IBM System Storage TS3310 Tape Library

Maintenance Information for IBM Service Personnel

Machine

Note!

Before using this information and the product it supports, be sure to read the general information under ″Notices″ in the Appendix.

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

Released June 2007

This edition applies to the *IBM System Storage*^{TM} *TS3310 Tape Library Maintenance Information*, GA32-0478-03, and to the subsequent releases and modifications until otherwise indicated in new editions.

Read This First

This *IBM® System Storage™ TS3310 Tape Library Maintenance Information* (MI) contains information for trained service personnel. Use the MI as a guide when you make a service call to diagnose or maintain the library.

You may send your comments to IBM via email at: starpubs@us.ibm.com or use the Readers' Comments form at the back of this publication. Be sure to include the following:

- The exact title of the document: *IBM System Storage TS3310 Tape Library Maintenance Information*
- The part number
- The complete form number
- Where the problem is located (for example, a page number or table)

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Summary of Changes, 2nd Edition

- Incorporated 23U specifications
- Added email notifications
- Modified Web User Interface menus
- Added instructions for updating firmware using the Web User Interface
- Re-ordered the installation instructions to better distinguish between desktop and rack-mount installations
- Added new Service Action Tickets and Diagnostic Resolutions
- Updated the Parts List

Summary of Changes, 3rd Edition

- Incorporated specifications for additional expansion modules
- Modified Web User Interface menus
- Added new Service Action Tickets and Diagnostic Resolutions
- Updated the Parts List

Summary of Changes, 4th Edition

- Modified Control Panel menus
- Added support for Ultrium 4 Tape Cartridges
- Added new Service Action Tickets and Diagnostic Resolutions
- Updated the Parts List

Contents

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Preface

Trained service personnel should use this maintenance information to test, diagnose, and repair the IBM System Storage TS3310 Tape Library.

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

Related Publications

Refer to the following publications for additional information.

To obtain the latest version of these publications, visit the web at **http://www.ibm.com/storage/lto**.

- *IBM System Storage TS3310 Tape Library SCSI Reference* (GA32-0476) provides supported SCSI commands and protocol governing the behavior of SCSI interface.
- *IBM System Storage TS3310 Tape Library Setup and Operator Guide* (GA32-0477) provides information for installation and operation.
- *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.

Getting Assistance

If this document does not help you solve the problem, contact your next level of support.

Start Service

Problem Area	If...	Then...
Error Message	**Your library issues an Operator Intervention...** You will know when an Operator Intervention has been issued when the **Library**, **Drives**, or **Media** button at the bottom of the Operator Panel screen turns yellow or red. Operator Interventions are also indicated by the amber Operator Intervention Alert LED on the front panel of the library to the right of the power button, or by e-mail notifications, if this feature is enabled.	• Touch the **Library**, **Drives**, or **Media** button at the bottom of the Operator Panel screen, then touch **Operator Interventions** to view the error message(s). • After reading an error message, touch the **Resolve** button to display the suggested resolution for the problem. • Refer to “Service Action Tickets (Txxx) and Diagnostic Resolutions (DRxxx)” on page 6-1 for more information about the Service Action Ticket number (T*xxx*).
	The resolution for an Operator Intervention suggests a CRU or FRU replacement...	Before replacing a CRU or FRU: • Refer to “Service Action Tickets (Txxx) and Diagnostic Resolutions (DRxxx)” on page 6-1 for additional information on resolving the problem. • Observe the LEDs on all components (For more information, see “Interpreting LEDs” on page 7-8.). If the LEDs on a component indicate that there is a problem, reseat the component. • Visually check, and reseat if necessary, all of the cables that are connected to the failing FRU or CRU. For more information, see “Checking / Reseating Cables” on page 7-19. • If possible, power cycle the library. • If the error occurs again, replace the suspect component.
	A TapeAlert message was received...	Refer to Appendix A, “TapeAlert Flags,” on page A-1.
	You are experiencing a problem with your library and no Operator Intervention was created...	If after trying all diagnostic procedures you are unable to resolve the problem, contact your next level of support.
	The Operator Panel displays, ″Error - cannot Determine Personality″...	1. Power cycle the library. 2. If the same message appears, replace the Compact Flash Card (see “Library Control Blade or Compact Flash Card” on page 8-36.
	You get repeated errors, multiple functions surface failure messages, or T*xxx* codes...	Open and close an Access Door to ensure that all previous error handling is completed and to enable normal library robotic function.

Problem Area	If...	Then...
	HTML error 404 appear on computer screen when trying to launch the Web User Interface...	1. Verify that

Problem Area	If...	Then...
Firmware	**A firmware problem is suspected...**	Verify that you are running the latest levels of library and drive firmware, then upgrade if necessary (see “Methods of Updating Firmware” on page 7-15). If new firmware does not resolve the problem, contact your next level of support.
	The Library firmware does not complete the boot-up process and appears hung... Failure of the **Working** screen to appear on the Operator Panel in 15 minutes indicates that the boot-up process is not completing.	1. Power OFF the library and wait at least one minute before powering ON to recover the problem. 2. If a library firmware update was just performed, try to repeat the update procedure.
	Library firmware is being updated...	Additional time is required by the library, including a blank screen then a backlit screen, before the **Working** screen appears.
	All firmware (library and drive) is not at the latest level...	Refer to “Methods of Updating Firmware” on page 7-15 for instructions on updating all of the components which are not at the latest level. The procedure will direct you to the IBM web site to check for latest firmware levels.
Logs	**You are required to capture a library log or a drive dump...**	• For information on capturing a library log, refer to “Methods of Capturing Logs” on page 7-6. For information on capturing a drive log, refer to “Using the ITDT SCSI Firmware Update, Dump Retrieval and Drive Test Tool” on page 7-17.
	You need to acquire library or drive information at the host...	Refer to Appendix E, “Message Retrieval at the Host,” on page E-1.
Diagnostics	**You need to run library diagnostic tests...**	Refer to “Service Menu: System” on page 7-4.
Configuration	**Configuring the library resulted in less storage slots than are actually present.**	Verify that the Capacity Expansion license keys have been applied as needed.
Configuration	**You are reinstalling a feature requiring a License Key code.**	1. From the Operator Panel, select **Setup** → **License**. 2. Re-enter the license key code. If the license key code can not be located, contact your IBM Sales Representative.

Problem Area	If...	Then...
Power	**If the power supply power switch is ON and power indicator is OFF...**	1. Verify that the power switch is ON. 2. Verify that the power cable is properly seated on the Power Supply. 3. Analyze the problem by observing the Power Supply LEDs (see "Power Supply LEDs" on page 7-13). 4. If necessary, replace the failing power supply (refer to "Power Supply (Primary and Redundant)" on page 8-42).
	If the blue LED on the power supply is ON, the power ON/OFF button on the front of the library is ON (button pushed IN), but the power indicator on the front of the library is OFF...	1. Suspect a failing power ON/OFF push button on the front of the library, or a loose or broken cable. 2. Check and reseat internal cable from the power ON/OFF push button to the back of the operator panel to the backplane connect board (BCB). See "Internal Cables" on page 7-22. 3. See "Replacing the Power Switch/LED Board Assembly" on page 8-23.
Picker	**The Picker is stuck in one position and is making a clicking sound...**	1. Visually verify that all gear racks (front and rear) are properly aligned. If they are not aligned, refer to "Verifying Front and Rear Gear Racks Alignment" on page 8-15. 2. Ensure the Y-axis Assembly is level from front to back. If a gear rack gap was discovered, or if the Y-axis Assembly was previously removed and replaced, one side may be off by one or two teeth. With the top cover removed, and power OFF, slowly lift the Y-axis Assembly and re-insert (see "Y-axis/Picker Assembly" on page 8-45). 3. Check for broken gear teeth on the Y motor. If there are broken teeth, see "Y Motor" on page 8-59.
	The Picker Assembly does not move within five minutes after Power ON...	1. Check cable connections from the Cable Spool to the Y-axis Assembly and from the Y-axis Assembly to the Picker. 2. With Access Doors closed, note if the green LED on top of the Picker is ON. • For a 5U library, open the I/O Station door to view. • For a 14U library or larger, look through the expansion module window. 3. If the green LED is OFF, suspect the Picker Assembly, the Y-axis Assembly, the module-to-module communication terminator, or an open door. 4. If the Picker Assembly is still not working, contact your next level of support.
Performance	**If the library is experiencing excessive retries and/or the Y-axis Assembly seems noisy...**	• Ensure both front and rear gear racks on all modules above the bottom-most module on a multiple module unit (such as a 14U library) are in the lock-down position. Gear racks between modules must not have a gap between them; otherwise, the Y-axis Assembly will no longer be level. • Ensure the Y-axis Assembly is level from front to back. If a gear rack gap was discovered, or if the Y-axis Assembly was previously removed and replaced, one side may be off by one or two teeth. With the top cover removed, and power OFF, slowly lift the Y-axis Assembly and re-insert (see "Y-axis/Picker Assembly" on page 8-45). • Ensure that the Y-axis motor is properly inserted in the opening in the base plate (see Figure 8-60 on page 8-61).

Problem Area	If...	Then...
Web User Interface	**A Web User Interface Help page is not opening...**	Verify that other help pages are not currently open. If other pages are currently open, close them and try again.
Library Not Booting	• **There is a blank operator panel/display** • **Picker doesn't move** • **Display is stuck on IBM or initialization for more than 20 minutes** • **Lights are not correct on back of library.**	Suspect the LCB compact flash or the power supply.

Product Description

The IBM System Storage™ TS3310 Tape Library offers high performance, capacity, and technology designed for reliability and the heavy demands of tape storage. This library is highly modular with scalability varying from the base library 5U control module with up to four additional expansion units for a total of 41U height. This automated tape library incorporates high-performance IBM LTO Ultrium Tape Drives for the midrange to enterprise open systems environment. The Ultrium 4 cartridge has a native data capacity of 800 GB (1600 GB at 2:1 compression). IBM LTO Ultrium 4 tape drives can read and write original LTO Ultrium 3 data cartridges and read LTO Ultrium 2 data cartridges. The Ultrium 3 cartridge has a native data capacity of 400 GB (800 GB at 2:1 compression). IBM LTO Ultrium 3 tape drives can read and write original LTO Ultrium 2 data cartridges and read LTO Ultrium 1 data cartridges.

The base TS3310 library contains the library control module, fixed tape cartridge storage of 30 slots, I/O station of 6 slots, a touch screen display, cartridge handling robotics, and up to two LTO Ultrium tape drives.

You can add up to 4 optional expansion modules to a control module. Each 9U expansion module can accommodate up to 4 LTO Ultrium Tape Drives and up to 80 tape cartridge slots and 12 configurable I/O station slots.

This library supports LTO Ultrium 4 Tape Drives with either Serial Attached SCSI (SAS) or native switched fabric Fibre Channel attachment for connection to a wide spectrum of open system servers. It also supports LTO Ultrium 3 Tape Drives with either LVD Ultra160 SCSI or native switched fabric Fibre Channel attachment.

The TS3310 library supports Application Managed Encryption (AME), System Managed Encryption (SME), and Library Managed Encryption (LME) on Ultrium 4 SAS (Serial Attached SCSI) and Fibre Channel (FC) drives using Ultrium 4 media. The AME function is standard on all libraries, while the SME and LME features require a license key.

Front Panel Components

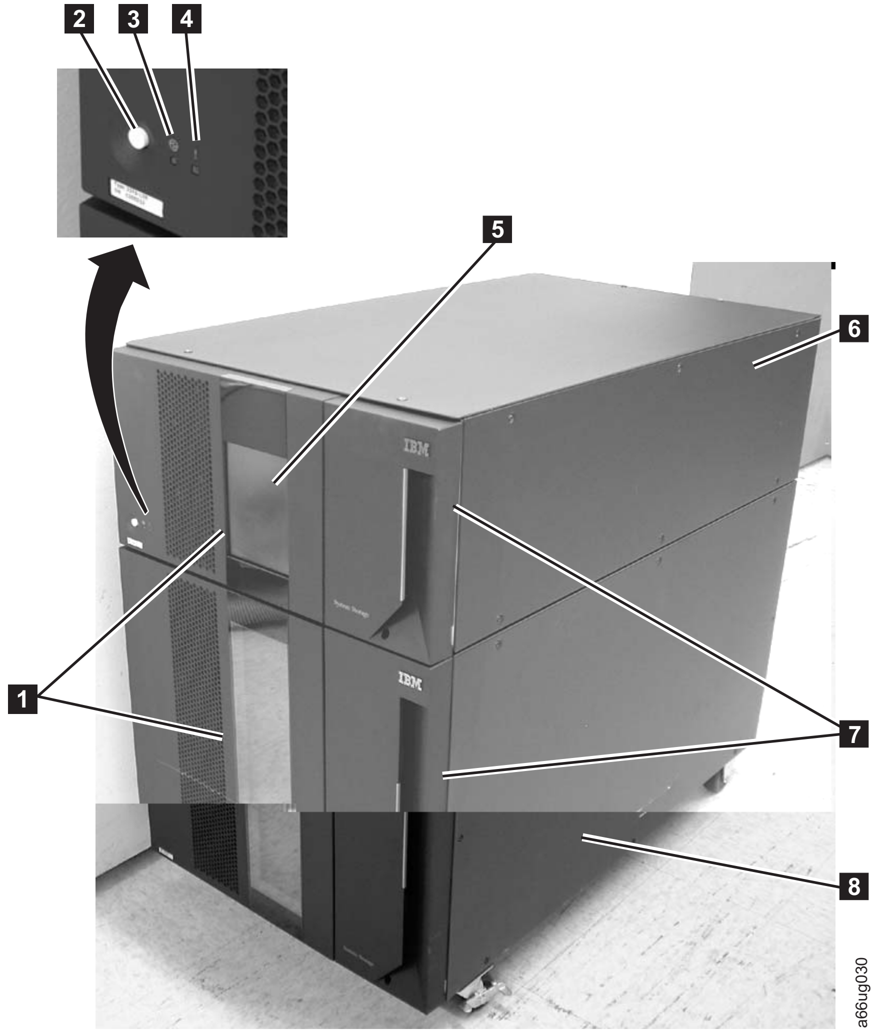


Figure 2-1. Front panel of a 14U library

1	Access doors	5	Operator Panel
2	Power button	6	5U control module
3	Green power ON LED	7	I/O Stations
4	Amber Operator Intervention Alert LED	8	9U expansion module

Control Module (3576 Model L5B)

All library configurations include the control module (6 in Figure 2-1). The control module contains the robotics, library control blade (LCB), and touch screen display. The control module also contains an I/O station, fixed storage slots, tape drives, and at least one power supply.

The control module can contain one or two tape drives and one or two power supplies. At least one power supply is always required.

Expansion Module (3576 Model E9U)

Each 9U expansion module (**8** in Figure 2-1 on page 2-2) is a supplementary module that is attached to the 5U Control Module. Like the control module, the expansion modules provide fixed storage slots, tape drive slots, and power supply slots. The I/O station in an expansion module can be configured as storage.

If an expansion module contains only cartridges (no drives), all power is derived from the control module.

I/O Station

I/O Stations (7 in Figure 2-1 on page 2-2) are located on the front panel of the library and enable the importing and exporting of cartridges without interrupting normal library operations. A control module I/O Station has a capacity of six cartridges. A 9U expansion module I/O Station has a capacity of 12 cartridges.

Note:
This library reads bar code labels to identify the specific cartridges in each slot. Ensure that all cartridges placed in the library have appropriate bar code labels.

When an I/O Station slot is assigned to a logical library, only that logical library can access that slot. The I/O Station is shared among all logical libraries, but the I/O Station slots are owned by one logical library at a time.

In a 5U library, the six I/O Station slots cannot be configured as storage. In a library that has expansion modules, the I/O Stations can be configured as follows:

Table 2-1. Library I/O Station configurations

Number of Expansion Modules	Number of License Keys	I/O slots in expansion modules	I/O slots in control module	Total number of I/O Station Slots
0	0	0	6	6
1	0	12	0	12
1	1	12	6	18
2	1	24	0	24
2	2	24	6	30
3	2	36	0	36
3	3	36	6	42
4	3	48	0	48
4	4	48	6	54

Note: I/O slots can be reassigned each time the I/O Station is opened by rearranging the order of the cartridges in the I/O Station.

Access Door

Each control module and expansion module has a door on the front panel that allows access to the internal components of the library.

This door is locked by the I/O Station. To open the Access Door (**1** in Figure 2-1 on page 2-2), you must first open the I/O Station.

If you want to restrict access to the library, lock the I/O Station door. To do this:

From the Operator Panel: **Operations** → **Lock I/O Station** → **Lock/Unlock**

From the Web User Interface: **Manage Cartridges** → **Lock/Unlock I/O Station Doors**

Attention: When any Access Door is opened, all in-progress motion commands stop, the Picker lowers to the bottom of the library, and the library is taken offline. When this happens, the library must be put back online manually. (see “Taking the Library Online” on page 7-28). When the Access Door is closed, the library returns any media in the Picker to its original storage slot.

Operator Panel

The Operator Panel (5 in Figure 2-1 on page 2-2) is the touchscreen display device located on the Access Door of the control module. Library operations and service functions are performed from this screen.

The Web User Interface offers some of the same functionality as the Operator Panel via a web browser which enables remote access to the library. For more information on the Operator Panel and the Web User Interface, see “User Interfaces” on page 4-1.

Power Button

Pressing the Power Button (2 in Figure 2-1 on page 2-2) on the front panel of a control module turns the Picker and Operator Panel ON or OFF; however, power is still applied to the power supplies. The Power Button is used during library shutdown and to manually reboot the library.

Front Panel LEDs

Two LEDs are located on the front of the library to the right of the Power Button.

- Green power ON LED (3 in Figure 2-1 on page 2-2): When lit, this LED indicates that the library power is ON.
- Amber Operator Intervention Alert LED (4 in Figure 2-1 on page 2-2): When lit, this LED indicates that there is a Library, Drives, or Media Operator Intervention available. To access the Operator Intervention, select **Tools** → **Operator Intervention** from the Operator Panel.

Rear Panel Components

The following components are located on the rear panel of the library:

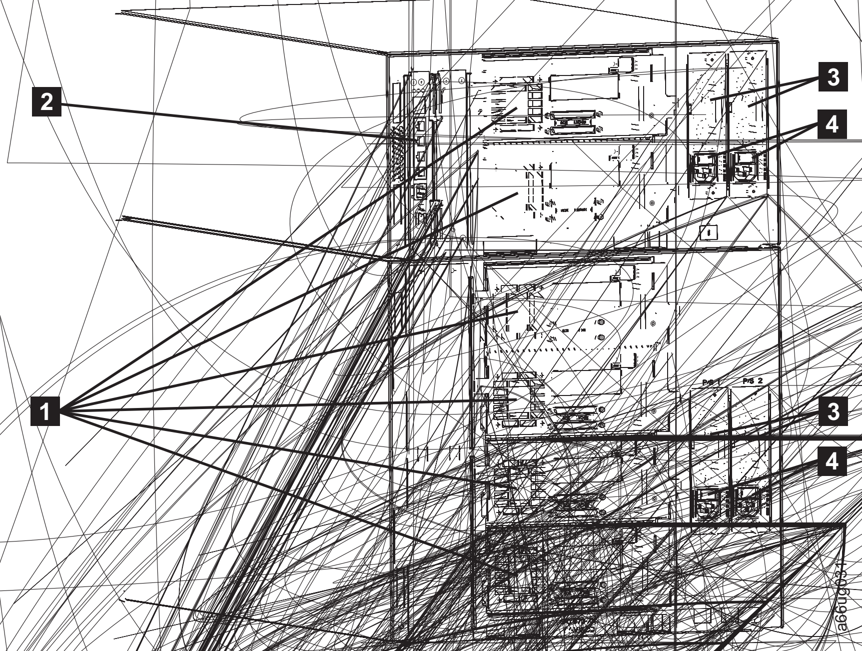


Figure 2-2. Rear panel of a 14U library

1	Tape drives (SCSI drives shown)	3	Power supplies (2 in control module; 2 in expansion module)
2	Library Control Blade	4	Power supply switches

Library Control Blade (LCB)

The Library Control Blade (2 in Figure 2-2) manages the entire library, including the Operator Panel and Picker, and is responsible for running system tests to ensure that the library is functioning properly.

The LCB houses the Compact Flash Card which stores vital product data (VPD) such as library settings, serial number, etc.

The LCB indicates status with three light emitting diodes (LEDs). These LEDs, located near the top of the LCB, are green, amber, and blue in color.

- Green indicates a good status.
- Amber indicates a degraded status.
- Blue indicates a potential fault. See "Interpreting LEDs" on page 7-8.

Tape Drives

The library supports Ultrium SCSI, Serial Attached SCSI (SAS), and Fibre Channel tape drives.

Tape drives (**1** in Figure 2-2 on page 2-5) are hot addable (library power remains ON and operations of the installed tape drives are still active). Drives can be removed and installed without tools.

SCSI tape drives are attached directly to a host. Fibre Channel tape drives can be directly attached to a host or a Storage Area Network (SAN). Each SAS link is point-to-point so a maximum of 2 hosts could share a dual-port SAS tape drive.

Drives mounted in sleds are installed into tape drive slots in the rear of the library. If a tape drive slot is empty, a metal plate covers the empty drive slot. This metal plate serves as a safety cover, provides electrical termination for drive circuits, and prevents debris from entering the library.

Power Supply

The library supports single and redundant power configurations. Each control module must have at least one power supply. A single power configuration will have a power supply installed in the left slot of each library module as viewed from the rear. A redundant power configuration will have power supplies installed in both slots of each library module.

The single configuration has a single AC line input and a single DC power supply. The optional redundant configuration has dual AC line input and dual DC power supplies. A power supply (**3** in Figure 2-2 on page 2-5) can be hot swapped if the library has a redundant power supply. A redundant power supply can be hot added.

A power switch (**4** in Figure 2-2 on page 2-5) is located on every power supply. This switch is used to remove all power from the library for emergency and service situations. Except in emergency situations, use the shutdown procedure before switching OFF the power switch. For more information, see “Shutting Down the Library” on page 7-28.

The power system of the library contains the following components:
- Power supply
- AC power cord

The power supply has three light emitting diodes (LEDs) that provide status information. These LEDs, located to the right of the power switch, are green, amber, and blue in color.
- Green indicates a good AC or DC status.
- Amber indicates a degraded status.
- Blue indicates a potential fault. See “Interpreting LEDs” on page 7-8.

Interior Components

The following components are located inside the library:
- “Storage Columns” on page 2-7
- “Robotic System” on page 2-7

Storage Columns

Storage columns within the library store reads each cartridge bar code label and the fiducial labels that identify the types of cartridge magazines and tape drives installed in the library.

Optional Features

The table below lists additional features that can be added to the library to enhance performance.

Table 2-2. Optional features

Type of Feature	Description	Feature Code
Ultrium 4 Tape Drive	3 Gb SAS interface	8139
	4 Gb Fibre Channel interface	8142
Ultrium 3 Tape Drive	SCSI interface	8037
	4 Gb Fibre Channel interface	8042
Power Supply	Redundant	1900
Feature Licenses	Capacity Expansion	1640
	Path Failover	1682
	Transparent LTO encryption	5900
Library and Drive Code Update	Library and drive code update by an IBM Service Representative	0500
Rack Mount Kit	Hardware required to mount your library in a31	

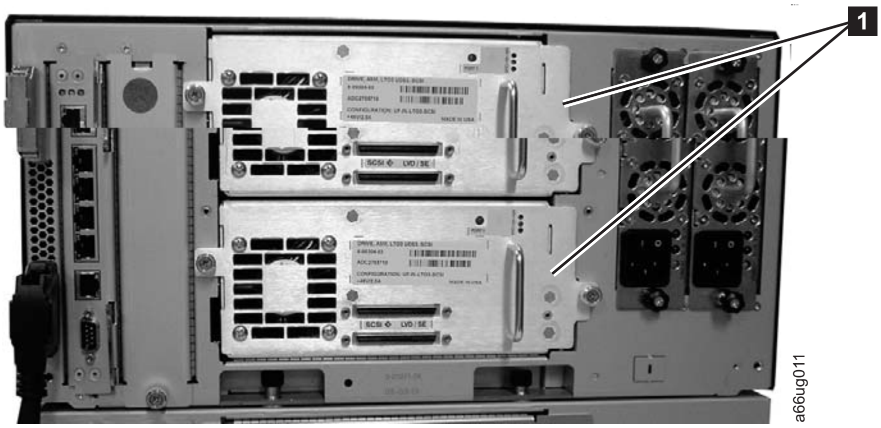


Figure 2-5. SCSI Ultrium Tape Drives in the library control module

Note: SCSI, SAS, and Fibre Channel drives are allowed in the same physical and logical libraries. However, you should ensure that the host application will support a mix of interface drive types.

Speed Matching

To improve system performance, this 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 drives customizes each read/write data channel for optimum performance. The customization enables compensation for variations in the recording channel transfer function, media characteristics, and read/write head characteristics.

Power Management

The 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.

Redundant Power Supply (Feature Code 1900)

The optional redundant configuration power supplies may be hot swapped without interrupting library operation. Each supply in a control module and expansion module includes its own input AC line cord. During redundant operation, each supply carries one-half the power load. If a line cord or power supply fails, the second supply sources the complete power load. Optionally, a single power supply and line cord may be installed if redundant power is not required. The second power supply slot is physically covered in this configuration. The library may be upgraded to redundant power at a later time.

Feature Licenses

A feature license controls the setting of feature-enabled flags that are based on a user input key and the library serial number that is stored in the library vital product data (VPD). A unique key exists for each library based on an encryption of the chassis serial number and a feature code.

