and supports data rates of 20 or 40 MBps.
- Ultra2 SCSI: Uses an 8- or 16-bit bus and supports data rates of 40 or 80 MBps.
- Ultra3 SCSI: Uses a 16-bit bus and supports data rates of 80 or 160 MBps.
- Ultra160 SCSI: Uses a 16-bit bus and supports data rates of 80 or 160 MBps.

SME. System Managed Encryption

SNMP. Simple Network Management Protocol, a standard TCP/IP protocol to send alerts about conditions (such as need for operator intervention) over a TCP/IP LAN network to an SNMP monitoring station.

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.

SR. Service representative, see also *CE*.

SRAM. Static random access memory.

SS. Status store.

SSL. SSL, or Secure Socket Layer is a cryptographic protocol that provide secure communications on the Internet for such things as web browsing, e-mail, Internet faxing, instant messaging and other data transfers. This protocol allows applications to communicate across a network in a way designed to prevent eavesdropping, tampering, and message forgery.

ST. Store.

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

START. Start maintenance.

subsystem. A secondary or subordinate system, usually capable of operating independently of, or asynchronously with, a controlling system.

SUPP. Support.

sync. Synchronous, synchronize. Occurring with a regular or predictable time relationship.

T

tachometer, tach. A device that emits pulses that are used to measure/check speed or distance.

tape cartridge. A container holding magnetic tape that can be processed without separating it from the container.

tape void. An area in the tape in which no signal can be detected.

TCP/IP. Transmission Control Protocol/Internet Protocol.

TCU. Tape control unit.

TH. Thermal.

thread/load operation. A procedure that places tape along the tape path.

TM. Tapemark.

U

UART. Universal asynchronous receiver/transmitter.

unload. Prepare the tape cartridge for removal from the drive.

utilities. Utility programs.

utility programs. A computer program in general support of the processes of a computer; for instance, a diagnostic program.

uv. Under voltage.

V

VOLSER. Volume serial number.

volume. A certain portion of data, together with its data carrier, that can be handled conveniently as a unit.

VPD. Vital product data. The information contained within the tape drive that requires nonvolatile storage used by functional areas of the drive, and information required for manufacturing, RAS, and engineering.

W

word. A character string that is convenient for some purpose to consider as an entity.

World Wide Node Name (WWNN). In a fibre channel connected library, the Drive ID as listed in the Web User Interface.

Write. Write command.

WT. world trade.

X

XR. External register.

XRA. External register address register.

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Setup, Operator, and Service Guide
Machine Type 3573

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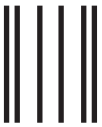

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