IBM System Storage TS3100 Tape Library and TS3200
Tape Library

Setup, Operator, and Service Guide

Machine Type 3573

IBM System Storage TS3100 Tape Library and TS3200
Tape Library

Setup, Operator, and Service Guide

Machine Type 3573

Read this First

Accessing Online Technical Support

For online Technical Support for your Library, visit:

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

Registering for My Support

My Support registration provides email notification when new firmware levels have been updated and are available for download and installation. To register for My Support, visit the web at **http://www.ibm.com/support/mySupport**.

Sending Us Your Comments

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

- E-mailing IBM:
  - Internet or IBMLink™ from US: *starpubs@us.ibm.com*
  - IBMLink from Canada: *STARPUBS at TORIBM*

  Include the following information in your e-mail:
  - Exact publication title
  - Form number (for example, GA32-1234-02) or part number (located on the back cover of the publication)
  - Page number to which you are referring
- Using the Readers' Comments form at the back of this publication
- Mailing your comments to:

  International Business Machines Corporation
  Information Development
  Department GZW
  9000 South Rita Road
  Tucson, AZ 85744-0001 USA

Contacting IBM Technical Support

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

All other Countries/Regions: Visit **http://www.ibm.com**.

To open a Service Request online: Under **Get Support**, click on **Open a Service Request**.

iii

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.

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.
32-55 kg (70.5-121.2 lbs)	A hazardous condition due to the weight of the unit. Weight symbols are accompanied by an approximation of the product's weight.

Laser Safety and Compliance

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

Class I Laser Product

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

Performing the Safety Inspection Procedure

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

1. Stop all activity on the SCSI bus.
2. Turn off the power to the tape drive.
3. Disconnect the SCSI cable and check the SCSI bus terminator for damage.
4. Unplug the tape drive's power cord from the electrical outlet.
5. Check the tape drive's power cord for damage, such as a pinched, cut, or frayed cord.
6. Check the tape drive's SCSI bus (signal) cable for damage.
7. Check the cover of the tape drive for sharp edges, damage, or alterations that expose its internal parts.
8. Check the cover of the tape drive for proper fit. It should be in place and secure.
9. Check the product label on the bottom of the tape drive 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. Be sure to disconnect all power cords in the rack cabinet before servicing any device in the rack cabinet.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

CAUTION:

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

(R001)

CAUTION:

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

- **Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must do the following:**
  - **Remove all devices in the 32U position and above.**
  - **Ensure that the heaviest devices are installed in the bottom of the rack cabinet.**
  - **Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.**
- **If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.**
- **Inspect the route that you plan to take to eliminate potential hazards.**
- **Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.**
- **Verify that all door openings are at least 760 x 230 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)

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`.

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 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

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.

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, operation, and maintenance.
- *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 Ultrium Device Driver Installation and User's Guide* (GA32-0430) provides instructions for attaching IBM-supported hardware to open-systems operating systems. It indicates what devices and levels of operating systems are supported. It also gives requirements for adapter cards, and tells how to configure hosts to use the device driver. All of the above are with the Ultrium family of devices.
- *IBM Ultrium Device Driver Programming Reference* (GC35-0483) supplies information to application owners who want to integrate their open-systems applications with IBM-supported Ultrium hardware. The reference contains information about the application programming interfaces (APIs) for each of the various supported operating-system environments.

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 2U library houses up to 22 tape cartridges and a 1-slot I/O Station in a compact 2U form factor with easy access to tape cartridges via two removable magazines. The 4U library houses up to 45 tape cartridges (44 storage slots and 1 dedicated cleaning cartridge slot) and a 3-slot I/O Station in a compact 4U form factor with easy access to tape cartridges via four removable magazines.

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 2U library media capacity is up to 8.8 TB (17.6 TB with 2:1 compression) data storage per unit. The 4U library media capacity is up to 17.6 TB (35.2 TB with 2:1 compression) data storage per unit.

Both libraries come with Ultrium 3 LVD SCSI or Ultrium 3 4Gb Fibre Channel drives, which allow connection to a wide spectrum of open systems servers. IBM Ultrium 3 Tape Drives can read and write LTO Ultrium 2 Data Cartridges at original Ultrium 2 capacities. IBM Ultrium 3 tape drives 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).

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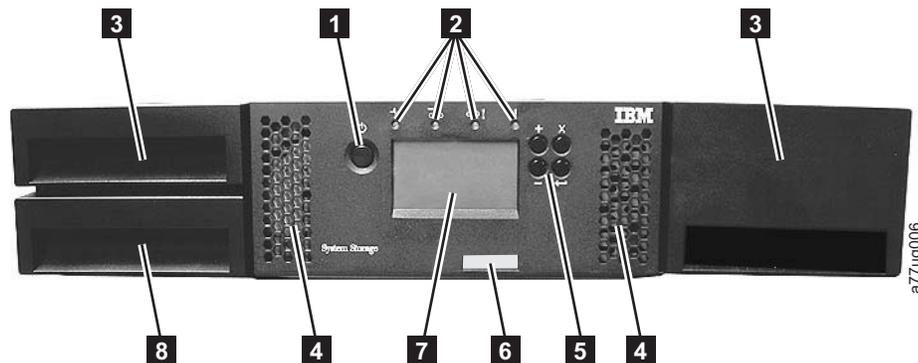
Figure 1-1. Front panel of a 2U library
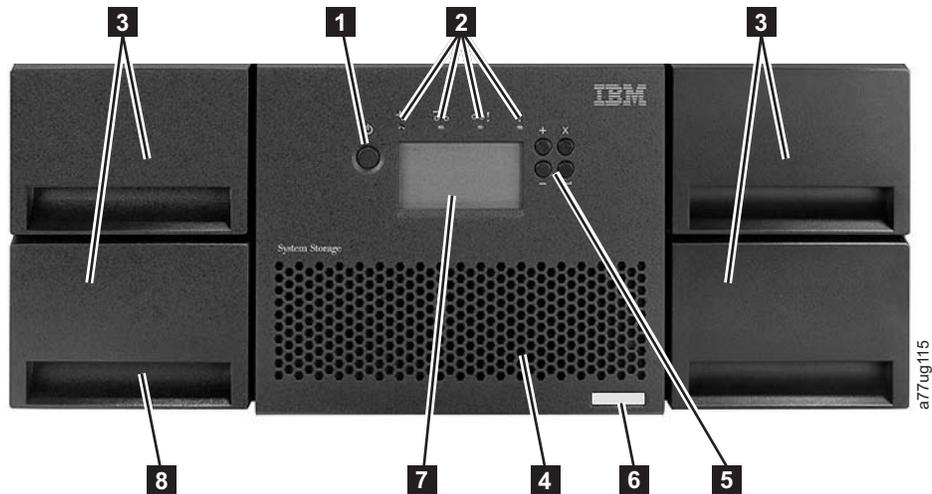
Figure 1-2. Front panel of a 4U library

Table 1-1 below contains front panel descriptions for both the 2U library in Figure 1-1 on page 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 or initiate a controlled power OFF of the unit (soft power down). No power switch or button can be found on the back panel of the library.
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. • **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. • **Media 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. **Note:** 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. The Media Attention LED will turn OFF. • **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. It will be cleared when the error state is resolved.

Number	Item	Description

3	Cartridge magazines	• The 2U library contains two cartridge magazines.
		  – The left magazine can hold up to 10 cartridges. (The left magazine houses the 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 8 cartridges. (The lower left magazine also contains the 3-slot I/O Station and one dedicated cleaning cartridge slot.)
		  – 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** (upper left button) - This button is used in interaction mode to navigate forward through menu items. • **Down** (lower left button) - This button is used in interaction mode to navigate backward through menu items. • **Cancel** (upper right button) - This button is used in interaction mode. Pushing this button will cancel a user action and return to the last menu item. • **Enter** (lower right button) - This button is used in interaction mode and, when pushed, will 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 a 1-slot I/O Station. • The 4U library has a 3-slot I/O Station.

Rear Panel
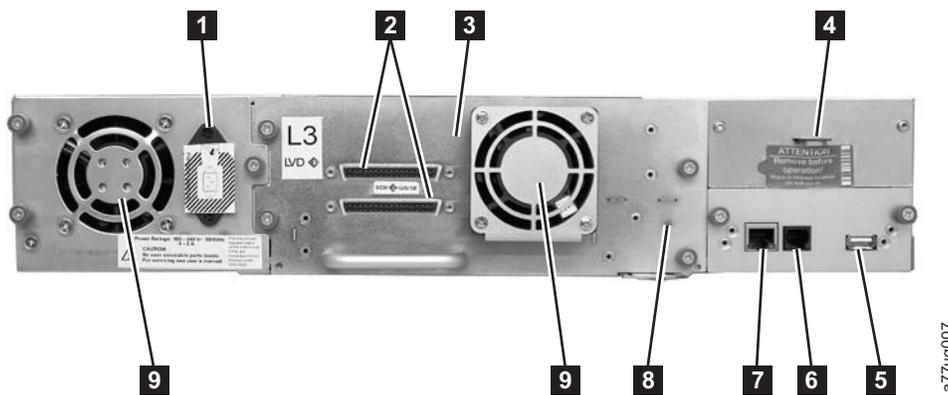
Figure 1-3. Rear panel of a 2U library with a SCSI drive
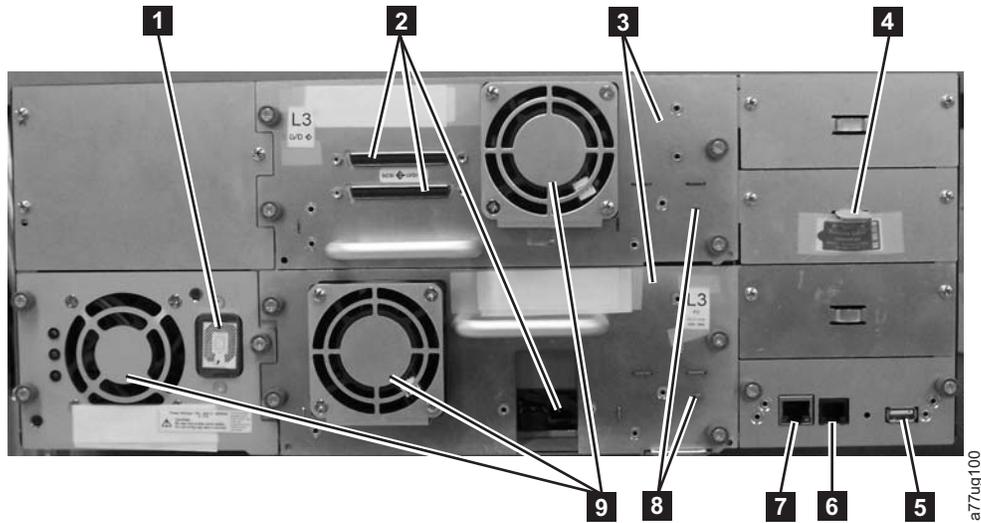
Figure 1-4. Rear panel of a 4U library with one SCSI drive and one Fibre Channel drive

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 an additional redundant power supply.
2	Host interface connectors	The library has one of the following host interface connectors on the drive sled: • a 68-pin HD SCSI connector • a 4 Gb Fibre Channel connector
3	Tape drive sled	This library supports the Ultrium 3 Tape Drive. The 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.
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 IBM Service Personnel.
6	Serial port	This port is used to communicate serially with the library using an RJ-11 connector. For use by IBM 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	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.
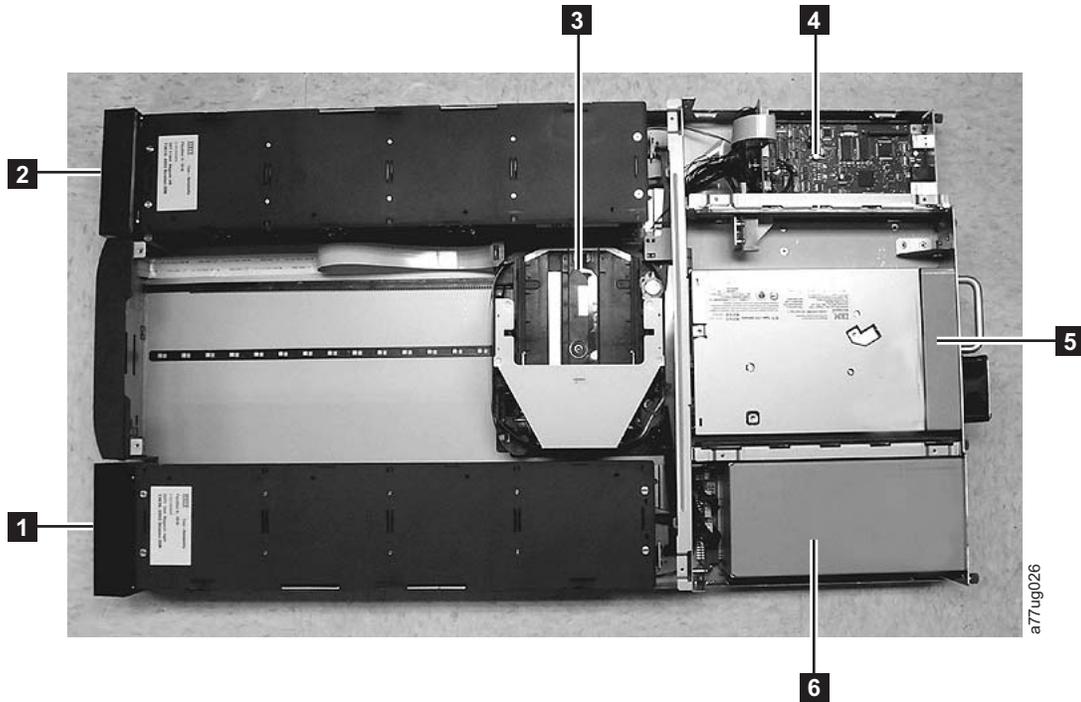
Figure 1-5. Internal view of the library

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 twelve 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 ten cartridges and houses the 1-slot I/O Station. • In a 4U library, the left magazines can hold up to 20 cartridges and houses the 3-slot I/O Station and the dedicated cleaning cartridge slot.
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 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 tape drive sled. • The 4U library houses up to two tape drive sleds.
6	Power supply	The power supply is a customer replaceable unit (CRU) and the sole source of power for the library.

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.

Host Interfaces

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

- SCSI
- Fibre Channel

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.

SCSI Interface

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

The library supports SCSI LVD attachments by using SCSI cables with 68-pin, D-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

or Ultra320 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 1-8.

Table 1-4. 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; Ultra320 SCSI buses have a bandwidth of 320 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 1-5. Recommended maximum quantity of drives per SCSI bus

Type of Drive	Type of SCSI Bus	
	Ultra160	Ultra320
LVD Ultrium 3	2 (1 drive at 2:1 compression)	2 (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. 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 1-13.

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 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.

Fibre Channel

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

Fibre Channel Interface

Cables and Speeds: Ultrium 3 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, 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)

The library uses 50-micron cables internally. Therefore, you must use a 50-micron cable to attach to the library's port. To attach to a 62.5-micron SAN, you must attach the 50-micron cable to an active port, such as a port on a switch.

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 WWNN or 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.

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 WWNN or WWPN, persistent binding causes a tape drive's WWN 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.

Fibre Channel 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`.

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.

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.

SCSI Element Types and Addresses

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

Table 1-6. 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)
Storage Elements (STE)	4096 (0x1000) - 4117 (0x1015)

Table 1-7. 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)
Data Transfer (Drives) Elements (DTE)	256 (0x100), 257 (0x101)
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.

Table 1-8. 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)	Not Available		Slot 22 4117 (0x1015)	Slot 21 4116 (0x1014)	Slot 20 4115 (0x1013)	Slot 19 4114 (0x1012)
Slot 4 4099 (0x1003)	Slot 5 4100 (0x1004)	Slot 6 4101 (0x1005)	Slot 7 4102 (0x1006)	Drive 1 256 (0x100)	Slot 18 4113 (0x1011)	Slot 17 4112 (0x1010)	Slot 16 4111 (0x100F)	Slot 15 4110 (0x100E)
I/O slot 16 (0x10)	Slot 1 4096 (0x1000)	Slot 2 4097 (0x1001)	Slot 3 4098 (0x1002)		Slot 14 4109 (0x100D)	Slot 13 4108 (0x100C)	Slot 12 4107 (0x100B)	Slot 11 4106 (0x100A)

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. The dedicated cleaning cartridge slot (Slot 9) does not have an assigned element address.

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

Maximum Library Storage Capacity and Data Transfer Rate

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

Table 1-10. Tape drive model and interface type

Tape Drive Model	Host Interface
Ultrium 3	Ultra160 or Ultra320 SCSI LVD (depending on drive; single-ended (SE) is not recommended as it will severely degrade performance)
Ultrium 3	4 Gb Fibre Channel

Table 1-11. Library storage capacity and data transfer rate

Characteristic	2U Library Specification	4U Library Specification
Maximum storage capacity	• 22 data cartridges • Native: 8.8 TB • Compressed: 17.6 TB (2:1 compression)	• 44 data cartridges • Native: 17.6 TB • Compressed: 35.2 TB (2:1 compression)

Characteristic	2U Library Specification	4U Library Specification
Maximum data transfer rate	Native: 80 MB/s (288 GB/hr.) Compressed: 160 MB/s (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 partition equals the entire physical library.
- The library prevents requests from the server to move media across the boundaries of 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 1-13.)
- 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" on page 1-13). 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. IBM recommends 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 Control 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 control 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 Control 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 Control Path Failover feature is activated by a license key.

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

Ultrium 3 Tape Drive Sled

Figure 1-6. Library drive sled with Ultrium 3 SCSI Tape Drive (also available with Fibre Channel tape drive)

Speed Matching

To improve system performance, the Ultrium 3 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 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 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 400 GB native capacity (up to 800 GB with 2:1 hardware data compression).

Supported cartridges include:
- IBM TotalStorage LTO Ultrium 400 GB Data Cartridge (Ultrium 3)
- IBM TotalStorage Write-Once-Read-Many Data Cartridge (WORM; Ultrium 3 only)
- IBM TotalStorage LTO Ultrium 200 GB Data Cartridge (Ultrium 2)
- IBM LTO Ultrium 100 GB Data Cartridge (Ultrium 1; read only)
- IBM TotalStorage LTO Ultrium Cleaning Cartridge

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

Library Specifications

Physical Specifications

Specification	2U library	4U library
Height	87.6 mm (3.4 in.)	185.2 mm (7.3 in.)
Width	447.5 mm (17.6 in.)	447.5 mm (17.6 in.)
Depth	740 mm (29.1 in.) from rack mount ears	810 mm (31.9 in.) from rack mount ears
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 Specification

Library with Ultrium 3 SCSI drive(s)	2U library	4U library
Maximum storage capacity	Maximum number of data cartridges: 22 Native: 8.8 TB Compressed: 17.6 TB (2:1 compression)	Maximum number of data cartridges: 45 Native: 17.6 TB Compressed: 35.2 TB (2:1 compression)
Number of slots	23 (including I/O Station)	48 (Including 3 I/O station slots and 1 dedicated cleaning slot.)
Maximum data transfer rate	Native: 80 MB/s (288 GB/hour) Compressed: 160 MB/s (576 GB/hour (2:1 compression)	
Drive type	Ultrium 3 SCSI drive	
Interface	Ultra160 or Ultra320 SCSI LVD	
Library with Ultrium 3 Fibre Channel drive(s)	**2U library**	**4U library**

Library with Ultrium 3 SCSI drive(s)	2U library	4U library
Maximum storage capacity	Maximum number of data cartridges: 22 Native 8.8 TB Compressed: 17.6 TB (2:1 compression)	Maximum number of data cartridges: 45 Native: 17.6 TB Compressed: 35.2 T (2:1 compression)
Number of slots	23 (including I/O Station)	48 (Including 3 I/O station slots and 1 dedicated cleaning slot.)
Maximum data transfer rate	Native: 80 MB/s (288 GB/hr.) Compressed: 160 MB/s (576 GB/hr.) (2:1 compression)	
Drive type	Ultrium 3 Fibre Channel drive	
Interface	Fibre Channel 4 Gb/s	

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**.

Supported Device Drivers

Device drivers are included on a CD-ROM in the ship group for the library. 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_ultrium_tape_IUG.pdf and IBM_ultrium_tape_IUG.ps contain the current version of the *IBM Ultrium Device Drivers Installation and User's Guide*.
- IBM_ultrium_tape_PROGREF.pdf and IBM_ultrium_tape_PROGREF.ps contain the current version of the *IBM Ultrium 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

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 aside.

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
  - Data cartridge
  - Cleaning cartridge
  - Foot pads (for desktop installation)
  - Extra prism fiducials for cartridge magazines
  - *IBM Translated Safety Notices*
  - *IBM License Agreement for Machine Code*
  - Installation Quick Reference
  - Setup, Operator, and Service Guide
  - Warranty information
  - Device Driver CD-ROM
  - Quality Hotline card
- With every library containing a SCSI drive:
  - SCSI terminator
  - SCSI wrap tool
  - SCSI library-to-host cable (supplied by customer)
- With every library containing a Fibre Channel drive:
  - Fibre wrap tool
  - Fibre Channel library-to-host/switch cable (supplied 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 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.
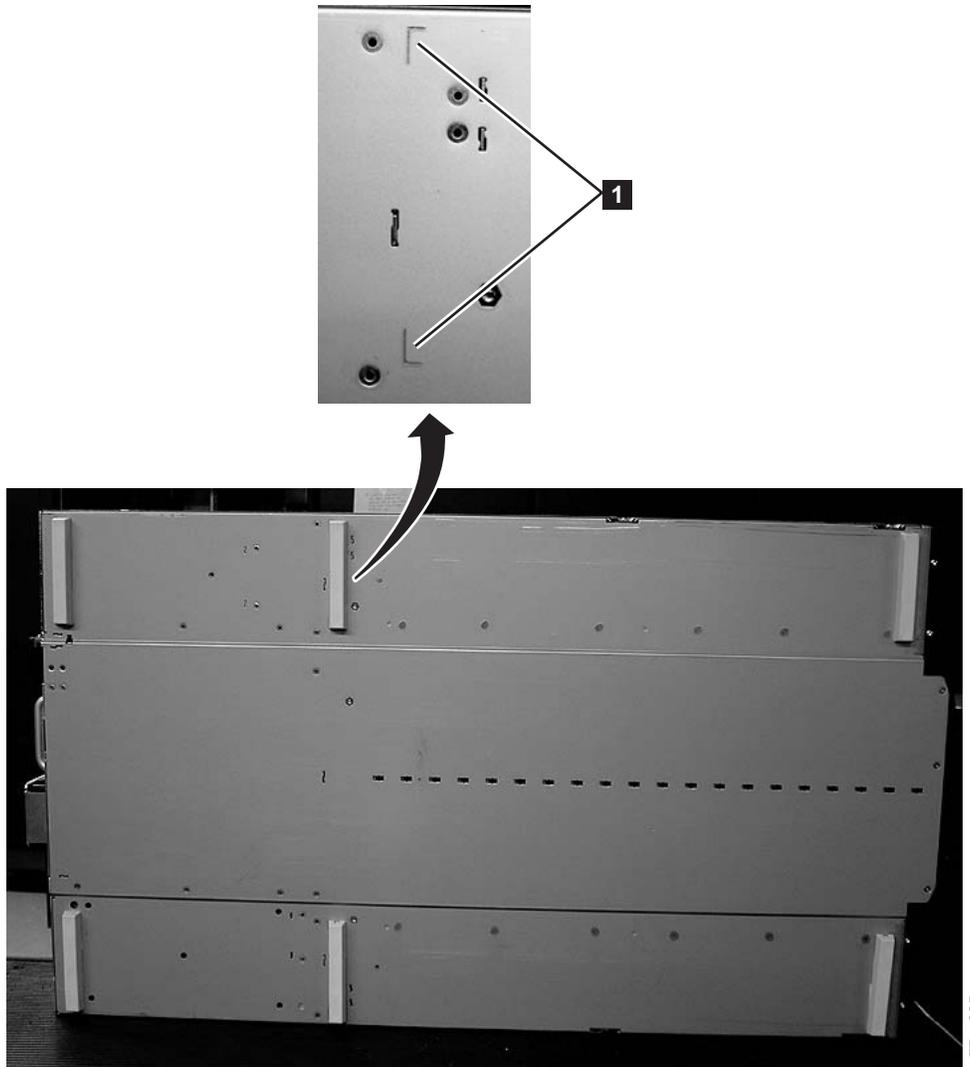
Figure 2-1. Installing foot pads on the bottom of the library chassis

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 on page 2-4).