After a feature is enabled, it cannot be disabled. The library's serial number can only be assigned at the factory.

The library uses feature licenses to enable the Capacity Expansion, Path Failover, and Transparent LTO Encryption features.

Capacity Expansion (Feature Code 1640)

At any time, the Capacity Expansion feature (Feature Code 1640) allows you to enable the unused storage slots within a library via a firmware license key.

The TS3310 Tape Library Model L5B control module includes license key enablement for 82 total cartridges, thus enabling all cartridge slots in the control module and approximately one half the capacity of an added expansion module. To enable the remaining cartridge storage slots, you must purchase Capacity Expansion feature #1640 for each expansion module you want to fully enable. For example, one Capacity Expansion feature #1640 would be required to totally access and enable all available cartridge slots in a 14U configured library (one control module and one expansion module). Two Capacity Expansion features #1640 would be required to totally access and enable all available cartridge slots in a 23U configured library (one control module and two expansion modules).

To see your library's current configuration:

- From the Operator Panel: view the **Capacity View** home screen.
- From the Web User Interface: **Monitor System** → **System Summary**

To enter a Capacity Expansion license key:

From the Operator Panel: **Setup** → **License**

When the license key is entered, the total number of available slots in the library increases. To verify that the number of slots did increase:

- From the Operator Panel, view the Capacity View home screen.
- From the Web User Interface: **Monitor System** → **System Summary**

Table 2-3. Licensable cartridge slots (storage and I/O) per model

Library Configuration	Number of Available I/O Station Slots*	Number of Accessible Storage Slots	Total Slots**	Capacity Expansion License Keys
5U library (control module)	6	30	36	no license key required
14U library (control module + 9U expansion module)	6/12/18	76/70/ 64	82	no license key
	6/12/18	122/116/110	128	1 license key required to enable the full capacity of a 14U library

Table 2-3. Licensable cartridge slots (storage and I/O) per model (continued)

Library Configuration	**Number of Available I/O Station Slots***	**Number of Accessible Storage Slots**	**Total Slots****	**Capacity Expansion License Keys**
23U library (control module + 2 9U expansion modules)	6/12/18/ 24/30	122/116/110/ 104/98	128	no license key
	6/12/18/ 24/30	168/162/156/ 150/144	174	each license key enables full capacity of one 9U expansion module
	6/12/18/ 24/30	212/206/200/ 194/188	218	2 license keys required to enable the full capacity of a 23U library
32U library (control module + 3 9U expansion modules)	6/12/18/24/ 30/36/42	168/162/156/150 144/138/132	174	no license key
	6/12/18/24/ 30/36/42	212/206/200/194 188/182/176	218	each license key enables full capacity of one 9U expansion module
	6/12/18/24/ 30/36/42	260/254/248/242 236/230/124	266	2 license keys enable an additional 46 slots on each of two 9U expansion modules
	6/12/18/24/ 30/36/42	304/298/292/286 280/274/268	310	3 license keys required to enable the full capacity of a 32U library

Table 2-3. Licensable cartridge slots (storage and I/O) per model (continued)

Library Configuration	Number of Available I/O Station Slots*	Number of Accessible Storage Slots	Total Slots**	Capacity Expansion License Keys
41U library (control module + 4 9U expansion modules)	6/12/18/24/ 30/36/ 42/48/54	212/206/200/194 188/182/176/ 170/164	218	no license key
	6/12/18/24/ 30/36/ 42/48/54	260/254/248/242 236/230/224/ 218/212	266	each license key enables full capacity of one 9U expansion module
	6/12/18/24/ 30/36/ 42/48/54	304/298/292/286 280/274/268/ 262/256	310	2 license keys enable an additional 46 slots on each of two 9U expansion modules
	6/12/18/24/ 30/36/ 42/48/54	352/346/340/334 328/322/316/ 310/304	358	3 license keys enable an additional 46 slots on each of three 9U expansion modules
	6/12/18/24/ 30/36/ 42/48/54	396/390/384/378 372/366/360/ 354/348	402	4 license keys required to enable the full capacity of a 41U library

*The I/O station in the 9U expansion module, contains 12 slots which can be configured as either I/O or storage slots. If the 9U expansion module I/O slots are configured as I/O, the control module slots can be configured as storage slots.

**The number of available I/O and storage slots listed in the table above are adjusted for the unusable slots in each configuration that are not accessible due to space restrictions which limit the movement of the Picker.

Path Failover (Feature Code 1682)

The Path Failover feature includes license keys for activating control path failover and data path failover. Path Failover is a combination of two previous features: Control Path Failover (key entered at the library user interface) and Data Path Failover (key entered at the device driver interface). A single activation key entered at the library user interface now activates both features unless the LTO-3 drive firmware level is equal to or lower than 69U2 and/or the library firmware is equal to or lower than 1.95. For either or both of these two cases, the device driver interface Data Path Failover key activation will still be required. The Path Failover feature is available on select drives.

Control Path Failover

A control path is a logical path into the library through which a server sends standard SCSI Medium Changer commands to control the logical library. Additional control paths reduce the possibility that failure in one control path will cause the entire library to be unavailable. Use of the control path failover feature further reduces that possibility.

Data Path Failover

Data Path Failover is designed to provide a failover mechanism in the IBM device driver, which enables you to configure multiple redundant paths in a SAN environment. In the event of a path or component failure, the failover mechanism is designed to automatically provide error recovery to retry the current operation using an alternate, pre-configured path without aborting the current job in progress. This allows you flexibility in SAN configuration, availability, and management.

Encryption

The TS3310 library supports host encryption on LTO Ultrium 4 Fibre Channel and SAS drives using LTO Ultrium 4 data cartridges. The drives support three configurations for establishing encryption policy and providing encryption keys to the drive:

- Application Managed Encryption (AME). Encryption policies and keys are established and provided by the host application. This is a standard feature for all Ultrium 4 drives in the TS3310 library.
- System Managed Encryption (SME). This encryption configuration is transparent to the host application. SME policies are established by an IBM device driver, which may also be used as a proxy between a key server and the drive for providing encryption keys to the drive. SME requires the transparent LTO Encryption license key (Feature Code 5900).
- Library Managed Encryption (LME). This encryption configuration is transparent to the host application. SME policies are established by the library, which may also be used as a proxy between a key server and the drive for providing encryption keys to the drive. LME requires the transparent LTO Encryption license key (Feature Code 5900).

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

Library & Drive Code Update (Feature Code 0500)

Order feature code 0500, Library and Drive Code Update, if you would like an IBM Service Representative dispatched to your location to update your library and drive firmware.

Location Coordinates

A numbering system is used to identify components of the library. The library location coordinates contain the following digits: [Module],[Column],[Slot]. The figure below illustrates how a library with a control module and an expansion module are numbered.

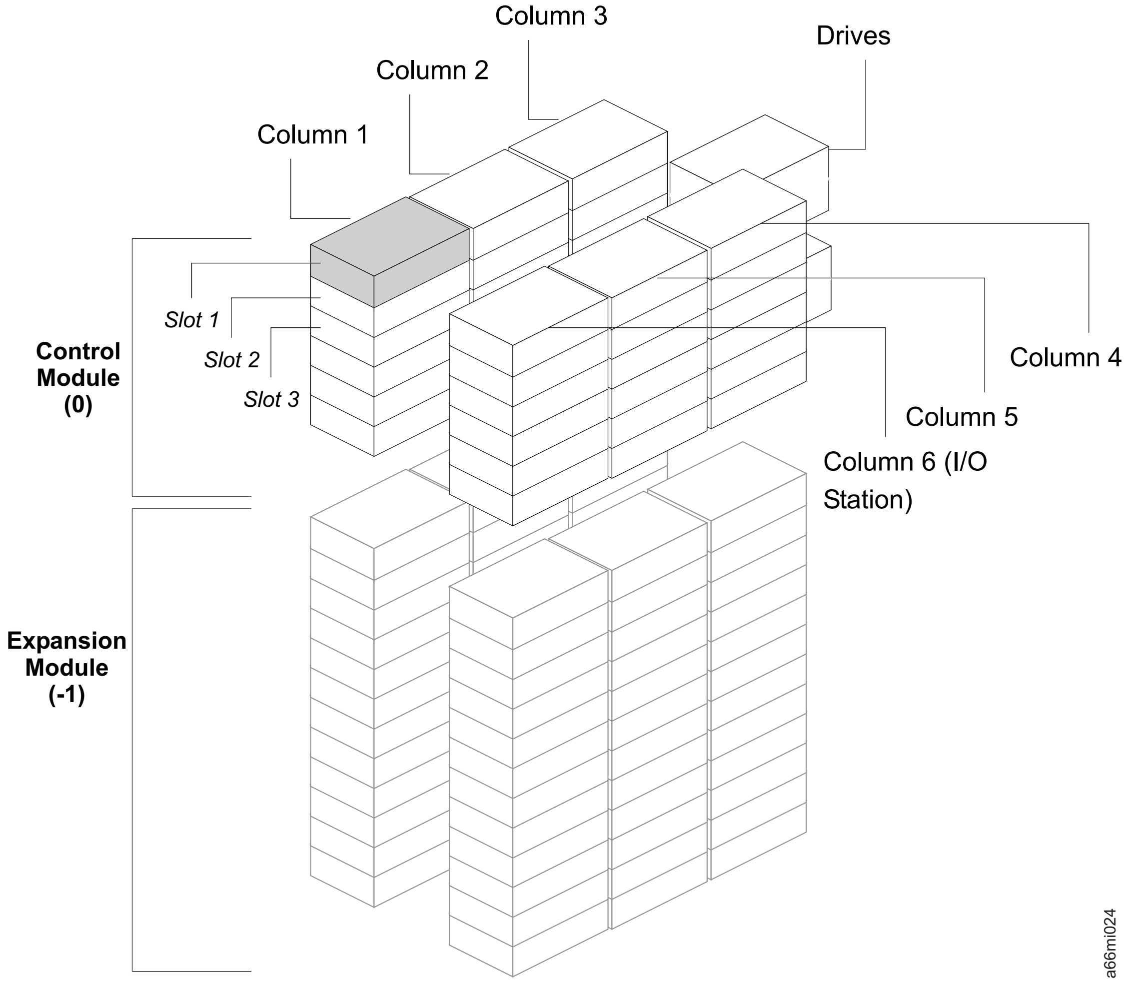


Figure 2-6. Library Location Coordinates

The module digit uses a zero-based numbering system. The control module is labeled as `0` (zero). The front, left-most column in the module is labeled 1. The top slot in each column is labeled 1. For more information, refer to the sections that follow.

Modules

Library modules are represented by the first digit of a library coordinate. Modules are identified relative to the control module (CM). The CM is number `0`. The module stacked below the CM is numbered with a negative integer depending on its relative position to the CM. The expansion module directly below the CM is number `-1`. If there is an expansion module installed about the CM, it will be numbered +1.

Columns

A storage column is a group of slots arranged vertically in the library. Columns are represented by the second digit of a library coordinate. Columns are identified relative to the front left of the library. The column in the front left of the library is number 1. The column numbering continues around the library in a clockwise direction. The I/O Station column is always number `6`.

Slots

Fixed storage slots are represented by the third digit of the library location coordinate. Slots are numbered from top to bottom within each column starting with 1 at the top of the column.

Drives

Drives are addressed by module and drive bay within a module. The drive bays within a module are numbered from top to bottom. A one-based numbering system is used. The top drive bay is drive bay 1. A full address of a drive is of the form [Module, Drive Bay], examples: [0,1], [-1,2].

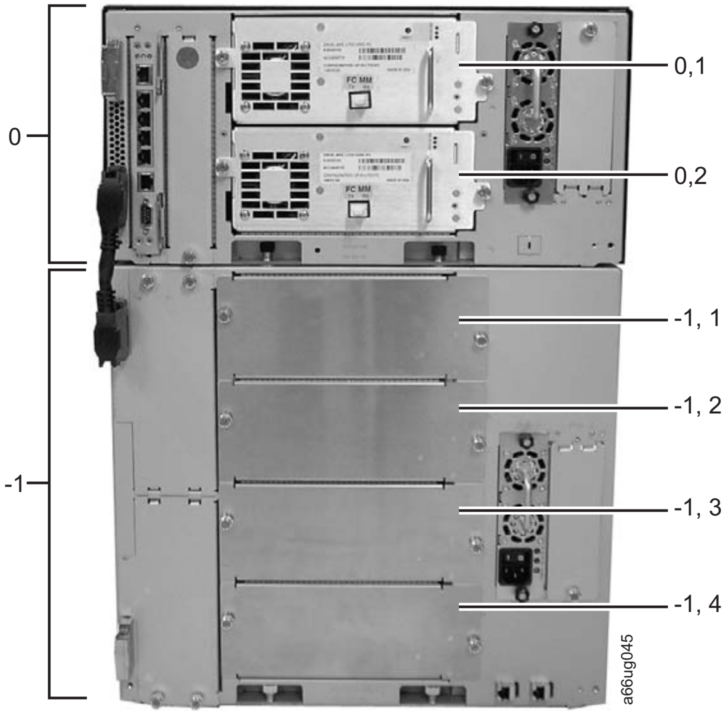


Figure 2-7. Drive location coordinates

Power Supplies

Power supplies are addressed as [Module, PS#], where PS# is 1 for the left supply and 2 for the right, as viewed from the rear of the library.

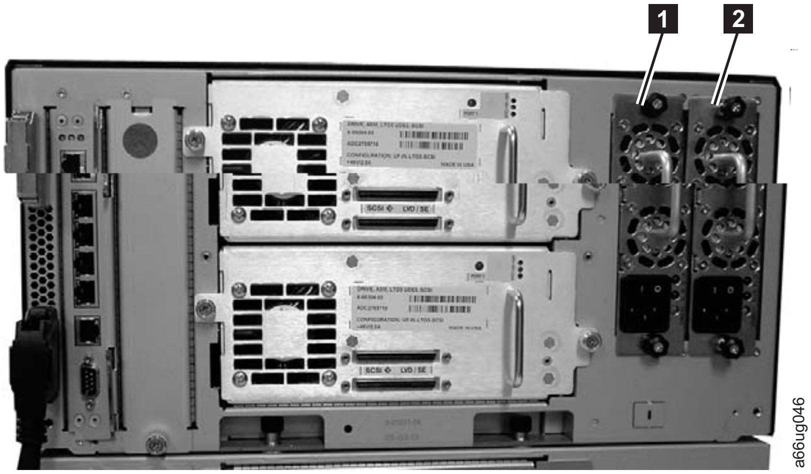


Figure 2-8. Power supply location coordinates

1	0, 1 (PS1 primary power supply in a control module)	**2**	0, 2 (PS2 redundant power supply in a control module)

Data Cartridges

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

- The Ultrium 4 Data Cartridge is green
- The Ultrium 3 Data Cartridge is slate blue
- The Ultrium 2 Data Cartridge is purple
- The Ultrium 1 Data Cartridge is black

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

The native data capacity of Ultrium data cartridges is as follows:

- The Ultrium 4 cartridge has a native data capacity of 800 GB (1600 GB at 2:1 compression)
- The Ultrium 3 cartridge has a native data capacity of 400 GB (800 GB at 2:1 compression).
- The Ultrium 2 cartridge has a native data capacity of 200 GB (400 GB at 2:1 compression).
- The Ultrium 1 cartridge has a native data capacity of 100 GB (200 GB at 2:1 compression).

When processing tape in the cartridges, Ultrium Tape Drives use a linear, serpentine recording format.

- The Ultrium 4 drive reads and writes data on 896 tracks, sixteen tracks at a time.
- The Ultrium 3 drive reads and writes data on 704 tracks, sixteen tracks at a time.
- The Ultrium 2 drive reads and writes data on 512 tracks, eight tracks at a time.
- The Ultrium 1 drive reads and writes data on 384 tracks, eight tracks at a time.

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

Figure 2-9 shows the IBM TotalStorage® LTO Ultrium 800 GB Data Cartridge and its components. All LTO family data cartridges are similar.

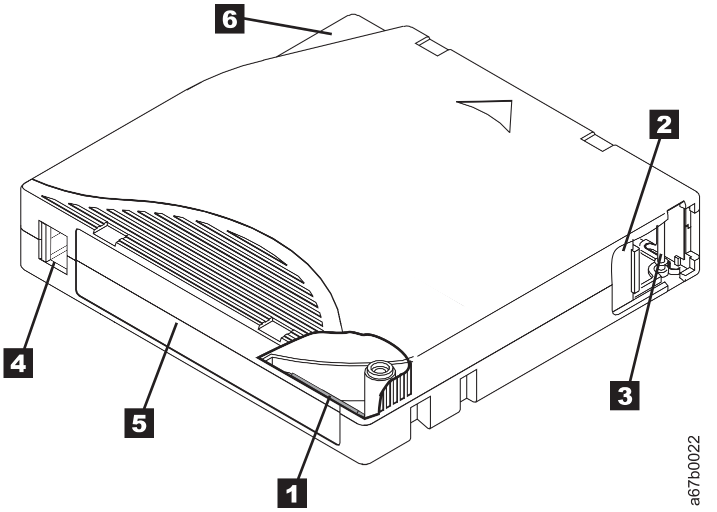


Figure 2-9. Ultrium Cartridge

1	Linear Tape-Open Cartridge Memory (LTO-CM) chip	**4**	Write-protect switch
2	Cartridge door	**5**	Label area
3	Leader pin	**6**	Insertion guide

All generations of the IBM LTO Ultrium Data Cartridge contain a Linear Tape-Open Cartridge Memory (LTO-CM) chip in the cartridge (**1** in Figure 2-9). The cartridge memory chip contains information about the cartridge and the tape, such as the name of the manufacturer that created the tape, and statistical performance and usage information (such as number of loads/unloads). The CM reader uses a radio-frequency interface to read this information when the cartridge is loaded into the drive. The cartridge statistics are updated just before the cartridge is unloaded.

The cartridge door (**2** in Figure 2-9) 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 2-9). 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 2-9) prevents data from being written to the tape cartridge. .

The label area (**5** in Figure 2-9) provides a location to place a label. .

The insertion guide (**6** in Figure 2-9) is a large, notched area that prevents the cartridge from being inserted incorrectly.

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

Environmental and Shipping Specifications for Tape Cartridges

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

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

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

The following table gives the environment for operating, storing, and shipping LTO Ultrium Tape Cartridges.

Table 2-4. Environment for operating, storing, and shipping the LTO Ultrium Tape Cartridge

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

Note:

1. The short term or operational storage environment is for storage durations of up to six months.
2. The long term or archival storage environment is for durations of six months up to ten years.

Multi-Path Architecture

Storage Area Network (SAN)-ready Multi-Path Architecture allows homogeneous or heterogeneous open systems applications to share the library's robotics without middleware or a dedicated server (host) acting as a library manager. The Multi-Path Architecture is compliant with the following attachment interfaces:

- SCSI
- Fibre Channel
- SAS (Serial Attached SCSI)

The library is certified for SAN solutions (such as LAN-free backup). LAN-free drive sharing is not available on SAS drives.

Multi-Path Architecture allows additional control paths and data paths to be configured for any one logical library.

Using Multiple Control Paths

The lowest physical drive in a logical library is automatically set as the control path drive for that logical library. Each drive in a logical library can be a control path drive.

Command failures and time-outs are costly. Customers want their libraries 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 send the same command to an alternate control path. 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, HP-UX, Linux, Solaris, and Windows hosts are currently supported for this feature.

The control path failover feature is activated by entering a license key into the library. To order the feature, call an IBM Sales Representative.

For more information on control paths, refer to the *Setup and Operator Guide* for this library.

Using Multiple Data Paths for Data Path Failover

The Path Failover feature (Feature Code 1682) includes the Control Path Failover function and the Data Path Failover function.

Data Path Failover and Load Balancing functions exclusively support native Fibre Channel Tape Drives in the library using the IBM device driver for AIX and Linux. Data Path Failover is designed to provide a failover mechanism in the IBM device driver, which enable multiple redundant paths to be configured in a SAN environment. In the event of a path or component failure, the failover mechanism is designed to automatically provide error recovery to retry the current operation using an alternate, pre-configured path without aborting the current job in progress. This allows flexibility in SAN configuration, availability, and management.

When accessing a tape drive device that has been configured with alternate paths across multiple host ports, the IBM device driver automatically selects a path through the host bus adapter (HBA) that has the fewest open tape devices and assigns that path to the application. This autonomic self-optimizing capability is called Load Balancing. The dynamic load balancing support is designed to optimize resources for devices that have physical connections to multiple HBAs in the same machine. The device driver is designed to dynamically track the usage on each HBA as applications open and close devices, and balance the number of applications using each HBA in the machine. This may help optimize HBA resources and improve overall performance. Further, Data Path Failover provides autonomic self-healing capabilities similar to Control Path Failover, with transparent failover to an alternate data path in the event of a failure in the primary host-side path.

Data Path Failover is not available on HP-UX at this time.

The Data Path Failover and Control Path Failover features are activated by the Path Failover license key (Feature Code 1682). .

For additional information, refer to your device driver documentation.

Lightweight Directory Access Protocol (LDAP)

The library now supports the Lightweight Directory Access Protocol (LDAP). LDAP is the industry standard Internet protocol that provides centralized user account management. Enabling LDAP allows existing user accounts residing on an LDAP server to be integrated into the library's current user account management subsystem. User account information is centralized and shared by different applications, simplifying user account management tasks.

Administrative users can configure and enable LDAP. Once LDAP is enabled, users can log into the library using either LDAP or local authentication. To use LDAP authentication, a user must enter a directory service user name and password and specify an LDAP domain. To use local authentication, a user must enter only a local user name and password.

Administrative users can add, delete, and modify only local user account information. The library web client and operator panel do not allow you to create, modify, or delete user account information on an LDAP server. This must be done by the directory service provider. Refer to your server documentation for more information regarding LDAP user accounts.

LDAP server guidelines

The library supports the Microsoft® Active Directory® LDAP server. Windows® Services for Unix® 2.5 is required for this support. The library supports user account information in the schema defined by RFC 2307. User password schemes must be encrypted using UNIX crypt. In addition, User names (uid) and passwords (userPassword) must be created using lowercase characters to be compatible with the library. For LDAP users with user privileges, access to library logical libraries is determined by group assignment on the LDAP server. Groups must be created on the LDAP server with names that correspond to the library logical library names. Users with user privileges must be assigned to these groups on the LDAP server to have access to the corresponding logical libraries on the library. LDAP users with administrative privileges have access to all logical libraries and administrative functions and do not need to be assigned to logical library-related groups on the LDAP server.

Note:
When LDAP (Lightweight Directory Access Protocol) is enabled, the login screen gives the user a choice between using local authentication (the login and password are stored on the library) or LDAP authentication (the login and password are stored on a server, and the user must specify the LDAP domain name). If LDAP access is disabled, the LDAP options will not appear on the login screen.

Specifications

Table 2-5. Physical specifications for the library

Physical Specification	**Measurement**	
	5U control module	**9U expansion module**
Width	44.45 cm (17.5 in.)	44.45 cm (17.5 in.)
Depth	76.83 cm (30.25 in.)	76.83 cm (30.25 in.)
Height	21.87 cm (8.61 in.)	40.0 cm (15.75 in.)

Table 2-6. Library component weight

Component	Weight
Drive	4.082 kg (9.0 lbs.)
Power supply	1.814 kg (4.0 lbs.)
Robotics	2.041 kg (4.5 lbs.)
5U control module chassis (empty)	21.55 kg (47.5 lbs.)
9U expansion module chassis (empty)	29.48 kg (65.0 lbs.)

Table 2-7. Power specifications for a 5U Control Module and 9U Expansion Module

Power Specification	Measurement			
	5U control module		9U expansion module	
Voltage	100 to 127 Vac.	200-240 Vac.	100 to 127 Vac.	200-240 Vac.
Frequency	50 to 60 Hz	50 to 60 Hz	50 to 60 Hz	50 to 60 Hz
Current	2.0 A	1.0 A	2.0 A	1.0 A
Inrush current	50 A	100 A	50 A	100 A
Power	200 W	200 W	200 W	200 W
kVA	0.2	0.2	0.2	0.2
kBtu/hr	0.68	0.68	0.68	0.68

Table 2-8. Other specifications for the library

Specification	Measurement
Maximum altitude	2500 m (8202 ft) for operating and storage

Table 2-9. Environmental specifications for the library

Environmental Factor	Operating (see Note)	Storage	Shipping
Drive temperature	10 to 38°C (50 to 100°F)	10 to 43°C (50 to 109.4°F)	-40 to 60°C (-40 to 140°F)
Heat output	542 W (483 Cal/Hr)	Not applicable	Not applicable
Relative humidity	20 to 80%	10 to 90%	10 to 90%
Maximum wet bulb temperature	26°C (79°F) max.	27°C (80.6°F) max.	29°C (84.2°F) max.
Note: The operating environment of the library must not conflict with the media storage requirements (see the section about media storage requirements in the Setup and Operator Guide. The library may be capable of operating at elevated temperatures for an extended period of time, the temperature could shorten the useful life of media that is stored in the library. If media is stored in the library for more than 10 hours, the storage temperature requirements for media should be met. It should be assumed that media stored in the library will be 2 degrees above ambient temperature when the library is powered ON.			

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.

Maintenance Plan

The library consists of two hardware subsystems, the library and the tape drives. The tape drive is packaged in a common drive sled and each drive sled is a CRU. When a drive failure occurs, the drive sled is removed and returned to IBM for repair. The library maintenance package supports the library and the library interfaces with the tape drives.

Maintenance Start

Start all maintenance activity for the library using the information in “Start Service” on page 1-1. An error-to-action table is provided to quickly determine which procedure to use for the reported problem. You are also shown how to prepare the library for service. Subsystem problem determination information is included to help determine the failing components.

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

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/` in the following directories:

- AIX
- HP-UX
- LINUX
- Solaris
- Windows

Note: The device driver for the AS/400® server and System i™ server is included in the OS/400® operating system.

For more information about device drivers, refer to any of the preceding directories.

Library Components

Become familiar with each of these components and how they can be accessed for service.

14U Library, Front view, I/O Station Door Open

Figure 3-1. Front view of a 14U library with the I/O Station door open

Library Rear View

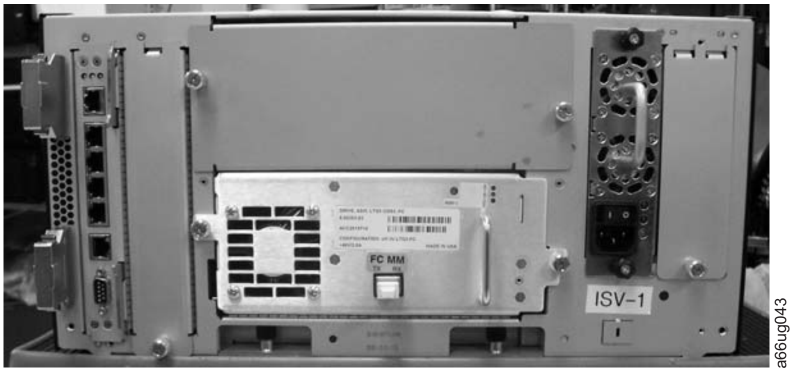


Figure 3-2. Rear view of a 5U library

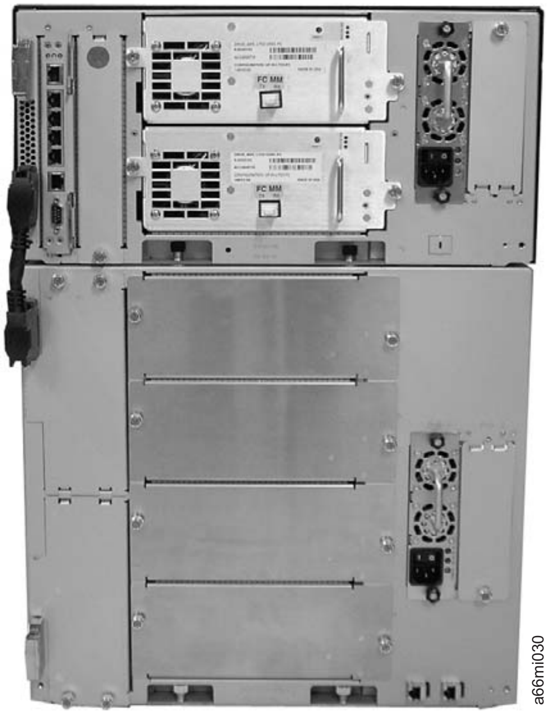


Figure 3-3. Rear view of a 14U library

I/O Station Lock Assembly

Figure 3-4. I/O Station Lock Assembly installed in the library

1	I/O Station Lock Assembly installed in the library

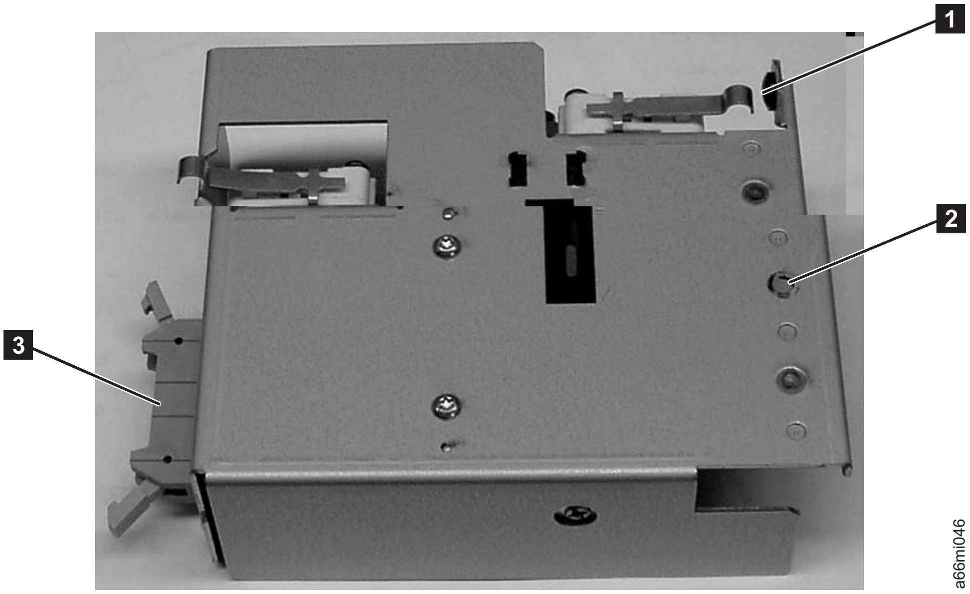


Figure 3-5. I/O Station Lock Assembly (top view)

1	Switch actuator lever
2	Mounting screw
3	I/O Station cable connector

I/O Station with Slide Assembly

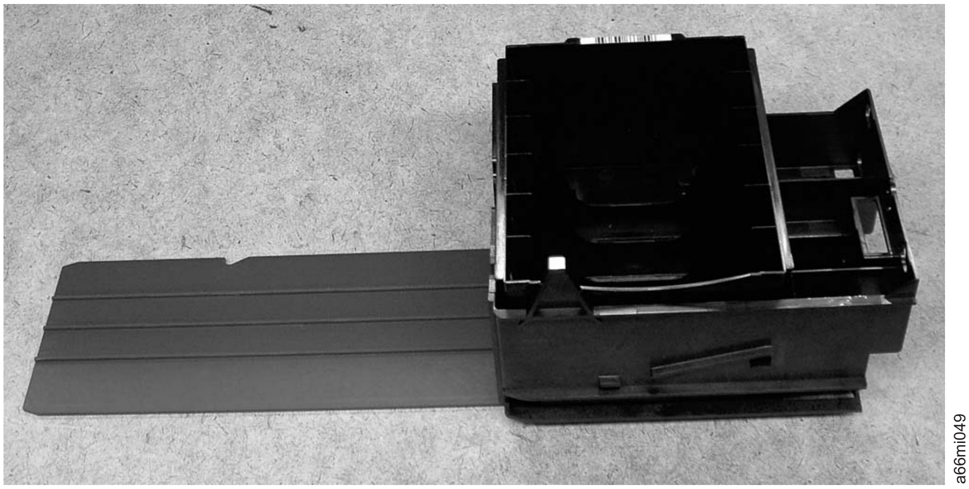


Figure 3-6. I/O Station with Slide Assembly

Access Door, Inside, With Operator Panel

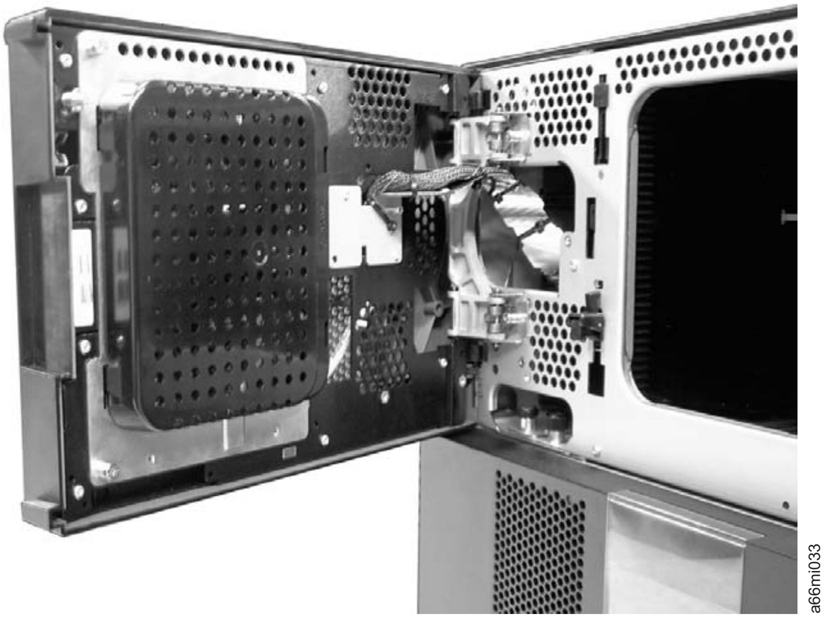


Figure 3-7. Access Door open showing back of Operator Panel

Gear Rack

Figure 3-8. Gear racks inside the library

1	Front gear rack	**2**	Rear gear rack

Y-Axis/Picker Assembly

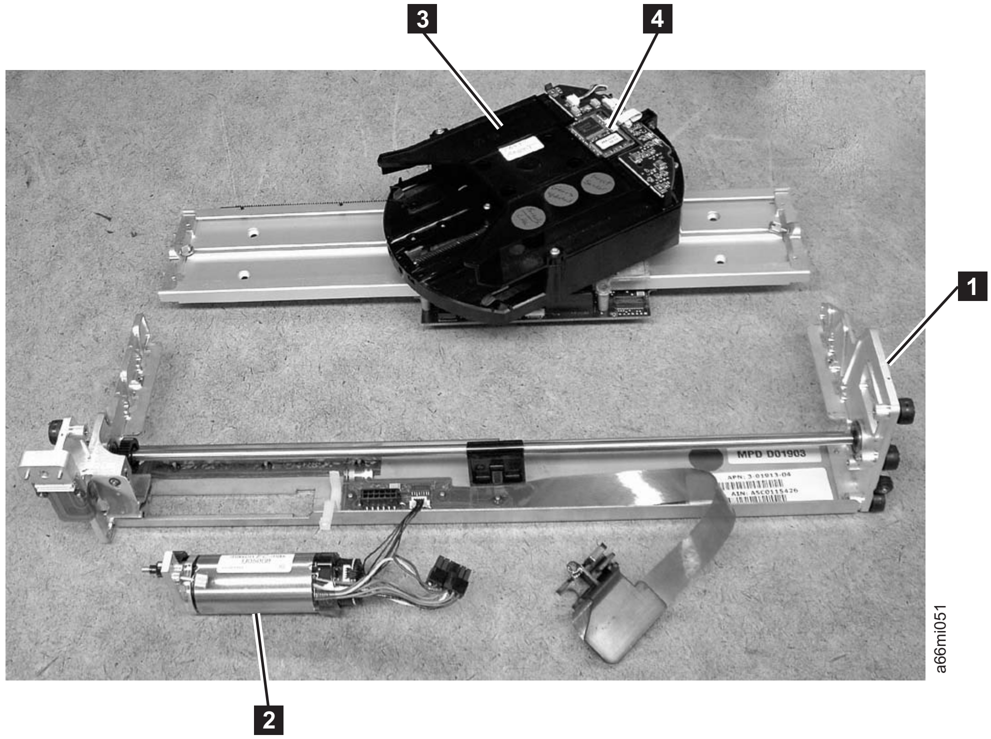


Figure 3-9. Y-axis/Picker Assembly

1	Y-axis Assembly	3	Picker
2	Y Motor	4	Bar Code Scanner

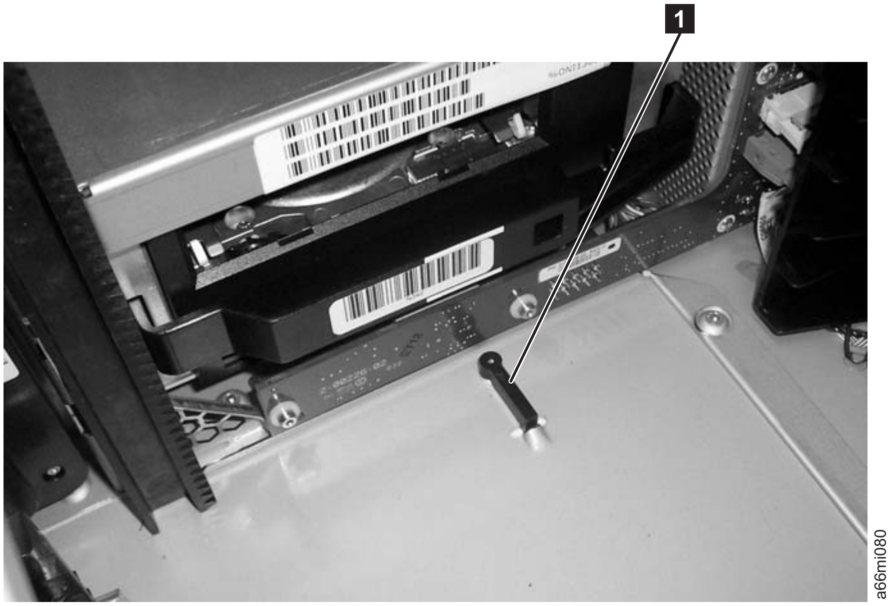


Figure 3-10. Y-axis/Picker Home Sensor Flag

1	Y-axis/Picker Home Sensor Flag

Cable Spool Assembly

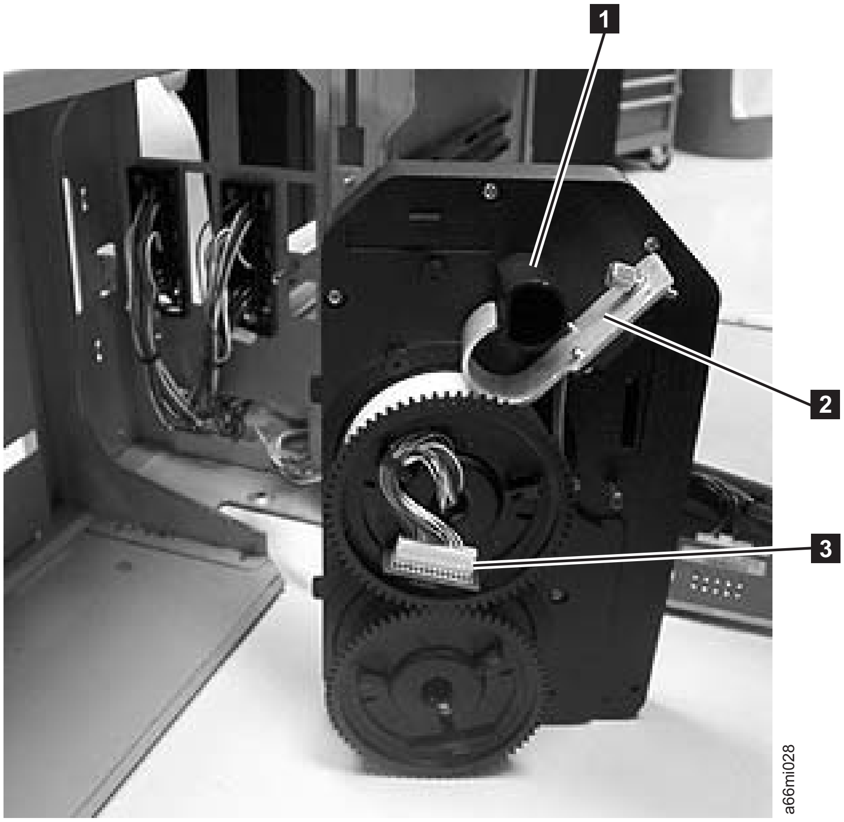


Figure 3-11. Cable spool assembly

1	Plastic guide peg	**2**	Spooler flat cable handle	**3**	Terminal Board

Library Control Blade (LCB)

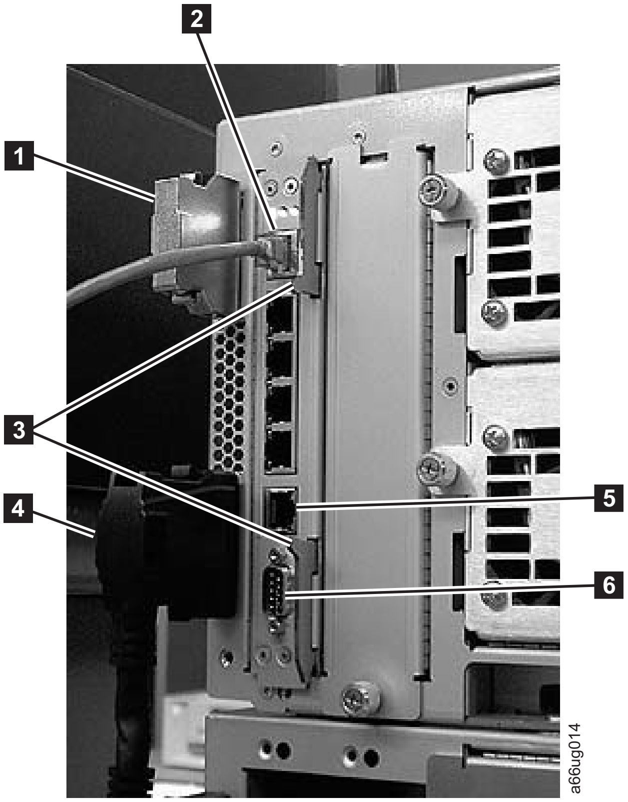


Figure 3-12. Library Control Blade (external library view)

1	Module-to-module terminator	4	Module-to-module cable
2	Ethernet cable	5	Ethernet port (for Service use)
3	Latches	6	Serial port (for Service use)

Compact Flash Card on LCB

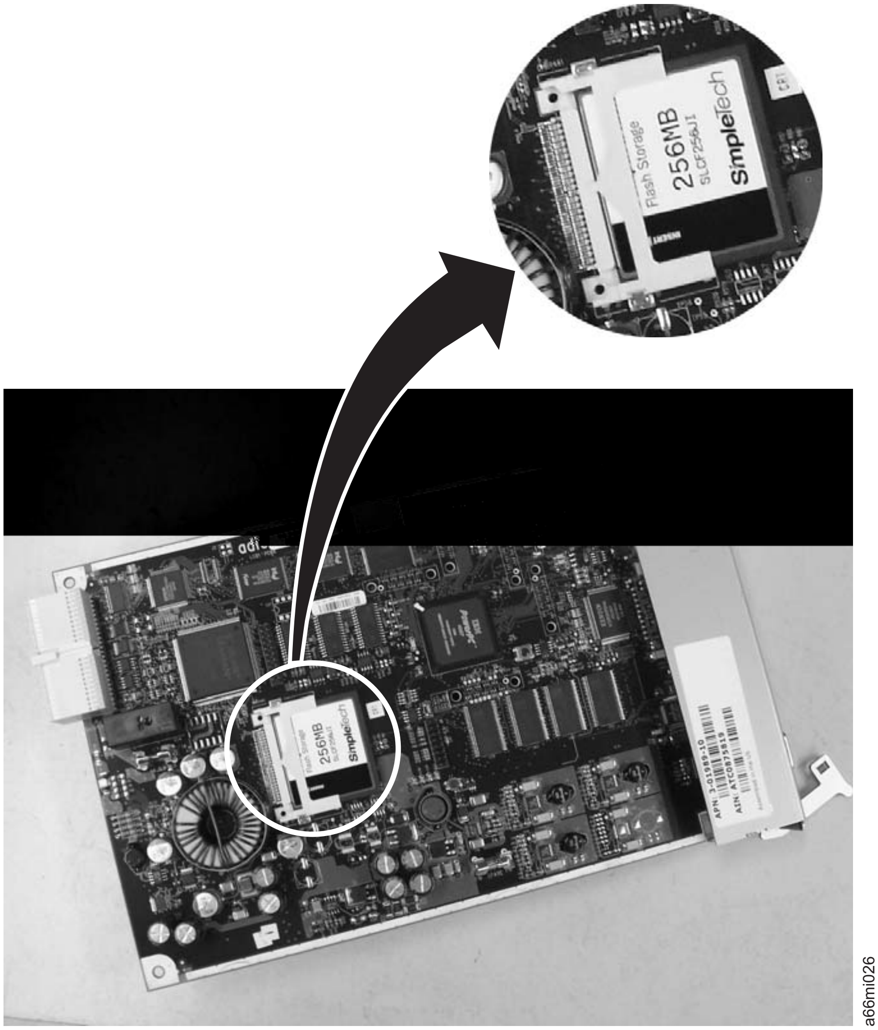


Figure 3-13. Library Control Blade and Compact Flash Card

Power Supply

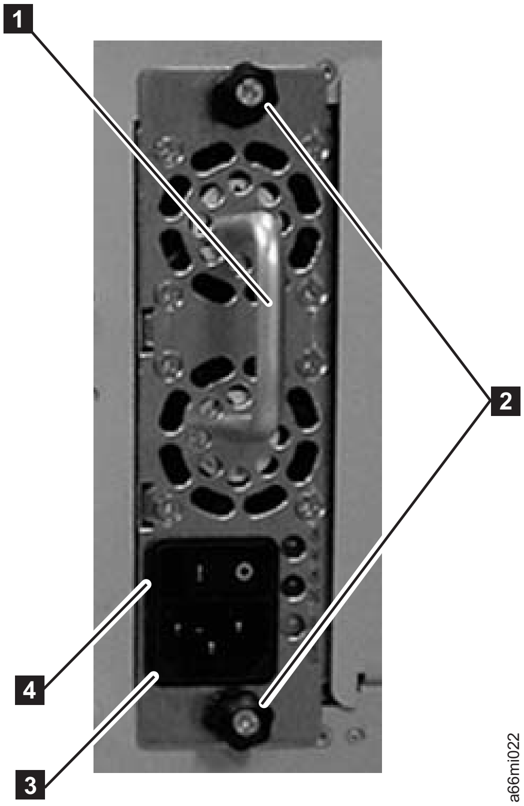


Figure 3-14. Power Supply

1	Handle	3	Power cable
2	Thumb screws	4	Power switch

Drive Sleds, Rear Panel

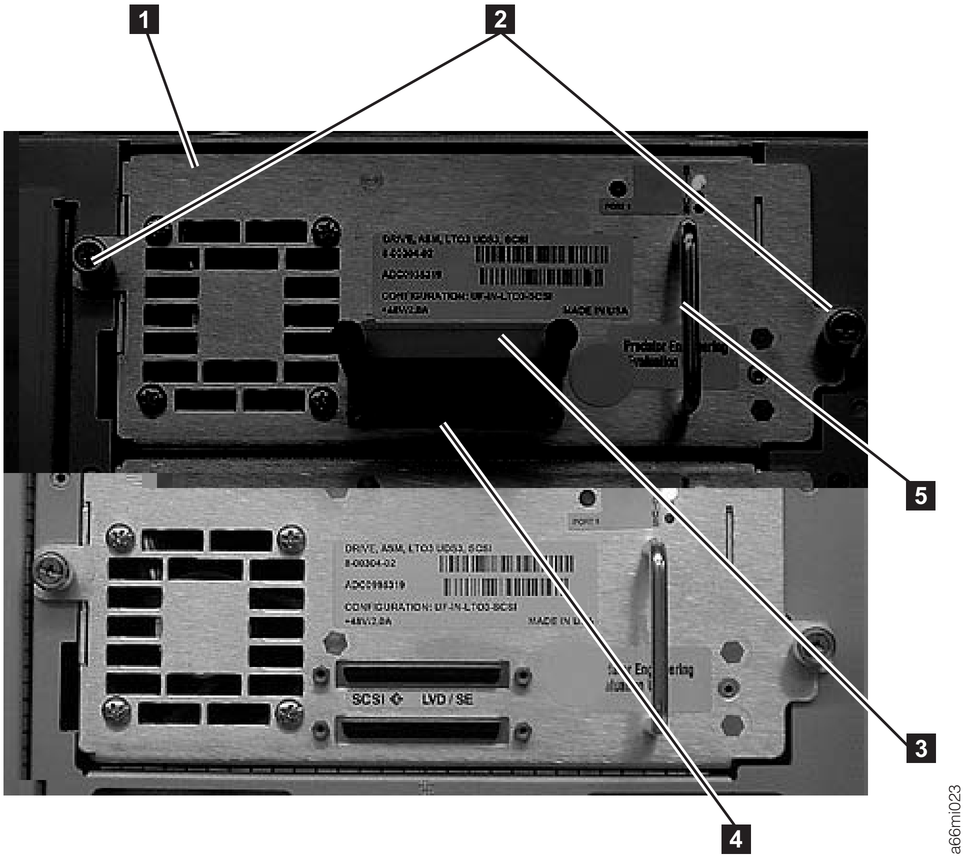


Figure 3-15. LTO 3 drive sleds

1	Tape drive sled	**4**	SCSI cable receptacle
2	Thumb screws	**5**	Handle
3	SCSI terminator		

Note: This library supports any combination of LTO 3 and LTO 4 drives.

User Interfaces

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

The Operator Panel is located on the front door of the control module (CM) and allows users to work locally on the library via the user interface. The Web UI allows users to view and perform some library functions from remote sites and is best viewed using Internet Explorer 5.0 or higher, or Firefox 1.0 or higher.

Operator Panel

The Operator Panel is physically attached to the front door of the control module (CM). The user interface appears on the touchscreen LCD display of the Operator Panel for executing basic library management functions. Audible feedback, such as "key click" sounds, are generated when a user touches a button on the touchscreen.

Login Screen

○ Local Authentication

● LDAP Authentication

abcco.city.ldap.com

Figure 4-1. Operator Panel Login screen

To fill in the **User name**, lightly touch the blank field to display the alphabetic and numeric touch pads then, use the touch keys to spell out the user ID and touch **OK**. Similarly, enter the **Password** and touch **OK**.