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)

The 2U library and the 4U library are easily installed into a standard 19-inch rack system. 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
     - 2 mounting brackets
   - Packaged in the small bag with no label:
     - 1 T8 Torx wrench
     - 2 anchors
     - 2 large screws to secure the mounting brackets to the rack
     - 6 small countersunk screws for securing the anchors and the top of the mounting brackets
   - Packaged in the small bag with "Round Hole" on the label: 9 screws to be used on racks with round holes.
   - Packaged in the small bag with "Square Hole" on the label: 9 screws to be used on racks with square holes.

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.) of rack space. A 4U library requires 4U (7 in.) of rack space.

3. Using the screws for your rack type (round holes or square holes) and a #2 Phillips screwdriver, 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. The rails extend to fit a variety of rack depths. Each rail requires 2U of rack space (**1** in Figure 2-5 on page 2-7).
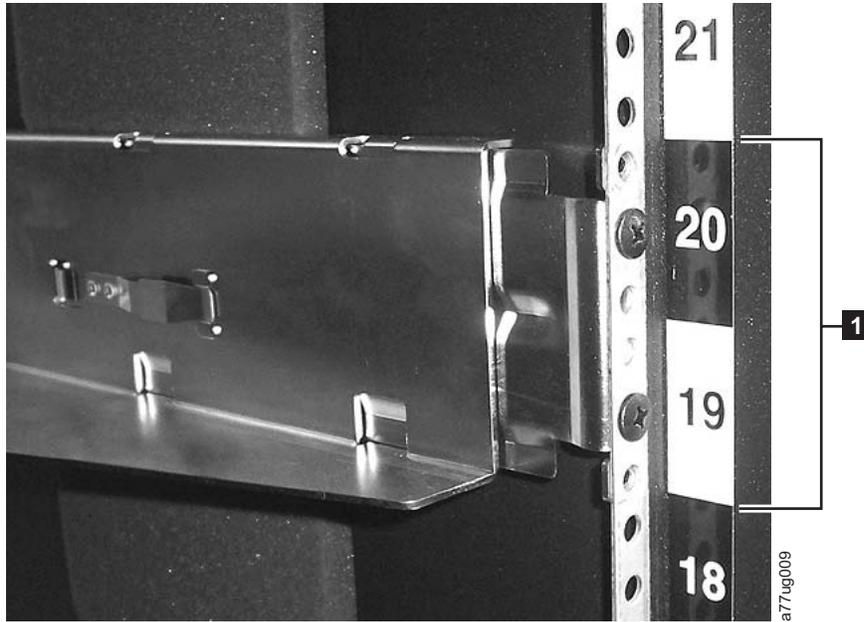
Figure 2-5. Rear view of a rail installed in a rack

4. Using the Torx wrench included in your shipment, remove the screws (**1**) as shown in Figure 2-6. Screw locations on the 4U library are similar.
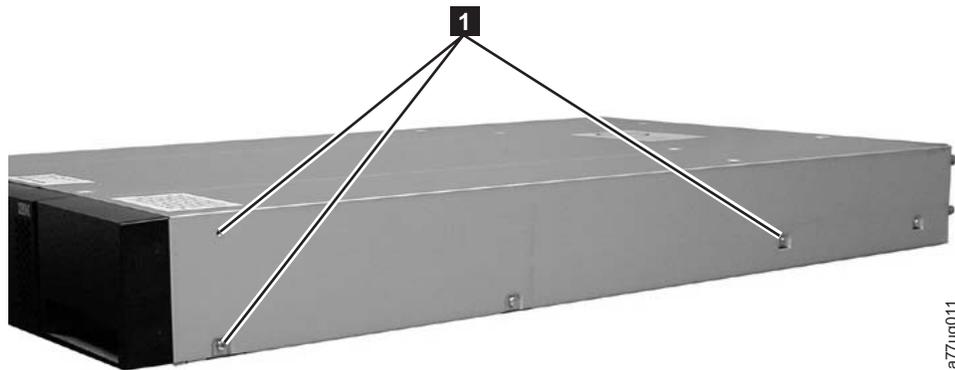
Figure 2-6. 2U library side screws to remove

5. Install the library rack anchors (**2**) as shown in Figure 2-7 on page 2-8 on each side of your library using the longest counter-sunk screws included in the rack kit.
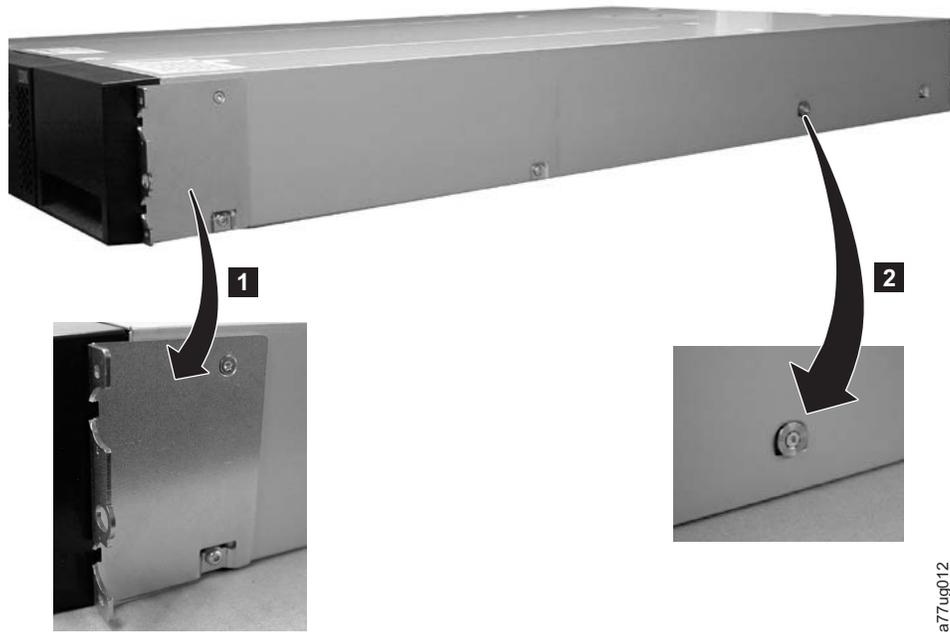
Figure 2-7. 2U library rack anchors and mounting brackets

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 2-8 and Figure 2-9 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 2-8. Sliding the 2U library into the rack

Figure 2-9. Sliding the 4U library into the rack

8. Using a #2 Phillips screwdriver, secure the library to the rack (see Figure 2-10 for a 2U library; see Figure 2-11 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 2-10. Securing the 2U library to the rack
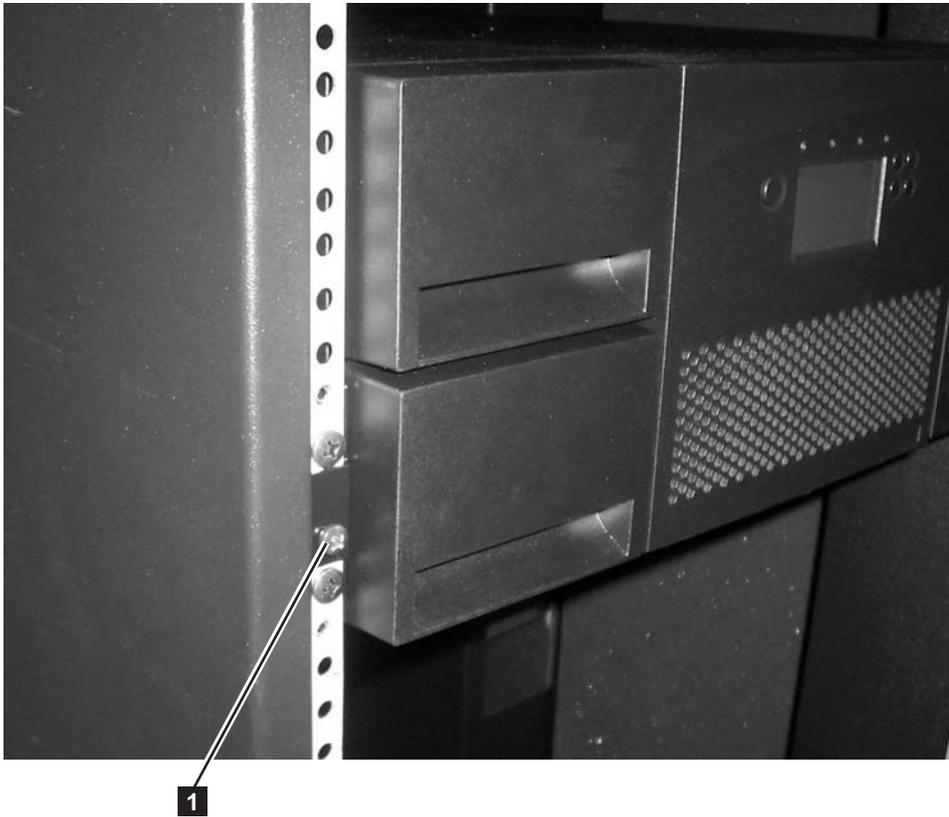
Figure 2-11. Securing the 4U library to the rack

Attaching the Library to a Server

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

- SCSI
- Fibre Channel

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 2-12 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 2-13 on page 2-11).
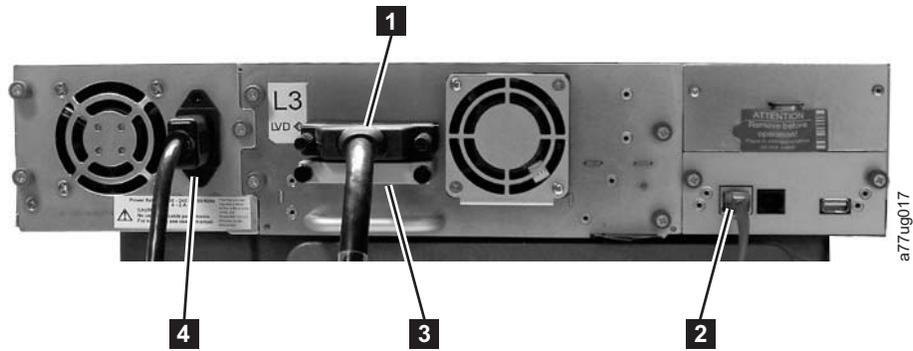
Figure 2-12. Attaching a SCSI host interface cable to the 2U library
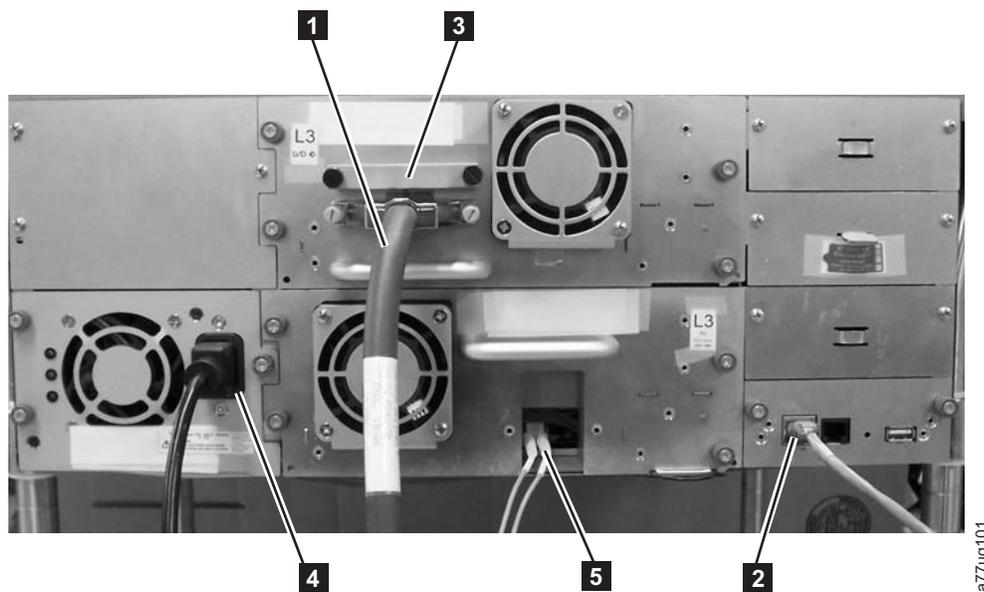
Figure 2-13. Attaching host interface cables to the 4U library. This 4U library contains one SCSI drive and one Fibre Channel drive.

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 2-12) 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: The Ultrium 3 tape drive is an Ultra160 or Ultra320 SCSI LVD device. Only cables and terminators specified for Ultra160 or Ultra320 use or labeled as Multi Mode 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 Figure 2-14.

4. Plug the network ethernet cable **2** in Figure 2-12 on page 2-11 or Figure 2-13 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.

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 Figure 2-14 and the procedure below.
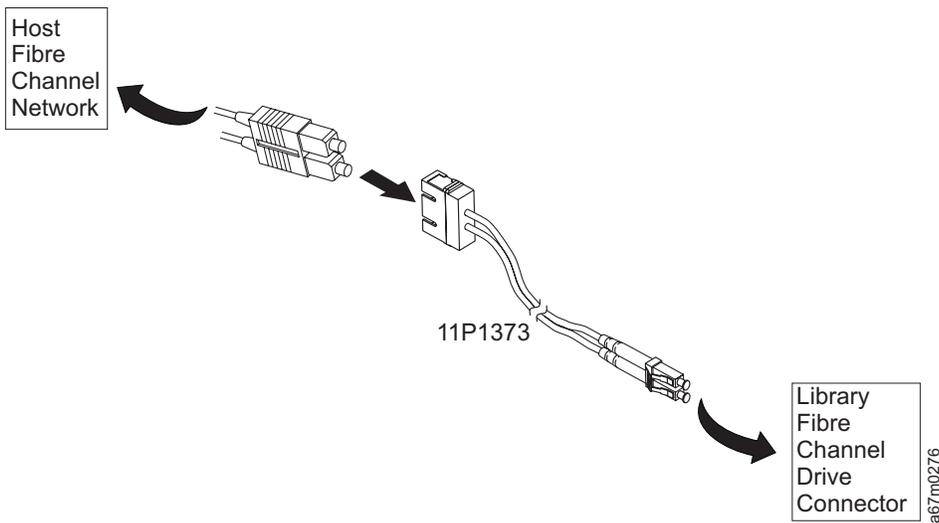
Figure 2-14. Interposer installation

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.

1. Plug one end of the power cord (**4** in Figure 2-12 on page 2-11 or Figure 2-13 on page 2-11) into the power connector on the back panel of the library.
2. Plug the other end of the power cord into the nearest properly grounded power outlet.
   Attention: To disconnect all power from the library, remove the power cord from the outlet. The power button only puts the power on stand-by.
3. 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.

Preparing the Host

Follow these general guidelines:

1. Make sure that your backup application supports the SCSI or Fibre Channel host bus adapter (HBA).
2. If the host server is connected to a network, check with the system administrator before turning host power OFF.
3. 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.
4. Make sure that LUN scanning is enabled on the SCSI host adapter.
5. Make sure that Fibre Channel Tape Support is enabled on the Fibre Channel HBA if installing a library with a Fibre Channel drive.

Verifying the Connection

1. Depending on the server configuration, you may need to change the SCSI 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. 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, consult the operating system documentation.

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.

Default library configuration settings are listed in the following table.

Table 2-2. Default library configuration settings

Configuration Item	Default Setting for 2U library	Default Setting for 4U library
DHCP (Dynamic Host Configuration Protocol)	ON	ON
Network Address	0.0.0.0	0.0.0.0
Drive IDs	SCSI drive: 4 Fibre Channel drive: 4	Drive 1* (SCSI or Fibre Channel): 4 Drive 2** (SCSI or Fibre Channel): 5
Res. (Reserved) Slots***	0	0
Drive Power ON/OFF	ON	ON
Library Mode	Random	Random
* Drive 1 is the lower drive slot in a 4U library. ** Drive 2 is the upper drive slot in a 4U library. *** Zero Res. (Reserved) Slots implies 100 percent active slots.		

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 2-22.

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. Press the UP button to display 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, 3, and 7. If you do not want to use DHCP as your library network setting, complete Steps 1, 2, 4, 5, 6, and 7.

1. Press the DOWN button to highlight the **Network** menu.
2. Press the ENTER button to display the **Network** screen.
3. 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 ENTER button to highlight the **DHCP** field.
   b. Press the DOWN button to select **ON**.

    c. Press the ENTER button to apply your selection.

    d. Skip to Step 7.

4. Press the DOWN button to select **IP Address**.

    a. Press the ENTER 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 ENTER button to highlight the next digit(s) in your IP Address.

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

5. Press the DOWN button to select **Netmask**.

    a. Press the ENTER 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 ENTER 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 ENTER button to apply your entries.

6. Press the DOWN button to select **Gateway**.

    a. Press the ENTER 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 ENTER 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.

7. Press the ENTER button to return to the **Configure** menu.

8. Press the CANCEL button to return to the **Main** menu.

9. Press the CANCEL button to return to the home screen.

Configure Your Library using the Web User Interface

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

Logging on to the Web User Interface

To complete the configuration of your library using the Web User Interface, follow the steps below. If you have a 2U library, proceed to the section, "Choosing Library Settings" on page 2-17.

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**
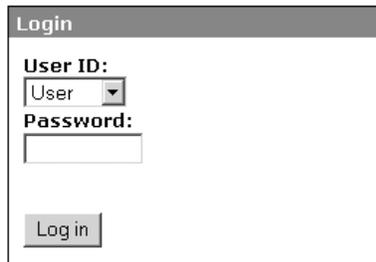
Figure 2-15. Log in screen on the Web User Interface

Choosing the Number of Logical Libraries for Your 4U Library

If you have a 2U library or do not wish to partition your 4U 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. 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 dedicated cleaning slot (DCS) are shared among all logical libraries.

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

Figure 2-16. 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 2-17).

1. Expand **Configure Library** in the left navigation pane of the Web User Interface.

2. Click **Library Settings (General)** and enter the following:

   - **Library Name** - Enter a name for your library. A maximum of 8 characters is allowed.

   - **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** shown on the Operator Control Panel menu under the **Configure** 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. Slots will be reserved starting with the highest element address (Slot 44).

   - **Auto Clean Enabled** - Automatically cleans drive when drive requests cleaning <u>AND</u> cleaning cartridge is present in the library.

   - 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 2-17. The 2U library Configure Library: General screen

Figure 2-18. 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 or Fibre Channel). Refer to Figure 2-19.
3. Click one of the following:
   - **Refresh** - to update the current screen
   - **Submit** - to apply the changes made to the screen

Figure 2-19. 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 2-20. Configure Library: Network page

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

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.

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. Click the **OCP Access PIN Enabled** box to require the user to enter a personal identification number to use the Operator Control Panel.
6. Enter an **OCP Access PIN Code** that will allow the user access to the Operator Control Panel.
7. In **Repeat OCP Access PIN Code**, enter the personal identification number again.
8. In **Support Name**, enter the name of the person that will be able to offer the user help with the library.

9. In **Support Phone**, enter the phone number of the person that will be able to offer the user help with the library.

10. In **Support Email**, enter the email address of the person that will be able to offer the user help with the library.

11. Click one of the following:
    - **Refresh** - to update the current screen.
    - **Submit** - to apply the changes made to the screen.

Figure 2-21. 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 2-22. The Configure Library: Date and Time screen

Entering Control Path Failover License Activation Key

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

Figure 2-23. The Configure Library: Control Path Failover License Activation screen

3. Click **Activate** to save the license key. The following screen will display if you have correctly entered the license key.
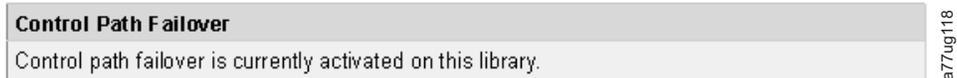
Figure 2-24. License Key verification screen

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.
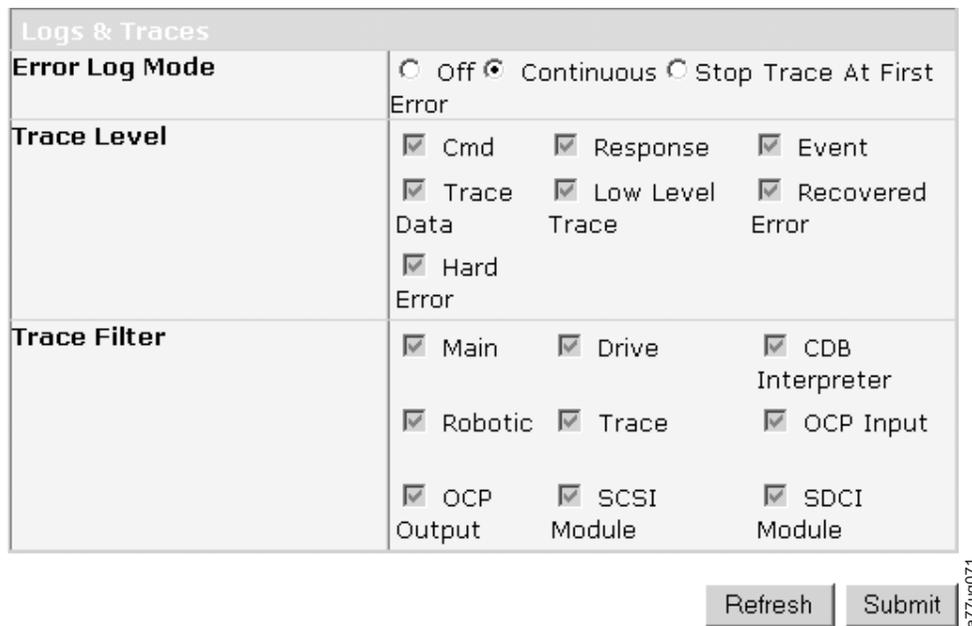
Figure 2-25. The Configure Library: Logs and Traces screen

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 2-26. The Configure Library: Event Notification screen

Saving Library Configuration using the Web User Interface

This function is not 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.

Important: Each time you change the configuration of your library, you should save the configuration using the Web User Interface or by updating your written list of library settings. To save library configuration using the Web User Interface, complete the following procedure.

1. Navigate to **Configure Library → Restore Defaults**
2. Click **Save Vital Product Data**. This will make a copy of the configuration of your library on the accessor for restoration at a later time.