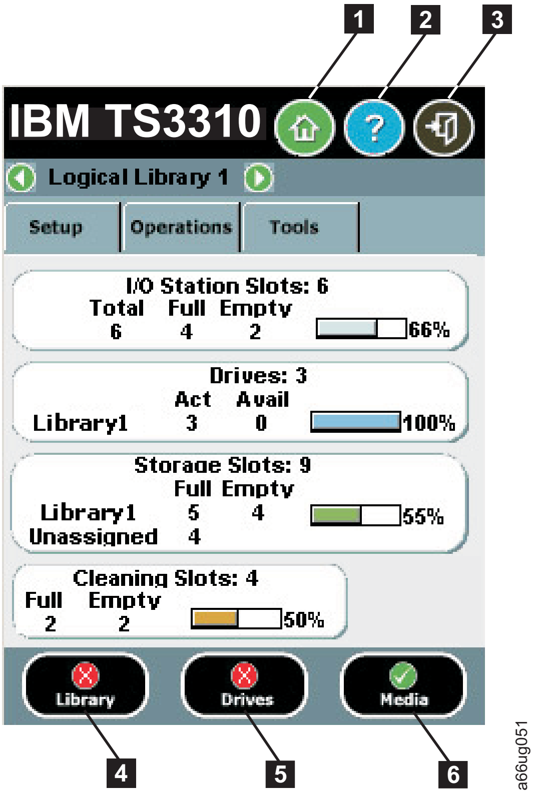
For initial login, the administrator should use the following:

- User name: **admin**
- Password: **secure**

Note:
When LDAP (Lightweight Directory Access Protocol) is enabled, the login screen gives the user a choice between using local authentication (the login and password are stored on the library) or LDAP authentication (the login and password are stored on a server, and the user must specify the LDAP domain name). If LDAP access is disabled, the LDAP options will not appear on the login screen.

After initial login, change the Administrator password. From the Operator Panel, select **Setup** → **Users** → **Modify**.

Common Operator Panel Elements



I/O Station Slots: 6
Total Full Empty
6 4 2 66%

Drives: 3
Act Avail
Library1 3 0 100%

Storage Slots: 9
Full Empty
Library1 5 4 55%
Unassigned 4

Cleaning Slots: 4
Full Empty
2 2 50%

Figure 4-2. Operator Panel common header elements and subsystem status buttons

Common Header Elements

All Operator Panel screens (except for the Login screen) contain the following common elements in the header:

- **Home** (**1** in Figure 4-2) - displays the default **Capacity View** screen.
- **Help** (**2** in Figure 4-2) - context-sensitive help for the associated page
- **Logout** (**3** in Figure 4-2) - ability to log out

- **Logical Library #** - Displays the designation for the current logical library. You can click the arrows on either side of the library designation to scroll through other available logical libraries.

Note: When the library is busy performing certain tasks, a ″Not Ready’ message will display alternately with the ’IBM TS3310’ notation at the top of the screen.

System Summary and Subsystem Status

The health of the library can be gauged by three subsystem status buttons located at the bottom of the home page. These buttons provide easy access to the health of the library for faster recovery if problems occur. You can select the buttons to view detailed information about the library and gain access to library subsystems. The three subsystems are:

- **Library** (4 in Figure 4-2 on page 4-2)- opens a library menu selection screen and then the operator interventions for the library.
- **Drives** (5 in Figure 4-2 on page 4-2)- opens the operator intervention screen for drives.
- **Media** (6 in Figure 4-2 on page 4-2)- opens the operator intervention screen for media.

Each button has three states indicated by color. The three states are:

- Good - green
- Degraded - yellow (An operator intervention has been created.)
- Investigate - red (An operator intervention has been created; however, the library may still be operational.)

Keyboards

When a user touches a text box requiring data entry, a keyboard screen appears. Either the alphabetic or numeric keyboard appears, depending on the type of input field. All alphabetic character entries are lower case. The text box appears at the top of the screen and the number/characters appear as they are entered. The **123** button opens the numeric keyboard from alphabetic keyboard, The **abc** button opens the alphabetic keyboard from the numeric keyboard. The back arrow erases one character at a time.

Attention: To use the touchscreen effectively, tap lightly to make your selections.

Home Page

The **Home Page** screen provides tabular data on the capacity of the various areas of the library. Use this screen to see a quick summary of the capacity of the selected logical library based on a

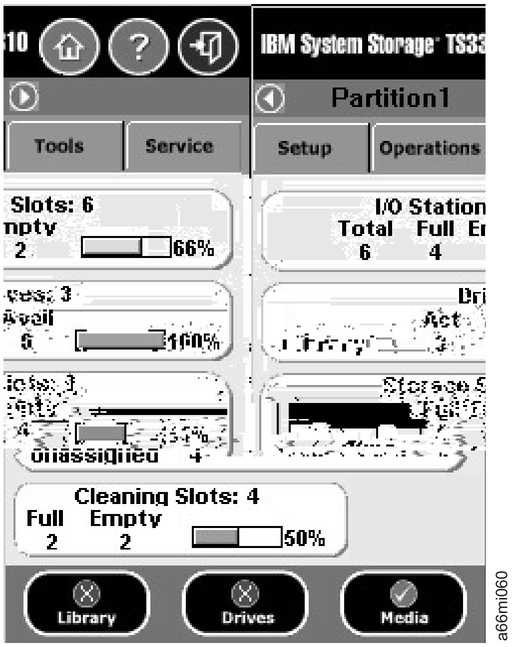


Figure 4-3. Home Screen Capacity View

If users have access to more than one logical library, they can navigate to other logical libraries using arrows next to the logical library name at the top of the screen.

If an administrative user is logged in, a view of the physical library appears.

If a user is logged in, the first logical library that they have access to, in alphabetical order, appears.

Menus Available from the Operator Panel

The following four menus organize commands into logical groups:

- The **Setup** menu consists of commands that you can use to set up and configure various aspects of the library, including logical libraries connectivity, network, physical library, users, date and time, licenses, and SNMP trap registration.

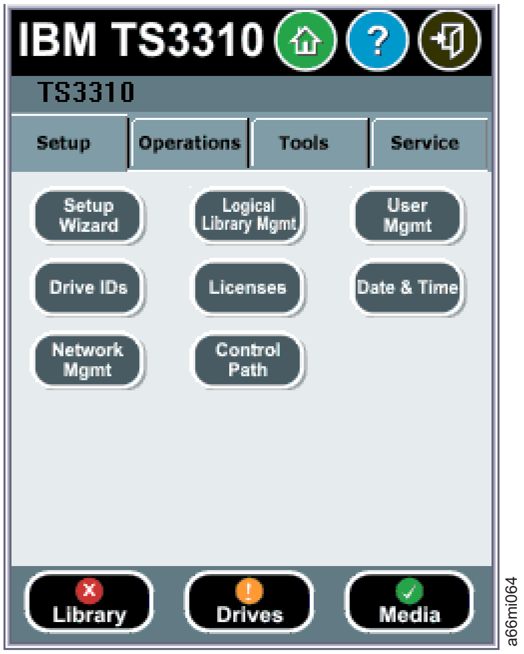


Figure 4-4. Setup menu screen

- The **Operations** menu consists of commands that enable you to change the library's mode of operations, import and export cartridges, load and unload drives, move media, and shutdown/restart the library.

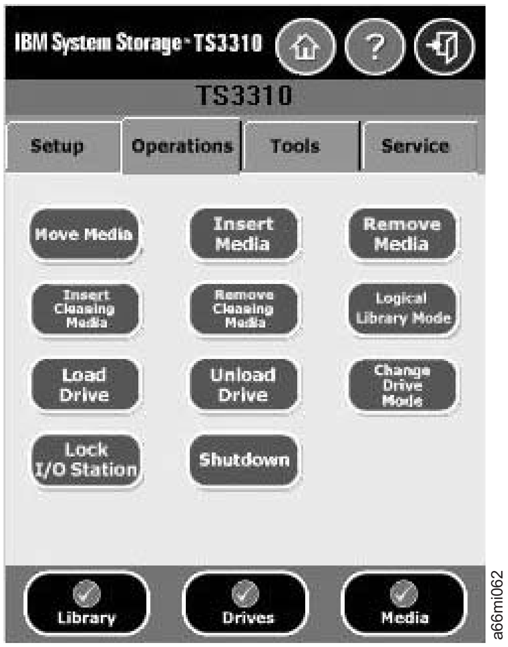


Figure 4-5. Operations menu screen

- The **Tools** menu consists of commands that you can use to maintain your library such as viewing operator interventions, capturing the library snapshot, identifying ports, and updating firmware using an FMR (Firmware) cartridge.

Figure 4-6. Tools menu screen

The following menu tree shows all functions available from the Operator panel interface.

Table 4-1. Tape Library Operator Panel Menu Tree

⊟ Setup	⊟ Operations	⊟ Tools	⊟ Service
–Setup Wizard	–Move Media	–Operator Interventions	–Drives
–Logical Library Mgmt	–Insert Media	–Drive Mgmt	–System
–User Mgmt	–Remove Media	–Drive Info	–Exit
–Drive IDs	–Insert Cleaning Media	–About Library	
–Licenses	–Remove Cleaning Media	–Service	
–Date & Time	–Logical Library Mode	–Internal Network	
–Network Mgmt	–Load Drive	–System Settings	
–Control Path	–Unload Drive	–Security	
	–Change Drive Mode	–Display Settings	
	–Lock I/O Station		
	–Shutdown		

Web User Interface (UI)

The Web UI is accessible from a web browser and is best viewed using Internet Explorer 5.0 or higher, or Firefox 1.0 or higher.

To manage the library using the Web UI, you must set up the initial network configuration of the library from the Operator Panel touchscreen. For more information, see the *Setup and Operator Guide*.

Logging in to the Web User Interface

Initial login information is as follows:

- User: **admin**
- Password: **secure**

For more information on user privileges, see “User Privileges” on page 4-8.

Note:
When LDAP (Lightweight Directory Access Protocol) is enabled, the login screen gives the user a choice between using local authentication (the login and password are stored on the library) or LDAP authentication (the login and password are stored on a server, and the user must specify the LDAP domain name). If LDAP access is disabled, the LDAP options will not appear on the login screen.

Common Header Elements

All Operator Panel screens (except for the Login screen) contain the following common elements in the header:

- **Help** - context-sensitive help for the associated page
- **Logout** - ability to log out

Menus Available from the Web User Interface

Table 4-2. Menus available from the Web User Interface

Welcome Page

- ⊟ **Monitor System**
  - System Summary
  - Library Map
  - Logged in Users
  - Network Settings
- ⊟ **Manage Cartridges**
  - Data Cartridges
  - Cleaning Cartridges
  - I/O Station
  - Lock/Unlock I/O Station Doors
- ⊟ **Manage Drives**
  - Load
  - Unload
  - Clean
  - State (Online/Offline)
  - Control Paths
  - Drive IDs
  - Fibre Channel Ports
- ⊟ **Manage Library**
  - Perform Inventory
  - Setup Wizard
  - Logical Libraries

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

  - Cleaning Slots
  - I/O Station Slots
- ⊟ **Settings**
  - Feature Licenses
  - Date & Time
  - Email Notifications
  - Outgoing Server (SMTP) Configuration
  - Contact Information
  - Network
  - SNMP
  - SNMP Traps
  - Save/Restore Configuration
- ⊟ **Manage Access**
  - Users
  - LDAP
  - Set Session Timeout
- ⊟ **Service Library**
  - Operator Interventions
  - Capture Library Log
  - Capture Drive Log
  - View/Update Library Firmware Level
  - View/Update Drive Firmware Levels
  - Reset Drive
  - Shutdown/Restart Library

User Privileges

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

There are three types of user privileges in the library.

- **Service users** are allowed access to the entire physical library and all of its logical libraries as well as access to a hidden **Service** menu that includes service tools and diagnostics.
- **Administrative users** are allowed access to the entire physical library and all of its logical libraries. One and only one administrator user must be assigned the login name **`admin`**.
- **Users** are allowed to operate a logical library, but not perform actions that affect the physical library.

User privileges include:

- A screen saver is invoked after 10 minutes of inactivity on the Operator Panel. The Web User Interface (UI) does not use a screen saver. The User, Administrative user, or Service user who is inactive between 10 and 30 minutes returns to the last accessed screen when activating the screen again.

- Any logged in User, Administrative user, or Service user who is inactive for more than 30 minutes is logged out.
- Up to 18 Users and/or one Administrative user can be logged in at one time on the Web UI. Only one user (Administrative or Service) can be logged in at one time on the Operator Panel. One Administrative user can disconnect another Administrative user.
- Any user can be logged in to only one interface at a time.
- When a Service user logs in, all other Users and Administrative users are logged out and notified that they cannot perform actions on the library. A message is posted that Service is logged in and no other users can access the library until after Service has logged out.

The following table describes how to access the library functions from both the control panel and the Web UI. For each interface, column ″A″ indicates Administrative privileges; column ″U″ indicates User privileges. In each column, ″X″ indicates that access is allowed; ″–″ if access not allowed.

Table 4-3. System Functions, Commands, and Access

Function	**Control Panel Menu Command and Access**			**Web UI Command and Access**		
		A	**U**		**A**	**U**
Libraries						
Setup Wizard	**Setup** → **Setup Wizard**	X	—	**Manage Library** → **Setup Wizard**	X	—
Create Logical Libraries	**Setup** → **Logical Library Mgmt** → **Create Logical Library**	X	—	**Manage Library** → **Logical Libraries**	X	—
Delete Logical Libraries	**Setup** → **Logical Library Mgmt** → **Delete Logical Library**	X	—	**Manage Library** → **Logical Libraries**	X	—
Delete ALL Logical Libraries	**Setup** → **Logical Library Mgmt** → **Delete All Logical Libraries**	X	—	**Manage Library** → **Logical Libraries**	X	—
Change Logical Library Mode	**Operations** → **Logical Library Mode**	X	X	**Manage Library** → **Logical Libraries**	X	X
Perform Inventory	N/A			**Manage Library** → **Perform Inventory**	X	X
Display Library Information	**Tools** → **About Library**	X	X	**Monitor System** → **Library Map**	X	X
Capture Library Log	N/A			**Service Library** → **Capture Library Log**	X	—
Cleaning Slots	**Setup** → **Logical Library Mgmt** → **Configure Cleaning Slots**	X	—	**Manage Library** → **Cleaning Slots**	X	—
I/O Station Slots	**Setup** → **Logical Library Mgmt** → **Configure I/O Slots**	X	—	**Manage Library** → **I/O Station Slots**	X	—
I/O Station Lock/Unlock	**Operations** → **Lock I/O Station** → **Lock/Unlock**	X	—	**Manage Cartridges** → **Lock/Unlock I/O Station Doors**	X	—

Table 4-3. System Functions, Commands, and Access (continued)

Function	Control Panel Menu Command and Access			Web UI Command and Access		
		A	**U**		**A**	**U**
Update Library Firmware	N/A			**Service Library → View/Update Library Firmware Level**	X	—
Shutdown/ Restart Library	**Operations → Shutdown**	X	—	**Service Library → Shutdown/Restart Library**	X	—
Users/System Access						
Create New Users	**Setup → User Mgmt → Create User**	X	—	**Manage Access → Users**	X	—
Modify Users	**Setup → User Mgmt → Modify User**	X	—	**Manage Access → Users**	X	—
Enter License Key	**Setup → Licenses**	X	—	**Manage Library → Settings → Feature Licenses**	X	—
Display Logged in Users	N/A			**Monitor System → Logged in Users**	X	—
LDAP Configuration	**Setup → User Mgmt → LDAP Configuration**	X	—	**Manage Access → LDAP**	X	—
User Session Timeout	**Tools → System Settings → User Session Timeout (Minutes)**	X	—	**Manage Access → Set Session Timeout**	X	—
Disable Remote Service User	**Tools → System Settings → Disable Remote Service Users**	X	—	N/A		
Drives		**A**	**U**		**A**	**U**
Set Drive IDs	**Setup → Drive IDs**	X	—	**Manage Drives → Drive IDs**	X	—
Load Drive	**Operations → Load Drive**	X	X	**Manage Drives → Load**	X	X
Unload Drive	**Operations → Unload Drive**	X	X	**Manage Drives → Unload**	X	X
Change Drive Mode	**Operations → Change Drive Mode**	X	X	**Manage Drives → State (Online/Offline)**	X	X
Clean Drive	**Tools → Drive Mgmt → Clean drive**	X	—	**Manage Drives → Clean**	X	—
Display Drive Information	**Tools → Drive Info**	X	X	**Service Library → View/Update Drive Firmware Levels**	X	—
Capture Drive Log	N/A			**Service Library → Capture Drive Log**	X	—
Fibre Channel Ports	**Setup → Drive IDs**	X	—	**Manage Drives → Fibre Channel Ports**	X	—
Reset Drive	N/A			**Service Library → Reset Drive**	X	—

Table 4-3. System Functions, Commands, and Access (continued)

Function	**Control Panel Menu Command and Access**			**Web UI Command and Access**		
		A	**U**		**A**	**U**
Create FMR Tape	**Tools** → **Drive Mgmt** → **Create an FMR tape**	X	—	N/A		
Update Drive Firmware	**Tools** → **Drive Mgmt** → **Update drive firmware using FMR**	X	—	**Service Library** → **View/Update Drive Firmware Levels**	X	—
Erase FMR Tape	**Tools** → **Drive Mgmt** → **Erase an FMR tape**	X	—	N/A		
Media/Cartridges						
Move Data Cartridges	**Operations** → **Move Media**	X	X	**Manage Cartridges** → **Data Cartridges**	X	X
Insert Data Cartridges	**Operations** → **Insert Media**	X	X	**Manage Cartridges** → **I/O Station**	X	X
Remove Data Cartridges	**Operations** → **Remove Media**	X	X	**Manage Cartridges** → **Data Cartridges**	X	X
Cleaning Cartridges	**Operations** → **Insert Cleaning Media** and **Operations** → **Remove Cleaning Media**	X	X	**Manage Cartridges** → **Cleaning Cartridges**	X	X
Manage Cartridges in I/O Station	N/A			**Manage Cartridges** → **I/O Station**	X	X
Manual Cartridge Assignment	**Tools** → **System Settings** → **Manual Cartridge Assignment**	X	—	N/A		
System/Network Settings						
Network Configuration	**Setup** → **Network Mgmt** → **Network Configuration**	X	—	**Manage Library** → **Settings** → **Network**	X	—
Save/Restore Configuration	N/A			**Manage Library** → **Settings** → **Save/Restore Configuration**	X	—
Date and Time	**Setup** → **Date & Time**	X	—	**Manage Library** → **Settings** → **Date & Time**	X	—
Network Time Protocol (NTP)	**Setup** → **Date & Time**	X	—	**Manage Library** → **Settings** → **Date & Time**	X	—
Trap and SNMP	**Setup** → **Network Mgmt** → **SSL/SNMP Configuration** → **SSL or Trap Registration or SNMP Version**	X	—	**Manage Library** → **Settings** → **SNMP** and **Manage Library** → **Settings** → **SNMP Traps**	X	—
Control Path	**Setup** → **Control Path**	X	—	**Manage Drives** → **Control Paths**	X	—

Table 4-3. System Functions, Commands, and Access (continued)

Function	Control Panel Menu Command and Access			Web UI Command and Access		
		A	U		A	U
Operator Intervention	**Tools → Operator Intervention**	X	—	**Service Library → Operator Interventions**	X	—
DNS Configuration	**Setup → Network Mgmt → DNS Configuration**	X	—	N/A		
Enter Contact Information	N/A			**Manage Library → Settings → Contact Information**	X	—
Set Email Notifications	N/A			**Manage Library → Settings → Email Notifications**	X	—
Internal Network Configuration	**Tools → Internal Network**	X	—	N/A		
Touch Screen Audio	**Tools → System Settings → Touch Screen Audio**	X	X	N/A		
Display System Summary	N/A			**Monitor System → System Summary**	X	X
Display Network Settings	N/A			**Monitor System → Network Settings**	X	X
Outgoing Server Configuration	N/A			**Manage Library → Settings → Outgoing Server (SMTP) Configuration**	X	—
Service						
Enter Service Menu	**Tools → Service**	X	—	N/A		
Service Drives	**Tools → Service → Drives**	X	—	N/A		
Service System	**Tools → Service → System**	X	—	N/A		
Security Settings	**Tools → Security**	X	—	N/A		
Adjust Display	**Tools → Display Settings**	X	X	N/A		

Function	Control Panel Menu Command and Access			Web UI Command and Access		
		A	U		A	U
Service User						
View Library Logs	**Tools → Library Tests**	X	—	N/A		
Email Logs	**Tools → Library Tests**	X	—	N/A		
Library Demo	**Tools → Library Tests**	X	—	N/A		

Function	Control Panel Menu Command and Access			Web UI Command and Access		
		A	U		A	U
Reset to Factory Defaults	**Tools → Factory Defaults**	X	—	N/A		

Safety Instructions

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

Note: In addition to the safety instructions in this guide, local and professional safety rules apply.

Read and carefully observe the hazard alert information in this guide and in the *IBM TotalStorage 3576 Modular Tape Library Setup and Operator Guide*.

Danger notices contain a Dxxxx reference number. Caution notices contain a Cxxxx reference number. Rack safety notices contain a Rxxxx reference number. Use the reference number to locate the translation in *IBM Translated Safety Notices* (Part number 96P0851).

Danger Notice

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

A sample danger notice follows:

DANGER

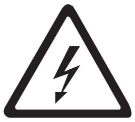
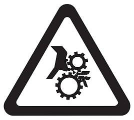
> **An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.** *(D004)*

Caution Notice

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition.

A caution notice can be accompanied by one of several symbols shown in the table below.

Table 5-1. Caution Notice 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.
	A hazardous condition due to mechanical movement in or around the product.
	A hazardous condition due to the weight of the unit. Weight symbols are accompanied by an approximation of the product's weight.

Sample caution notices:

Table 5-2. Examples of Symbol Use

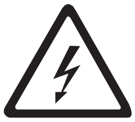
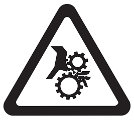
	The controller card contains a lithium battery. **CAUTION:** **The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1–800–426–4333. Have the IBM part number for the battery available when you call. *(C007)***
	**CAUTION:** **To avoid personal injury, before lifting this unit, remove all appropriate subassemblies per instructions to reduce the system weight. *(C012)***
	**CAUTION:** **The weight of this part or unit is more than 55 kilograms (121.2 pounds). It takes specially trained persons and/or a lifting device to safely lift this part or unit.** *(C011)*

Table 5-2. Examples of Symbol Use (continued)

	**CAUTION:** **This assembly contains mechanical moving parts. Use care when servicing this assembly.** ***(C025)***

Area of Application

The information in this document applies to the entire Tape Library. Additional safety instructions for components used in the equipment are not invalidated by these instructions.

Note: Other manufacturers' documentation forms an integral part of the Tape Library documentation.

This *manual* is intended for training personnel for service work and maintenance work. Therefore, the hazard alert messages apply only to maintenance of the equipment. Knowledge of safety rules for work on electronic and mechanical systems is required. Only trained specialists (maintenance trained) are allowed to maintain and repair the Tape Library.

Class I Laser Product

The Tape 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.

ac Grounding Inspection

1. Power Off the Tape Library.
2. Disconnect all cables.
3. Disconnect the power cord from its source.
4. Inspect the power cable for visible cracks, wear, or damage.
5. Inspect the power supply enclosure covers to ensure all screws are installed and tight.

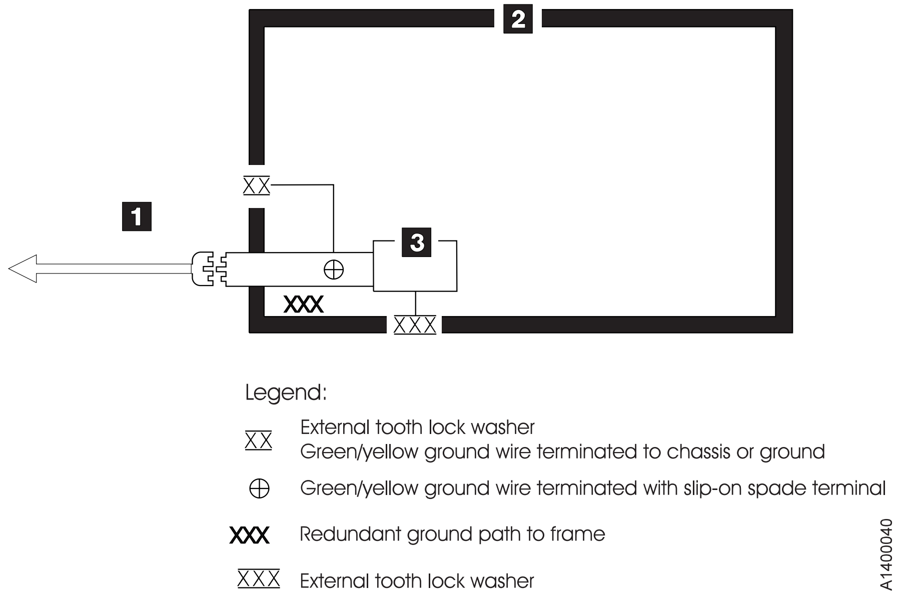


Figure 5-1. ac ground diagram

1	ac Ground	**2**	Chassis Frame	**3**	ac Ground Terminated in Power Supply

Before Working on Equipment

Before beginning work, become familiar with the location of the:

- Main Switch
- Power source connection

Note: Bridging of door guards is not advisable.

Attention: Never put door guards out of operation other than as instructed by supervision.

All drive units and all hazardous voltages must be switched OFF.

Proceed with extreme caution if the system cannot be switched off at the main switch because of required work (for example, functional checks).

Normal Operating Modes

In normal operation, the host controls the Tape Library.

Emergency Operating Mode

Emergency operations are meant for:

- Manual inserts and retrievals of media
- Manual operation of the drives

Before Restarting Equipment

Movement of components inside the library can cause serious injury. Before starting the Tape Library, ensure that the library door is closed.

Working on Parts With Line Voltage Present

Caution Statements:

1. **Contact with live electrical parts can cause severe or fatal burns and internal injury as the consequence of electrical shock. After contact with live parts, persons often cannot break loose from the part by themselves.**
2. **Components being worked on must only have voltage present when this is specifically required.**
3. **Before working on other electrical components, switch OFF power with the Main switch.**
4. **Never assume a circuit is without power - always test for power off with a meter.**

Work on live parts of the equipment must be authorized by supervision.

When performing such work, observe the following:

- Accident prevention rules
- Perform the following:
  - Use only suitable tools and measuring devices in good working condition.
  - Check the measuring devices for correct adjustment of measuring ranges.
  - Work with one hand only. This can prevent injury to internal organs in case of electrical shock.
  - Avoid contact with conducting floors (especially metal) or equipment parts. If necessary, cover the working area with suitable protective rubber mats.

Power Cords

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

All power cords use an appliance coupler that complies with the International Electrotechnical Commission (IEC) Standard 320, Sheet C13.

If the power cord that you receive does not match your receptacle, contact your local dealer.

Power cords used in the United States and Canada are listed by Underwriter’s Laboratories (UL), are certified by the Canadian Standards Association (CSA), and comply with the plug standards of the National Electrical Manufacturers Association (NEMA).

Mechanical Maintenance

Observe the following:

- Location of the escape routes and emergency exits - keep these free of obstacles
- Keep dismounted machine components and other parts safe and inaccessible for unauthorized persons
- Keep the equipment clean during work; clean up carefully afterward

Before and after work, remove and reinstall all safety provisions installed for maintenance, such as:

- Covers
- Hazard alert messages
- Warning signs
- Grounding wires

Clothing must be in agreement with the following safety rules:

- No metal fasteners
- Should be close-fitting so that it cannot be caught in moving machine parts
- Buttoned or rolled up sleeves
- Place the ends of a scarf or tie into the clothing.
- For long hair, use a protection that fully covers it.
- Remove watch, rings, and jewelry.

Wear safety glasses when:

- Using a hammer
- Using an electric drill
- Working on springs, and retaining rings.
- Soldering, working on cables
- Cleaning with chemical agents
- All work that endangers the eyes

When handling heavy components, wear safety shoes.

Refrain from any action that could endanger persons or that could damage installations or equipment.

Safety Check

Check all guards every six months:

- Door interlocks
- Tape Library access

Rack Safety

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 cabinets.**
- **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.**

CAUTION:

- **Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.**
- **Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, 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 power requirement of the supply circuit.**
- **(For sliding drawers) Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack may become unstable if you pull out more than one drawer at a time.**
- **(For fixed drawers) This drawer is a fixed drawer and should not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack may cause the rack to become unstable or cause the drawer to fall out of the rack.**

(R001)

Disposal of Library Components Containing Mercury

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

Service Action Tickets (Txxx) and Diagnostic Resolutions (DRxxx)

Before you begin servicing the library, refer to "General Service Guidelines" on page 7-2.

Service Action Tickets

When the library detects a problem, it generates an error code and displays it in the Operator Intervention report, along with a full description of the problem and suggestions for resolving it.

The sections below offer more information than will be displayed in an Operator Intervention on the Operator Panel. Refer to this information for additional help in resolving problems.

Check your host for Sense Data and refer to Appendix B, "Sense Data," on page B-1.

Important: It is recommended that Service Action Tickets not be allowed to accumulate in the Operator Intervention reports. After an incident has been resolved or repaired, the Service Action Ticket should be closed.

T001: Manually remove cartridge from Picker, motion OK

Description	The Picker is logically not expecting to see a cartridge in the Picker but the cartridge present sensor indicates otherwise. The cartridge cannot legitimately be returned to a home slot nor can it be placed in a destination slot. The VOLSER (Volume Serial Number) may be unknown, the library may be full, or changing the host(s) inventory is disruptive.
Detection Scenarios	1. The Picker becomes enabled after a door is opened or the library system boots up and discovers that the cartridge present sensor detects a cartridge. 2. The system has tried to recover from a PUT failure and wants to return the cartridge to a home slot; however, the home slot recovery logic completes without recovery (home slot is a drive or the I/O Station is open or the I/O Station is full). 3. The cartridge present sensor and sensing circuit is falsely representing the presence of a cartridge.

Root Causes	1. Operator did not recover cartridge. 2. Operator put a cartridge in the Picker. 3. Power loss during a move with media and the library logic cannot legitimately return it to the proper cell. 4. Physical contamination such as dust and debris on the sensor gives a ″false full state″. 5. Various electrical failures.
Possible CRU Replacements	• Tape Cartridge • Library Control Blade
Possible FRU Replacements	• Picker Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit
Resolution	Perform “DR001: Manually Recover Tape from Picker” on page 6-38.

T002: PUT operation failed, cartridge final position unknown, motion OK

Description	The library cannot successfully put a cartridge into a drive, storage or I/O location and the final “resting place” of the cartridge is unknown. There are no additional recovery logic paths to be exercised. Fundamental servo control seems OK. If the operation was initiated by a host MOVE MEDIA, the MOVE MEDIA command has failed with a SK/ASC/ASCQ 4h/15h/01h (hardware mechanical positioning error).
Detection Scenarios	PUT is not successful, PUT recovery is not successful, and a cartridge is not known to be properly seated in the Picker or a storage slot.
Root Causes	1. Magazine is damaged. 2. Magazine is the wrong type for the cartridge. 3. A storage cell is blocked by foreign material or not clipped in and seated correctly. 4. Calibration problem resulted in improper Picker position. 5. Picker offset problem. 6. Cartridge is damaged. 7. Unlabeled cartridge or intermittently readable cartridge label in destination slot. 8. Drive load mechanism is not working. 9. A variety of Picker problems such as slipping gears, encoder issues, etc.
Possible CRU Replacements	• Tape Cartridge • Library Control Blade
Possible FRU Replacements	• Picker Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit
Resolution	Perform “DR002: Manually Recover Tape from Source or Destination Slot” on page 6-38.

T003: GET operation failed, cartridge final position unknown, motion OK

Description	The library cannot successfully get a cartridge from a drive, storage or I/O location. The final “resting place” of the cartridge is unknown. There are no additional recovery logic paths. Fundamental servo control appears to be OK. If the operation was initiated by a host MOVE MEDIA, the MOVE MEDIA command has failed with an ASC/ASCQ of 4h/15h/01h (hardware mechanical positioning error).
Detection	

Root Causes	1. Magazine is damaged, wrong type, cell is blocked by foreign material, or not clipped in and seated correctly. 2. Calibration problem. 3. Picker offset problem. 4. Destination cell full with labeled cartridge (invalid inventory). 5. Destination cell is full with cartridge that has damaged label or is unlabeled or has an intermittently readable label. 6. A variety of Picker problems such as slipping gears, encoder issues, Y-axis assembly not level, etc.
Possible CRU Replacements	• Tape Cartridge • Library Control Blade
Possible FRU Replacements	• Picker Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit
Resolution	Perform “DR004: Manually Inspect Destination Element” on page 6-39.

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T005: X, Y, θ motion profile failure, cartridge in Picker, motion NOT OK

Description	An unrecoverable motion failure occurs during a move with a cartridge in the Picker. This problem only occurs during a move and NOT a get or put. Because the cartridge is in the Picker, cartridge recovery must be a part of the resolution strategy. This ticket cause specifically excludes any Z-axis motion failures that are typically associated with GET or PUT actions. Specifically included are motion failures that occur while pivoting, moving on the X-axis, or moving on the Y-axis.
Detection Scenarios	1. A specified move in the X-axis cannot complete. 2. A specified move in the Y-axis cannot complete. 3. A specified movement in the θ-axis cannot complete.
Root Causes	1. A large number of electrical hardware failures. Code or hardware detects that motion control is not occurring properly (encoder issues, motor driving circuit issues, motor winding issues, cable connection issues, etc.). 2. A relatively small number of mechanical hardware errors that do not result in the detection of a complete obstruction but where motion control does not appear to be normal (contamination or damage to encoder wheel, high friction, etc).
Possible CRU Replacements	• Tape Cartridge • Library Control Blade
Possible FRU Replacements	• Picker Assembly • Y Motor • Y-axis Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit

Resolution	• Perform “DR001: Manually Recover Tape from Picker” on page 6-38 • Perform “DR005: Motion Failure Diagnostic (a Library Verify Test)” on page 6-39.

T006: X, Y, θ motion profile failure, no cartridge in Picker, motion NOT OK

Description	An unrecoverable motion failure occurs at an operational point where a cartridge is not in the Picker. Because the cartridge is not in the Picker, cartridge recovery is not necessary as part of the resolution to this issue. This cause specifically excludes any Z-axis motion failures. Specifically included are motion failures that occur while pivoting, moving on the X-axis or moving on the Y-axis.
Detection Scenarios	1. A specified move in the X-axis cannot complete. 2. A specified move in the Y-axis cannot complete. 3. A specified movement in the θ-axis cannot complete.
Root Causes	1. A large number of electrical hardware failures. Code or hardware detects that motion control is not occurring properly (encoder issues, motor driving circuit issues, motor winding issues, cable connection issues, etc.). 2. A relatively small number of hardware errors that do not result in complete obstruction but where servo control does not appear to be normal.
Possible CRU Replacements	• Tape Cartridge • Library Control Blade
Possible FRU Replacements	• Picker Assembly • Y Motor • Y-axis Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit
Resolution	Perform “DR005: Motion Failure Diagnostic (a Library Verify Test)” on page 6-39.

T007: X, Y, θ motion obstruction, motion OK

Description	A complete physical obstruction exists in a motion path that precludes repeated attempts to move beyond a certain point in the range of motion. Servo control appears normal but a move profile cannot be completed. Cartridge may have been returned to a home slot.
Detection Scenarios	1. A specified move in the X-axis cannot complete but motion control appears normal. 2. A specified move in the Y-axis cannot complete but motion control appears normal. 3. A specified move in the θ-axis cannot complete but motion control appears normal.

Root Causes	1. Operator Intervention that results in foreign material or an obstructing object in a library motion path. 2. Picker locking mechanism left engaged in the library motion path (see Figure 8-1 on page 8-5). 3. Certain damaged hardware conditions that obstruct motion at a particular point along an axis.
Possible CRU Replacements	Tape

Detection Scenarios	While checking the status of a drive after a PUT motion profile to the drive is completed, the drive does not report back a loaded state.
Root Causes	1. Defective drive. 2. Defective tape cartridge. 3. Motion profile was successful as detected at motor encoders but cartridge did not get placed far enough. 4. Picker dragged cartridge back out of drive but not far enough to trigger Picker cartridge present sensor.
Possible CRU Replacements	• Tape Cartridge • Drive Sled
Possible FRU Replacements	• Picker Assembly
Resolution	Perform “DR030: Drive Load Failure Resolution” on page 6-47.

T010: Drive unload failed

Description	The library is expecting the drive to achieve an unloaded state, but the drive does not.
Detection Scenarios	1. After being issued a move media from a host that requires a GET from a drive, the drive never achieves the unloaded state. 2. When GUI commands are issued that require a drive unload (manual drive unload, move media, etc.) and the drive never achieves the unloaded state. **Note:** Since the library will always issue an unload command, it will not be possible to determine if a host unload command failed first, followed by a subsequent failure of a library issued unload command.
Root Causes	Drive fails to unload after the library issues an unload command.
Possible CRU Replacements	• Tape Cartridge • Drive Sled
Resolution	Perform “DR003: Drive Unload Diagnostic” on page 6-39.

T012: Drive control prevented due to SCSI Prevent/Allow Media Removal

Description	The library needs to issue a command to the drive (such as an unload) but cannot because the drive has been issued a Prevent SCSI command by a host.
Detection Scenarios	1. Library tries to issue an unload command. 2. Library tries to issue a command associated with drive brick download.
Root Causes	A host is either properly or improperly reserving the drive while a user or host is trying to properly or improperly perform some action on the drive.
Possible FRU Replacements	No library FRU is involved. Rather this is an indication that a host may have orphaned a reserve on the drive.

Resolution	Perform “DR016: Host Prevent/Allow Diagnostic” on page 6-44.

T013: Invalid or damaged library serial number label

Description	The library will report a problem when it cannot read a serial number or detects an invalid serial number.
Detection Scenarios	1. At first power ON during installation, the library must establish the serial number for the first time. There may be no serial number in system memory at this point. 2. At any power up, system memory already has a serial number established for the Library Control Blade. 3. A Library Control Blade is improperly swapped into a different physical library and the system reads the physical library label.
Root Causes	1. Library Control Blades swapped between libraries. 2. Label is damaged, misaligned, or placed on the cartridge incorrectly. 3. Bar code scanner not working properly. 4. Entire communication path to bar code scanner is not working properly.
Possible CRU Replacements	Library Control Blade
Possible FRU Replacements	• Picker Assembly • Y Motor • Y-axis Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit **Note:** The system serial number label is part of the enclosure FRU.
Resolution	Perform “DR007: Bar Code Scanner Diagnostic (a Library Verify Test)” on page 6-40.

T014: I/O Station Magazine Missing

Description	There is a fixed bar code label location on the I/O Station structure behind the removable magazines. It decodes as %XXX. The purpose of the label is to allow the library to detect that an I/O Station magazine is not installed. This is important on I/O Station magazines, because they are user removable. While performing an inventory of the I/O Station magazines, the library ends up verifying the presence of the magazine by NOT detecting this special fixed label.
Detection Scenarios	Any time the library attempts to inventory an I/O Station magazine, it will read the fixed label if a magazine is missing. I/O Station magazines are always expected to be present.

Root Causes	1. Missing I/O Station magazine 2. A cartridge in an I/O Station just happens to have a label that decodes as “%XXX”. **Note:** The inability to communicate between the Library Control Blade and the bar code scanner should result in a different ticket cause.
Resolution	Perform “DR023: I/O Station Magazine Missing” on page 6-45.

T015: Cannot read sled bar code label

Description	When the library is attempting to determine the type of a drive and verify its physical presence in the library, it cannot do so because it cannot read a label where it expects to find one.
Detection Scenarios	1. Installation of a drive into a library drive slot triggers the library to discover it. 2. Boot up causes the library to physically discover any drive that is electrically connected in the system.
Root Causes	1. Damaged label or marginal label that cannot be read 2. Drive with invalid label is present (earlier generation of plug compatible drive sled)
Possible CRU Replacements	Drive sled
Resolution	Perform “DR007: Bar Code Scanner Diagnostic (a Library Verify Test)” on page 6-40.

T017: Invalid storage or I/O position

Description	Calibration completes and the coordinates of each storage and I/O element are calculated. The calculated values are determined to be outside travel limits that have been established for the robot.
Detection Scenarios	Calculated element positions fail validity check against travel limits.
Root Causes	1. Calibration targets not in position. 2. Calibration sensor detects edges but is not correctly finding calibration target edges.
Possible FRU Replacements	• Fiducial targets • Storage Column • Y Motor • Y-axis Assembly • Y-axis Cable Spool • Picker Assembly • Internal Cables and Boards Kit
Resolution	If the problem can not be resolved using the information in this document, perform “DR021: Contact Tech Support” on page 6-45

T018: Invalid Drive Position

Description	Calibration completes and the coordinates of each drive are calculated. The calculated values are determined to be outside travel limits that have been established for the robot.
Detection Scenarios	Calculated element positions fail validity check against travel limits.
Root Causes	1. Drive calibration target is not in position. 2. Calibration sensor detects edges but is not correctly finding calibration target edges.
Possible CRU Replacements	Drive Sled
Possible FRU Replacements	• Y Motor • Y-axis Assembly • Picker Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit
Resolution	If the problem can not be resolved using the information in this document, perform "DR021: Contact Tech Support" on page 6-45

T019: Cannot calibrate drive, motion OK

Description	System electrically detects a drive and is able to scan the bar code label but cannot successfully calibrate the position of the drive. The calibration search pattern completes successfully.
Detection Scenarios	Calibration motion completes but edge finding of one or more edges does not occur.
Root Causes	1. Calibration sensor not functioning properly. 2. Calibration target not functioning properly. 3. Drive or Picker position is so far off nominal that search pattern cannot locate target.
Possible CRU Replacements	Drive Sled
Possible FRU Replacements	• Y Motor • Y-axis Assembly • Y-axis Cable Spool • Picker Assembly • Internal Cables and Boards Kit
Resolution	If the problem can not be resolved using the information in this document, perform "DR021: Contact Tech Support" on page 6-45

T020: Cannot calibrate storage, motion OK

Description	System cannot successfully calibrate the position of a storage magazine but the calibration search pattern completes successfully.
Detection Scenarios	Calibration motion completes but edge finding of one or more edges does not occur.

Root Causes	1. Calibration sensor not functioning properly. 2. Calibration target not functioning properly. 3. Drive or Picker position is so far off nominal that search pattern cannot locate target. This can also generate a T083: Picker Assembly not level. 4. The Picker Lock mechanism is not in the appropriate unengaged position.
Possible FRU Replacements	• Fiducial Targets • Y Motor • Y-axis Assembly • Y-axis Cable Spool • Picker Assembly • Internal Cables and Boards Kit
Resolution	If the problem can not be resolved using the information in this document, perform “DR021: Contact Tech Support” on page 6-45.

T021: Lost electrical connection/communications with drive sled

Description	The library had been communicating with a drive sled and had considered it to be assigned to a logical library. Two way communications no longer occur. This ticket is specifically NOT caused by physical removal of a drive if the drive is not assigned to a logical library.
Detection Scenarios	1. Routine polling of the sled can no longer occur. 2. Specific library to drive sled commands are not responded to.
Root Causes	1. Drive is physically remove/unplugged (intentional or never installed correctly). 2. Various hardware failures on the drive sled. 3. Various hardware failures in the library.
Possible CRU Replacements	• Library Control Blade • Drive Sled
Possible FRU Replacements	• Internal Cables and Boards Kit • Expansion Module Chassis
Resolution	Perform “DR029: Drive Communication Loss Resolution” on page 6-47.

T022: Lost electrical connection/communication with drive brick

Description	Internal to the drive, the sled control board can no longer communicate with the drive brick.
Detection Scenarios	1. Routine Polling between sled control board and drive brick can no longer occur. 2. Specific commands such as unload, reset, etc. are not responded to.

Root Causes	1. Cable broken, unplugged, damaged, etc. 2. Drive brick failure.
Possible CRU Replacements	Drive Sled
Resolution	Perform the following: 1. “Removing a Drive Sled” on page 8-34 2. “Replacing a Drive Sled” on page 8-35

T023: Drive sled fan spinning too slow or not at all

Description	A drive sled fan is spinning too slow or not at all.
Detection Scenarios	Regular polling/monitoring of the fan indicates a problem.
Root Causes	1. Hardware failure of fan. 2. Wiring or PCBA failure. 3. Blocked air paths. 4. Physical obstruction.
Possible CRU Replacements	Drive Sled
Resolution	Perform the following: 1. “Removing a Drive Sled” on page 8-34 2. “Replacing a Drive Sled” on page 8-35

T024: AC power loss

Description	A power supply has detected loss of AC power. AC power loss to a single power supply control module is unlikely to be able to post this ticket due to the speed at which system shut down occurs after an AC loss. This Ticket is most likely to occur when there is AC loss to a redundant power supply in a control module or any supply in any expansion module.
Detection Scenarios	AC power status from the supply creates an interrupt that is managed by software.
Root Causes	1. AC supply is gone (cord removed, customer side AC failure, etc.). 2. Individual on/off switch for the supply has been set to off. 3. Hardware failure inside supply.
Possible CRU Replacements	• Power Supply • Expansion Module
Possible FRU Replacements	Internal c1.254943210.8069T6119.7117227.7695Tm0Tc()Tj02m()Tj/.0.806992257bTf3.9o5

Detection Scenarios	Regular polling between Library Control Blade and power supply is not successful.
Root Causes	1. Detected fan failure in the supply. 2. Detected over temp condition in the supply. 3. Detected DC failure in the supply. 4. Detected over current failure in the supply.
Possible CRU Replacements	• Power Supply • Library Control Blade
Possible FRU Replacements	Internal Cables and Boards Kit
Resolution	Before performing any remove/replace procedures, refer to "Start Service" on page 1-1 for additional diagnostic procedures.

T026: Key Server Failover

Description	The Key Management feature of this library allows the user to connect 2 key servers for redundancy. If communication to the primary server is interrupted, the library will automatically switch or failover to the secondary server. This RAS ticket will be generated to notify the user of this failover event.
Detection Scenarios	• When the library detects that it can no longer communicate with the primary key server and automatically switches to the secondary key server. • When the library detects that it can no longer communicate with the secondary key server and automatically switches to the primary key server.
Root Causes	1. Primary Key Server is not connected properly. 2. Primary Key Server is not configured properly. 3. Library Ethernet settings are not configured properly.
Resolution	See "DR079: Resolve Key Server Comm. Failure" on page 6-58.

T027: Key Server Communication Failure

Description	The Key Management feature of the TS3310 library allows the user to connect 2 key servers for redundancy. If communication to one of these servers fails, then this ticket will be generated. A separate ticket will be created for each key server that fails.
Detection Scenarios	Library detects that communication with a key server is not successful
Root Causes	1. Primary Key Server is not connected properly. 2. Primary Key Server is not configured properly. 3. Library Ethernet settings are not configured properly.
Resolution	See "DR079: Resolve Key Server Comm. Failure" on page 6-58.

T031: Cannot unlock I/O Station

Description	System logic or external command is requiring I/O station lock to unlock but it will not.

Detection Scenarios	When unlock action is attempted, lock/unlock position sensor does not detect the proper state.
Root Causes	1. Lock mechanism not working properly. 2. Lock position sensor not working properly. 3. Mechanical binding or obstruction prevents proper motion and detection. 4. Mechanical failure of sensor flag.
Possible CRU Replacements	Library Control Blade
Possible FRU Replacements	• I/O Station Lock wwww

Possible CRU Replacements	• Cartridge • Tape Drive
Resolution	If the cartridge is managed by a host application, export the cartridge via the host application. If the cartridge is managed by the library, perform the following: • Remove the suspect cartridge (To export a data cartridge using the Operator Panel, select **Operations** → **Export Media**. To export a cleaning cartridge using the Operator Panel, select **Operations** → **Export Cleaning Media**. To export a data cartridge using the Web User Interface, select **Manage Cartridges** → **Data Cartridges**. To export a cleaning cartridge using the Web User Interface, select **Manage Cartridges** → **Cleaning Cartridges**.). • Import a new cartridge (To import a data cartridge using the Operator Panel, select **Operations** → **Import Media**. To import a cleaning cartridge using the Operator Panel, select **Operations** → **Import Cleaning Media**. To import a data cartridge using the Web User Interface, select **Manage Cartridges** → **I/O Station**. To import a cleaning cartridge using the Web User Interface, select **Manage Cartridges** → **Cleaning Cartridges**.).

T034: Drive TapeAlert Flag 4 - Media

Description	System determines that the drive has issued a TapeAlert 4 indicating an unrecoverable read, write or positioning error that the drive specifically isolates to a the media.
Detection Scenarios	Tape drive issues a TapeAlert 4 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform “DR044: Tape Alert 4 Media Error” on page 6-52

T035: Drive TapeAlert Flag 5 - Read Failure

Description	System determines that the drive has issued a TapeAlert 5 indicating an unrecoverable read error where isolation is uncertain between drive and media.
Detection Scenarios	Tape drive issues a TapeAlert 5 which is recognized by the library during the continuous 4 second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform “DR045: Tape Alert 5, 6 – Read/Write Failure” on page 6-52.

T036: Drive TapeAlert Flag 6 - Write Failure

Description	System determines that the drive has issued a TapeAlert 6 indicating an unrecoverable write error where isolation is uncertain between drive and media.
Detection Scenarios	Tape drive issues a TapeAlert 6 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform "DR045: Tape Alert 5, 6 – Read/Write Failure" on page 6-52.

T037: Drive TapeAlert Flag 8 - Not Data Grade

Description	System determines that the drive has issued a TapeAlert 8 indicating that the tape cartridge in the drive is not a data grade tape.
Detection Scenarios	Tape drive issues a TapeAlert 8 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform "DR046: Tape Alert 8 – Suspect Data Grade Tape" on page 6-52.

T038: Drive TapeAlert Flag 9 - Write Protected

Description	System determines that a write was attempted on a write protected tape.
Detection Scenarios	Tape drive issues a TapeAlert 9
Root Causes	Write protect feature on tape is protecting the tape but the user is trying to write to it.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform "DR014: Write Protect or WORM Diagnostic" on page 6-43.

T039: Drive TapeAlert Flag 12 - Unsupported Format

Description	System determines that the drive has issued a TapeAlert 12 indicating that the media loaded is an unsupported format. In the case

Detection Scenarios	Tape drive issues a TapeAlert 12 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform “DR015: Unsupported Format Diagnostic” on page 6-43.

T040: Drive TapeAlert Flag 15 - MIC Chip Failure

Description	System determines that the drive has issued a TapeAlert 15 indicating that MIC (memory in cassette) of the media loaded is not working properly. The MIC is the memory that is part of the cartridge, also called LTO CM.
Detection Scenarios	Tape drive issues a TapeAlert 15 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform “DR047: Tape Alert 15 – Cartridge Memory Failure” on page 6-53

T041: Drive TapeAlert Flag 16 - Forced Eject

Description	System determines that the drive has issued a TapeAlert 16 indicating that an unload of a drive was triggered while the drive was actively reading or writing. The source of the unload can be either an operator initiated manual push button on the drive itself or a GUI initiated command.
Detection Scenarios	Tape drive issues a TapeAlert 16 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform “DR048: Tape Alert 16 – Forced Reject” on page 6-53.