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" on page 2-23
2. "Choosing Library Settings" on page 2-23
3. "Choosing Drive(s) Interface Identification/Settings" on page 2-23
4. "Entering Network Settings using the Operator Control Panel" on page 2-23
5. "Setting the Operator Control Panel Access PIN" on page 2-24
6. "Entering Date and Time using the Operator Control Panel" on page 2-24

7. "Entering Control Path Failover License Activation Key using the Operator Control Panel" on page 2-25
8. "Restoring Factory Default Settings using the Operator Control Panel" on page 2-25

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 ENTER 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.
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 the dedicated cleaning slot (DCS).
5. Click **Save**.

Choosing Drive(s) 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.
5. Select a Port Speed, Port Type, and Loop ID for each Fibre Channel drive.
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, 3, and 7. If you do <u>not</u> want to use DHCP as your library network setting, complete Steps 1, 2, 4, 5, 6, and 7.

1. Press the DOWN button to highlight the **Network** menu.
2. Press the ENTER button to display the **Network** screen.
3. If you do <u>not</u> 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 ENTER button to highlight the **DHCP** field.
   b. Press the DOWN button to select **ON**.
   c. Press the ENTER button to apply your selection.

d. Skip to Step 7.
4. Press the DOWN button to select **IP Address**.
   a. Press the ENTER 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 ENTER button to highlight the next digit(s) in your IP Address.
   d. After entering the final digits, press the ENTER button to apply your entries.
5. Press the DOWN button to select **Netmask**.
   a. Press the ENTER 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 ENTER 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 ENTER button to apply your entries.
6. Press the DOWN button to select **Gateway**.
   a. Press the ENTER 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 ENTER 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.
7. Press the ENTER button to return to the **Configure** menu.
8. Press the CANCEL button to return to the **Main** menu.
9. 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 ENTER 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 ENTER 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 ENTER 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 ENTER to move to the next field.
5. After you have correctly entered the time, press ENTER to select Time.

6. Press the DOWN button to select Date.
7. Press the ENTER 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 ENTER to move to the next field.
9. After you have correctly entered the date, press ENTER to select Date.
10. Press the DOWN button to select SUBMIT.
11. Press ENTER to apply your changes.

Entering Control Path Failover License Activation Key using the Operator Control Panel

1. Navigate to **Configure** → **Control Path Failover**.
2. Press the ENTER button to highlight the first digit of the 12-digit license key.
3. Use the UP and DOWN buttons to select each digit.
4. Press the ENTER 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.

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 4-15.

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 2-27 on page 2-26) has ten storage slots and houses the 1-slot I/O Station. The right magazine (see Figure 2-28 on page 2-26) 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 1-10.
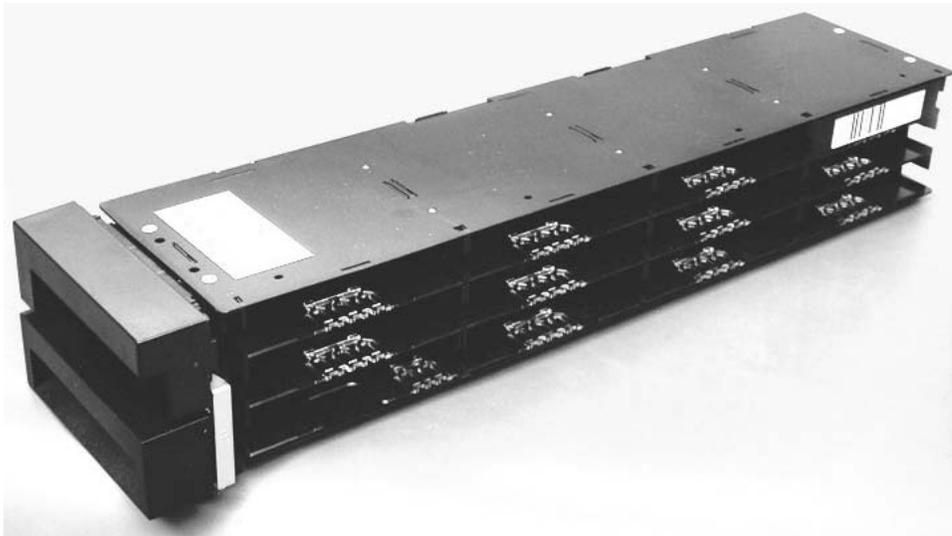
Figure 2-27. 2U library left magazine

Figure 2-28. 2U library right magazine

2U Library I/O Station

The I/O (Input/Output) Station (see Figure 2-29 on page 2-27) 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.
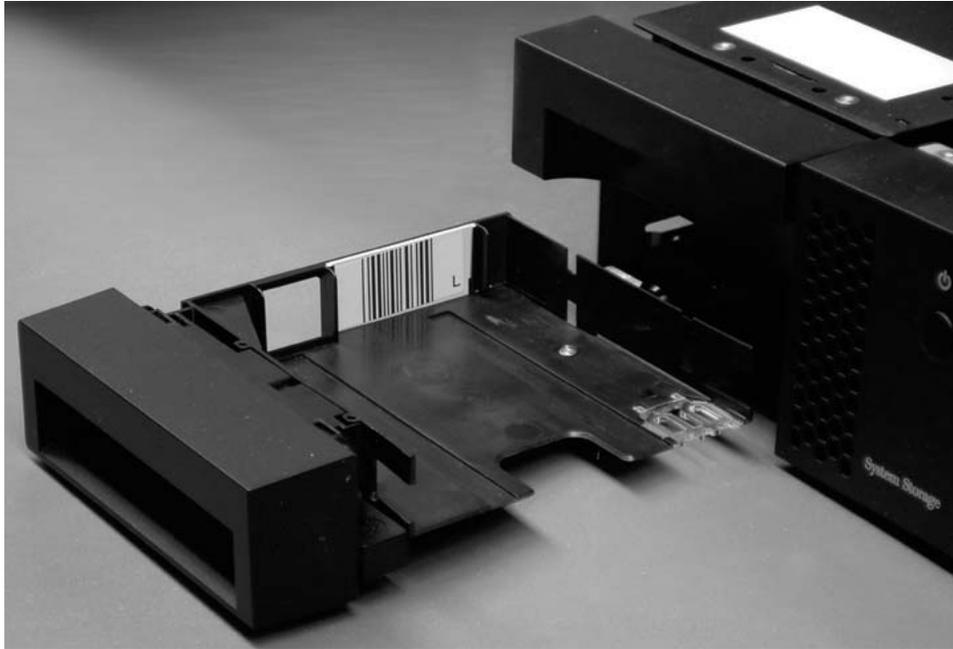
Figure 2-29. 2U library I/O Station in the left magazine

4U Library Cartridge Magazines

The 4U library has four cartridge magazines, two on each side (see Figure 2-30 on page 2-28 and Figure 2-31 on page 2-29). 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 2-30 on page 2-28). 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 1-11.

Figure 2-30. 4U library left magazines

a77ug106

Figure 2-31. 4U library right magazines

4U Library I/O Station

The I/O Station in a 4U library (see Figure 2-32 on page 2-30) 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 2-32. 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 2-33) that allow the user to push the cartridges out of the I/O station.
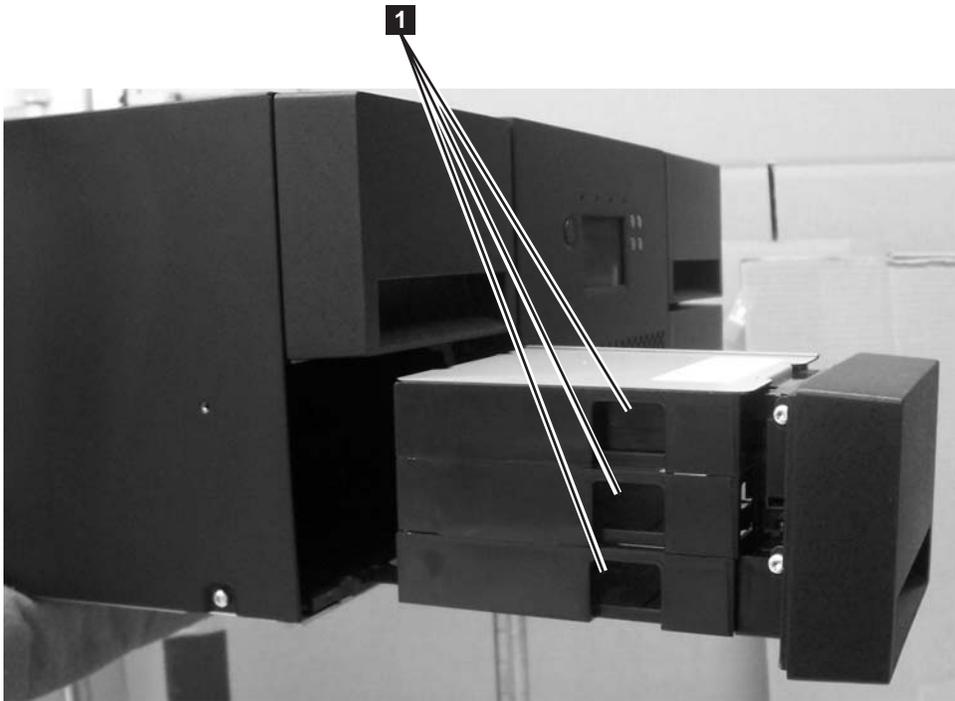
Figure 2-33. Finger Holes on back side of 4U Library I/O Station

Populating the Library with Data Cartridges

For information on working with the cartridge magazines, see "Cartridge Magazines" on page 2-25.

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 1-10 or "4U Library I/O Slots, Storage Slots, and Drive Slots Element Addresses and Physical Locations" on page 1-11 for determining slot location.
4. Insert cartridges in the right magazine(s).
5. Put all magazines back into the library.

Inserting the Cleaning Cartridge

In a 4U library, the top slot of the right column of the lower left magazine is a dedicated cleaning slot (DCS). This slot holds the cleaning cartridge.

In a 2U library, the cleaning cartridge can be placed in any storage slot.

With the Auto Clean feature enabled, a drive will be cleaned automatically when necessary.

Unlock the left cartridge magazines.
- Using the Operator Control Panel: **Control** → **Magazines**
- Using the Web User Interface: **Manage Library** → **Release Magazine**
- Remove the magazine from the library. In a 4U library remove the lower left magazine. In a 2U library remove any magazine.
- Insert the cleaning cartridge. In a 4U library, insert the cleaning cartridge in the top slot of the back column of the magazine (refer to "4U Library I/O Slots, Storage Slots, and Drive Slots Element Addresses and Physical Locations" on page 1-11) In a 2U library insert the cleaning cartridge in any storage slot.
- Push the magazine back into the library.

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 appropriate information to keep the user informed. When the POST is finished, the library will display the current library status in the Home Screen.

```
           Startup
Firmware Rev:    120R
Drive:           1
Magazines:       2
I/O Station:     empty

Idle  Random           Offline
```

⇩

```
           TS3100

           IBM

Accessor           Drive 1
    ✓                  ✓
Idle  Random           Offline
```
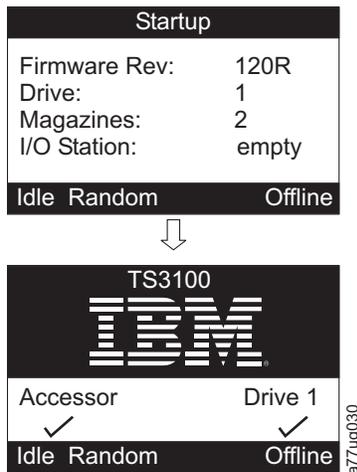
Figure 3-1. Power-ON Screens

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 reasonable rate of approximately 1-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 **Media Attention** LED will indicate that there is a piece of media which is bad/marginal, or invalid. The LED will turn OFF when all marginal and invalid cartridges have been exported from the library.

> **Note:** To identify the 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. The Media Attention LED will turn OFF.

- 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. 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 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 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 pressing CANCEL within the first 3 seconds.

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.

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.
- The red X indicates that user intervention is required and that the library is not capable of performing 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.

Table 4-1. Menu navigation shortcuts

Component	Information/Activity	Menu Navigation Shortcuts	
		Operator Control Panel	**Web User Interface**
Library	Access PIN, enable/disable	**Configure › Set Access PIN**	**Configure Library › User Access**
	Auto Clean, enable	**Configure › Library Settings › Auto Clean**	**Configure Library › General**
	Configuration, save and restore	**Configure › Restore Defaults**	**Configure Library › Restore Defaults**
	Date and time, set	**Configure › Set Date and Time**	**Configure Library › Date & Time**
	Diagnostics, run Library Verify test	**Service › Library Verify**	Not available with this interface.
	Diagnostics, run other tests	**Service › Run Tests**	**Service Library › Perform Diagnostics**
	Event notifications: add, modify, and delete	Not available with this interface.	**Configure Library › Event Notification**
	Error logs and traces, set mode	Not available with this interface	**Configure Library › Logs & Traces**
	Firmware, identify current level	**Monitor › Library › Identity**	**Monitor Library › Library Identity**
	Firmware, update	Not available with this interface.	**Service Library › Upgrade Firmware**
	I/O Station, current status	**Monitor › Library › Status**	**Monitor Library › Library Status**
	I/O Station, open	**Control › Open I/O Station**	Not available with this interface
	IP Address, current	**Monitor › Library › Identity**	**Monitor Library › Library Identity**
	Inventory, perform	**Control › Re-Inventory**	**Manage Library › Perform Inventory**
	Logical libraries, select	**Configure › Logical Libraries**	**Configure Library › Logical Libraries**
	Logs, view	**Monitor › Library › Error Log**	**Service Library › View Logs**
	Mode, change	**Configure › Library Settings › Mode**	**Configure Library › General**
	Mode, current	**Monitor › Library › Identity**	**Monitor Library › Library Identity**
	Network configuration, change	**Configure › Network**	**Configure Library › Network**
	Network configuration, view	**Monitor › Library › Network**	**Configure Library › Network**
	Power cycles	**Monitor › Library › Status**	**Monitor Library › Library Status**
	Restart	Not available with this interface.	**Service Library › Reboot**
	SCSI Inquiry string	**Monitor › Library › Identity**	**Monitor Library › Library Identity**
	Serial Number	**Monitor › Library › Identity**	**Monitor Library › Library Identity**
	Slots, number active	**Configure › Library Settings › Active Slots**	**Configure Library › General**
	Status, current	**Monitor › Library › Status**	**Monitor Library › Library Status**
	Time elapsed since power ON	**Monitor › Library › Status**	**Monitor Library › Library Status**

Table 4-1. Menu navigation shortcuts (continued)

Component	Information/Activity	Menu Navigation Shortcuts	
		Operator Control Panel	**Web User Interface**
Drive	Clean	**Service ▸ Service ▸ Clean Drive**	**Service Library ▸ Clean Drive**
	Control path, enable	**Configure ▸ Drive ▸ Control Paths**	**Configure Library ▸ Drive**
	Control Path Failover, license key	**Configure ▸ Control Path Failover**	**Configure Library ▸ Control Path Failover**
	Diagnostics, run	**Service ▸ Service ▸ Drive Tests**	**Service Library ▸ Perform Diagnostics**
	Firmware, current level	**Monitor ▸ Drive ▸ Identity**	**Monitor Library ▸ Drive Identity**
	Firmware, upgrade	**Service ▸ Service ▸ Drive FW Upgrade**	**Service Library ▸ Upgrade Firmware**
	Interface type	**Configure ▸ Drive ▸ Drive Interface**	**Configure Library ▸ Drive**
	Power, turn OFF/ON	**Service ▸ Service ▸ Drive Power**	**Configure Library ▸ Drive**
	SCSI/Loop ID, current	**Monitor ▸ Drive ▸ Identity**	**Monitor Library ▸ Drive Identity**
	Serial Number	**Monitor ▸ Drive ▸ Identity**	**Monitor Library ▸ Drive Identity**
	Status, current	**Monitor ▸ Drive ▸ Status**	**Monitor Library ▸ Drive Status**
	Temperature	**Monitor ▸ Drive ▸ Status**	
Magazines	Unlock	**Control ▸ Magazines**	**Manage Library ▸ Release Magazine**
Cartridges	Inventory	**Monitor ▸ Inventory ▸ Magazines**	**Manage Library ▸ Perform Inventory**
	Move	**Control ▸ Move Cartridges**	**Manage Library ▸ Move Media**

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.

Monitor ↕ Library ↕ Drive ↕ Inventory

Control ↕ Open I/O Station ↕ Move Cartridges ↕ Magazines ↕ Re-Inventory

Configure ↕ Logical Libraries ↕ Library Settings ↕ Drive ↕ Network ↕ Set Access PIN ↕ Set Date and Time ↕ Control Path Failover ↕ Restore Default

Service ↕ Library Verify ↕ Run Tests ↕ Service (Drives)
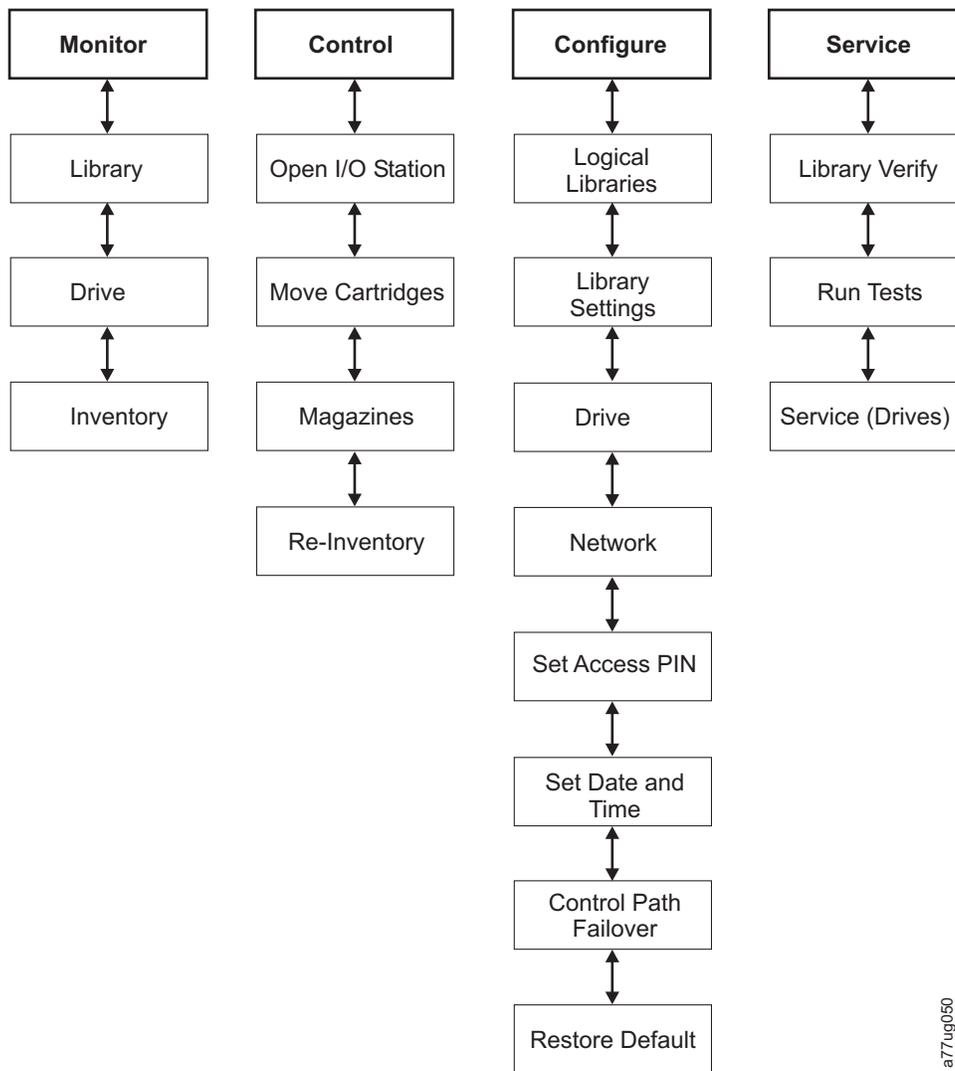
a77ug050

Figure 4-1. 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.
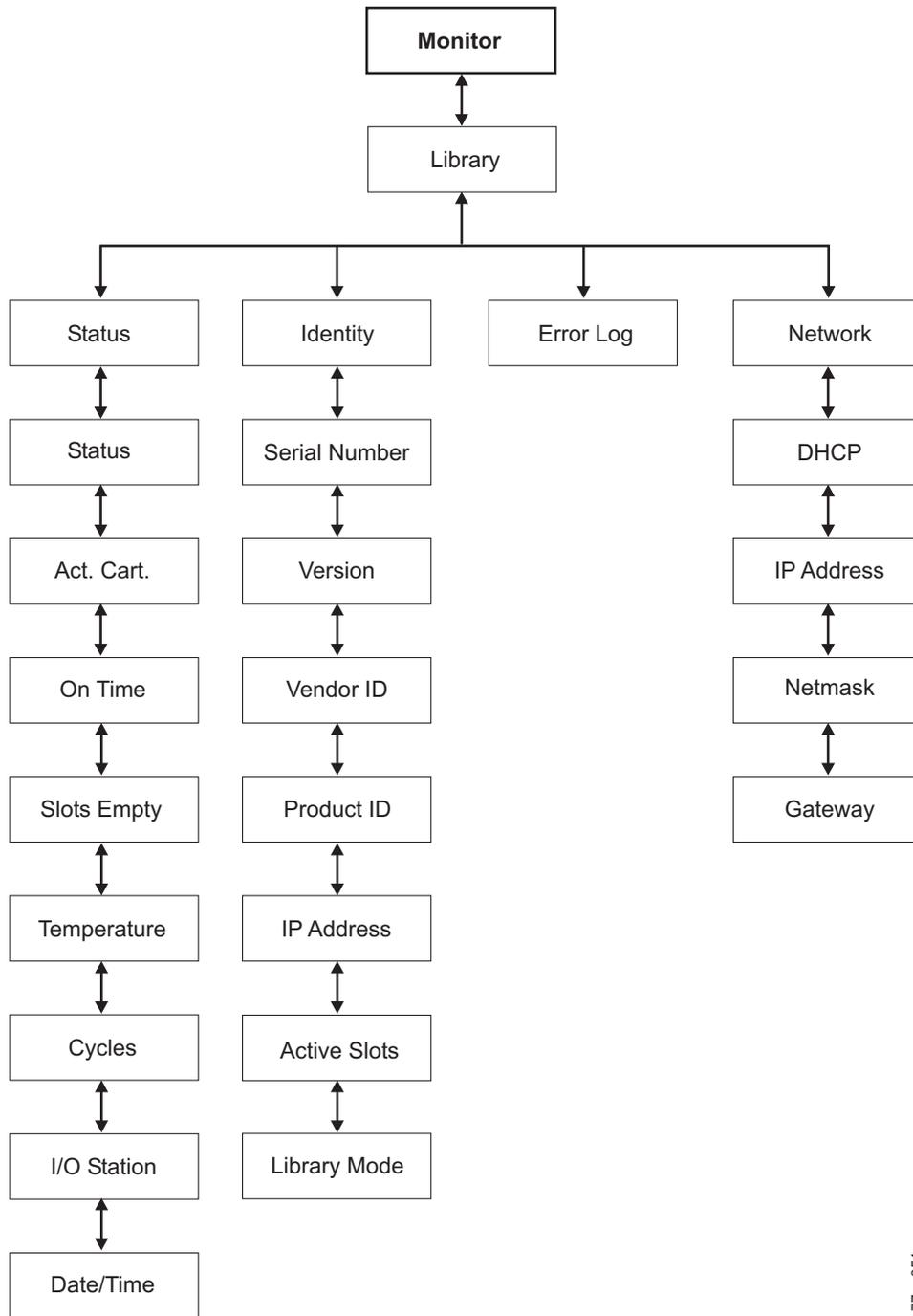
Figure 4-2. Monitor: Library menu