T045: Drive TapeAlert Flag 20 - Clean Now

Description	System determines that the drive has issued a TapeAlert 20 indicating that the drive requires cleaning. This should be coincident with a ″C″ on the drive seven segment display.
Detection Scenarios	Tape drive issues a TapeAlert 20 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.

Possible CRU Replacements	• Tape Drive • Tape Cartridge
Resolution	Perform "DR018: Manually Clean Drive" on page 6-44.

T046: Drive TapeAlert Flag 21 - Clean Periodic

Description	System determines that the drive has issued a TapeAlert 21 indicating that the drive requires cleaning. This should be coincident with a ″C″ on the drive seven segment display.
Detection Scenarios	Tape drive issues a TapeAlert 21 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	• Tape Drive • Tape Cartridge
Resolution	Perform "DR018: Manually Clean Drive" on page 6-44.

T047: Drive TapeAlert Flag 22 - Expired Cleaning Media

Description	System determines that a cleaning media is expired.
Detection Scenarios	• Tape drive issues a TapeAlert 22 • Code that manages library based cleaning determines that a cartridge is consumed based on actively managing the use count.
Root Causes	Cleaning tape is used up.
Possible CRU Replacements	• Tape Cartridge
Resolution	If the cartridge is managed by a host application, export the cartridge via the host application. If the cartridge is managed by the library, perform the following: • Remove the suspect cartridge (To export a cleaning cartridge using the Operator Panel, select **Operations** → **Export Cleaning Media**. To export a cleaning cartridge using the Web User Interface, select **Manage Cartridges** → **Cleaning Cartridges**.). • Import a new cartridge(To import a cleaning cartridge using the Operator Panel, select **Operations** → **Import Cleaning Media**. To import a cleaning cartridge using the Web User Interface, select **Manage Cartridges** → **Cleaning Cartridges**.).

T048: Drive TapeAlert Flag 23 - Invalid Cleaning Tape

Description	System determines that the drive has issued a TapeAlert 23 indicating that the drive was expecting a cleaning tape but the loaded cartridge is not a cleaning tape.
Detection Scenario	Tape drive issues a TapeAlert 23 which is recognized by the library during the continuous four second polling cycle of drive status.

Root Causes	• User or library attempts to mount a cleaning tape but the tape is not actually a cleaning tape. • User mistakenly loads a data tape as a cleaning tape • Inventory or application issue results in data tape being loaded when drive expects cleaning tape
Possible CRU Replacements	• Tape Cartridge
Resolution	If the cartridge is managed by a host application, export the cartridge via the host application. If the cartridge is managed by the library, perform the following: • Remove the suspect cartridge(To export a cleaning cartridge using the Operator Panel, select **Operations** → **Export Cleaning Media**. To export a cleaning cartridge using the Web User Interface, select **Manage Cartridges** → **Cleaning Cartridges**.). • Import a new cartridge(To import a cleaning cartridge using the Operator Panel, select **Operations** → **Import Cleaning Media**. To import a cleaning cartridge using the Web User Interface, select **Manage Cartridges** → **Cleaning Cartridges**.).

T049: Drive TapeAlert Flag 30 - Hardware A

Description	System determines that the drive has issued a TapeAlert 30 indicating a hardware error that requires a drive power cycle before the drive might recover to a usable state.
Detection Scenario	Tape drive issues a TapeAlert 30 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Drive Sled
Resolution	Before performing the following: • "Removing a Drive Sled" on page 8-34 • "Replacing a Drive Sled" on page 8-35 refer to "Start Service" on page 1-1 for additional diagnostic procedures. • Perform "DR049 Tape Alert 30,31 – Drive Hardware Error" on page 6-53. • From the Operator Panel, select **Tools** → **Service** → **Drive** to run the drive diagnostic. A blank, scratch cartridge is required for this test.

T050: Drive TapeAlert Flag 31 - Hardware B

Description	System determines that the drive has issued a TapeAlert 31 indicating a hardware error that requires a drive power cycle before the drive might recover to a usable state.
Detection Scenario	Tape drive issues a TapeAlert 31 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.

Possible CRU Replacements	Drive Sled
Resolution	• Perform "DR049 Tape Alert 30,31 – Drive Hardware Error" on page 6-53. • From the Operator Panel, select **Tools** → **Service** → **Drive** to run the drive diagnostic. A blank, scratch cartridge is required for this test.

T051: Drive TapeAlert Flag 32 - Interface

Description	System determines that the drive has issued a TapeAlert 32 indicating a tape drive has detected a problem with the application client interface.
Detection Scenarios	Tape drive issues a TapeAlert 32 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Drive
Resolution	Perform "DR012: Host Cabling Diagnostic" on page 6-42.

T052: Drive TapeAlert Flag 33 - Eject media error recovery

Description	System determines that the drive has issued a TapeAlert 33 indicating that the drive requires a cartridge to be ejected in order to resolve a problem.
Detection Scenarios	Tape drive issues a TapeAlert 33 which is recognized by the library during the continuous four second polling cycle of drive status.
Root Causes	Drive has determined that there is a problem per its internal algorithms.
Possible CRU Replacements	Tape Drive
Resolution	1. Perform "DR037: Eject Media" on page 6-49. 2. From the Operator Panel, select **Tools** → **Service** → **Drive** to run the drive diagnostic. A blank, scratch cartridge is required for this test.

T060: Door Open

Description	At boot time or run time the library detects that at least one main door is open. The main access door switches are physically wired in series and the system firmware can not distinguish which switch/door is open. In addition, the health of the module-to-module connection and termination affects the series wiring of the switches. Firmware logic will not report this ticket if the module-to-module termination is totally missing or not proper.
Detection Scenario	Constant monitoring of the switch electrical circuit (hardware interrupt) detects a door open. This is true at run time or boot up.

Root Causes	1. Any main access door is actually open. 2. A number of electrical hardware failures in the door switch circuit (this includes intermittent issues). 3. Mechanical issues where door switch is not being made even though door is closed (this includes intermittent issues).
Possible CRU Replacements	• Module-to-Module communication cable • Module communication terminator • Library Control Blade
Possible FRU Replacements	• Door Interlock Switch • Internal cables and boards kit
Resolution	Perform "DR019: Door Open Diagnostic" on page 6-44.

T061: Tape Alert 55 - Loading Failure

Description	When loading a tape into drive, a hardware malfunction can prevent the tape from being loaded in the drive, or the tape may actually get stuck in the drive.
Detection Scenarios	After loading a drive, the drive generates a Tape Alert 55, which is noticed by the library.
Root Causes	1. A drive hardware error that prevents the tape from being loaded. 2. A damaged tape that cannot be loaded into the drive.
Possible FRU Replacements	• Drive sled
Resolution	Perform "DR078: Resolve Tape Load/Unload Failure" on page 6-57.

T062: Frame Configuration Problem

Description	At boot time or run time the library physical frame configuration is not valid.
Detection Scenarios	1. Code determines that there is greater then

Root Causes	1. Greater than one control module exists in a stack of frames wired together. 2. Five frames or greater are actually above the control module. 3. Five frames or greater are actually below the control module. 4. Hardware failure results in one or more invalid geo bit patterns. 5. Hardware failure results in one or more valid but incorrect geo bit patterns when compared to frame count (more frames detected than actual or less frames detected than actual).
Possible CRU Replacements	• Module-to-Module communication cable • Module communication terminator • Library Control Blade
Possible FRU Replacements	• Internal Cables and Boards Kit • Expansion module enclosure
Resolution	Perform "DR010: Expansion Module Connectivity Diagnostic" on page 6-41.

T063: Cannot Read or Mismatch WWN Label

Description	The library logic learns the library worldwide name (WWN) of the system by reading an internal WWN bar code label. This is done at first boot up from a "cleared to ship" condition in order to establish the WWN. It is also done on subsequent boot ups to verify that the persisted information on the library compact flash file system matches the physical library chassis. The library will report a problem when it cannot read the WWN or if it reads a WWN value that does not match the persisted library configuration. A different motion related problem will be reported if motion is preventing the proper reading of the WWN.
Detection Scenarios	1. At first boot up from clear to ship, the library must establish the WWN for the first time. There may be no WWN in system memory at this point. 2. Any power up. System memory already has a WWN established for the Library Control Blade. 3. The Library Control Blade is improperly swapped into a different physical chassis and the system reads the physical chassis WWN label.
Root Causes	1. The Library Control Blade has been swapped between libraries. 2. WWN label is damaged. 3. Bar code scanner is not working properly. 4. Entire communication path to bar code scanner is not working properly.
Possible CRU Replacements	Library Control Blade
Possible FRU Replacements	• Picker • Internal Cables and Boards Kit
Resolution	Perform "DR007: Bar Code Scanner Diagnostic (a Library Verify Test)" on page 6-40.

T064: Library Control Blade hardware failure

Description	The library encounters an error which appears to be isolated to hardware on the Library Control Blade itself.
Detection Scenarios:	Code detects a board level voltage problem.
Root Causes:	Board level voltage problems.
Possible CRU Replacements:	Library Control Blade
Resolution	• Observe library component LEDs (refer to “Interpreting LEDs” on page 7-8. • Refer to instructions to remove and replace the Library Control Blade (see “Library Control Blade or Compact Flash Card” on page 8-36).

T065: Library Control Blade robot power fuse (F3) blown (42 volt bus)

Description	The library detects that the 42V, F3 picker power fuse located on the LCB has blown.
Detection Scenarios	Monitoring of voltage divider indicates partial or complete voltage drop
Root Causes	1. Board level hardware failures 2. Permanent or temporary short in cables, connectors, Picker 3. Various hardware failures in Picker that cause too much current to be drawn
Possible CRU Replacements	• Library Control Board
Possible FRU Replacements	Picker
Resolution	Perform “DR035: Robot Fuse Blown Resolution” on page 6-49

T066: Drive power fuse (F1) blown

Description	The library detects that an F1 drive fuse located on a Drive Sled Interface Board (DSIB) has failed. Each module has a DSIB card to provide an electrical connection point for the drive sleds. Each DSIB has a replaceable fuse for the overall drive power bus. This protects the core library hardware components from some type of short or over current problem in one or more drives.
Detection Scenarios	• Monitoring of voltage divider indicates partial or complete voltage drop
Root Causes:	1. Board level hardware failure 2. Permanent or temporary short circuit conditions in drives, drive sleds, docking connectors, etc.
Possible CRU Replacements	Tape Drive
Possible FRU Replacements	• DSIB fuse • Internal Cables and Boards Kit
Resolution	Perform “Remove and Replace Drive Power Fuse” on page 8-78.

T067: Display Assembly hardware failure

Description	The library encounters an error which appears to be isolated to Operator Panel hardware. This includes the Operator Panel board.
Detection Scenarios	No communication with operator panel board.
Root Causes	1. Board level hardware failures 2. Display not plugged in 3. Cable failure or not plugged in
Possible FRU Replacements	• Operator Panel • Internal Cables and Boards Kit
Resolution	Remove and replace the Operator Panel (see "Operator Panel" on page 8-19).

T068: Destination element for a move media is full

Description	The robot has attempted to put to a drive, I/O, or storage element and has determined that the element is full. This is distinctly NOT a SCSI illegal request situation. At the beginning of the move media, the library inventory has indicated that the destination element was in an empty state to allow it to be a valid destination. During recovery operations, the library has concluded that the cell is obstructed by a piece of media. Any failure that is not thought to be a piece of media in the destination should not be mapped to this ticket.
Detection Scenarios	The destination element for a move media is full with a LABELED cartridge. Library inventory does not know that the cell is full.
Root Causes	Inventory has not occurred since cartridge was placed in element by some manual operator intervention.
Possible CRU Replacements	Tape Cartridge
Resolution	Perform "DR020: Re-inventory the Library" on page 6-45.

T069: Source element for a move media is empty

Description	The robot has attempted to get from a drive, I/O, or storage element and has determined that the element is empty. This is distinctly NOT a SCSI illegal request situation. At the beginning of the move media, the library inventory has indicated that the source element was not in an empty state and it was a valid source for a move media command. During recovery operations, the library has concluded that the cell is genuinely empty. Empty is defined as NOT containing a cartridge with a readable volume serial number.
Detection Scenarios	The library fails to successfully get a cartridge dur

Resolution	Perform “DR020: Re-inventory the Library” on page 6-45.

T070: Logical library control path failed

Description	The library media changer control path through a

T073: I/O Storage Door Open

Description	Certain IO doors can be designated as storage slots. When one of these doors is open, the system should not become operational because these storage slots would not be available to the robot. The ticket is posted as a means of informing the user that the library cannot become operational and that they should close the door so the system can lock it and start using it.
Detection Scenario	1. When the main doors are closed and the robot attempts to initialize, the state of "I/O Storage Doors" will be checked. 2. When the library powers up and the robot attempts to initialize, the state of the "I/O Storage Doors" will be checked.
Root Causes	1. I/O Storage door is left open by user. 2. Hardware failure in the I/O door open/closed sensing.
Possible FRU Replacements	• I/O Lock Assembly • I/O mechanism
Resolution	Perform "DR034: IO Storage Door Open Resolution" on page 6-48.

T074: Sled Auto-Leveling Failure

Description	The normal auto level process for a sled did not work. When a drive sled is inserted into a powered ON library or when a library powers ON, the firmware level of the drive sled is checked to be consistent with the level required by the main library firmware. If the level is not correct, the sled will be up-leveled or down-leveled accordingly. Failure in this process to set the correct firmware level in the sled results in this ticket.
Root Causes	1. Physical interruption of the firmware down load process. 2. Firmware problems. 3. Hardware failures that result in intermittent or failed communication between library and drive sled.
Possible CRU Replacements	• Firmware • Drive sled
Possible FRU Replacements	Internal Cables and Boards Kit
Resolution	Perform "DR033: Drive Sled Auto Level Resolution" on page 6-48.

T075: Unsupported Module Configuration

Description	The current level of library firmware does not support the module configuration as detected by scanned module serial number labels. The causes for this ticket will likely change over time as new valid configurations are added to the system. At GA time, the firmware will allow 5U, 14U, and 23U configurations. It will specifically not run with anything greater than 23U or with a 10U configuration.

Detection Scenario	During initialization, the robot reads serial numbers on the chassis modules that are present that indicate a configuration other than a 5U, 14U, or 23U.
Root Causes	1. The system really is an invalid configuration and all modules are labeled correctly. 2. A chassis module is not labeled correctly. 3. The firmware level loaded on the library does not support a valid configuration.
Possible CRU Replacements	Firmware
Possible FRU Replacements	Internal Cables and Boards Kit
Resolution	Perform "DR026: Unsupported Module Configuration" on page 6-46.

T076: Robot Initialization Failure

Description	This ticket is designed to notify the user if the robot cannot initialize at all.
Detection Scenario	1. Any time the main door(s) closes and the robot goes through an initialization sequence. 2. At power up of the library if the main door(s) is closed.
Root Causes	1. Complete loss of connection to robot (i.e. unplugged cable spool or equivalent). 2. Broken connection to y-motor 3. Numerous hardware failures on the picker assembly
Possible CRU Replacements	Library Control Blade
Possible FRU Replacements	• Picker assembly • Y-axis Assembly • Y-axis Cable Spool • Internal Cables and Boards Kit
Resolution	Perform "DR031: Robot Initialization Resolution" on page 6-47.

T077: I/O Station Partially Open or Unplugged

Description	This ticket is specifically designed to report the problem that would occur if the cable connecting any of the I/O stations is unplugged. Hardware limitations make it such that and unplugged I/O and a partially open I/O cannot be distinguished from one another. The default state of the open and closed door sensors is such that only the partially open state looks like the unplugged state (door not open + door not closed). The detection logic will check for this condition only at boot up to avoid triggering the ticket during any operational door open / close sequence.
Detection Scenario	Any time the library boots up it checks for the state of the I/O open and close sensors to see if there is a not open and not closed condition.

Root Causes	1. I/O station safety flap broken or loose. 2. I/O station is unplugged at boot up 3. I/O station is left in a not open and not closed state at boot up
Possible FRU Replacements	• I/O station safety flap • I/O Station Lock assembly • Internal Cables and Boards Kit
Resolution	Perform "DR036: I/O Station Partially Open or Unplugged" on page 6-49.

T079: Get Operation Failed, Motion OK

Description	The library cannot successfully get a tape from a drive, storage or I/O location. The tape is still resting in the source location. The robot is not obstructed in any way and can continue operations (unlike the case for T003). If the operation was initiated by a host move media, the move media command has failed with an ASC/ASCQ of 4h/15h/01h (hardware mechanical positioning error).
Detection Scenario	The picker cannot get a tape from the source location. It can scan or touch the tape to verify that it is present.
Root Causes	1. Picker has broken fingers. 2. Picker has bad calibration so it is not positioned correctly. 3. Picker has bad **'y'** gears so it is not at the height it thinks it is at. 4. An obstruction that prevents the picker fingers from getting into the tape grooves. 5. A bad tape that is jammed and stuck in the slot. 6. A damaged slot or drive that will not release the tape.
Possible CRU Replacements	• Cartridge
Possible FRU Replacements	• Picker • Y-axis assembly • Column assembly
Resolution	Perform "DR076: Resolve Get Failure" on page 6-57.

T080: Control module serial number changed or chassis removed

Description	When the library powers ON and the robot initializes, the bar code serial number (SN) labels in each module are scanned by the robot beginning at the bottom of the library (closest to the y-axis home) and then working up. The library uses the control module (CM) SN and any expansion module SN to establish key operational properties and characteristics of library storage slots and partitions. A change in the CM SN or the removal of an EM (even if it is replaced with another EM) will "break" any already established partition in such a way that it must be deleted. This ticket was designed to notify the user that a condition exists that requires the deletion of a partition(s) and allow the user to assess whether perhaps human error is involved such as mixing the Library Control Blade's compact flash memory between libraries
Detection Scenario	At library power ON, the robot attempts to scan all module SN's. When SN's are discovered, they are compared to persistent data on the Library Control Blade's compact flash.
Root Causes	1. A Library Control Blade is improperly swapped into a different physical chassis and the system reads the physical chassis label. 2. A CM chassis FRU is replaced in an already configured system 3. A previously detected and configured EM is removed completely from a vertical stack of modules. 4. A previously detected and configured EM is removed completely from a vertical stack of modules and replaced with another EM of similar OR different size and location.
Resolution	Perform "DR039: Logical Library Deletion Required" on page 6-50.

T081: Incorrect Module Brand Detected

Description	The branding of a system is accomplished in two different ways. The firmware uses information saved on the compact flash to determine what brand the firmware and GUI's will present to the user. There is also physical branding of the system in the form of different cosmetic skins, badging, paint, external labels, etc. on each module. In addition, each module has a machine readable bar code label that carries a module serial number (SN) and branding information that should match the physical branding of the module. The library manufacturing process should install a machine readable bar code label that matches the external, user visible branding of the module. Because the library robot can read this bar code label, it can check the branding of the physical modules against the branding of the firmware and GUI's. This ticket is a defensive tool used to notify the user that there is a mismatch in the branding mechanisms. The root cause of a mismatch can be manufacturing defects, logistical errors (shipping the wrong spare part), or user errors such as moving parts between systems.

Detection Scenario	At library power ON, the robot attempts to scan all module bar code labels. When the OID number on each label is read, the embedded branding information is compared to persisteent data on the system compact flash.
Root Causes	1. Various manufacturing defect errors, mislabeling or part mix ups. 2. Spare part logistics error where wrong module FRU or compact flash FRU is sent to a customer site. 3. End users or Service personnel mixing and matching hardware from multiple systems of different branding in the field.
Resolution	Perform “DR040: Incompatible module branding” on page 6-50.

T082: Bar Code Scanner not operating

Description	The bar code scanner is detected to be in a state where the library control logic cannot use it. Library robot power

Detection Scenario	1. The robot cannot move to its Y-axis parking position after homing in Y because the front of the Y Carriage hits the floor. Parking position is below homing position. 2. Front and back magazine fiducial positions on the left side are not at the same Y level. This test algorithm can detect non-level conditions in both directions (front high or back high). **Note:** There are a few known false detection scenarios: Certain specific size obstructions sitting on the floor of the library. Magazines not seated correctly. Damaged fiducials that can be detected but are detected as mispositioned because they are damaged.
Root Causes	1. Robot drive gears not installed in Y racks at the same time. This can result in the two ends of the Y Carriage being 1 to 2 teeth out of synchronization. 2. Y racks not seated properly/evenly. Both the front and rear Y rack are intended to be released from their shipping latches and lowered such that the racks in the very bottom module rest on the floor of the unit. 3. There are hardware failure and assembly failure modes that can result in the front and rear drive gears on the Y Carriage being excessively out of phase with each other.
Possible FRU Replacements	• Y-axis Assembly • Internal Cables and Boards Kit
Resolution	Perform "DR041: Check Robot Installation" on page 6-50.

T084: Library managed cleaning cartridge is missing

Description	When using the library to manage drive cleaning, the cleaning cartridges that are imported into the library are not visible to any host and are not part of any partition. Rather, they are in the "system" partition. Under all circumstances, the user should use the import and export cleaning cartridge functions to move cleaning cartridges into and out of the cleaning slots in this "system" partition. If the library becomes aware during inventory that a system cleaning cartridge has been removed manually (through an open door and/or with the power OFF) this ticket will be used to notify the user that this cleaning resource is now missing. Because the cartridge has gone missing, the library cleaning functionality is no longer intact. It is either degraded (fewer cartridges available) or totally absent (no cleaning cartridge in the library).
Detection Scenario	1. When library inventory occurs during robot initialization from a power ON. 2. When library inventory occurs during robot initialization from a door close.
Root Causes	1. User removes cartridge manually instead of via export cleaning media GUI functionality. 2. Bar code label on a system cleaning cartridge is not read during inventory. 3. Any scenario where a properly imported system cleaning cartridge which has not yet been properly exported is detected to be missing based on library inventory operations.

Possible CRU Replacements	Cleaning cartridge
Resolution	Perform “DR042: Import a Library Cleaning Cartridge” on page 6-51.

T085: Cleaning slot occupied by non imported cartridge

Description	When using the library to manage drive cleaning, the cleaning cartridges that are imported into the library are not visible to any host and are not part of any partition. Rather, they are in the “system” partition. Under all circumstances, the user should use the import and export cleaning cartridge functions to move cleaning cartridges into and out of the cleaning slots in this “system” partition. If the library becomes aware during inventory that an unexpected (non-imported) cartridge has been inserted into a cleaning

Detection Scenario	In libraries of 23U or greater, the library discovers a bar code labeled cartridge in the top slot of either column 4 or 5 during inventory.
Root Causes	A user manually places a cartridge in the top slot of either column 4 or 5 during inventory in a library that is at least 23U or greater.
Possible CRU Replacements	Cartridge
Resolution	Perform “DR049 Tape Alert 30,31 – Drive Hardware Error” on page 6-53.

T087: Invalid or Damaged Library SN Label, Library Can Continue

Description	The library logic learns the SN of the system by reading an internal SN label. This is done at first boot-up from a ″cleared-to-ship″ condition in order to establish the SN. It is also done on subsequent boot-ups to confirm that the Compact Flash memory card is in the proper library. The library will report this ticket when it cannot read the library SN but it has confirmed functionality of the bar code reading system by successfully reading some other bar code label in the library and it has the library serial number stored in memory from a previous successful read.
Detection Scenario	Any power-up. System memory already has a valid SN established for the LCB.
Root Causes	• Label is damaged. • Label is missing. • Label is physically obstructed. • Label is readable but does not meet minimum criteria to be considered a library SN label. • Scanner cannot read the serial number label.
Possible CRU Replacements	• LCB Flash Memory • LCB
Possible FRU Replacement	CM or EM module
Resolution	Perform “DR051: Replace Library SN Label Advised” on page 6-54.

T089: RAS Ticket Email Did Not Reach Destination

Description	The user can configure the library to send an email to a specified address whenever a RAS ticket is generated. This email will include a description of the RAS ticket and will optionally include the library snapshot. The library will report this ticket if it receives any error codes when trying to send out this email. This ticket indicates that there is something wrong with the customer’s internal network or its settings, but there is no error on the library side. Note that the library cannot detect all errors that could occur on a network, but can determine if the email was successfully sent to the mail server on the network.
Detection Scenario	Any time a RAS ticket is generated and the library has been configured to generate a RAS email.

Root Causes	• Email settings on the library are not correct. • The library is not connected to the network. • Library is plugged into the wrong network port. • Network cable is damaged. • Some other configuration error on the customer's network.
Resolution	Perform "DR053: Check Network Configuration" on page 6-54.

T090: Invalid Cleaning Tape

Description	System determines that the tape used to clean a drive is not a cleaning tape. This ticket differs from the Tape Alert 23 ticket (T048) in that this ticket will be generated anytime a non-cleaning tape is used to clean a drive, not just in the case where the drive requires cleaning and posts a Tape Alert 23.
Detection Scenario	After loading a tape to clean a drive, the system notices that cleaning has not begun within 30 seconds.
Root Causes	• User or library attempts to mount a cleaning tape but the tape is not actually a cleaning tape. • User mistakenly loads a data tape as a cleaning tape. • Inventory or application issue results in data tape being loaded when drive expects cleaning tape.
Resolution	Perform "DR077: Resolve Invalid Cleaning Tape" on page 6-57.

T091: Tape Alert 56 - Unload Failure

Description	When attempting to unload a tape, a drive brick hardware malfunction can prevent the tape from being ejected. The tape may actually be stuck in the drive.
Detection Scenario	After unsuccessfully attempting to unload a tape, the drive generates a Tape Alert 56, which is noticed by the library.
Root Causes	• A drive hardware error that prevents the tape from being unloaded. • A damaged tape that cannot be unloaded from the drive.
Possible FRU Replacements	• Drive sled
Resolution	Perform "DR078: Resolve Tape Load/Unload Failure" on page 6-57.