Under **Status** are the following items:
- Status - current status of the library
- Act. Cart - the serial number of the active cartridge
- On Time - the amount of time the library has been powered ON
- Slots Empty - the number of empty slots in the library
- Temperature - the current temperature status of 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 **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 **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 **Network** are the following items:
- DHCP - Dynamic Host Configuration Protocol
- IP Address
- Netmask
- Gateway

Monitor: Drive

This menu item displays drive information and settings.

```
                    ┌──────────────┐
                    │   Monitor    │
                    └──────────────┘
                           ↕
                    ┌──────────────┐
                    │    Drive     │
                    └──────────────┘
                           ↕
              ┌────────────┴────────────┐
              ↓                         ↓
      ┌──────────────┐         ┌──────────────┐
      │   Status     │         │   Identity   │
      └──────────────┘         └──────────────┘
              ↕                         ↕
      ┌──────────────┐         ┌──────────────┐
      │  Drive (n)   │         │  Drive (n)   │
      └──────────────┘         └──────────────┘
              ↕                         ↕
      ┌──────────────┐         ┌──────────────┐
      │   Status     │         │ Firmware Rev │
      └──────────────┘         └──────────────┘
              ↕                         ↕
      ┌──────────────┐         ┌──────────────┐
      │   Activity   │         │  Vendor ID   │
      └──────────────┘         └──────────────┘
              ↕                         ↕
      ┌──────────────┐         ┌──────────────┐
      │   Source     │         │  Product ID  │
      └──────────────┘         └──────────────┘
              ↕                         ↕
      ┌──────────────┐         ┌──────────────┐
      │ Temperature  │         │Serial Number │
      └──────────────┘         └──────────────┘
              ↕                         ↕
      ┌──────────────┐         ┌──────────────┐
      │   Cooling    │         │ SCSI/Loop ID │
      └──────────────┘         └──────────────┘
              ↕                         ↕
      ┌──────────────┐         ┌──────────────┐
      │    Link      │         │    WWNN      │
      │  (FC only)   │         │  (FC only)   │
      └──────────────┘         └──────────────┘
              ↕
      ┌──────────────┐
      │    Speed     │
      │  (FC only)   │
      └──────────────┘
              ↕
      ┌──────────────┐
      │   Topology   │
      │  (FC only)   │
      └──────────────┘
```

a77ug035
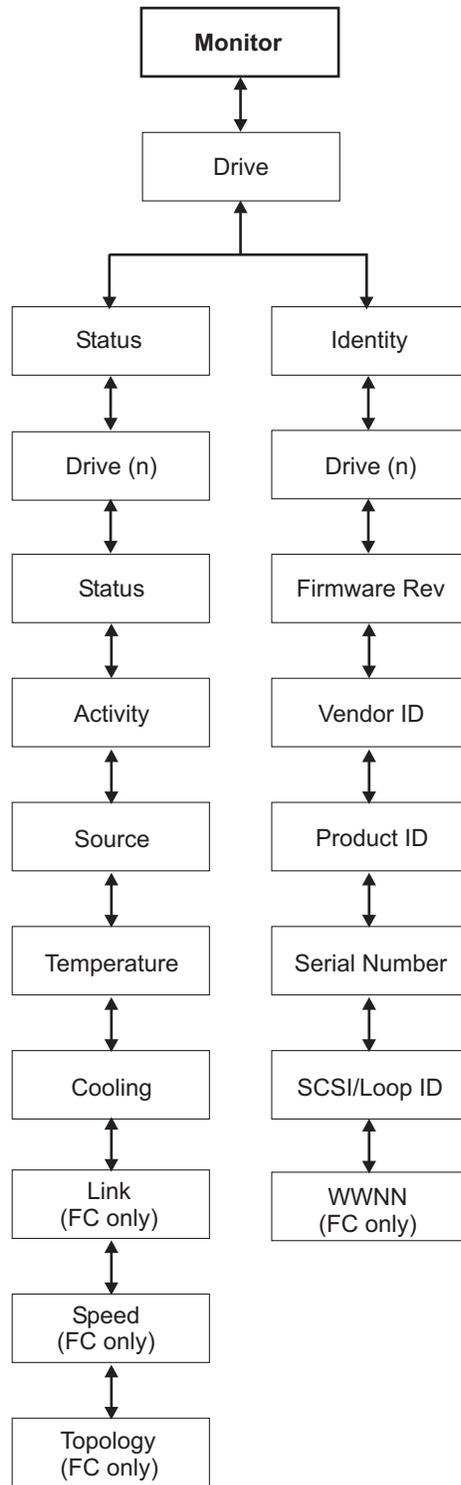
Figure 4-3. Monitor: Drive menu for a SCSI library

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
- Temperature - not supported

- 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" on page 1-8)

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 or Fibre Channel drive
- WWNN - the fibre library's World Wide Node Name

Monitor: Inventory

This menu item displays the current library inventory.
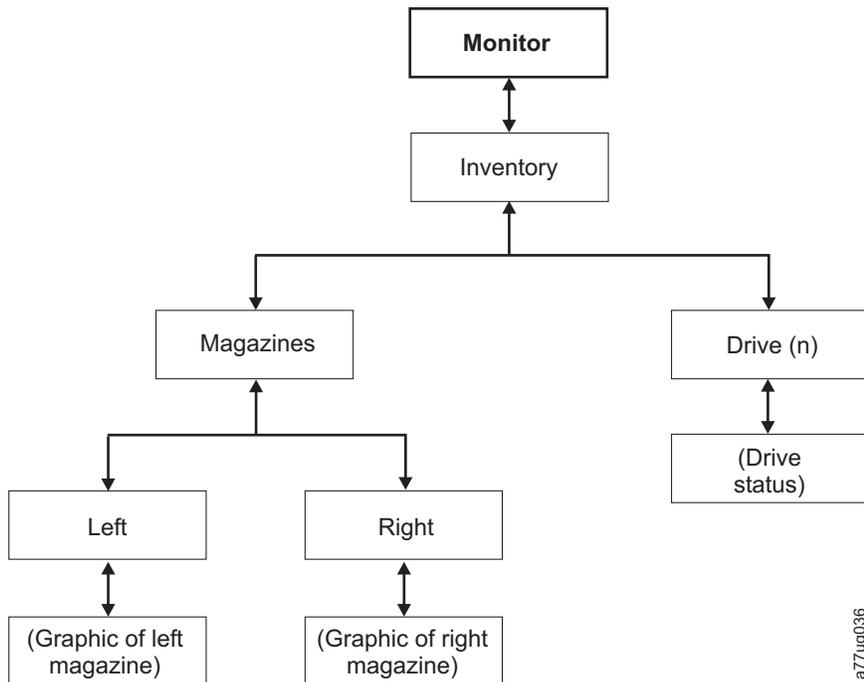
Figure 4-4. Monitor: Inventory menu

Under **Magazine** choose one of the following to see a graphical representation of the cartridge magazine(s). Slots containing cartridges will be highlighted.
- Left - choose this option to see the left magazine(s)
- Right - choose this option to see the right magazine(s)

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

Note: For a 4U library, the top slot in the right column of the lower left magazine is a dedicated cleaning slot (DCS) that is used to house the cleaning cartridge.

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

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.
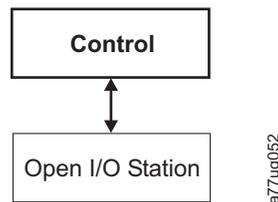
Figure 4-5. Control: I/O Station menu

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.
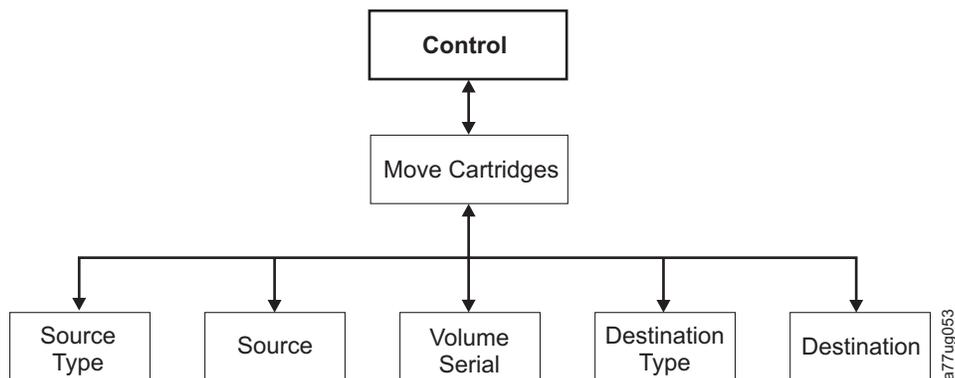
Figure 4-6. Control: Move Cartridges menu

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 Media 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.
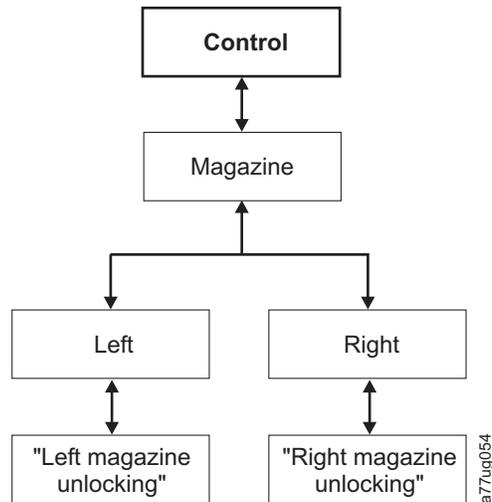
Figure 4-7. Control: Magazine menu

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.
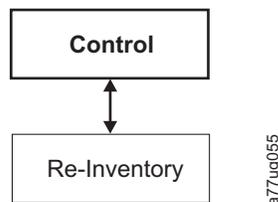
Figure 4-8. Control: Re-Inventory menu

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
- Control Path Failover
- Restore Defaults

Configure: Logical Libraries

Use this menu item to select the number of logical libraries.
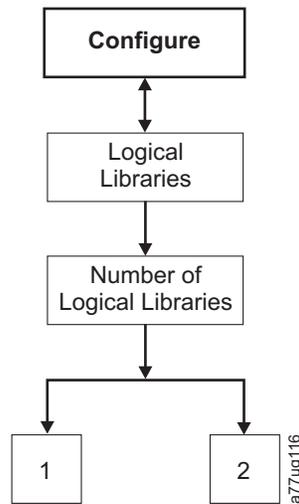
Figure 4-9. Configure: Logical Libraries menu

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

Configure: Library
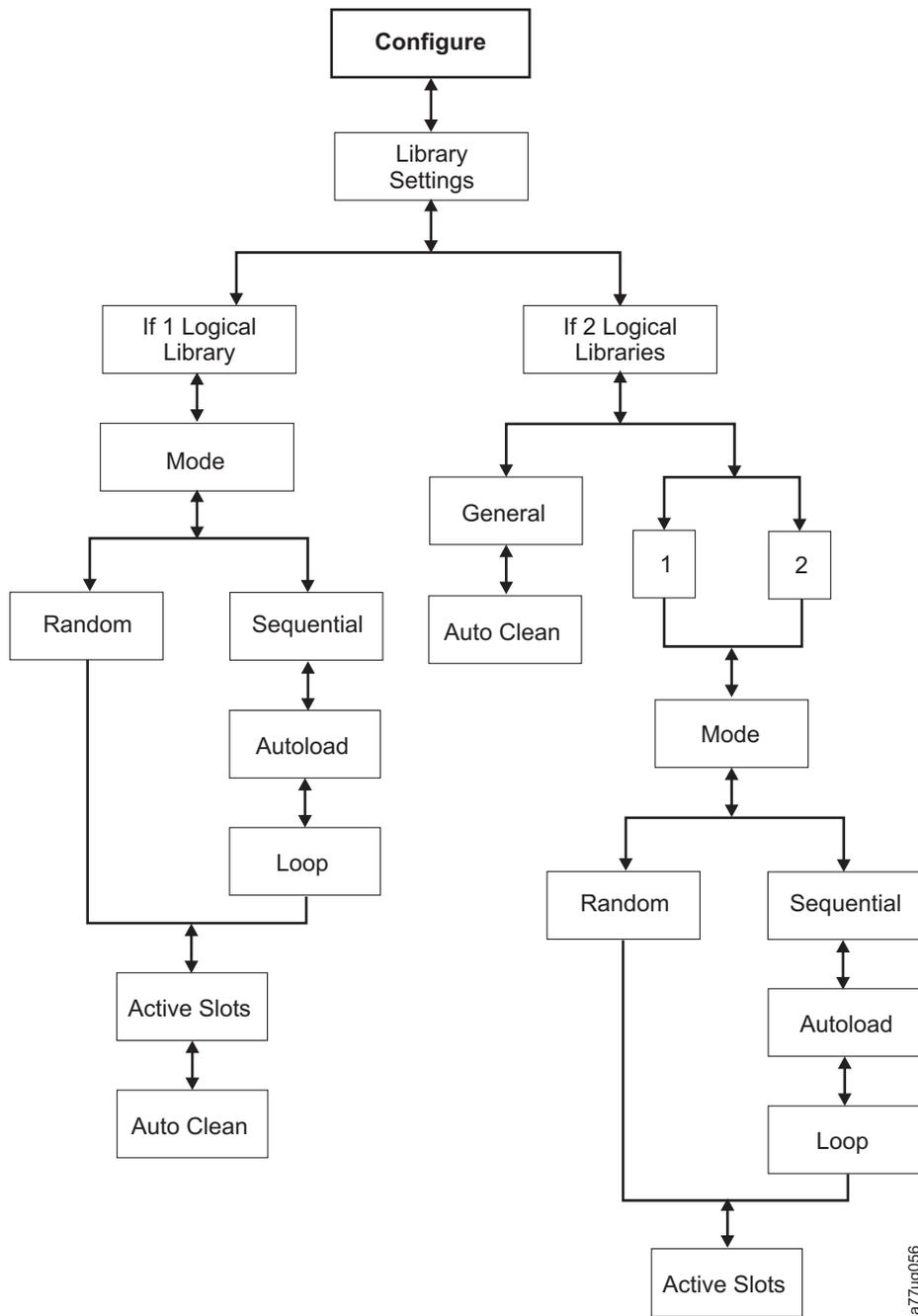
Figure 4-10. Configure: Library menu

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 22) 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 rewin/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 "CLNxxx" as part of the bar code.

  In a 4U library, the cleaning cartridge should be stored in the dedicated cleaning slot (DCS). The DCS is the upper right slot of the lower left magazine.

  In a 2U library, the cleaning cartridge can be stored in any data cartridge slot.

Configure: Drive
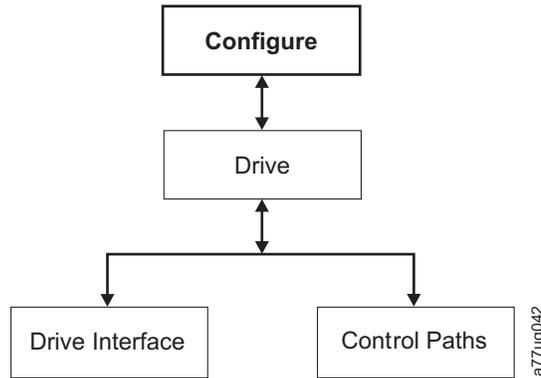
Figure 4-11. Configure: Drive menu

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 drive. For more information on drive interfaces, refer to "Host Interfaces" on page 1-6.
- Control Paths - use this to enable the drive as a control path drive (4U library only). 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
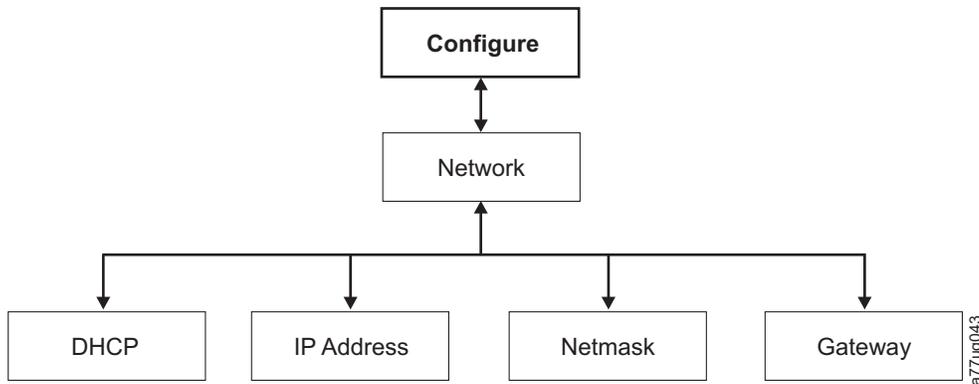
Figure 4-12. Configure: Network menu

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

- 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.

```
        ┌──────────────┐
        │  Configure   │
        └──────┬───────┘
               ↕
        ┌──────────────┐
        │Set Access PIN│     a77ug057
        └──────────────┘
```
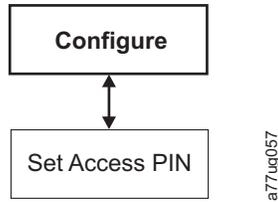
Figure 4-13. Configure: Set Access PIN menu

Configure: Set Date and Time

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

```
        ┌──────────────┐
        │  Configure   │
        └──────┬───────┘
               ↕
        ┌──────────────┐
        │   Set Date   │     a77ug046
        │   and Time   │
        └──────────────┘
```
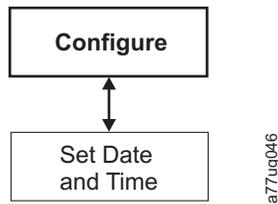
Figure 4-14. Configure: Set Date and Time menu

Configure: Control Path Failover

Use this menu item to enter the Control Path Failover License Activation key.

```
        ┌──────────────┐
        │  Configure   │
        └──────┬───────┘
               ↕
        ┌──────────────┐
        │ Control Path │     a77ug119
        │   Failover   │
        └──────────────┘
```
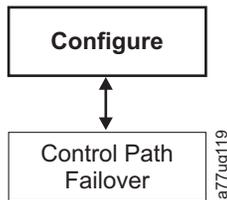
Figure 4-15. Configure: Control Path Failover

Configure: Restore Defaults

Use this menu item restore the factory default settings. For a listing of default configuration setting, see "Configuring Your Library" on page 2-13.

```
        ┌──────────────┐
        │  Configure   │
        └──────┬───────┘
               ↕
        ┌──────────────┐
        │Restore Default│    a77ug045
        └──────────────┘
```
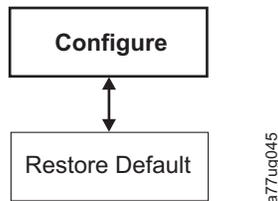
Figure 4-16. Configure: Restore Defaults menu

Service Menu

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

Service: Library Verify

This is an overall diagnostic that exercises all library components. To run the Library Verify test, complete the following procedure.
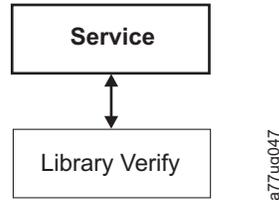
Figure 4-17. Service: Library Verify menu

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
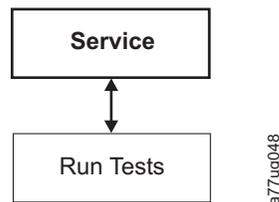
Figure 4-18. Service: Run Tests menu

The following library diagnostics are available in this menu:

- System Test - this test exercises library components
- Slot to Slot Test - Depending on the number of cycles selected, this test moves all cartridges in the library (at least one slot must be open) by moving cartridges in the library to a drive (no reading or writing) and then back to its home slot.

Service: Service (Drives)

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 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.
- Drive FW Upgrade - allows drive firmware to be upgraded using a customer-supplied FMR (firmware) cartridge
- Drive Tests - Power On Self Test (POST), SCSI Wrap Test, Normal Read/Write Test, Head Test, Media Test
- Drive Power - use this item to turn drive power ON and OFF
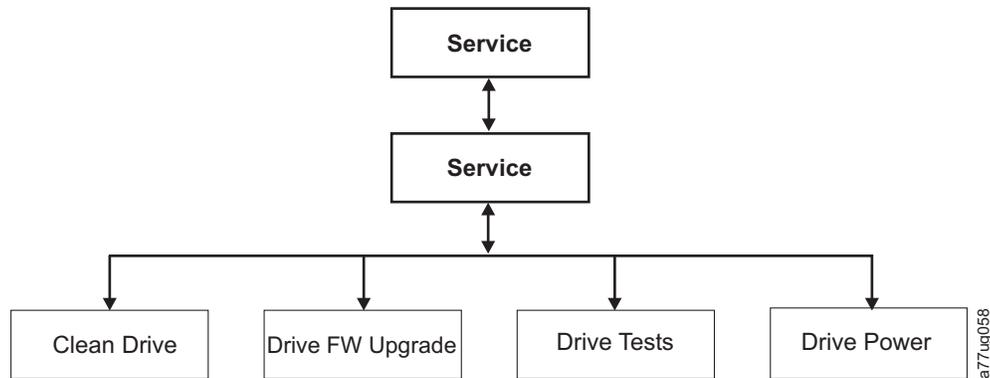
Figure 4-19. Service: Service menu

1. Using the Operator Control Panel, open the I/O Station (**Control** → **I/O Station**).
2. Insert a blank or scratch cartridge into the I/O Station.
3. Close the I/O Station by pushing it into the library.
4. Navigate to the desired test (**Service** → **Service** → **Drive Tests**).
5. Run the test.
   - 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 Chapter 6, "Troubleshooting," on page 6-1.
6. Remove the cartridge from the I/O Station, then close the I/O Station.
7. Press **Cancel** to exit the screen.

Web User Interface Menus

The following menus are available on the Web User Interface.

Table 4-2. Web User Interface Menus

▬ Monitor Library

        Library Identity

        Drives Identity

        Library Status

        Drives Status

        Inventory

▬ Configure Library

        Logical Libraries

Table 4-2. Web User Interface Menus (continued)

General

Drives

Network

User Access

Date & Time

Control Path Failover

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"
- "Monitor Library: Drive Identity" on page 4-19
- "Monitor Library: Library Status" on page 4-21
- "Monitor Library: Drive Status" on page 4-22
- "Monitor Library: Inventory" on page 4-24

Monitor Library: Library Identity
This page provides access to the static information about the library. No changes
can be made from this page. Table 4-3 lists all available elements on the Library
Identity page. An "X" indicates that the element displays for the specified library
type.

Table 4-3. 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

Table 4-3. Library Identity page elements (continued)

Menu Item	Description	2U	4U
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 4-36.	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
Library Mode	This is the current mode of the library. Mode choices are Random and Sequential. For more information, see "Configure Library: General" on page 4-26	X	
WWide Node Name	This is the Worldwide Node Name assigned to your library.		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

Figure 4-20. 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 or Fibre Channel). Table 4-4 lists all available elements on the Drive Identity page. An "X" indicates that the element displays for the specified drive type.

Table 4-4. Drive Identity page elements

Menu Item	Description	2U Library		4U Library	
		SCSI	Fibre	SCSI	Fibre
Vendor ID	This identifies the manufacturer of the tape drive.	X	X	X	X

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

Menu Item	Description	2U Library		4U Library	
		SCSI	Fibre	SCSI	Fibre
Product ID	This is the SCSI inquiry string of the tape drive.	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
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 4-36.	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
Library Master (Control Path Drive)	If the Fibre Channel drive is the drive that 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
Data Compression	If the drive is compressing data, this element displays "Yes." If not, this element displays "No."		X		X
Interface Type	This identifies Fibre Channel drives.		X		X
Node Name	This is the Worldwide node Name assigned to the Fibre Channel drive.		X		X
Port A	This port is always "enabled."		X		X
Port Name	This is the name assigned to Port A on the drive.		X		X
Topology	This is the type of Fibre Channel 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 "disabled." It is not supported.		X		X

Drive Identity	1 (LUN)
Vendor ID	IBM
Product ID	ULT3580-TD3
Serial Number	1200019791
Firmware Revision	64D0
Element Address	256
Control Path Drive	No
Data Compression	Yes
Interface Type	Fibre Channel
Node Name	2001000E11800212
Port A	Enabled
Port Name	2002000E11800212
Topology	LN-Port
FC-AL Loop ID	04
Speed	auto
Port B	Disabled

Drive Identity	2 (LUN)
Vendor ID	IBM
Product ID	ULT3580-TD3
Serial Number	1210092621
Firmware Revision	64D0
SCSI ID	5
Element Address	257

a77ug091

Figure 4-21. The 4U library Monitor Library: Drive Identity page showing one SCSI drive (#1) and one Fibre Channel 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 4-5 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 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 upper left magazine is "Present" or "Not Present".	X	
Right Magazine	This displays whether the upper right magazine is "Present" or "Not Present".	X	

Table 4-5. Library Status page elements (continued)

Menu Item	Description	2U	4U
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 4-22. 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 or Fibre Channel). Table 4-6 lists all available elements on the Drive Status page. An "X" indicates that the element displays for the specified drive type.

Table 4-6. Drive Status page elements

Menu Item	Description	2U Library		4U Library	
		SCSI	Fibre	SCSI	Fibre
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
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
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

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

Menu Item	Description	2U Library		4U Library	
		SCSI	Fibre	SCSI	Fibre
Drive Temperature (normal range: 15°C - 55°C)	This page element is not supported.	X	X	X	X
Cooling Fan Active	This indicates whether the drive cooling fan is "On" or "Off".	X	X	X	X
Drive Activity	This indicates whether or not the drive is operating.	X	X	X	X
Port A Status	"Light detected" means the Fibre Channel connection is ON. "No light detected" means the Fibre Channel connection is OFF.		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 Fibre Channel connection to the host.		X		X
FC-AL Loop ID	This is the Fibre Channel - Arbitrated Loop ID of the drive.		X		X

Drive 1 Status As Of 11:04:14 Library Time

Status	⊘ Idle
Cartridge In Drive	N.A.
Drive Error Code	No Error
Drive Temperature (normal range: 15 °C – 55 °C)	N.A.
Cooling Fan Active	On
Drive Activity	Idle
Port A Status	logged out
Port Name	2002000E111006CC
Speed	4 Gb/s
Topology	L-Port
FC-AL Loop ID	4

Drive 2 Status As Of 11:04:14 Library Time

Status	⊘ Ready
Cartridge In Drive	None
Drive Error Code	No Error
Drive Temperature (normal range: 15 °C – 55 °C)	N.A.
Cooling Fan Active	On
Drive Activity	Ready

Refresh

a77ug093

Figure 4-23. 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.

Inventory As Of 14:02:04 Library Time

Drive Inventory

Drive	Status	Label	Source
1	Empty	------------	

Magazine Inventory

8	9	10		+
4	5	6	7	
IO-Station	1	2	3	

22	21	20	19	+
18	17	16	15	
14	13	12	11	

Refresh

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

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

Configure Library Menu

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

- "Configure Library: Logical Libraries" on page 4-26
- "Configure Library: General" on page 4-26
- "Configure Library: Drive" on page 4-27

- "Configure Library: Network" on page 2-18
- "Configure Library: User Access" on page 4-29
- "Configure Library: Date & Time" on page 4-30
- "Configure Library: Logs & Traces" on page 4-30
- "Configure Library: Event Notification" on page 4-31
- "Configure Library: Restore Defaults" on page 4-32

Configure Library: Logical Libraries

To partition your 4U 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 dedicated cleaning slot (DCS) are shared among all logical libraries.
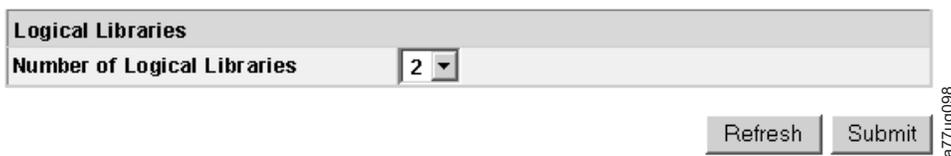
Figure 4-26. The 4U library Configure Library: Logical Libraries page

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 4-7. 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

Table 4-8. 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. In a 4U 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.	X	X

Figure 4-27. The 4U library Configure Library: General and Extended page

Configure Library: Drive

This page allows you to modify the current ID assigned to the drive. You can also able to select **Power ON** through this page for a SCSI library. The displayed information will vary depending on the library model and drive type (SCSI or Fibre Channel). Table 4-9 lists all available elements on this page. An ″X″ indicates that the element displays for the specified drive type.

Table 4-9. Drive Identity page elements

Menu Item	Description	2U Library		4U Library	
		SCSI	Fibre	SCSI	Fibre
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 SCSI drive, click in the box to power ON the selected drive.	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
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 number of the drive slot in the library that contains the drive.		X		X
Port B Configuration	Port B is not supported. This Port is disabled.		X		X

Figure 4-28. 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 4-29. Configure Library: Network page

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

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.

Configure Library: User Access

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

User Access	
Access Level	2 ▾
Access Level Name	admin
New Password (Enter Up To Ten Characters)	*****
Repeat Password	*****
OCP Access Pin Enabled	☐
OCP Access Pin Code	*****
Repeat OCP Access Pin Code	*****
Support Name	
Support Phone	
Support Email	

Refresh   Submit

Figure 4-30. 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.

OCP Access PIN Enabled
Select this item, if you would like the Operator Control Panel display to be password protected.

OCP Access PIN Code
The password for accessing the Operator Control Panel when the OCP Access PIN is enabled.

Repeat OCP Access PIN Code
Enter the OCP Access PIN Code 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 4-31. 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: Control Path Failover

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

Figure 4-32. The 4U library Configure Library: Control Path Failover page

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

Figure 4-33. Control Path Failover license verification page

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 4-34. Configure Library: Logs & Traces page

It is recommended that you select **Coninuous** 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 4-35. 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, restore vital product data, and save vital product data.

Figure 4-36. Configure Library: Restore Defaults page

The following elements are displayed on the **Restore Defaults** page.

Restore Factory Defaults

Click this button to restore the following factory default settings:

- DHCP (Dynamic Host Configuration Protocol): **On**
- Network Address: **0.0.0.0**
- Drive ID:
    - **4** for a SCSI drive
    - **4** for a Fibre Channel drive
- Res. (Reserved) Slots: **0**
- Drive Power ON/OFF: **On**
- Library Mode: **Random**

Restore Vital Product Data

Click this button to restore the last saved library configuration from the library accessor to the library control board.

Save Vita Product Data

Click this button to save the current library configuration from the library control board to the library accessor.

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.
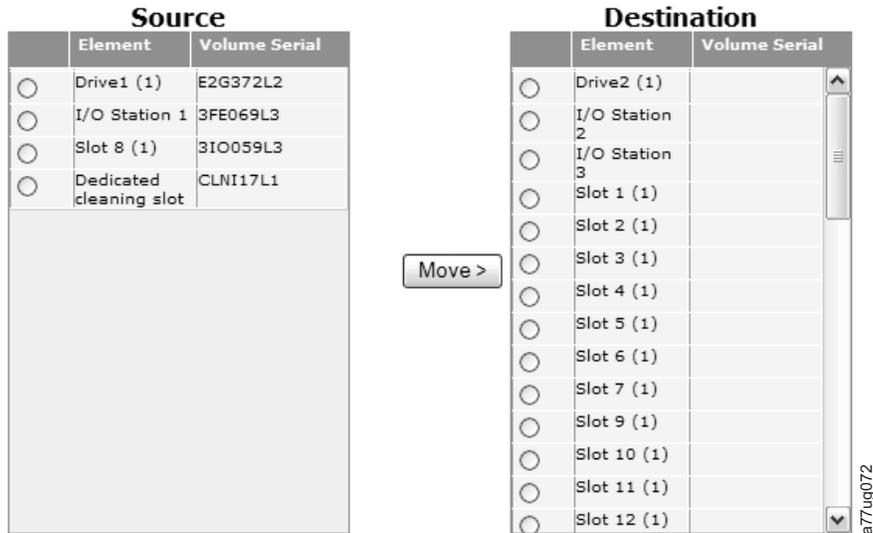
Figure 4-37. Manage Library: Move Media page

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.

Status In the **Source** screen, this identifies the element as full. In the **Destination** screen, this identifies the element as empty.

Information
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.
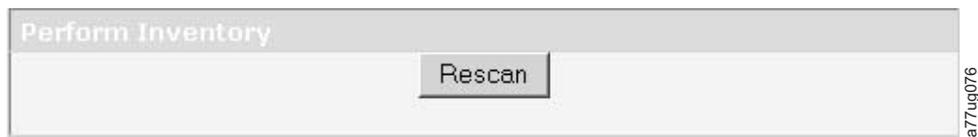
Figure 4-38. Manage Library: Perform Inventory page

Manage Library: Release Magazine

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

Figure 4-39. 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

Service Library: Clean Drive

This page allows the user to clean the tape drive.

Figure 4-40. The 2U library Service Library: Clean Drive page

Figure 4-41. The 4U library Service Library: Clean Drive page

Advanced Diagnostics (for Service Personnel Only)

Advanced diagnostics are available to Service personnel after logging in to the Web User Interface using a service password.

Figure 4-42. Service Library: Advanced Diagnostics page

Service Library: View Logs

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

- Log Type
- Total Number of Entries
- Start Entry
- Number of Entries per Page

Figure 4-43. Service Library: View Logs page

View Drive Logs

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


```
06.05.17 10:22:35.04 LIB/ERR <F1 00 > -- Drive Comm.-Err.
06.05.17 10:22:31.06 LIB/ERR <F2 00 > -- Drive Sled Miss.
06.05.17 10:21:46.75 LIB/ERR <F2 00 > -- Drive Sled Miss.
06.05.17 10:20:55.28 LIB/ERR <F2 02 > -- Drive Sled Miss.
```

Figure 4-44. Service Library: View Drive Logs screen

Save Drive Dump

This menu item allows a drive dump to be saved to the host computer.

Figure 4-45. Service: Save Drive Dump

Service Library: Perform Diagnostics

This page provides the system administrator with general tests to verify the usability and reliability of the library. The user selects the number of test cycles before starting the test. To cancel the test before it completes the cycles, select the STOP button.

Figure 4-46. 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.

Figure 4-47. The 2U library Service Library: Upgrade Firmware page

Upgrade Library Firmware

Currently Installed Library Firmware	0.60
Library Firmware File	[_____] Browse...
	Upload

Upgrade Drive 1 Firmware

Drive Firmware Revision	64D0
Drive Firmware File	[_____] Browse...
	Update

Upgrade Drive 2 Firmware

Drive Firmware Revision	64D0
Drive Firmware File	[_____] Browse...
	Update

a77ug097

Figure 4-48. 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.

Reboot

Reboot

a77ug077

Figure 4-49. Service Library: Reboot page

Chapter 5. Ultrium Media

To ensure that your IBM Ultrium Tape Drive conforms to IBM's specifications for reliability, use only IBM LTO Ultrium tape cartridges. The IBM TotalStorage® LTO Ultrium 400 GB Data Cartridge cannot be interchanged with the media used in other IBM non-LTO Ultrium tape products.

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

Data Cartridge	Case Color
Ultrium 3 WORM	Slate blue top; platinum (silvery gray) bottom
Ultrium 3	Slate blue
Ultrium 2	Purple
Ultrium 1	Black

All three generations contain 1/2-inch, dual-coat, metal-particle tape. The native data capacity of Ultrium data cartridges is as follows:

Data Cartridge	Native Data Capacity
Ultrium 3 WORM	400 GB (800 GB at 2:1 compression)
Ultrium 3	400 GB (800 GB at 2:1 compression)
Ultrium 2	200 GB (400 GB at 2:1 compression)
Ultrium 1	100 GB (200 GB at 2:1 compression)

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.

Cartridge Compatibility

Table 5-1. Ultrium data cartridge compatibility with Ultrium 3 tape drive

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

Data Cartridge

When processing tape in the cartridges, Ultrium Tape Drives use a linear, serpentine recording format. The Ultrium 3 drive reads and writes data on 704 tracks, sixteen tracks at a time. The first set of tracks) is written from near the beginning of the tape to near the end of the tape. The head then repositions to the next set of tracks for the return pass. This process continues until all tracks are written and the cartridge is full, or until all data is written.
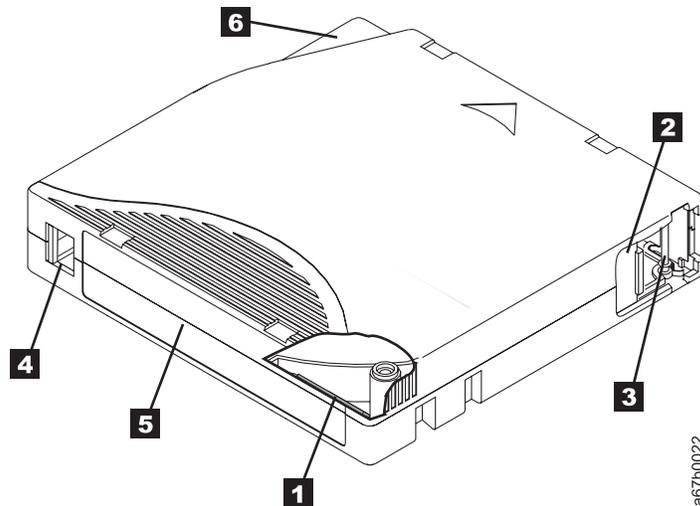
Figure 5-1. The IBM TotalStorage LTO Ultrium 400 GB Data Cartridge

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

The cartridge door (**2** in Figure 5-1) protects the tape from contamination when the cartridge is out of the drive. Behind the door, the tape is attached to a leader pin (**3** in Figure 5-1). When the cartridge is inserted into the drive, a threading mechanism pulls the pin (and tape) out of the cartridge, across the drive head, and onto a non-removable take-up reel. The head can then read or write data from or to the tape.

The write-protect switch (**4** in Figure 5-1) prevents data from being written to the tape cartridge. For more information, see "Write-Protect Switch" on page 5-6.

The label area (**5** in Figure 5-1) provides a location to place a label. For more information, see "Bar Code Label" on page 5-4.

The insertion guide (**6** in Figure 5-1) is a large, notched area that prevents the cartridge from being inserted incorrectly.

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

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. To meet this data storage requirement, a new WORM feature has been made available on IBM LTO Ultrium generation 3 drives. The WORM feature can be enabled by upgrading to WORM-capable drive firmware and using a special WORM tape cartridge.

No physical hardware changes are required to make Ultrium 3 drives compatible with the WORM feature; however, appropriate WORM-capable drive firmware must be installed.

WORM Media

Because standard read/write media are incompatible with the WORM feature, a specially formatted WORM tape cartridge 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. "Ordering Media Supplies" on page 5-18 provides information on how to choose and purchase the appropriate WORM tape cartridges for your library.
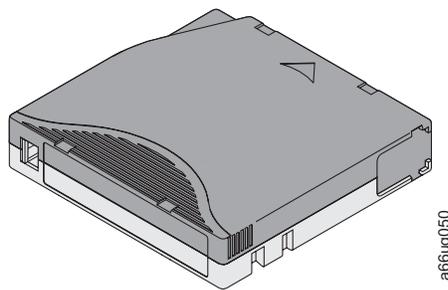
Figure 5-2. Ultrium 3 WORM Tape Cartridge

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 IBM 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 operator intervention will be postedError Code 7 will post on the drive's single-character display (SCD).

- Inserting a WORM tape cartridge into a drive that is not compatible with WORM causes the cartridge to be treated as an unsupported medium. The library will report a media operator intervention.

Cleaning Cartridge

A specially labeled IBM LTO Ultrium Cleaning Cartridge is supplied in your shipment to clean the drives in your library. The drive itself determines when a head needs to be cleaned and communicates this to the library.

When the cleaning is finished, the drive ejects the cartridge and the Picker takes the cartridge and places it back in its designated cleaning slot.

To remove a cleaning cartridge from its designated cleaning slot, export it from the library.

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 "Data Cartridge" 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 next available 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-CM is 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

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

Ultrium Tape Drive/Library	Bar Code Label Requirements
3580	Not required
3581	Required with optional Bar Code Reader
3582	Required
3583	Required
TS3100 (3573)	Required
TS3200 (3573)	Required
TS3310 (3576)	Required
TS3500 (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, or 3. L identifies the cartridge as an LTO cartridge. 1 indicates that the cartridge is the first generation of its type; 2 indicates that the cartridge is the second generation of its type; 3 indicates that the cartridge is the third generation of its 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 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 Tape Drive

Cartridges	VOLSER
Ultrium 3 Data Cartridge	xxxxxxL3
Ultrium 3 WORM Cartridge*	xxxxxxLT
Ultrium 2 Data Cartridge	xxxxxxL2
Ultrium 1 Data Cartridge (READ ONLY)	xxxxxxL1
IBM TotalStorage LTO Ultrium Cleaning Cartridge (universal)	CLNUxxL1
*An Ultrium 3 Tape Drive must have a minimum firmware level of 54xx for it to be compatible with the WORM cartridge.	

The LTO cartridge label uses the bar code symbology of USS-39. A description and definition is available from the Automatic Identification Manufacturers (AIM) specification Uniform Symbol Specification (USS-39) and the ANSI MH10.8M-1993 ANSI Bar code specification.

To determine the complete specifications of the bar code and the bar code label, visit the web at **http://www.ibm.com/storage/lto** (search for "**IBM LTO Ultrium Cartridge Label Specification**"), 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 "Data Cartridge" 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.
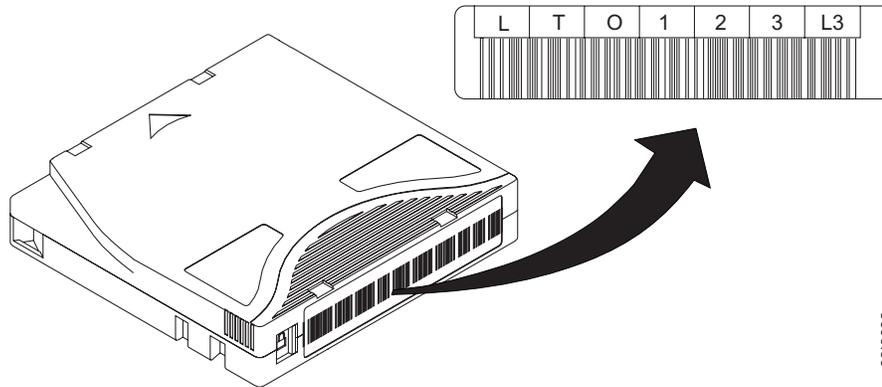
Figure 5-3. Sample bar code label on the LTO Ultrium 3 Tape Cartridge. The volume serial number (LTO123) and bar code are printed on the label.

Guidelines for Using Bar Code Labels

Apply the following guidelines whenever 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 Chapter 5, "Ultrium Media," 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 on page 5-7) determines whether you can write to the tape. If the switch is set to the:

- 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.
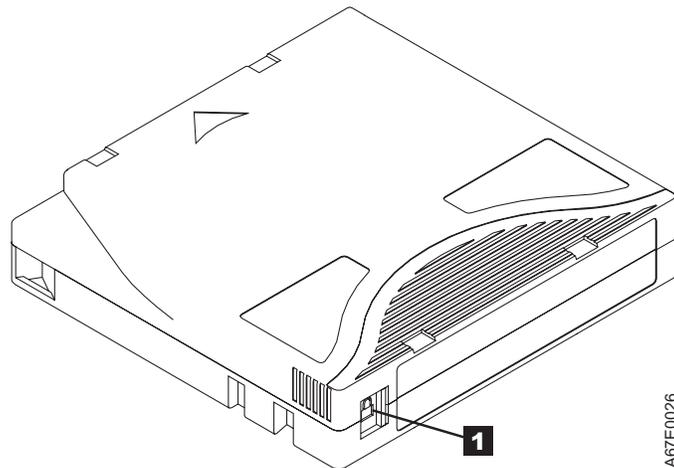
Figure 5-4. Setting the write-protect switch

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:

- 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 (**2** in Figure 5-8 on page 5-11). If the leader pin has become dislodged, go to "Repositioning or Reattaching a Leader Pin" on page 5-10.
- 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.

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 a polyethylene plastic wrap or bag 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 making it available for use.
- 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 (**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 5-10.
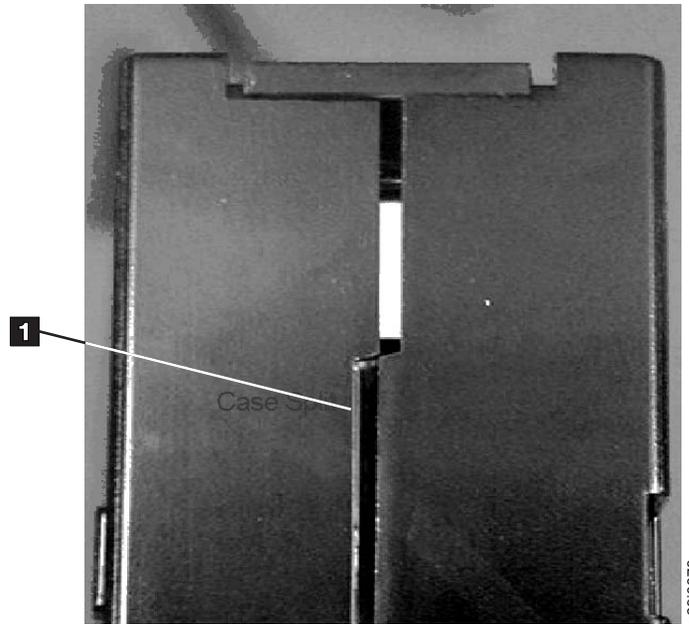
Figure 5-7. Checking for gaps in the seams of a cartridge

- Check that the leader pin is properly seated (see 2 in Figure 5-8 on page 5-11).
- If you suspect that the cartridge has been mishandled but it appears usable, discard the mishandled cartridge.

Examples of Cartridge Problems

Example: Split Cartridge Case (see "Perform a Thorough Inspection" on page 5-9)

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

1. Look for cartridge mishandling.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin (see "Repositioning a Leader Pin" on page 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 5-11)

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. 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 and move data 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 and move data to another cartridge. Continued use of a repaired cartridge may void the warranties of the drive and the cartridge.