T094: Drive Cover Plate Missing

Description	At boot time or runtime, the library detects that at least one of the unoccupied drive bays does not have a cover on it. For safety reasons, if an empty drive bay does not have a cover, the robot is slowed to one-half speed to minimize the risk of someone putting their hand inside the library and having the robot run into it at full speed. Library operations will take twice as long in this state. As suers normally remove this cover to insert or remove drives, the library will wait 10 minutes after detecting this condition before posting the RAS ticket. The library does not have the capability of displaying the location of the drive cover plate in question.
Detection Scenario	• Missing drive cover plate • Drive cover is loose or ajar and not electrically connected
Root Causes	• User removed the panel and forgot to put it back. • Panel was not put on securely and the electrical connection is not solid. • The panel is damaged in such a way that the electrical connection cannot be made.
Possible CRU	Drive cover plate.
Resolution	Perform "DR054: Replace Drive Cover Plate" on page 6-55.

T095: Installation & Verification Test Failure

Description	The library contains a verification test that can be run to validate that the system has been installed properly and is up and running. The library will post this ticket whenever an error occurs during this Installation & Verification Test that is not covered by some other RAS ticket. As there is no specific resolution strategy to assist in diagnosis, the only customer action is to contact Service.
Detection Scenario	During the Installation & Verification Test run, any library error occurs that is not already handle by an existing RAS ticket.
Root Causes	Any function executed by the Installation & Verification Test that does not complete successfully.
Resolution	Perform "DR021: Contact Tech Support" on page 6-45.

T096: Module Communication Error

Description	The system is having a problem finding and/or communicating with all the modules in the library.
Detection Scenario	At boot up, the library cannot determine the status of all modules.
Root Causes	• Bent pin on a terminator or a box-to-box cable. • I/O station sensor error. • I2C bus error.
Possible CRU Replacements	LCB
Possible FRU Replacement	CM or EM module
Resolution	Perform "DR056: Resolve Module Communication" on page 6-55.

T108: Incompatible Drive in Library

Description	Different library configurations support different drives. The drive sleds will contain certain configuration information that the library will use to validate that the drive is indeed configured properly. If a drive's configuration data does not match what the library expects, the drive will not be usable and this ticket will be generated.
Detection Scenario	When drive is installed, the configuration data does not match what is expected.
Root Causes	• User installed a drive from a different brand library. • User did not purchase the drive from an official TS3310 sales channel. • Drive sled does not have the correct configuration information programmed.
Possible FRU Replacement	Drive sled
Resolution	Perform "DR068: Incompatible Tape Drive"

T110: Drive Firmware Mismatch Detected

Description	Each drive installed in the library is programmed with firmware from the drive manufacturer. All drives in the library should have the same firmware version. The library checks the library firmware version upon initialization and again when a new drive is inserted. If the drive do not all have the same firmware, a ticket will be generated. Rather than trying to list all the differences, the ticket will simply instruct the user to look at the System Information screen to identify which drives need to be updated.
Detection Scenario	On initialization, the library detects that not all drives have the same firmware version.
Root Causes	A drive was installed that had a different firmware version than other drives in the library.
Possible FRU Replacement	Drive sled
Resolution	Perform "DR070: Resolve Drive Firmware Mismatch" on page 6-56.

T112: Invalid Drive Firmware Image

Description	During initialization or when a drive is inserted while the library is operating, the library checks the product firmware level of the installed drive brick and compares that version to the version that it stores internally in its file system. If they are not the same, the library automatically updates the drive brick with this internally stored code image.
Detection Scenario	The automatic updates of the drive brick firmware fails.
Root Causes	The drive brick firmware image stored on the library's file system is corrupt.
Resolution	Perform "DR072: Resolve Drive Brick Autolevel Failure" on page 6-56.

T114: Tape Not Assigned to Logical Library

Description	At bootup, or after a door open event, the picker performs an inventory of the entire library. If a cartridge is located in a slot that is not part of a logical library, the cartridge will be inaccessible to the user and must be manually removed. This ticket will be generated upon the first occurance of such a cartridge; a separate ticket will not be generated for each cartridge found.
Detection Scenario	During inventory, a cartridge is found in a slot that does not belong to a logical library.
Root Causes	• Tape was manually placed into the slot. • A partition was deleted that contained media and the library was power cycled or the main door was opened.
Resolution	Perform "DR074: Resolve Cartridge Not Assigned to Partition" on page 6-56.

T115: Installation and Verification Test Warning

Description	The library contains a verification test that can be run to validate that the system has been installed properly and is up and running. The library will post this ticket whenever an error occurs during this test that does not affect the overall functionality of the library. This serves as a warning that a problem may be developing.
Detection Scenario	During the Installation & Verification Test run, any error occurs that is not serious enough to limit library functionality.
Root Causes	Any function that is executed by the Installation & Verification Test that does not complete successfully.
Resolution	Perform "DR075: Resolve Installation & Verification Test Warning" on page 6-57.

Diagnostic Resolutions

Diagnostic Resolutions are accessed via wizard screens on the Operator Panel. When an Operator Intervention occurs, a diagnostic resolution wizard is available to help you resolve the problem.

Important: It is recommended that Service Action Tickets not be allowed to accumulate in the Operator Intervention reports. After an incident has been resolved or repaired, the Service Action Ticket should be closed.

DR001: Manually Recover Tape from Picker

Problem:

The library has a cartridge in the Picker but cannot recover without user intervention to remove the cartridge.

Troubleshooting Steps:

1. Open the library main Access Doors.
2. Rotate the Picker by hand so that the opening faces the drives.
3. Use the gear thumb wheel on the right side of the Picker base closest to you to manually drive the cartridge out of the Picker towards the tape drives.
4. Close the library main Access Doors once the cartridge has been removed. Wait for the library to initialize.
5. Import the cartridge to the appropriate logical library via the host application.
6. Continue operations.

If there is no cartridge in the Picker when you investigate, it is likely that the cartridge present sensor in the Picker is malfunctioning.

Remove and replace the Picker. Refer to "Picker Assembly" on page 8-53.

DR002: Manually Recover Tape from Source or Destination Slot

Problem

The library robot (Picker assembly) has failed during a move media. The cartridge must be manually recovered before operations should be continued.

Troubleshooting Step:

1. Open the main Access Door(s) and find the cartridge. It may be stranded between the Picker and the source or destination of the move.
2. Recover the cartridge.
3. Close the doors and wait for the system to complete initialization.
4. Use the **Tools** → **Service** → **Library** → **Robot** test to verify if the robot is operational.
   - If the test fails, refer to “Start Service” on page 1-1.
   - If the test passes, Close the Operator Intervention and continue operations and monitor for reoccurrence.

DR003: Drive Unload Diagnostic

Problem:

A tape drive did not unload a cartridge when it should have. Automatic recovery has failed. User intervention required.

Troubleshooting Steps:

1. Retry drive unload from host backup application.
2. Open the library Access Doors.
3. Push the blue unload button on the front of the drive. Remove the cartridge if it is ejected by the drive.
4. Import the drive into the appropriate logical library.
5. If the cartridge remains stuck in the drive, refer to “Manual Cartridge Removal from a Drive” on page 8-81.

DR004: Manually Inspect Destination Element

Problem:

The library attempted to put a cartridge in a drive, storage, or the I/O Station. The destination location appears to be blocked or partially blocked. The library has successfully returned the cartridge to the source location.

Troubleshooting Steps:

1. Identify the coordinate provided in the Details of the ticket.
2. Open the library bulk load doors *(Access Doors)* and locate the problem location.
3. Inspect it for the presence of unlabeled media, or other contamination or damage that prevented the library robot from placing the cartridge.

DR005: Motion Failure Diagnostic (a Library Verify Test)

Problem:

The Picker has failed to perform a motion. The detected failure is likely to be a genuine hardware failure.

Troubleshooting Step:

1. Open the I/O Station door then the Access Door and look for any obvious problems such as unplugged cables or damage to the Picker.
2. Remove any tapes from the Picker or from the path of the Picker.
3. Close the doors and wait for the system to complete initialization.
4. Select **Tools** → **Service** → **Library** → **Robotics** to determine if the failure is permanent.
   - If the test fails, refer to “Start Service” on page 1-1.
   - If the test passes, monitor for reoccurrence.

DR006: Drive Diagnostic (a Library Verify Test)

This tape drive diagnostic requires a blank, scratch cartridge.

Problem:

A drive is suspected of having a problem.

Troubleshooting Steps:

1. From the Operator Panel, select **Tools** → **Service** → **System**.
2. Touch **Yes** to take all logical libraries OFFLINE.
3. Select **Library**.
4. Select **Drive**.
5. Select the drive to be tested.
6. Place a scratch cartridge in the top slot of the top I/O Station, then close the I/O door.
7. When the **Assign I/O** screen is displayed, touch **System**, then **Next** to continue.
8. Touch **Next** to begin the test.
9. The scratch cartridge will be returned to the top slot of the top I/O Station and the results of the test will be displayed.
10. Touch **Exit** to return to the **Library Verify** screen.
11. Touch **Back** to return to the **System Diagnostics** screen.
12. Touch **Back** to return to the **Library Offline** screen.
13. Touch **No** to exit the ″bring all logical libraries OFFLINE″ screen.
14. Touch **Back** to return to the **Service Menu** screen.
15. Touch **Exit** to return to the **Tools** menu.
16. Touch the **Operations** tab, then touch the **Logical Library Mode** button to bring the logical libraries back ONLINE.

DR007: Bar Code Scanner Diagnostic (a Library Verify Test)

Troubleshooting Steps:

1. Check the facility AC power and the power supply power switch.
2. Correct them if necessary and Close the Operator Intervention.
3. If the facility AC power and the power supply power switch are OK, see "Power Supply (Primary and Redundant)" on page 8-42.

DR010: Expansion Module Connectivity Diagnostic

Problem:

The library requires two connectors to be plugged into two specific ports on the rear of the library in order to automatically detect its configuration. In a multi-module system, these plugs are placed in the expansion modules at the very top and bottom of the vertical stacking. In addition, cables must connect modules together.

Troubleshooting Steps:

Are the terminators and all module to module cables plugged in properly?

- **No** - You reported that the cables and terminators were not plugged in correctly. Select Continue, then power down the library, plug the cables in and power the library back on. When the library powers up, it should detect the presence of the cables and terminators and properly configure itself.
- **Yes** - Place both terminators on the CM to begin isolating the problem. You may back up or proceed with the Self Test.
  - **Self Test Failed** - Self Test failed. Contact IBM Service to order replacement terminators. See product documentation to determine how to order parts.
  - **Self Test Passed** - Self Test passed. Both terminators and the control module are working properly. Continue to isolate the failure by plugging the terminator into the first upper module and installing the module-to-module communication cable. Once the terminator and cables are installed, perform the Self Test again.

    If there is no upper expansion module, select the **Next** button.
    - **Self Test Failed** - Self Test failed. Contact IBM Service to order replacement cable or upper expansion module. See product documentation to determine how to order parts.
    - **Self Test Passed** - Upper expansion module Self Test passed or there was no upper expansion module. Continue to isolate the failure by plugging the terminator into the first lower module and installing the module-to-module communication cable. Once the terminator and cables are installed, perform the Self Test again.

      If there is no lower module, select the **Next** button.
      - **Self Test Failed** - Self Test failed. Contact IBM Service to order replacement cable or lower expansion module. See product documentation to determine how to order parts.
      - **Self Test Passed** - All self testing has passed. Problem is no longer detected.

        The library must be power cycled for the module configuration to be fully invoked as the intended operating configuration.

DR011: I/E (I/O Station) Lock Diagnostic (a Library Verify Test)

Problem:

The library cannot lock or unlock the I/O Station in module *n*.

Troubleshooting Steps:

To proceed with troubleshooting the library should be taken out of service.

- All host operations should be quiesced by the user.
- All logical

Troubleshooting Step:

1. If the drive is SCSI:
   - check for proper termination
   - check cable length meets SCSI limits
   - check host and drive connectors for bent or broken pins
   - secure host and drive connectors
2. If the drive is Fibre Channel:
   - check cable connections are secure
   - check for broken or pinched cables
   - check for cable bend radius too sharp
   - check cable connections are clean
3. Check all hardware components between host and drive are communicating correctly.
4. Check host HBA and components are communicating correctly.
5. If problem remains unresolved, contact your next level of support.

DR014: Write Protect or WORM Diagnostic

Problem:

A back up application attempted to write data to a write protected or WORM cartridge.

Troubleshooting Step:

Determine whether the cartridge should be write protected or not.

If not, export the cartridge via your back up application and correct the problem by manually changing the write protect switch on the cartridge.

If the cartridge is correctly set as a ″read only″ tape, investigate your host application to determine why a write was attempted.

DR015: Unsupported Format Diagnostic

Problem:

A cartridge that is not a correct format has been loaded into a drive. There are several common scenarios:

1. FMR update cartridge loaded as a data cartridge
2. Cleaning cartridge loaded as a data cartridge
3. Data cartridge loaded as a FMR cartridge
4. Data cartridge loaded as a cleaning cartridge

Troubleshooting Step:

If the cartridge was loaded to the drive via the Library GUI, export the cartridge via the library **Operations** → **Media** → **Export** function. Import the proper type of cartridge for the desired operation and continue.

If the cartridge was loaded to the drive via a host application, export the cartridge via the host application. Import the proper type of cartridge for the desired operation and continue.

DR016: Host Prevent/Allow Diagnostic

Problem:

The library has been commanded to perform an operation involving certain restricted resource. these resources are currently under control of a particular host and cannot be used for the operation. The library cannot use these resources until they are set to Allow Media Removal Mode by the host.

Troubleshooting Step:

Determine which host currently has a prevent media removal set. Use the host application or OS functionality to clear the Prevent mode.

DR018: Manually Clean Drive

Problem:

A drive has reported that it requires cleaning. This problem should be addressed differently based on your system setup.

Troubleshooting Steps:

There are two cases to consider:

1. Library controlled or host controlled cleaning is enabled. When this problem is reported, the cleaning process should have already been triggered if there was a valid, not expired cleaning cartridge available. Normally you can close this problem and consider it as notification that a cleaning cycle of a cartridge has been consumed. Cleaning cartridges have a limited number of useful cycles. Consult the user information you received with your cleaning cartridge for specific cycle life information.
2. No automatic cleaning is enabled. The drive is in a state where it requires cleaning and can not be used for normal operations again until it is cleaned. The library provides a user prompted cleaning function where a cleaning cartridge can be imported into the library to perform a one-time clean operation. Consult your user documentation for instructions on how to perform a one-time clean operation or how to enable automatic cleaning on the library.

DR019: Door Open Diagnostic

Problem:

One of the library's main Access Doors has been opened.

There are two basic scenarios to recover from:

1. Door open DID NOT interrupt a library MOVE MEDIA.
2. Door open DID interrupt a library MOVE MEDIA.

Resolutions:

1. Door open DID NOT interrupt a library MOVE MEDIA.

   If the door opening was planned and performed when the Picker was idle, recovery consists of simply closing the door. The library will re-inventory and trigger back up applications to resynchronize inventory.
2. Door open DID interrupt a library MOVE MEDIA.

   If the door opening was not planned, MOVE MEDIA operations may have been interrupted. Check back up applications to make sure that no jobs have been interrupted. Follow the **Resolve** instructions for any other problems.

DR020: Re-inventory the Library

Problem:

The library has encountered a problem that indicates a mismatch between library inventory and host application inventory. A re-inventory of the library is required.

Troubleshooting Step:

Check for unlabeled media or media with a damaged label.

To trigger an inventory of the library, open and close one of the bulk load doors *(Access Doors)*. The library will automatically notify host applications that the inventory status of the library has changed and host applications should synchronize to the new library inventory.

DR021: Contact Tech Support

This Operator Intervention requires technical assistance from IBM. Please contact an IBM Service Representative by phone or web to open a Service Request.

In the USA: 800-IBM-SERV (1-800-426-7378)

All other countries/regions: http://www.ibm.com

To open a Service Request online: http://www.ibm.com

At the direction of IBM Technical Support, you may be asked to perform the following functions:

- Capture Snapshot (From the Web User Interface, select **Service Library** → **Capture Library Log**
- Close Operator Intervention.

DR022: Power Supply Not Present

Problem:

A power supply is detected to be missing in the system. This is most likely caused by an actual removal of a power supply.

Troubleshooting Step:

If you have recently removed a power supply from the library, replace it and **Close** this Operator Intervention.

If all power supplies appear to be present, see “Power Supply LEDs” on page 7-13.

DR023: I/O Station Magazine Missing

Problem:

An

DR024: Close IO Door

Problem:

An I/O Station door is open but the library requires it to be closed to continue operation.

Troubleshooting Step:

Close the I/O Station door and close the Operator Intervention.

DR026: Unsupported Module Configuration

Problem:

The library has detected a configuratin of expansion module frames that is not supported by the current firmware. There are two possible scenarios:

- The configuration is valid and your system requires newer firmware to support the configuration.
- The configuration of EM's is not a valid configuration.

Troubleshooting Steps:

In all cases, contact Service to determine a course of action. Be prepared to describe the number of modules in your system.

DR027: Replace Library SN Label

Problem:

The library can not read one of the module serial number labels but has already validated that the bar code scanning system is working properly. There are two likely scenarios:

1. Line of sight from the scanner to the module serial number bar code label is blocked by foreign material such as a media bar code label.
2. The module serial number bar code label is damaged and the bar code scanner can not read it reliably.

Troubleshooting Steps:

1. Open the main library doors.
2. Look for and remove any obstructions in front of the module serial number bar code labels.
3. If no obvious foreign material is found, the module SN is damaged and the EM or CM will need to be replaced. The library is not operational until it can successfully read the bar code label. Contact Service for possible CM or EM replacement.

DR028: Motion Obstruction Diagnostic

Problem:

The library robot has failed to perform a motion. It appears that the motion has been obstructed by a foreign object or a misplaced cartridge.

Troubleshooting Steps:

1. Open the main Access Door(s) and look for any obvious foreign objects or tapes obstructing motion.
2. Look under the robot to make sure that there is no tape or other hidden obstruction on the floor of the library.
3. Close the doors and wait for the System to complete initialization.
4. Use the **Tools → Service → Library → Robot Test** to exercise the robot and verify that the obstruction is cleared.
    - If the test fails, refer to "Start Service" on page 1-1 for further troubleshooting instructions.
    - If the test passes, the obstruction is cleared. Monitor for reoccurrence.

DR029: Drive Communication Loss Resolution

Problem:

The system can no longer communicate with a drive sled.

There are a few scenarios that can create this problem.

1. A user removed a drive sled
2. A hardware failure that results in the drive appearing to be disconnected.

Troubleshooting Steps:

1. If the drive was intentionally removed, close this problem.
2. If the problem occurred during operation, make sure the sled was properly installed. Check the thumb screws on the drive to make sure they are tight and the drive is mounted flush to the library chassis.
3. Check for other problems. There are other problems such as T066-Drive Power Fuse Blown, that can cause drive communication loss.
4. If the steps above do not resolve the problem, replace the drive. Refer to "Drive Sled" on page 8-34.

DR030: Drive Load Failure Resolution

Problem:

The robot was unable to load a tape drive. The robot motion completed normally but the drive did not report that it successfully loaded the tape.

There are two possible scenarios that can lead to this problem:

1. The drive hardware is not functioning properly.
2. The robot hardware is not functioning properly.

Troubleshooting:

1. The problem is most likely isolated to the specific drive referenced under the Details button. However, check for the same problem being reported for other drives in the system.
2. If this same problem is reported on multiple drives, replace the Picker. Refer to "Picker Assembly" on page 8-53.
3. If this problem is isolated to an individual drive, replace the drive. Refer to "Drive Sled" on page 8-34.

DR031: Robot Initialization Resolution

Problem:

During a power ON or after closing library main access doors, the robot did not initialize properly.

A common cause for this problem is an unplugged cable that leads to the robot. Other permanent hardware failures that result in loss of connection to the robot can also be a root cause.

Troubleshooting Steps:

1. Open the library main access doors. This will allow access to the robot and remove power from the robot. Check for any obvious disconnected cables leading to the robot.
2. If any disconnected cables are discovered, plug them in and close all main access doors. The robot automatically attempt to initialize.
3. If no problem is found or the robot still fails, contact IBM Technical Support.

DR032: Control Path Failure Resolution

Problem:

A control path to a library has failed. It is likely that a drive sled failure is being reported as a separate problem.

In libraries with more than one drive you have the option to use an alternate drive as the control path if your host connection architecture permits it.

Changing the control path can be a temporary work around until the original drive problem is corrected OR a permanent change in your setup.

Procedure:

1. Use the functions under the **Setup> Control Path** menu to switch the control path.
2. Whether you change the control path or not, you may Close this problem.
3. Any associated drive problem must be resolved separately.

DR033: Drive Sled Auto Level Resolution

Problem:

The library has attempted to change the firmware level in a drive sled but the process failed.

Troubleshooting Steps:

1. Using the drive coordinate from the problem Details, identify the drive sled that failed.
2. After you have located the drive on the rear of the library, unscrew the thumbscrews and pull the drive out of the library completely for at least 30 seconds. Re-insert the drive and tighten the thumbscrews.
3. The library should now attempt to discover and initialize the drive again.
4. If this second attempt to establish the drive firmware level fails, contact IBM Technical Support .

DR034: IO Storage Door Open Resolution

Problem:

This library has an I/O station door that is configured to function as tape storage. This door was detected to be open at a time when the library needed it to be closed. The library cannot access these tape storage locations until this I/O door is closed and locked by the library.

Troubleshooting Steps:

There are two scenarios:

1. An I/O station door is genuinely open. If any I/O station doors are open, close them. Once the I/O station doors are closed, the library will automatically lock doors that are designated as storage. Close this operator intervention and monitor for reoccurrence.
2. There is a hardware failure that makes it appear that an I/O station door is open. If all doors already appear to be closed, use the I/O station test under **Tools** → **Service** → **Library** to test the function of the I/O station.

DR035: Robot Fuse Blown Resolution

Problem:

The robot has momentarily pulled too much current. Circuit protection has occurred and a fuse may have blown or an internal power supply may have temporarily shut OFF.

Troubleshooting Steps:

1. In all cases, the picker should be replaced as the likely root cause of the over current condition. See "Picker Assembly" on page 8-53.
2. In addition, if the fuse is blown on the LCB, the LCB will need to be replaced. See "Library Control Blade or Compact Flash Card" on page 8-36.
3. Picker replacement occurs with the library power OFF. Prior to powering down the library, open a main Access Door and then Close this problem.
4. If this problem is reported again with the new picker installed and the library powered back up, then the LCB must be replaced.

DR036: I/O Station Partially Open or Unplugged

Problem:

The I/O station appears to have failed.

Possible Causes:

1. The I/O Station safety flap may be broken
2. The I/O Station flap may be partially open. If so, please close it.
3. The control cable to the I/O Station is unplugged.
4. There is a hardware failure that makes it appear that an I/O Station door is partially open.

Troubleshooting Steps:

1. If any of the I/O Station safety flaps are broken, replace them.
2. If any of the I/O Station flaps are partially open, close them.
3. If none of the flaprs are partially open, open the access door and look for the unplugged cable on the back of the lock assembly.
4. If none of the flaps appear partially open and cables are connected, use the I/O Station test under the **Tools** → **Service** → **Library** menu to test the function of the I/O Station.

DR037: Eject Media

Problem:

A drive has reported a problem that requires the currently loaded tape to be ejected from the drive in order for the drive to recover. Using the drive coordinate from the problem Details, identify the drive sled.

Possible Causes:

1. The I/O Station safety door may be broken
2. The I/O Station door may be partially open. If so, please close it.
3. The control cable to the I/O Station is unplugged.
4. There is a hardware failure that makes it appear that an I/O Station door is partially open.

Troubleshooting Steps:

1. Eject the tape from the drive and remove it out of the library.
2. Inspect the tape and retire the tape if problems are found:
3.
   - damaged cartridge shell
   - misplaced barcode labels or foreign material
   - snapped tape/disconnected leader
4. If the tape appears good, retry operations with the tape.

DR039: Logical Library Deletion Required

Problem:

The system has detected a change in module configuration such as a new control module serial number or a removed expansion module that will invalidate any existing logical library(s). Although a logical library may be visible on the user interface, the assignment of storage slots and drives is broken due to the new module configuration.

Troubleshooting Steps:

1. Using the Operator Panel, navigate to **Setup** → **Logical Library** and delete any existing logical libraries.
2. Consult the *Setup and Operator Guide* for information on how to create new logical libraries.

DR040: Incompatible module branding

Problem:

The library has detected a branding mismatch. This is most likely caused by a manufacturing labeling error or a user mixing incompatible parts from multiple library systems.

Troubleshooting Steps:

1. If this problem was reported following a field upgrade, or the replacement of a defective part, it is likely that the new part is not correct or mislabeled. Refer to “DR021: Contact Tech Support” on page 6-45.
2. If this problem occurred following the swapping of chassis, control boards, or compact flash cards between libraries, the two libraries have incompatible parts and the parts should be returned to their original libraries.
3. If neither of these scenarios apply or the problem remains unresolved, refer to “DR021: Contact Tech Support” on page 6-45.
4. **Close** the ticket or **Exit** to leave the ticket open for future troubleshooting.

DR041: Check Robot Installation

Problem:

The library has detected a condition that indicates the Robot Assembly has been installed incorrectly. The Robot travels on rack gears located at the front and rear of the library. If the Robot is installed into the rack gears with one end higher or lower than the other, the Robot may not function properly.