Repositioning a Leader Pin

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

To place the leader pin in its proper position, you will need the following tools:
- Plastic or blunt-end tweezers
- Cartridge manual rewind tool (from Leader Pin Reattachment Kit, part number 08L9129)
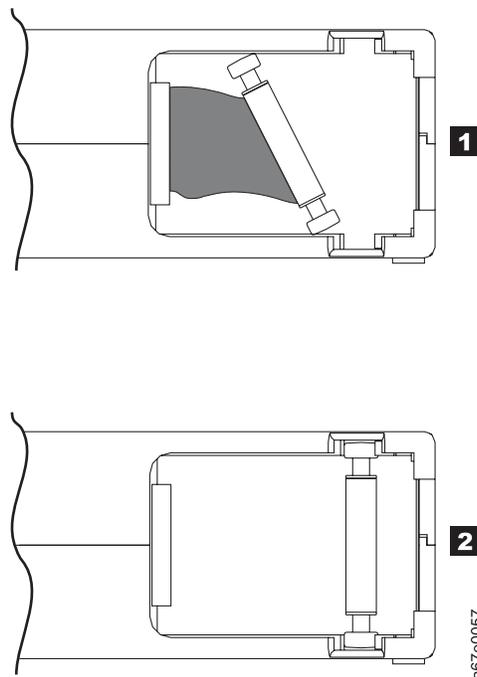
Figure 5-8. Leader pin in the incorrect and correct positions. The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

1. Slide open the cartridge door (**1** in Figure 5-9 on page 5-12) and locate the leader pin (**2** in Figure 5-9 on page 5-12) You may need to shake the cartridge gently to roll the pin toward the door.
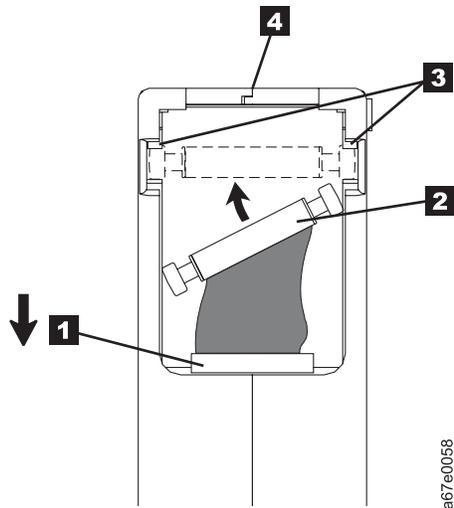
Figure 5-9. Placing the dislodged leader pin into the correct position. The cartridge door is open to show the leader pin.

2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips (**3** in Figure 5-9). **Be careful not to touch the tape.**

3. Press the leader pin gently into the clips until it snaps into place and is firmly seated.

4. Close the cartridge door.

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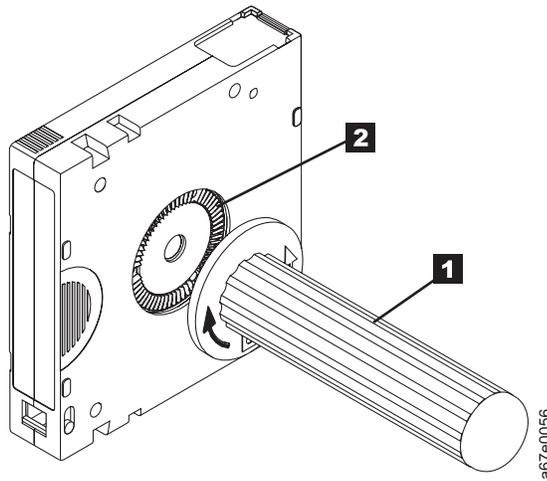
Figure 5-10. Rewinding the tape into the cartridge

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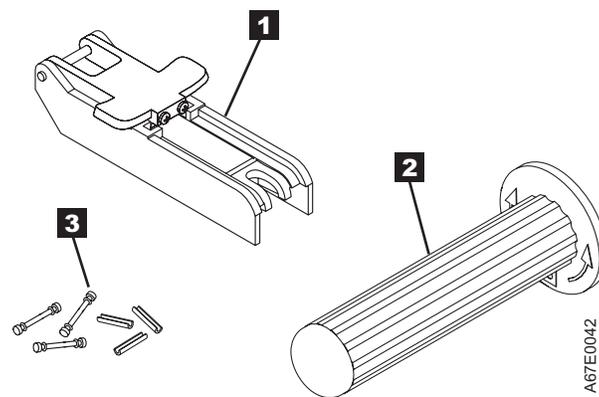
Figure 5-11. Leader Pin Reattachment Kit

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 reliability.

The following procedure describes how to reattach a leader pin.

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

1. Attach the leader pin attach tool (**1** in Figure 5-12 on page 5-14) to the cartridge (**2** in Figure 5-12 on page 5-14) so that the tool's hook (**3** in Figure 5-12 on page 5-14) 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**).
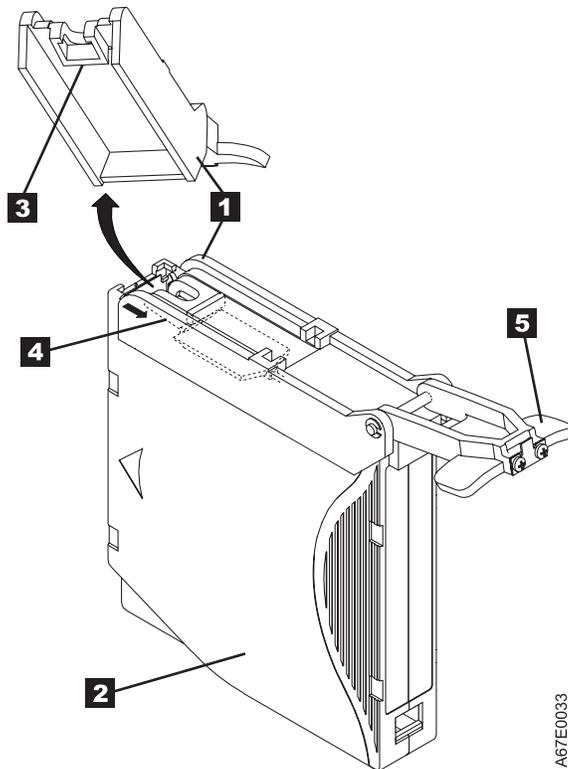
Figure 5-12. Attaching the leader pin attach tool to the cartridge. To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool (**1** in Figure 5-13 on page 5-15) 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** in Figure 5-13 on page 5-15).

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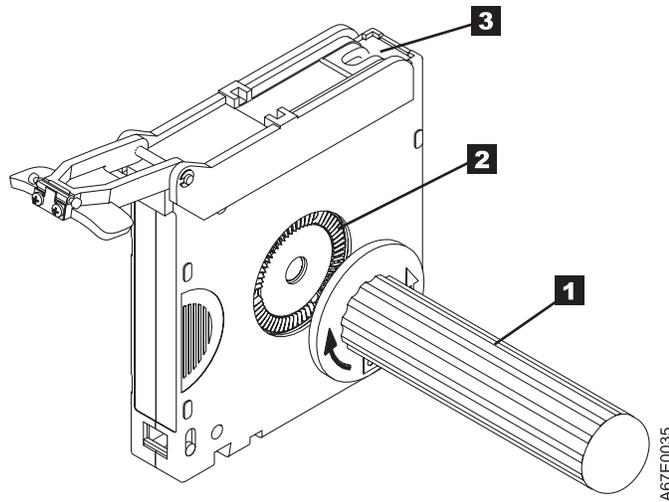
Figure 5-13. Winding the tape out of the cartridge. Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the cartridge door.

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

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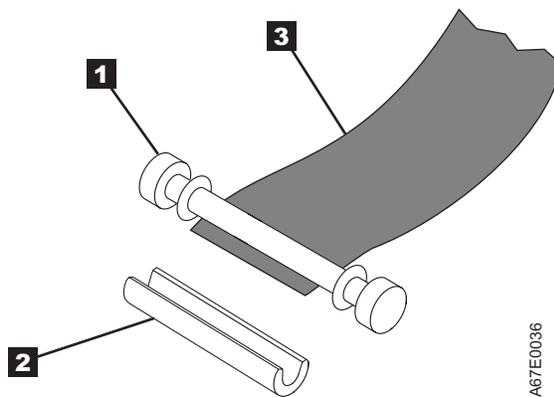
Figure 5-14. Removing the C-clip from the leader pin. Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool (**1** in Figure 5-15 on page 5-16).

8. Place a new C-clip into the retention groove (**2** in Figure 5-15 on page 5-16) on the leader pin attachment tool and make sure that the clip's open side faces up.

9. Place the leader pin into the cavity (**3** in Figure 5-15 on page 5-16) of the leader pin attach tool.

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

10. Fold the tape over the leader pin and hold it with your fingers (see Figure 5-15 on page 5-16).

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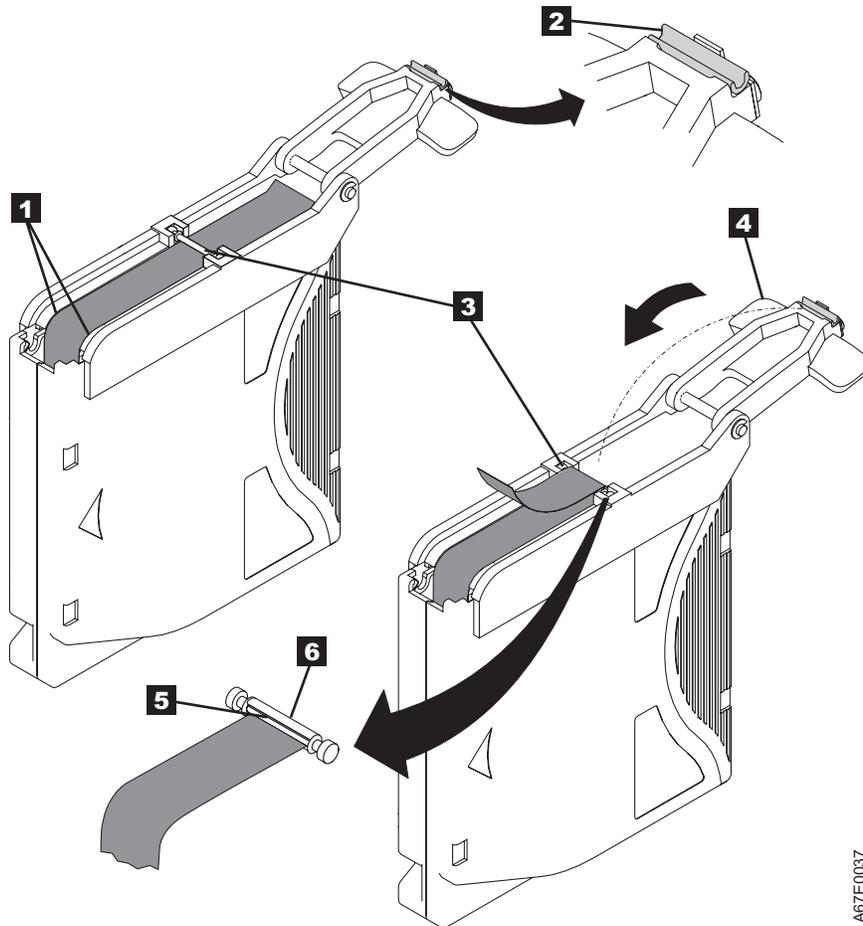
Figure 5-15. Attaching the leader pin to the tape

11. Close the pivot arm (**4** in Figure 5-15) 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** in Figure 5-15) so that it is flush with the reattached leader pin (**6** in Figure 5-15).

13. Use your fingers to remove the leader pin from the cavity (**3** in Figure 5-15) 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 a minimum of 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 Factor	Environmental Specifications			
	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. Operational storage equals less than one year.				
2. Archival storage equals one 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 1200 oersted peak field over the entire space that the cartridge occupies). Degaussing makes the cartridge unusable.

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

Ordering Media Supplies

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

Table 5-5. Media supplies

Supply Item	Methods of Ordering
IBM TotalStorage LTO Ultrium 400 GB Data Cartridge Bar code labels are pre-applied to cartridges. This media can be used with LTO 3 drives (read/write).	• Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 009. 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 (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). Or, call 1-888-IBM-MEDIA. Specify the VOLSER characters that you want.
IBM TotalStorage LTO Ultrium 400 GB Data Cartridge Order VOLSER labels separately. This media can be used with LTO 3 drives (read/write).	• Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 008. • Order as part number 24R1922 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). Or, call 1-888-IBM-MEDIA. Specify the VOLSER characters that you want.
IBM Ultrium 3 400 GB WORM Tape Cartridge (with attached labels) (IBM TotalStorage 3589 Model 028/Feature Code 2820 is a 20-pack of WORM cartridges labeled with starting volume serial information and, optionally, packed in individual jewel cases. Attached labels have been preprinted with a Bar Code that ends with LT, where L stands for LTO, and T identifies the cartridge as a WORM cartridge.) This media can be used with LTO 3 drives (read/write).	• Order by Machine Type/Model and Feature Code through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative. • Call 1-888-IBM-MEDIA.
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 (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`). • If you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative. • Call 1-888-IBM-MEDIA.
IBM TotalStorage LTO Ultrium 200 GB Data Cartridge Bar code labels are pre-applied to cartridges. This media can be used with LTO 2 drives (read/write) and LTO 3 drives (read/write).	• 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. • call 1-888-IBM-MEDIA.

Table 5-5. Media supplies (continued)

Supply Item	Methods of Ordering
IBM TotalStorage LTO Ultrium 200 GB Data Cartridge Order VOLSER labels separately (see "Ordering Bar Code Labels"). This media can be used with LTO 2 drives (read/write) and LTO 3 drives (read/write).	• Order the cartridge from your IBM Sales Representative or any authorized IBM Business Partner by specifying Machine Type 3589 Model 007. • call 1-888-IBM-MEDIA.
IBM LTO Ultrium 100 GB Data Cartridge Order VOLSER labels separately (see "Ordering Bar Code Labels"). This media can be used with LTO 1 drives (read/write), LTO 2 drives (read/write), and LTO 3 drives (read only).	• Order as part number 08L9120 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`), or • if you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative, or • call 1-888-IBM-MEDIA.
IBM TotalStorage 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 (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`), or • if you do not have Internet access, order the cartridge from any authorized IBM Business Partner or your IBM Sales Representative, or • call 1-888-IBM-MEDIA.
Leader Pin Reattachment Kit	Order as part number 08L9129 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`).
Manual Rewind Tool	Order as part number 08L9130 through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`).

Ordering Bar Code Labels

The IBM TotalStorage Tape Drive does not require cartridge bar code labels. 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/Colorflex 2550 W. Midway Blvd. Broomfield, CO 80020 U. S. A. Telephone: 800-522-3528 `http://www.colorflex.com/`	EDP Europe, Ltd. 43 Redhills Road South Woodham Ferrers Chelmsford, Essex CM3 5UL U. K. Telephone: 44 (0) 1245-322380 `http://www.edpeurope.com/media_labelling.htm`

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

In America	In Europe and Asia
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/Library SCSI or Loop ID:**

  Ensure that the SCSI ID of the Drive/Library (or Fibre Channel Loop ID) is correct and not the same as other devices that may be on the same bus.

- **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:**

  Make sure that Fibre Channel Tape Support is enabled 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.

- **Backup Application Installation :**

  Refer to the documentation included with your backup application software instructions on how to verify proper installation.

- **Device Driver Installation:**

  Make sure that the proper device driver, if applicable, is installed for the library. Contact your support representative for more information.

  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.

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

  The library consists of 4 main 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.)
- **Other Possible Replacement Parts:**
  - Cartridge Magazines
  - 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 6-4 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 IBM 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 6-4.
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).
Attention LEDs	

Table 6-1. Troubleshooting table (continued)

Media 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.
Clean Drive LED	• Make sure you are using an Ultrium universal cleaning cartridge (see "Cleaning Cartridge" on page 5-4). • Make sure 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 4-36.
Update drive firmware	Refer to "Service: Service (Drives)" on page 4-16 or "Service Library: Upgrade Firmware" on page 4-36.
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 9-6.
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. Make sure 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.
Media	
Cleaning or data cartridge incompatible with drive.	Make sure 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.

Table 6-1. Troubleshooting table (continued)

Cannot write to or read from tape.	1. Make sure that the cartridge write-protect switch is in the write enabled position (see "Write-Protect Switch" on page 5-6).
	2. Make sure you have the appropriate data cartridge for your library model (see "Cartridge Compatibility" on page 5-1).
	3. Make sure you are using an Ultrium cartridge that has <u>not</u> been degaussed. Do not degauss Ultrium cartridges.
	4. Make sure 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. Make sure 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 4-34.
Drive ID (SCSI or Fibre Channel Loop)	
Changed drive ID, but the host server does not recognize the new ID	1. Make sure that all devices on the same bus/network have unique ID numbers.
	2. Make sure 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. Make sure 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. Make sure 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 Ultra320 SCSI bus and high-quality cabling with the library.
Customer Replaceable Units (CRU)	
Drive Sled	See "Isolating Drive Sled Problems" on page 6-5.
Power Supply	See "Isolating a Power Supply Problem."
Library Controller Card	See "Isolating a Library Controller Card vs. Accessor Enclosure Problem" on page 6-6.
Library Enclosure	See "Isolating a Library Controller Card vs. Accessor Enclosure Problem" on page 6-6.
Other Problems	
Web User Interface problems	See "Isolating Web User Interface Problems" on page 6-6.
Bar code scanner problems	See "Isolating Accessor Scanner Problems" on page 6-7.
Need help with a library password	See "Contacting IBM Technical Support" on page 8-6.

Procedures for Isolating CRU Problems

Isolating a Power Supply Problem

If the Library does not power on:

1. With library power OFF and the power cord unplugged, loosed the three thumb screws, pull the power supply out half way and then reseat the power supply and tighten the three thumb screws.
2. Ensure the power cord is plugged in at the library and at the electrical outlet and then turn library power ON.
3. Try another electrical outlet or plug another device into the outlet to test.
4. Try another power cord.
5. If the power supply seems to be delivering power to the library (Operator Control Panel and front panel LEDs 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 9-4).

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 IBM Technical Support.
3. Try reseating the drive sled.
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 SCSI or Fibre Channel 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).
8. Using the host interface test tool, ITDT, run the Scan function (s) to verify that the host application interface (SCSI 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 9-5).

5. If the error code indicates an accessor type error (slider, elevator, sled, etc.), release and remove both magazines (see "Control: Magazine" on page 4-10, "Manage Library: Release Magazine" on page 4-33, 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 9-7).

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 CRU (refer to "Replacing the Library Enclosure" on page 9-7).

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 RJ-45 connector.

2. Ensure the Network Setting is switched to ON via the Operator Control Panel or serial interface (RJ-11 connector). The default Network Setting of the library is ON.

3. Ensure that the correct IP, Netmask, and Gateway addresses are keyed into the network parameters. From the Operator Control Panel, navigate to **Configure → Network**.

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

5. 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.

6. 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.

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

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 5-4).
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 9-7).

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 support personnel Support menu tree.

Example Error Code

```
EVENT -6
```

```
8D 07
```

Where:
- Sequence number `6` indicates the position in sequence list, `0` being the most recent.
- Log shows a load error (code `8D` = sled blocked, sub code `07` = error during sled movement to rotation position).

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 the following table.

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
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 2-25). 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	
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	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.
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	
B0	Robotic controller response timeout. A command did not complete in the required amount of time.	Refer to "Contacting IBM Technical Support" on page 8-6
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 reached 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 00: drive sled #1 Subcode 02: drive sled #2	1. Verify that the indicated fan is operational and not obstructed. 2. If the error recurs, refer to "Contacting IBM Technical Support" on page 8-6.
DC	I²C Bus Failure	Refer to "Contacting IBM Technical Support" on page 8-6.
F0	Drive Over temperature Condition The subcode indicates which drive is affected. <u>Example:</u> 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. <u>Example:</u> 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. <u>Example:</u> 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	
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

> **Note:** Refer to "Contacting IBM Technical Support" on page 8-6 if a cartridge will not eject from the drive.

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 4-32.
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 4-10. To use the Web User Interface, see "Manage Library: Release Magazine" on page 4-33. If neither one of these processes works, see "Releasing the Magazines Manually."

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.
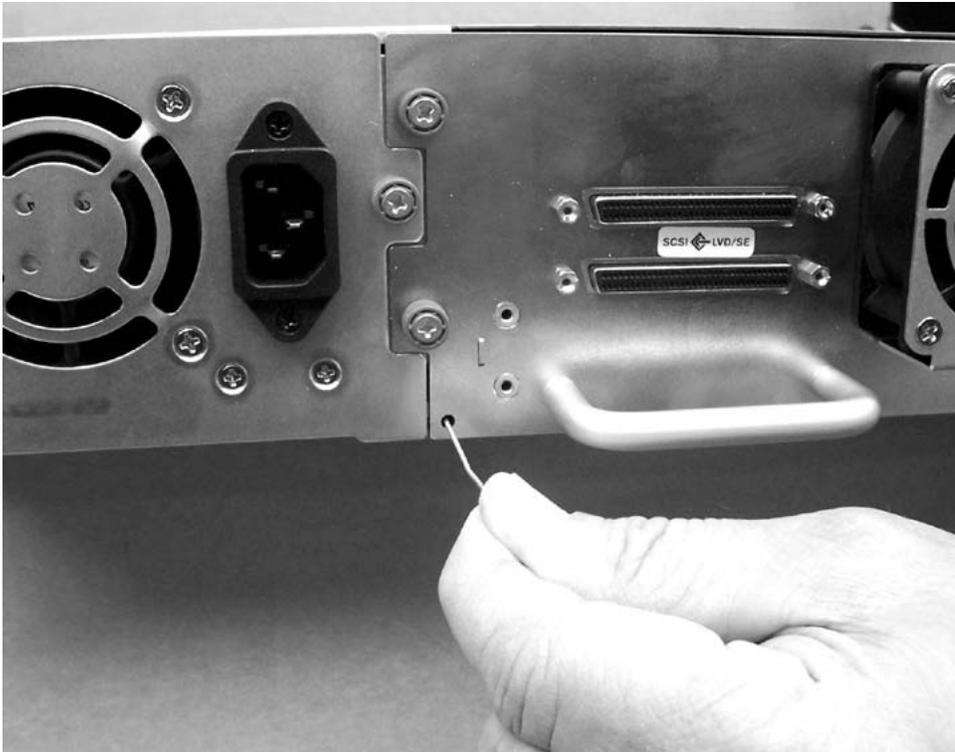
Figure 8-1. Access holes for the left magazine

a77ug024
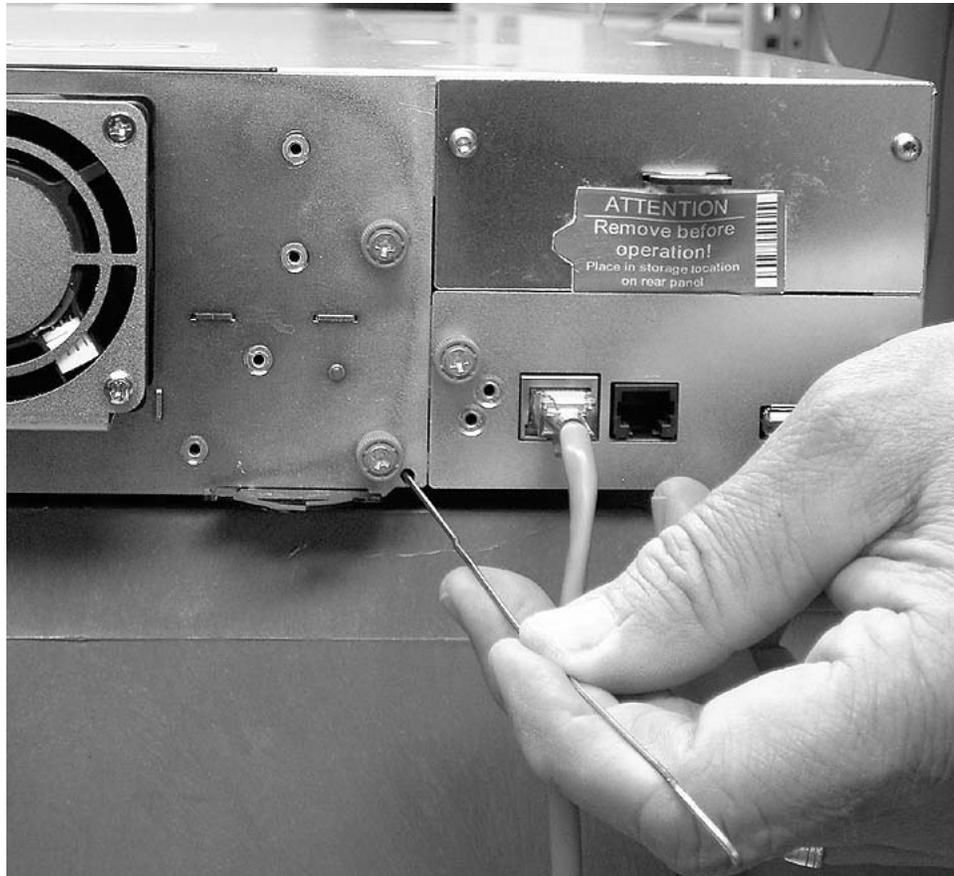
Figure 8-2. Access holes for the right magazine

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.

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 IBM Support for further instructions.

Using ITDT for Drive Firmware Updates and Log Retrieval

A newly designed tool, ITDT, is a tool with multiple functional capability and is a very quick, convenient and efficient method for drive firmware updates. As a note, drive log retrievals can be performed by the tool as well.

Below are some of the capabilities of this tool:

- Firmware update capability to all IBM LTO Tape Drive products.
- The tool does not require any special device drivers.
- The tool is available for most major platforms.
- The tool is capable of uploading drive log files.
- The tool's 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.
- The tool scans the bus and will find and display for selection all IBM LTO devices. The tool will not display and allow for selection 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.
- The tool is 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 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.
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:

- #1 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. Power OFF the library using the power button on the front panel.
3. Remove the host interface cable (**5**) and terminator (**2** for SCSI drive only).
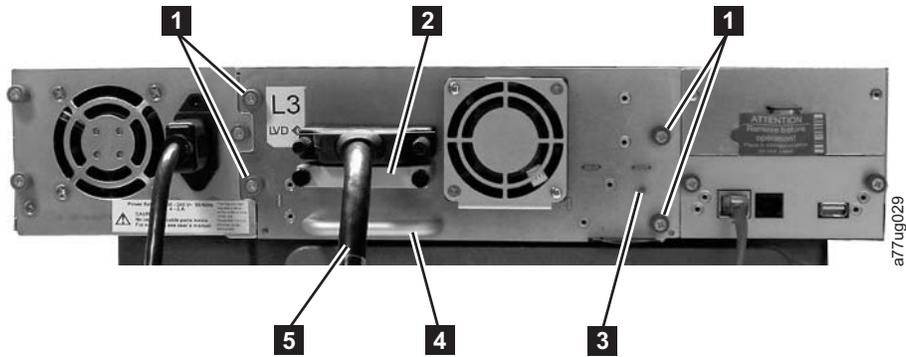
Figure 9-1. Drive sled components on back panel of a 2U library
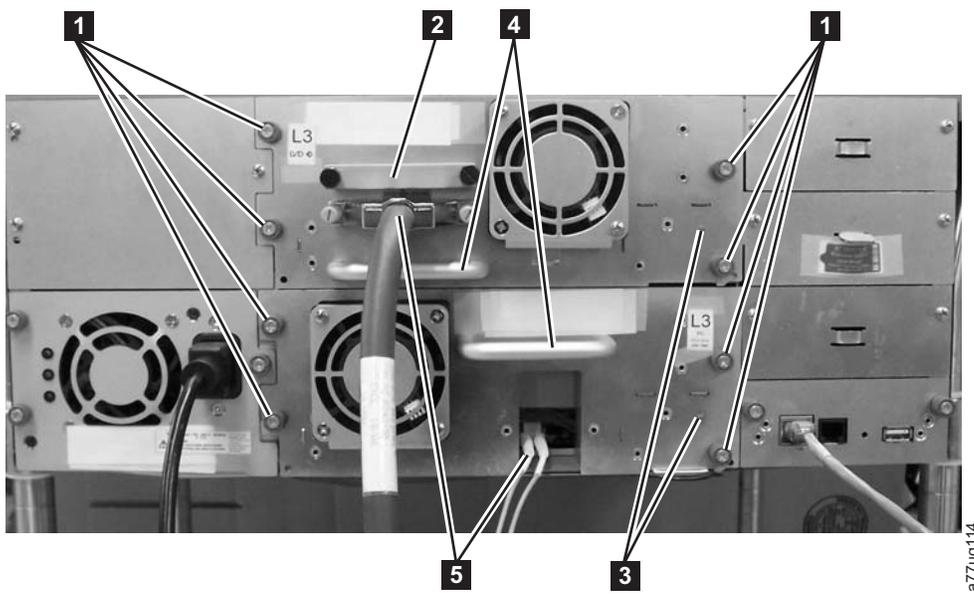
Figure 9-2. Drive Sled Components on back panel of 4U Library (SCSI and FC both shown)

4. Loosen the blue captive thumbscrews (**1**) on the drive.

5. Pull straight back on the tape drive handle (**4**) to remove it from the library.
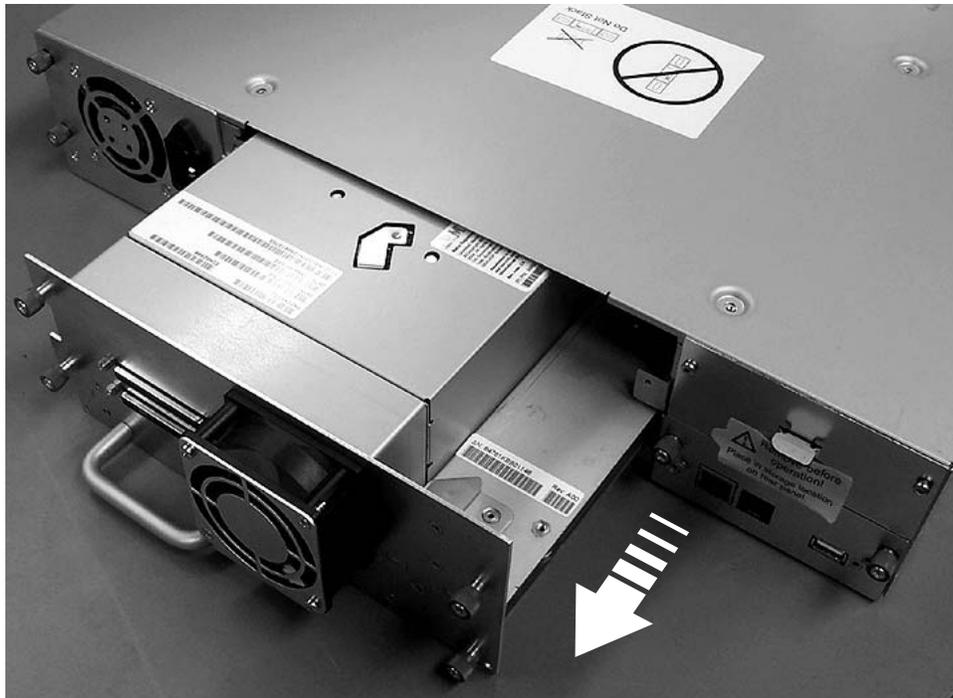
Figure 9-3. Pulling the drive out of the library

6. 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.

7. Extend the black pull-out tab located underneath the lower right corner of the drive sled.

8. 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.

9. 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

10. Tighten the captive thumbscrews (**1**) until the drive is secure.

   Note: Be sure to use supported cabling configurations.

11. Push the black tab back underneath the drive sled. When inserted properly, only the handle of the tab will be visible.

12. Power ON the library using the power button on the front panel.

13. Run the Library Verify test (refer to "Service: Library Verify" on page 4-16).

Replacing a Power Supply

1. Power OFF the library using the power button on the front panel.
2. Disconnect the power cord from the electrical source, then from the library.

Figure 9-5. A power supply being removed from the library

3. Loosen the three blue captive thumbscrews on the power supply located on the back panel of the library.

4. Grasp the top and bottom edge of the power supply and pull it out of the 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 4-16).

Replacing a Library Controller Card

The Library Controller Card contains the vital product data (VPD) for your library. The VPD contains your current library configuration.

1. Backup the VPD on the Library Controller Card installed in your library to the accessor control board (see "Configure Library: Restore Defaults" on page 4-32).

2. Power OFF the library using the power button on the front panel.

3. Disconnect the power cord from the electrical source, then from the back panel of the library.

4. Loosen the two blue captive thumbscrews on the Library Controller Card.

Figure 9-6. A Library Controller Card being removed from the library

5. Grasp the two thumbscrews and pull the Library Controller Card out of the library.

6. Remove the packaging from the replacement Library Controller Card.

7. Grasp the two thumbscrews and push the Library Controller Card into the library.

8. Tighten the two blue captive thumbscrews on the Library Controller Card.

9. Connect the power cord to the back panel of the library, then to the electrical source.

10. Power ON the library using the power button on the front panel.

11. Restore the VPD on the accessor control board to the new Library Controller Card (see "Configure Library: Restore Defaults" on page 4-32).

12. Run the Library Verify test (refer to "Service: Library Verify" on page 4-16).

13. Package the failed Library Controller Card in the same packaging that the new control board was shipped to you in and return to IBM.

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 4-33.
*   Using the Operator Control Panel, refer to "Control: Magazine" on page 4-10.
*   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.
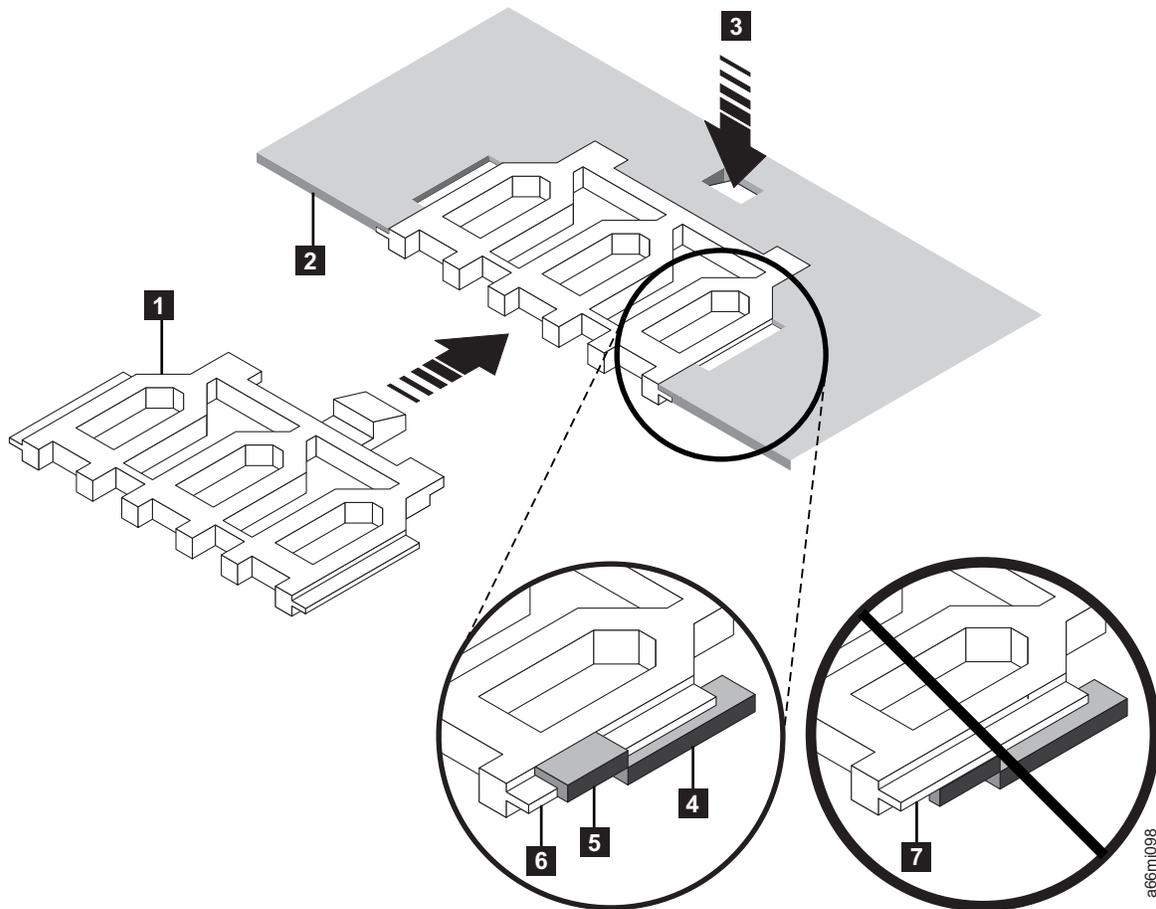
Figure 9-7. Magazine fiducial

1. Remove the cartridge magazine that requires a replacement fiducial (refer to "Cartridge Magazines" on page 2-25.

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 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 4-32.

1. Remove the magazines from your library (see "Cartridge Magazines" on page 2-25).

2. Turn OFF power to your library by using the power button on the front panel (**1** in Figure 1-1 on page 1-1).

3. On the rear panel of the library:

   - Disconnect the power cord (**4** in Figure 9-8).

   - Disconnect the host interface cable (**3** in Figure 9-8).

   - Disconnect the Ethernet cable (**5** in Figure 9-8), if necessary.

   - Loosen the blue thumbscrews on the tape drive (**1** in Figure 9-8), 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.
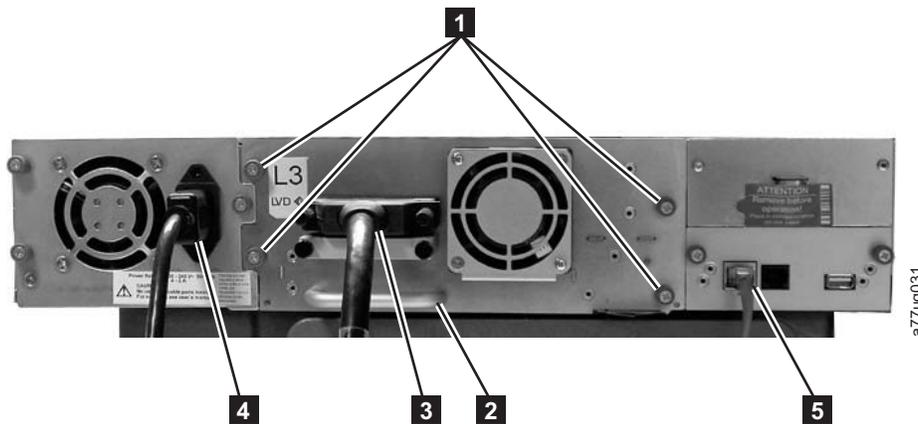
Figure 9-8. Rear panel of 2U library
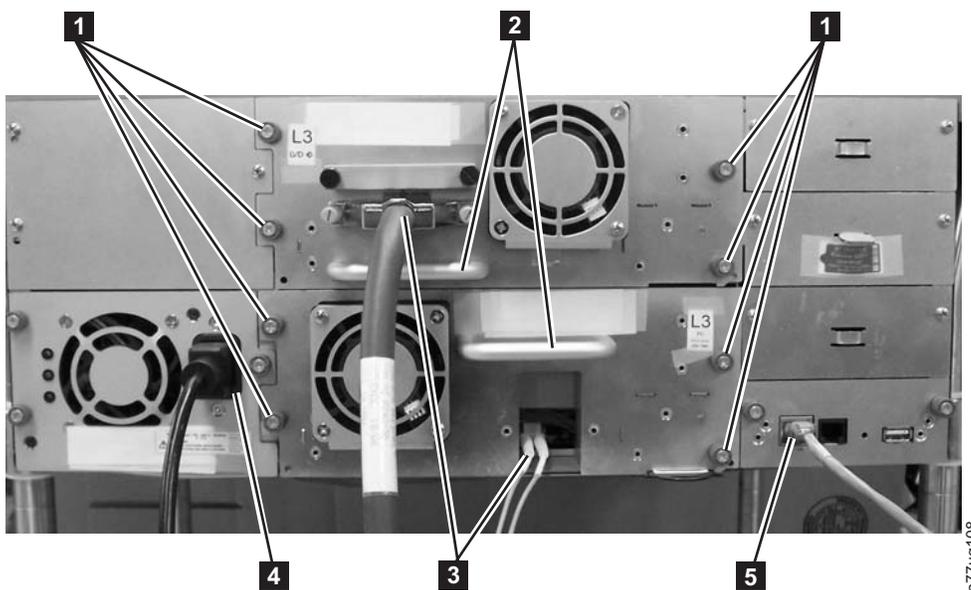
Figure 9-9. Rear Panel of 4U Library

4. If your library is installed in a rack:
   a. From the front of the library remove the two screws (**1** in Figure 9-10) anchoring the mounting brackets on the library to the rack.

Figure 9-10. 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 board. These items are included with the replacement library enclosure due to safety agency requirements.

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 2-7 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 9-10).
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 9-5.
9. Plug in the power cord and host interface cable into the replacement library enclosure.
10. Power on the library.
11. Exchange the left and right magazines in the replacement library enclosure with those taken out of the library enclosure being replaced. Put the magazines removed from the replacement library enclosure into the library enclosure being returned to IBM.
12. 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" on page 9-10).
13. Run the Library Verify test (refer to "Service: Library Verify" on page 4-16).

14. Securely package the library enclosure that was replaced (including the left and right magazines, library controller board, and power supply) and return to IBM.

   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.
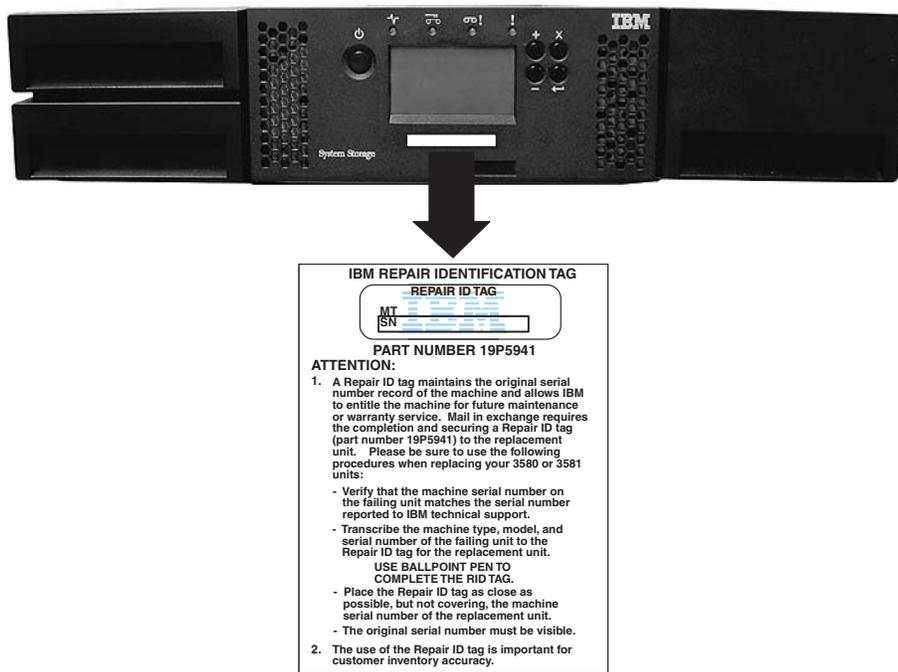
Figure 9-11. RID Tag applied to the front of a 2U library

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 and bar code labels, refer to "Ordering Media Supplies" on page 5-18.

Optional Features

Table 10-1. Optional Features

Feature Code	Description
1682	Control Path Failover (4U)
1901	Additional Power Supply (4U)
5096	LC-SC Fibre Cable Interposer
5602	2.5 M VHDCI/HD68 SCSI Cable
5604	4.5 M VHDCI/HD68 SCSI Cable
5610	10 M VHDCI/HD68 SCSI Cable
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 Drive Sled
8044	Ultrium 3 4Gb Fibre Drive Sled
8106	Right Side Magazine
8305	Data Cart (GEN3) 5-Pack
9848	Rack Power Distribution Unit (PDU) Line Cord

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
23R7162	LVD SCSI Drive Sled
23R7163	Fibre Channel Drive Sled
23R6472	Library Controller Card
23R6447	250 W Power Supply
23R6471	Left Cartridge Magazine (2U)
23R6452	Right Cartridge Magazine (2U/4U)
23R7170	Foot Pads

Table 10-2. Replacement Parts (continued)

Part Number	Description
23R5841	SCSI Terminator
23R5840	SCSI wrap tool
12R9314	Fibre Channel wrap tool
23R6470	Library Enclosure (2U)
23R7169	Library Enclosure (4U)
23R7175	Lower Left Cartridge Magazine (4U)
23R7174	Upper Left Cartridge Magazine (4U)
23R7172	Block Out Panel, Power Supply (4U)
23R7173	Block Out Panel, Drive Bay (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 10-6.

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 10-6
US/Canada • 2.8 m, 125V • FC 9800 • PN 39M5081 • (See Note)	NEMA 5-15P	Aruba, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, South Korea, Suriname, Taiwan, Trinidad Tobago, Venezuela, US	1

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 10-6
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
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

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 10-6
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
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

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 10-6
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
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 10-6shows the plugs that are used by the power cords in
Table 10-3 on page 10-2. Match the index number that is beside each plug to the
index number in the table.
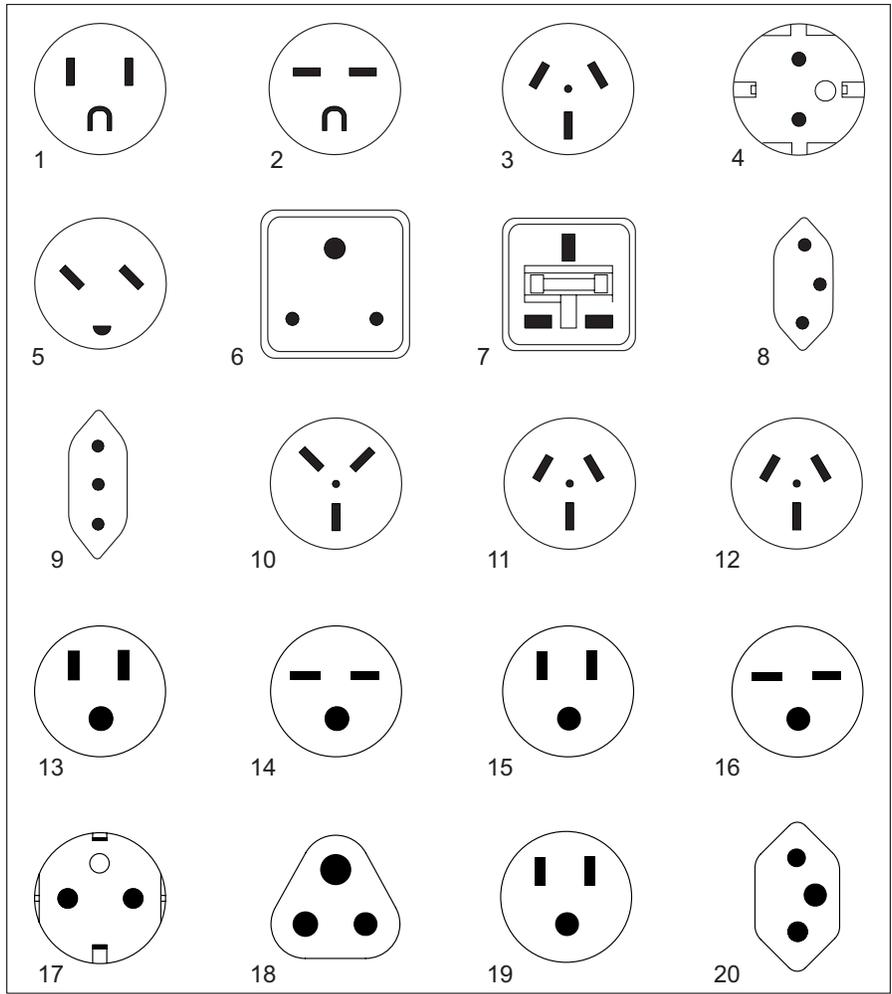
Figure 10-1. Types of Receptacles

Appendix A. 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 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 Tape Drives.

TapeAlert Flags Supported by the Library

Parameter Code	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: • Make sure 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	• Make sure 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.

- 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 A-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 5-6). 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.	Make sure 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 5-6).
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 A-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.

Appendix B. Sense Data

When a drive encounters an error, it makes sense data available. You can use IBM device drivers to examine the sense data and determine errors. Instructions for downloading, installing, and properly configuring the IBM device drivers are available in the *IBM Ultrium Device Drivers Installation and User's Guide*. The IBM device drivers may conflict with some commercial software applications unless properly configured. To avoid conflicts on Windows operating systems, refer to your device driver's procedures for setting the driver to manual startup mode. For applications that use Open Systems device drivers that are provided by IBM (for example, AIX®, Linux™, Sun Solaris, HP-UX, Windows 2003, and Windows 2000), the *IBM Ultrium Device Drivers Installation and User's Guide* contains information about how to obtain sense data after an error has occurred.

If your application uses other device drivers, see the appropriate documentation for those drivers to obtain the sense data.

Raw sense data (as returned from the drive) is documented in the *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference*.

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 B-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 B-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

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 B-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

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 transtion
	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

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

Table B-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 B-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
00   16 - Operation in progress
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
04   12 - Logical Unit Not Ready, Offline
08   01 - Logical Unit Communication Failure
09   00 - Track Following Error (Servo)
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
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
17   01 - Recovered Data with Retries
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
28   01 - Import or Export Element 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
29   04 - Device Internal Reset
     (Continued on next page)

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
	 2A 01 - Mode Parameters Changed — The Mode parameters for the drive have
	                       been changed by an initiator other than the one issuing the command
	 2C 00 - Command Sequence Error
	 2F 00 - Commands Cleared by Another Initiator
	 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 05 - Cannot Write Medium, Incompatible Format
	 30 07 - Cleaning Failure — A cleaning operation was attempted, but could not
	                       be completed for some reason
	 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
	 3B 0C - Position Past Beginning of Medium — A command that required the medium
	                       to be at BOP was attempted when the medium was not at BOP
	                       (e.g., Set Capacity)
	 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
	 3F 03 - Inquiry Data has Changed
	 3F 0E - Reported LUNs Data has Changed
	 3F 0F - Echo Buffer Overwritten
	 40 xx - Diagnostic failure — A diagnostic test has failed. The xx (ASCQ) is a
	                       vendor specific code indicating the failing component.
	 41 00 - Data Path Failure
	 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
	 48 00 - Initiator Detected Error Message Received
	 49 00 - Invalid Message Error
	 4A 00 - Command Phase Error
	 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
	        (Continued on next page)								

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** 50 00 - Write Append Error — A write type command failed because the point at which to append data was unreadable 51 00 - Erase failure — An Erase command failed to erase the required area on the media 52 00 - Cartridge fault — A command could not be completed due to a fault in the tape cartridge 53 00 - Media Load/Eject Failed — (Sense Key 03) An attempt to load or eject the cartridge failed due to a problem with the cartridge. 53 00 - Media Load/Eject Failed — (Sense Key 04) An attempt to load or eject the cartridge failed due to a problem with the drive 53 02 - Media Removal Prevented — An Unload command has failed to eject the cartridge because media removal has been prevented 5A 01 - Operator Medium Removal Request 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 A3 01 - OEM Vendor-Specific							
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	Reserved				Reserved			

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

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.

Appendix C. 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 = 3576]), refer to "Library Error Log Example" on page C-2 and locate the SCSI sense data.
- For drive errors [Resource Name = **rmt**n (for example, rmt0) and Resource Type = LTO], refer to "Drive Error Log Example" on page C-3 and locate the SCSI sense data.
- For SCSI bus errors (not SCSI adapter errors), refer to "SCSI Bus Error Example 1" on page C-4 and "SCSI Bus Error Example 2" on page C-5 to determine which host adapter, SCSI bus, and device or devices are affected.
- For Fibre Channel errors (not Fibre Channel adapter errors), determine which host adapter and device are affected.
- For SCSI adapter errors (not SCSI bus errors), use the maintenance package for the host.

Note: See Appendix B, "Sense Data," on page B-1 for further details on sense data.

Library Error Log Example

```
LABEL:      TAPE_ERR2
IDENTIFIER:      476B351D

Date/Time:      Wed Oct 11 11:42:17
Sequence Number: 25265
Machine ID:      000D090D4C00
Node ID:        tsm
Error Class:    H
Error Type:     PERM
Resource Name:  smc0
Resource Class: tape
Resource Type:  3576
Location:       40-60-00-6,0
VPD:
        Manufacturer................IBM
        Machine Type and Model......ULT3576-TL
        Serial Number...............IBM7810698
        Device Specific . (FW) .....x.xx    (Firmware Level)


Description
TAPE DRIVE FAILURE

Probable Causes
TAPE DRIVE

Failure Causes
TAPE
TAPE DRIVE
        Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES


Detail Data
SENSE DATA
0C00 0000 A500 0001 1009 0101 0000 0000 0000 0000 7000 0400 0000 0046 0000 0000
4400 8100 0000 0000 0000 0000 0000 0200 4801 E300 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 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 C-1. AIX ERRPT Library Error Log Example

Table C-1. AIX ERRPT Library Sense Data

Hex	Description
A5	SCSI Command
0001, 1009, 0101	Command Parameters
70	Byte 0 of Library Sense Data
04	Sense Key
4400	ASC/ASCQ (Additional Sense Code/Additional Sense Code Qualifier)
81	Library SAT (Service Action Ticket) Code

Drive Error Log Example

```
LABEL:          TAPE_ERR1
IDENTIFIER:       4865FA9B

Date/Time:      Wed Oct 10 11:39:43
Sequence Number: 25264
Machine ID:     000D090D4C00
Node ID:        tsm
Class:          H
Type:           PERM
Resource Name:  rmt2
Resource Class: tape
Resource Type:  LTO
Location:       40-60-00-2,0
VPD:
        Manufacturer...............IBM
        Machine Type and Model......ULT3576-TD3
        Serial Number..............1300015078
        Device Specific.(FW)........xxxx  (Firmware Level)
Description
TAPE OPERATION ERROR

Probable Causes
TAPE

User Causes
MEDIA DEFECTIVE
DIRTY READ/WRITE HEAD

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

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

Figure C-2. AIX ERRPT Drive Error Log Example

Table C-2. AIX ERRPT Drive Sense Data

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

SCSI Bus Error Example 1

```
LABEL:          SCSI_ERR10
IDENTIFIER:       0BA49C99

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

Description
SCSI BUS ERROR

Probable Causes
CABLE
CABLE TERMINATOR
DEVICE
ADAPTER

Failure Causes
CABLE LOOSE OR DEFECTIVE
DEVICE
ADAPTER

        Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES
        CHECK CABLE AND ITS CONNECTIONS

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

Figure C-3. Example of Error Suggesting SCSI Bus Problem, Which Takes Down Entire Bus

SCSI Bus Error Example 2

```
LABEL:          TAPE_ERR4
IDENTIFIER:     5537AC5F

Date/Time:      Wed Oct 17 09:00:41
Sequence Number: 16101
Machine Id:     00003ABF4C00
Node Id:        ofgtsm
Class:          H
Type:           PERM
Resource Name:  smc0
Resource Class: tape
Resource Type:  3576
Location:       40-58-00-0,1
VPD:
        Manufacturer................IBM
        Machine Type and Model......ULT3576-TL
        Serial Number...............IBM7810698
        Device Specific.(FW)........x.xx
Description
TAPE DRIVE FAILURE

Probable Causes
ADAPTER
TAPE DRIVE

Failure Causes
ADAPTER
TAPE DRIVE

        Recommended Actions
        PERFORM PROBLEM DETERMINATION PROCEDURES

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

Figure C-4. SCSI Problem Points to Library Control Path as Possible Cause

Summary Report

```
   1       2    34 5           6
FFE2F73A   1012150900 U H  rmt5          UNDETERMINED ERROR
0BA49C99   1012150800 T H  scsi8         SCSI BUS ERROR          7
C60BB505   1012141500  P S                 SOFTWARE PROGRAM ABNORM TERMINATED
C42F11D4   1012105200 U S VSC:DE    SOFTWARE ERROR
C42F11D4   1012105000 U S VSC:DE    SOFTWARE ERROR
FFFA352B   1012104900 U S MS:CS      SOFTWARE ERROR
FFFA352B   1012104900 U S MS:CS      SOFTWARE ERROR
5537AC5F   1012091700 P H rmt9         TAPE DRIVE FAILURE
5537AC5F   1012091700 P H rmt9         TAPE DRIVE FAILURE
5537AC5F   1012091700 P H rmt9         TAPE DRIVE FAILURE
5537AC5F   1012091600 P H rmt8         TAPE DRIVE FAILURE
5537AC5F   1012091600 P H rmt8         TAPE DRIVE FAILURE
5537AC5F   1012091600 P H rmt8         TAPE DRIVE FAILURE
C60BB505   1012082000 P S                 SOFTWARE PROGRAM ABNORM TERMINATED
C42F11D4   1011183600 U S VSC:DE      SOFTWARE ERROR
C42F11D4   1011183300 U S VSC:DE      SOFTWARE ERROR
C42F11D4   1011181800 U S VSC:DE      SOFTWARE ERROR
C42F11D4   1011174700 U S VSC:DE      SOFTWARE ERROR
FFFA352B   1011172900 U S MS:CS       SOFTWARE ERROR
FFFA352B   1011172900 U S MS:CS       SOFTWARE ERROR
C42F11D4   1011155300 U S VSC:DE      SOFTWARE ERROR
C42F11D4   1011153900 U S VSC:DE      SOFTWARE ERROR
C42F11D4   1011153800 U S VSC:DE      SOFTWARE ERROR
C42F11D4   1011150900 U S VSC:DE      SOFTWARE ERROR
```

Figure C-5. AIX ERRPT Commands Error Log Example

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

ERROR CLASS	DESCRIPTION
H	Hardware
S	Software
O	Informational

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

A69M0170

Retrieving from an AS/400 System with RISC Processor

IBM device drivers for the AS/400 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)

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

1. Type STRSST (Start System Service Tools) command on the command entry line on the AS/400 Main Menu, and press **[Enter]**.
2. On the "System Service Tool (SST)" screen, select **Start a service tool**, and press **[Enter]**.
3. On the "Start a Service Tool" screen, select **Product activity log**, and press **[Enter]**.
4. On the "Product activity log" screen, select **Analyze log**, and press **[Enter]**.
5. On the "Select Subsystem Data" screen, select **Magnetic media**, enter the From and To time period for searching the error log, and press **[Enter]**.
6. On the "Select Analysis Report Options" screen, select the following, and press **[Enter]**.
    a. Report type. 1
    b. Optional entries to include
        1) Informational . . . . YES
        2) Statistic . . . . NO
    c. Reference code selection
        1) Option 1
        2) Reference codes. . . . . *ALL
    d. Device selection
        1) Option 1
        2) Device type or resource names . . *ALL
7. On the "Log Analysis Report" screen, enter a **5** on an error line that has a resource type of 3583 (library) or 3580 (drive), and press **[Enter]**.
8. On the "Display Detail Report for Resource" screen, press:
    - F4=Additional Information.

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

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

      Pressing F9 will display the SCSI address information.

AS/400 Product Activity Log

```
Product Activity Log                              Page . . . :          1
                                          ROMLPAR1  08/26/05  10:28:40
  Invocation  . . . . . . :   Product Activity Log
  Title . . . . . . . . . :   Log ID Report

  System type . . . . . . :   9406
  System model  . . . . . :   825
  System release  . . . . :   V5R3M0
  System name . . . . . . :   ROMLPAR1
  System serial
    number  . . . . . . . :   10-F321B
  Log ID  . . . . . . . . :   09020145
  Include hexadecimal
    data  . . . . . . . . :   Y   Y=YES
                                 N=NO
  Product Activity Log                            Page . . . :          2
                                          ROMLPAR1  08/26/05  10:28:40
                      Detail Report for Resource
                                        Serial            Resource
  Name                Type        Model   Number            Name
  TAPMLB19            3580        001     00-1004538
  Log ID  . . . . . . . . . :   09020145    Sequence . . . . . . :    211510
  Date  . . . . . . . . . :     04/21/05    Time . . . . . . . . :    10:40:11
  Reference code  . . . . :     9350        Secondary code . . . :    00000000
  Table ID  . . . . . . . :     63A00001    IPL source/state . . :    B / 3
  Class . . . . . . . . . :     Permanent
  System ref code . . . . . :   63A09350
  Tape unit detected a read or write error on tape medium
  Physical location:
    Frame ID  . . . . . . . :
    Card position . . . . . :
    Device position . . . . :
  Logical address:
    PCI bus:                     Library:
      System bus  . . . . . :    36    I/O adapter . . . . . . :      2
      System board  . . . . :     0    I/O bus . . . . . . . . :      1
      System card . . . . . :    32    Library:                      20
                                       Controller  . . . . . . :       4
                                       Device  . . . . . . . . :       0
  SENSE DATA FOLLOWS. . . . :
  DATA OFFSET             0 1 2 3  4 5 6 7  8 9 A B  C D E F
  00000000               71000300 0000001C 00000000 53000600
  00000010               31190601 00020000 00000000 00000000
  00000020               00000301
    00000000 0000   C5D3F0F5 00000188 00E00180 8983EBC2   4B9D8001 00033A36 20E00902 01450000  *EL05...h....ic.B.................*
    00000000 0040   F3F8F2F8 F4F4F6F3 C1F00002 00240000   00200000 00050001 00140004 00000002  *38284463A0.......................*
    00000000 0060   00000000 00000000 00000000 40404040   40404040 40400000 00000000 00000000  *............         ..........*
    00000000 0080   00000000 00000000 00000000 00000000   00000000 00000000 00000000 0000E3C1  *..............................TA*
    00000000 00A0   D7D4D3C2 F1F94040 00000000 00000000   00000000 00000000 40404040 40404040  *PMLB19  ...............         *
    00000000 00C0   40404040 40404040 40404040 40404040   40404040 40404040 40404040 40404040  *                                *
    00000000 00E0   F6F3C1F0 F0F0F0F1 0000E2D3 C9C3C9D6   4040E5F5 D9F3D4F0 40400000 00000000  *63A00001..SLICIO  V5R3M0 ......*
    00000000 0100   01030000 00000000 00000141 00000000   00000000 01950000 00000000 00000197  *.....................n.........p*
    00000000 0120   00000000 00000000 00000000 00000000   00000000 00000000 00000000 00000000  *................................*
    00000000 0140   E3C1D7F2 F7404040 40404040 40404040   40404040 40404040 40404040 00070001  *TAP27                      ....*
    00000000 0160   00000000 10200003 00000000 00000000   00000000 00000000 0009001E 00000188  *..............................h*
    00000000 0180   F8807800 28440001 00002600 21410400   63A00001 93500100 45381202 05D80000  *8..................l&.......Q..*
    00000000 01A0   00000000 00004624 00000000 00000000   00040000 00003580 0001A170 02903435  *................................*
  Product Activity Log                            Page . . . :          3
                                          ROMLPAR1  08/26/05  10:28:40
    00000000 01C0   36310040 00007100 03000000 001C0000   00005300 06003119 06010002 00000000  *... ............................*
    00000000 01E0   00000000 00000000 03010000 00000000   00000000 00000000 00000000 00000000  *................................*
    00000000 0200   00000000 0000D9C5 D8400000 D9E2000C   02000000 0000E2C3 E2C91202 00180000  *......REQ ..RS........SCSI......*
    00000000 0220   00000000 0000C5D9 D940C3C8 C3D20444   8502D9E2 0000E2C3 E2C91202 00180300  *......ERR CHCK..e.RS..SCSI......*
    00000000 0240   00008000 0000E2D5 E2C47100 03000000   001C0000 0000C5D9 D7C11202 05D80000  *......SNSD............ERPA...Q..*
    00000000 0260   00171202 05D8D9C5 E2D70000 00171202   05D8D9E2 00000000 D4C5C4C9 C1000000C3  *.....QRESP.......QRS....MEDIA..C*
    00000000 0280   D7D7F1F2 F5C500D4 E3C1D7C3 D3D500C3   D7D7F6F4 F0F000E4 C6C9F0F0 F8F7F1C3  *PP125E.MTAPCLN.CPP6400.UFI00871C*
    00000000 02A0   D7D7F1F8 F5C600D5 00000000 00000000   00000000 00000000 00000000 00000000  *PP185F.N........................*
    00000000 02C0   00000000 00000000 00000000 00000000   00000000 00000000 C3D7D7F6 F3F0C3D5  *........................CPP630CN*
    00000000 02E0   F6F3C1F0 F9F3F5F0 F0F0F0F0 F0F0F0F0   F0F0F0F0 F0F1F9F7 F8F0F0F7 000E8D5  *63A093500000000000001978007..YN*
    00000000 0300   00000000 00000000 40404040 40404040   40404040 40404040 40404040 40404040  *........                        *
      * * * * * E N D   O F   C O M P U T E R   P R I N T O U T * * * * *
```

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.

Notices

This information was developed for products and services offered in the U.S.A. IBM may not offer the products, services, or features discussed in this document in other countries (or regions). Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

The following paragraph does not apply to the United Kingdom or any other country (or region) where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states (or regions) do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM web sites are provided for convenience only and do not in any manner serve as an endorsement of those web sites. The materials at those web sites are not part of the materials for this IBM product and use of those web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Trademarks

The following are trademarks of International Business Machines Corporation in the United States, or other countries (or regions), or both:

AIX	RS/6000
AS/400	xSeries
IBM	Tivoli
iSeries	TotalStorage
OS/400	zSeries
pSeries	System Storage
System i	System x
System p	System z
i5/OS	

The following are U.S. trademarks of Hewlett-Packard Company, International Business Machines Corporation, and Certance.

Linear Tape-Open
LTO
Ultrium

Intel is a registered trademark of Intel Corporation in the United States, or other countries (or regions), or both.

Microsoft, Windows, Windows NT, Windows 2000, and the Windows logo are registered trademarks of Microsoft Corporation in the United States, or other countries (or regions), or both.

Solaris and Sun are registered trademarks of Sun Microsystems Incorporated.

Unix is a trademark of The Open Group in the United States, or other countries or regions, or both.

Other company, product, or service names may be the trademarks or service marks of others.

Electronic Emission Notices

Federal Communications Commission (FCC) Class A Statement

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

IBM is not responsible for any radio or television interference caused by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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

European Union (EU) Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

People's Republic of China Class A Electronic Emission Statement

中华人民共和国"A类"警告声明

声 明
此为A级产品，在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对其干扰采取切实可行的措施。

Taiwan Class A Electronic Emission Statement

警告使用者：
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

Japan VCCI Class A ITE Electronic Emission Statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に
基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を
引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求
されることがあります。

Industry Canada Class A Emission Compliance Statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

Germany Electromagnetic Compatibility Directive

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

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

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

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

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

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

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

Korean Class A Electronic Emission Statement

이 기기는 업무용으로 전자파 적합등록을 받은 기기
이오니, 판매자 또는 사용자는 이점을 주의하시기
바라며, 만약 잘못 구입하셨을 때에는 구입한 곳에
서 비업무용으로 교환하시기 바랍니다.

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.

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

adj.   Adjustment.

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.

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.

BM 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.

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.

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.

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.

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.

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*.

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.

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.

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.

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.

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.

IPL. Initial program load.

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.

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

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.

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.

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.

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 3590 and the host processor. The 3590 has two SCSI ports.

Portable Document Format (PDF). A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact, can be distributed globally (via e-mail, the Web, intranets, or CD-ROM), and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

PROM. Programmable read only memory.

PS. Power supply.

PWR. Power.

R

rack. A unit that houses the components of a storage subsystem, such as the library.

rackmount kit. A packaged collection of articles used to install the rack mounted version of the library.

RAM. Random access memory.

Random access memory. A storage device into which data is entered and from which data is retrieved in a nonsequential manner.

RAS. Reliability, availability, and serviceability.

record. A collection of related data or words, treated as a unit.

recording density. The number of bits in a single linear track measured per unit of length of the recording medium.

recoverable error. An error condition that allows continued execution of a program.

ref. Reference.

reg. Register.

reinventory. To inventory again.

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.

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.

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.

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.

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.

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.

Write. Write command.

WT. world trade.

X

XR. External register.

XRA. External register address register.

Index

Readers' Comments — We'd Like to Hear from You

IBM System Storage TS3100 Tape Library and TS3200 Tape Library
Setup, Operator, and Service Guide
Machine Type 3573

Publication No. GA32-0545-01

Overall, how satisfied are you with the information in this book?

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Overall satisfaction	☐	☐	☐	☐	☐

How satisfied are you that the information in this book is:

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Accurate	☐	☐	☐	☐	☐
Complete	☐	☐	☐	☐	☐
Easy to find	☐	☐	☐	☐	☐
Easy to understand	☐	☐	☐	☐	☐
Well organized	☐	☐	☐	☐	☐
Applicable to your tasks	☐	☐	☐	☐	☐

Please tell us how we can improve this book:

Thank you for your responses. May we contact you?　☐ Yes　☐ No

When you send comments to IBM, you grant IBM a nonexclusive right to use or distribute your comments in any way it believes appropriate without incurring any obligation to you. IBM or any other organizations will only use the personal information that you supply to contact you about the issues that you state on this form.

Name

Address

Company or Organization

Phone No.

Fold and Tape　　　　　**Please do not staple**　　　　　Fold and Tape

BUSINESS REPLY MAIL

FIRST-CLASS MAIL　　PERMIT NO. 40　　ARMONK, NEW YORK

POSTAGE WILL BE PAID BY ADDRESSEE

International Business Machines Corporation
Information Development
Department GZW
9000 South Rita Road
Tucson, Arizona U.S.A. 85775-4401

Fold and Tape　　　　　**Please do not staple**　　　　　Fold and Tape

IBM ®
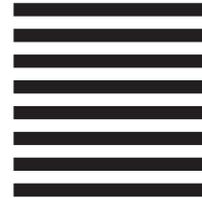
Part Number: 23R7507

Printed in USA

(1P) P/N: 23R7507

Spine information:

IBM System Storage TS3100 Tape
Library and TS3200 Tape Library

TS3100 Tape Library and TS3200 Tape Library Setup,
Operator, and Service Guide

Machine Type 3573

IBM