Troubleshooting Steps:

1. The installation of the Robot should be performed again to correct the problem. See the Library Maintenance Guide procedure for removing and replacing the Y-Axis assembly.
2. Prior to powering OFF the library to perform the procedure, close this operator intervention. When powering ON the library, monitor for reoccurrence.
   - If the operator intervention DOES NOT appear again, the problem has been corrected.
   - If the operator intervention DOES appear again, the problem still exists and additional steps should be performed:
     a. Check the Y-rack gear installation.
     b. Re-install the Robot.
     c. Replace the Y-Axis Assembly (refer to "Y-axis/Picker Assembly" on page 8-45.

DR042: Import a Library Cleaning Cartridge

Problem:

While performing inventory, the library determined that a cleaning cartridge is missing.

This cleaning cartridge was originally imported via the library operator interface specifically for the library to use for cleaning tape drives. This cartridge is not managed by any host applications.

It is likely that this cartridge was manually removed while the library was powered OFF or when the main access door was opened.

Troubleshooting Steps:

1. You can determine the bar code label of the missing cleaning cartridge and the coordinate where it used to be stored by selecting the **Details** button.
2. A valid cleaning cartridge should be imported into the library to allow cleaning operations to function properly.
3. If inspection of the cartridge slot shows the cartridge to be present, the bar code label is not being read reliably by the library. Replace the bar code label or the cartridge.

DR043: Invalid Cartridge in Cleaning Slot

Problem:

While performing inventory, the library determined that an invalid cartridge is occupying a cleaning slot.

In order for a cartridge to be a valid cleaning cartridge, it must be imported as a cleaning cartridge via the library operator interface.

It is likely that this invalid cartridge was manually inserted while the library was powered OFF or when the main access door was opened.

Troubleshooting Steps:

1. You can determine the bar code label of the invalid cleaning cartridge and the coordinate where it is located by selecting the **Details** button.
2. Open the library main access door(s) and remove this cartridge.
3. A valid cleaning cartridge should be imported into the library to allow cleaning operations to function properly.

DR044: Tape Alert 4 Media Error

Problem:

The tape cartridge is suspected due to failing tape operations. Data may be at risk based on the condition of the tape.

This problem may be caused by:
- the specific tape
- the specific drive
- the interaction of the tape and drive

Troubleshooting Steps:
1. Determine the specific cartridge and drive involved in the problem selecting the **Details** button.
2. Retry the operation with the same cartridge in the same drive.
3. If the retry attempt fails, copy data to a new cartridge.
4. Restart the current operation using a different cartridge.
5. If the problem remains unresolved, contact Service.

DR045: Tape Alert 5, 6 – Read/Write Failure

Problem:

A drive has detected a problem reading from or writing to a tape.

This problem may be caused by:
- the specific tape
- the specific drive
- the interaction of the tape and drive

Troubleshooting Steps:
1. Determine the specific cartridge and drive involved in the problem selecting the **Details** button.
2. Retry the operation with the same cartridge in the same drive.
3. If the retry attempt fails, try the operation to the same cartridge in a different drive.
4. If the cartridge fails in more than one drive, retire the cartridge.
5. It the cartridge tests OK, use a known good cartridge to test the drive by performing read/write operations from a host, or by using a drive-specific utility. Contact Service for information on a drive utility for your specific drive type.
6. If the problem persists, gather a drive log afer the next occurrence of a Table Alert 5 or 6. Drive logs are pulled by using the Tools>Drive Operations>Retrieve Drive Log menu selection from the local operator interface. Contact Service and provide the drive log.

DR046: Tape Alert 8 – Suspect Data Grade Tape

Problem:

A drive has determined that a tape is not data grade and therefore data should not be written to it.

There can be several possible causes of this problem. Not all of the causes are genuine bad tapes, but in some cases a cartridge should be retired.

Troubleshooting Steps:

1. Attempting invalid operations with a cleaning cartridge may cause this problem. If the cartridge is a cleaning cartridge, remove it from the host application inventory of valid data cartridges.
2. If the cartridge is new, the tape may not have been formatted by the cartridge manufacturer. The drive will automatically attempt to format the tape. If successful, all other operations to the tape will continue without incident and this problem can be closed.
3. On LTO cartridges, the cartridge memory chip may be corrupted. Using host application utilities, force a read of the entire tape. When the tape is unloaded, the drive should repair the memory chip corruption. Monitor this cartridge for reoccurrence of a Tape Alert 8. Retire this cartridge if the problem occurs again.

DR047: Tape Alert 15 – Cartridge Memory Failure

Problem:

A drive has determined that a memory in cassette (MIC) has failed. This will reduce performance. The cartridge memory may be repairable.

Troubleshooting Steps:

1. Attempt to repair the cartridge memory by using host backup application utilities to read the entire tape. When th tape is unloaded, the cartridge may be able to repair the tape memory.
2. To verify that the cartridge memory is repaired, attempt to use the cartridge again for normal read/write operations. If this cartridge fails again, retire the cartridge.

DR048: Tape Alert 16 – Forced Reject

Problem:

A cartridge was manually ejected from a drive while it was actively reading or writing. This typically occurse when a user is servicing the drive and has not stopped all host operations to the drive.

Troubleshooting Steps:

1. Establish the cartridge back into the library inventory and host backup installation inventory .
2. Restart the operation.

DR049 Tape Alert 30,31 – Drive Hardware Error

Problem:

The tape drive has detected an internal hardware error that requires a power cycle of the drive to recover.

Troubleshooting Steps:

1. Stop all additional host operations to this drive.
2. If a cartridge is still mounted in the drive, unload it using the host application or library operator interface.
3. Using the local library operator interface, take the drive offline with the **Operations** → **Drive** → **Change Mode**command.
4. Once the drive is offline, the blue LED on the rear of the drive should be turned on solid blue. At this point, remove the drive completely from the library for at least 1 minute.
5. Re-install the drive and wait for the normal drive LED states to be established:
   - green blink once per second
   - amber off
   - blue on solid (drive is offline)
6. Using the local library operator interface, take the drive online with the **Operations** → **Drive** → **Change Mode** command.
7. Attempt host operations again. If the drive fails immediately or the problem becomes chronic, contact Service.

DR050: Remove Cartridge from Invalid Location

Problem:

While performing inventory, the library determined that a cartridge is located in an invalid location. In any library 23U or taller, the top slot in each of storage columns 4 and 5 can not be accessed by the robot and therefore can not be used for cartridge storage. It is likely that this cartridge was placed into the slot manually by a user. The library will not place cartridges into these slots based on host or user commands.

Troubleshooting Steps:

1. Select the Details button to determine the barcode label of the cartridge and the coordinate where it is located.
2. Open the main access door(s) and remove this cartridge. Columns 4 and 5 are on the right side of the library as you face it.
3. Close the door(s) and resume operations.

DR051: Replace Library SN Label Advised

Problem:

The library can not read one of the module serial number labels but has already validated that the bar code scanning system is working properly.

Troubleshooting Steps:

1. Open the main library doors, and look for any obstructions in front of the module serial number bar code labels.
2. If no obvious foreign material is found, the module SN is damaged and the EM or CM will need to be replaced. The library is still operational but this should be scheduled as soon as possible.
3. Contact Service for possible CM or EM replacement.

DR053: Check Network Configuration

Problem:

The library has attempted to send an email to the specified address, but has encountered an error with the network configuration.

Troubleshooting Steps:

1. Check the email settings on the library to ensure that all values are correct.
2. Check to make sure the library is properly connected to the network.
3. Make sure the network cable is not damaged.
4. If there is no problem with these items, there is a configuration problem with your network. Contact your network administrator for assistance troubleshooting this issue.

DR054: Replace Drive Cover Plate

Problem:

The library has detected that a drive cover plate has been missing for at least 10 minutes. For safety reasons, the robot will run at a slower speed until the cover is replaced.

Troubleshooting Steps:

1. If the cover removal was intentional, reinstall the cover plate to resolve this issue. The robot will again move at full speed.
2. Check the back of the library for any loose, missing, or damaged drive cover plates.

DR055: Resolve Installation & Verification Test Error

Problem:A problem was detected while performing system validation testing.

Troubleshooting Steps:

Check the IVT logs for further details.

DR056: Resolve Module Communication

Problem:

The library has encountered an error when trying to initialize its modules.

Troubleshooting Steps:

1. Turn the library off.
2. Remove both the top and bottom terminators and carefully inspect them for bent pins. If any are found, contact Service for replacement.
3. Remove all module-to-module connectors and carefully inspect them for bent pins. If any are found, contact Service for replacement.
4. If no bent pins are found on any of these parts, contact Service for further assistance.

DR068: Incompatible Tape Drive

Problem:

The drive that is installed is not compatible with the library.

Troubleshooting Steps:

1. View the ticket details to see which drive is not compatible and remove that drive from the library.
2. Replace the drive cover plate.
3. Contact Service for assistance with resolving this issue.

DR069: Resolve Drive Firmware Update Failure

Problem:

An attempt to update the firmware of a drive was not successful.

Troubleshooting Steps:

1. Verify that the version being used for the upgrade is different from what the drive is currently using. If not, close this ticket and retry the upgrade with the correct firmware version.
2. If the upgrade is being performed via a firmware upgrade cartridge, ensure that the cartridge contains the correct firmware for the type and generation of the drive being updated. Also, check that the firmware upgrade cartridge is not corrupted. If so, close the ticket and upgrade again with the correct firmware upgrade cartridge.
3. If the update was not performed with a firmware upgrade cartridge, ensure that the file containing the firmware image is not corrupt or incomplete. If so, close the ticket and upgrade again with the correct firmware upgrade file.
4. If none of these conditions apply, close this ticket and attempt the upgrade a second time.
5. If this ticket reappears after retrying the upgrade, contact Service for assistance with resolving this issue.

DR070: Resolve Drive Firmware Mismatch

Problem:

The library has detected that all drives do not have the same firmware version.

Troubleshooting Steps:

1. Go to the Tools ⇒ Drive Info screen on the local control panel, or the System Summary page on the Web US to view the firmware version installed on each drive.
2. Note the drive(s) that do not have the latest version of firmware and upgrade those drives. See "Library & Drive Code Update (Feature Code 0500)" on page 2-13

DR072: Resolve Drive Brick Autolevel Failure

Problem:

The automatic update of drive brick firmware failed. The code image stored on the library appears to be invalid.

Troubleshooting Steps:

1. Download a new drive brick firmware image through the Web UI.
2. Close this ticket and reboot the library so that the drive brick upgrade is performed again upon initialization.
3. If this ticket reappears, contact Service for further assistance.

DR074: Resolve Cartridge Not Assigned to Partition

Problem:

At least on cartridge has been detected in a slot that is not assigned to any logical library and is therefore not accessible by the library or by any host application.

Troubleshooting Steps:

1. Go to the Reports ⇒Library Configuration screen in the Remote UI to view the partition map.
2. Open the main library door and look for cartridges in slots that are not included in any partitions per the Library Configuration Report.
3. Manually remove any of these cartridges and, if desired, import them back into the library.

DR075: Resolve Installation & Verification Test Warning

Problem:

The Installation & Verification Test returned a result indicating that one of the tests was not successful. The library is still functional and can be used normally, however this may be an indication of a developing problem.

Troubleshooting Steps:

1. Review the ticket details and the Installation & Verification Test logs to determine which library component failed.
2. Check if any new RAS tickets have been generated against the failed component. If so, contact Service for further assistance in resolving this issue.
3. Monitor the library for any further problems with this component. If no further RAS tickets are generated, the library can continue to be used normally.

DR076: Resolve Get Failure

Problem:

The library robot has failed during a move media, while trying to get a tape. Operations can continue, but the tape should be manually removed.

Troubleshooting Steps:

1. Open the library main door and inspect the picker for damaged fingers or any other obstruction. If found, remove the obstruction or contact Service for picker replacement.
2. View the ticket details for the tape location. Inspect the tape and slot for any damage that may cause the tape to get stuck in the slot. If the tape is damaged, replace the tape with a good one. If the slot is somehow damaged, contact Service for replacement.
3. If the tape is in a drive, inspect the drive for any damage that would prevent tape ejection. If found, replace the drive.

DR077: Resolve Invalid Cleaning Tape

Problem:

The system has detected that a non-cleaning tape was used to clean a drive.

Troubleshooting Steps:

1. Using the barcode listed in the ticket details, locate the tape in the library.
2. Remove the tape from the library. If it is in a cleaning slot, use the Export Cleaning Tape function to remove the tape.
3. If the drive cleaning operation was automatically scheduled, import a new cleaning tape into the library using the Import Cleaning Tape function.
4. If the drive cleaning operation was manual, close this ticket and perform the cleaning operation again with a valid cleaning tape.

DR078: Resolve Tape Load/Unload Failure

Problem:

A tape drive did not load a tape correctly. Library automatic recovery was not successful and user intervention is required.

Troubleshooting Steps:

1. Attempt to unload the tape from the drive using the host backup application that is currently using the drive, or via the remote or local UI.
2. Open the library main access doors and use the blue pushbutton on the front of the drive to trigger an unload. Press and hold the button continuously for 10 seconds.
3. If the tape is ejected, retrieve it and inspect it for any damage. If found, discontinue use of the tape.
4. If the tape is not ejected, contact Service for further assistance in resolving this issue.

DR079: Resolve Key Server Comm. Failure

Problem:

The library is not able to communicate with a Key Server. This does not indicate a problem with the library, but rather a configuration or setup issue.

Troubleshooting Steps:

1. Ensure that the library is properly connected to the network, and that the network cable is not damaged.
2. Ensure that the library's ip address settings are correct, and that the key management feature is configured appropriately.
3. Verify that the Key Server is powered on, and that it is also properly connected to the network.
4. Ensure that the key server's ip configuration is set properly, that the ports are configured correctly, and that they are active.
5. If there no problem with any of these items, then there is a configuration problem with your network.

DR080: Resolve Tape Unloading Failure

Problem:

A drive did not successfully unload a tape. Library automatic recovery was not successful and user intervention is required.

Troubleshooting Steps:

1. Attempt to unload the tape from the drive using the host backup application that is currently using the drive, or via the remote or local UI.
2. Open the library main access doors and use the blue pushbutton on the front of the drive to trigger an unload. Press and hold the button continuously for 10 seconds.
3. If the tape is ejected, retrieve it and inspect it for any damage. If found, discontinue use of the tape.

Service Procedures

This chapter contains library diagnostic information.

This library can automatically detect host servers in the Stor95.9080f0000.0028424.0673315.3062Tm

How the Library Reports Problems

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

If the self-test detects a problem, the library generates a service report, or Operator Intervention, that identifies which component is likely causing the problem. The library’s LEDs may also turn ON, OFF, or blink to indicate an abnormal state. If the problem is not severe, the library continues to provide full functionality to all unaffected logical libraries.

When possible, the library provides instructions for resolving problems. These instructions appear on the library’s Operator Panel.

Note: If resolution of the problems includes instructions to open an Access Door, an Access Door must be opened and closed to clear the error and to enable the robotics to function properly.

Customers can frequently resolve a simple problem themselves by using the information found in “Start Service” on page 1-1. If the problem involves a field replaceable unit (FRU), the customer must contact IBM Technical Support. Only qualified service technicians can service FRUs.

Operator Intervention Messages

From the **Tools** menu on the Operator Panel, you can view all of the library operator interventions. This view lists all of the library operator interventions in the order in which they were created starting with the most recent. Each message contains a Service Action Ticket (SAT) code (see “Service Action Tickets” on page 6-1) and an explanation of what error the library encountered. You can navigate resolution details from this screen as well (see “**Diagnostic Resolutions**” on page 6-38). Before replacing a library component, closing a ticket, or contacting IBM Technical Support, refer to “Start Service” on page 1-1 for additional help on resolving the problem.

Important: It is recommended that Service Action Tickets not be allowed to accumulate in the Operator Intervention reports. After an incident has been resolved or repaired, the Service Action Ticket should be closed.

Before ordering a CRU replacement part, observe the LEDs on all library components to determine exactly which part is failing. See “Interpreting LEDs” on page 7-8 for more information.

General Service Guidelines

Servicing a library typically includes the following steps:

1. Connect your laptop to the service port, located on the back of the Library Control Blade, in order to use the Web User Interface (UI) (see “Using the Service Port” on page 7-5).
2. Generate a log of the current status of the library (see “Methods of Capturing Logs” on page 7-6).

3. Assess the status of the library, using the following tools. Thoroughly examine all available reports and indicators.
    - Operator Interventions
    - LEDs
    - System diagnostics (which are available via the **Service** menu (see "Service Menu") on the library's Operator Panel)
4. Create a list of parts that you need to add, remove, or replace, and determine the order in which you plan to service them.
5. Order any necessary parts. (See "Parts List" on page 10-1.)
6. Review the cabling connections for each module. If you need to disconnect the cables to remove or replace a field replaceable unit (FRU), consider labeling the cables so you can reconnect them correctly.
7. When you are ready to service the library, determine whether you will need to take the entire library offline or whether you can take only certain logical libraries offline. See "Required Library State" on page 8-2.
8. Contact the library administrator to schedule a time to take the library or logical library offline, if necessary. Before taking the library offline, ask the administrator to complete or cancel any jobs that are in the queue.
9. Power OFF the library or take it (or just the affected logical libraries) offline.
10. Add, remove, and replace each part, as necessary.
11. After servicing the library (and preferably after servicing each part), power ON the library and run the appropriate diagnostic. From the Operator Panel, select **Service** → **System** → **Library** to access the Library Verify Tests.
12. When you finish adding, removing, and replacing all necessary parts, verify that all drives are online, then take the library online (see "Taking the Drives/Library Online/Offline" on page 7-27).
13. Close all open Operator Interventions.
14. Verify that your host applications can communicate with all drives and the library.
15. After verifying that the library is fixed and running smoothly, generate another log of the status of the library.
16. Complete the steps in "End of Call" on page 7-33.

Service Menu

The **Service** menu gives service personnel access to troubleshooting tools.

To access the **Service** menu, log into the Operator Panel using your service name and password.

Logging in to the Service Menu

To log in with service privileges:

1. Access the **Logon** window of the Operator Panel.
2. Type your service name (**service**) and password (**ser001)** in the appropriate fields.
3. Click **OK**.

If you do not remember your service name and password, you can access the five Library Verify Tests and the SCSI and Fibre Channel Wrap Tests by logging in to the Operator Panel as an Administrator and selecting **Tools** → **Service**.

Service Menu: System

From the Operator Panel: **Service** → **System**

1. Follow the menu path shown above.
2. Touch **Yes** to take all logical libraries OFFLINE.
3. Select **Library**, then choose one of the following diagnostic tests and follow the on-screen instructions:
   - Robotics - tests the library robotics (see “DR005: Motion Failure Diagnostic (a Library Verify Test)” on page 6-39)
   - I/O - tests the open/close and lock/unlock sensors of the I/O Station doors (see “DR011: I/E (I/O Station) Lock Diagnostic (a Library Verify Test)” on page 6-41)
   - Bar code - tests the ability of the bar code scanner to read an internal library bar code (see “DR007: Bar Code Scanner Diagnostic (a Library Verify Test)” on page 6-40)
   - Drive - tests the read/write function of a selected drive; a scratch (blank) cartridge is required for this test (see “DR006: Drive Diagnostic (a Library Verify Test)” on page 6-40)
   - Door - tests the open/close sensors of the Access Doors (Each Access Door in your library must be tested individually. After closing the Access Door just tested, wait until the library inventory is complete before running the next test or resuming normal library operations.)
4. Touch **Back** to return to the **System Diagnostics** screen.
5. Touch **Back** to return to the **Library Offline** screen.
6. Touch **No** to exit the **Bringing logical libraries OFFLINE** screen.
7. Touch **Back** to return to the **Service** menu screen.
8. Touch **Exit** to return to the **Tools** menu.
9. Touch the **Operations** tab, then touch **Logical Library Mode** to bring your logical libraries back ONLINE.

Service Menu: Drives (SCSI or Fibre Channel Wrap Test)

Tools/Materials that are required: SCSI or Fibre Channel Wrap Tool, the single-ended SCSI terminator that was shipped with the drive.

1. Ask the customer to vary the library and drives offline to ALL ATTACHED HOSTS.
2. From the Operator Panel, select **Operations** → **Change Drive Mode** → **Offline** for all drives being tested, then touch **Apply**.
3. Remove the SCSI or Fibre Channel cables from the drive being tested.
4. Install the LVD SCSI wrap tool to the lower connector or install the Fibre Channel wrap tool to the Fibre Channel connector.
5. For a SCSI drive, install the LVD SCSI terminator to the upper connector. The alternative is to connect a SCSI cable which has a terminator at the end of a daisy chain to the upper connector.
6. Start the SCSI or Fibre Channel Wrap Test by selecting **Tools** → **Service** → **Drives** → **Yes** → **(select drive to be tested)** → **Wrap Test** → **Next**.
7. If the wrap test fails, go to “Removing a Drive Sled” on page 8-34.

8. If the wrap test is successful, suspect the SCSI or Fibre Channel cables or host adapter.
9. If the cables/adapter do not fix the problem, call your next level of support.
10. When the problem is fixed, reconnect all cables.
11. Ask the customer to vary the library and drives online to ALL ATTACHED HOSTS.
12. From the Operator Panel, select **Operations** → **Change Drive Mode** → **Online** for all drives that were tested, then touch **Apply**.
13. From the Operator Panel, select **Operations** → **Logical Library Mode** → **Online** for all logical libraries, then touch **Apply**.

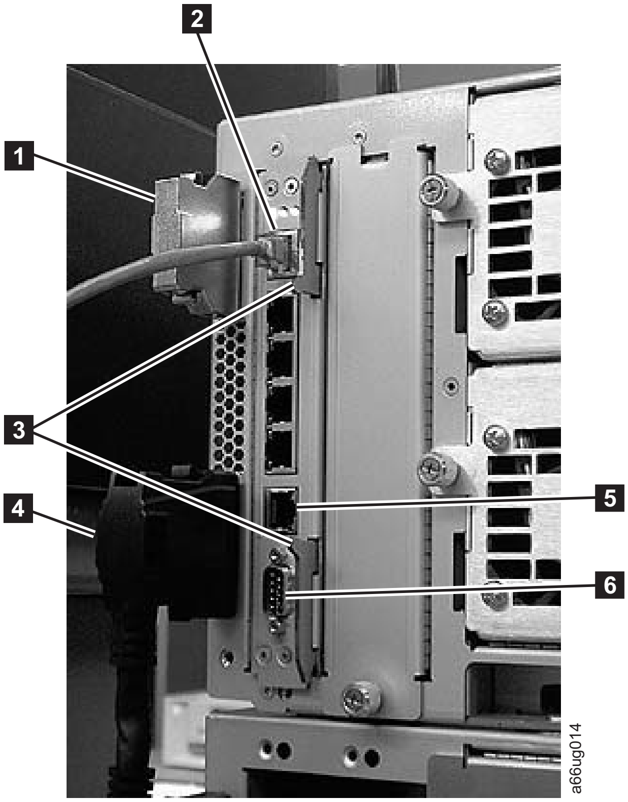
Service Menu: Exit

Touch **Exit** to return to the Capacity View home screen.

Using the Service Port

The Library Control Blade (LCB) provides an ethernet port that is reserved for use by service personnel. When servicing a library, connect your laptop to this port to access the Web User Interface.

To connect your laptop to the service port:



1. If necessary, close down your laptop's firewall and wireless network connection.
2. Install an Ethernet crossover cable between the laptop and the Ethernet service port (**5**) on the LCB.

3. Open a command window on the laptop. Select **Start** → **Run**, type **cmd**, and click **OK**.
4. Release the current DHCP lease by typing **ipconfig /release**.

   Note: The Service Port defaults as a DHCP (Dynamic Host Configuration Protocol) server.
5. Renew the lease by typing **ipconfig /renew**.
   - Windows informs you when a new lease has been obtained.
   - The IP address of the laptop should be in the 10.10.10.x range.

```
C:\>ipconfig /release
Windows IP Configuration
Ethernet adapter Local Area Connection 2:
Connection-specific DNS Suffix . :
IP Address . . . . . . . . . . . : 0.0.0.0
Subnet Mask. . . . . . . . . . . : 0.0.0.0
Default Gateway. . . . . . . . . :
Ethernet adapter AGN Virtual Network Adapter:
Connection-specific DNS Suffix . :
IP Address . . . . . . . . . . . : 0.0.0.0
Subnet Mask. . . . . . . . . . . : 0.0.0.0
Default Gateway. . . . . . . . . :
C:\>ipconfig /renew
Windows IP Configuration
Ethernet adapter Local Area Connection 2:
Connection-specific DNS Suffix . :
IP Address . . . . . . . . . . . : 10.10.10.100
Subnet Mask. . . . . . . . . . . : 255.255.255.0
Default Gateway. . . . . . . . . :
Ethernet adapter AGN Virtual Network Adapter:
Connection-specific DNS Suffix . :
IP Address . . . . . . . . . . . : 0.0.0.0
Subnet Mask. . . . . . . . . . . : 0.0.0.0
Default Gateway. . . . . . . . . :
C:\>
```

6. Type **ping 10.10.10.1** to verify your connection to the library. If the ping is not successful, repeat steps 4 and 5.
7. Open Internet Explorer.
8. Type in the IP Address, **10.10.10.1**.
9. Type in your service username and password.

Methods of Capturing Logs

IBM Service Personnel should capture logs using the library's service port (see "Capturing a Library Log using the Service Port" on page 7-7). Choose one of these methods for retrieving library and drive logs using the Operator Panel, Web User Interface, or a SCSI or Fibre Channel Interface:

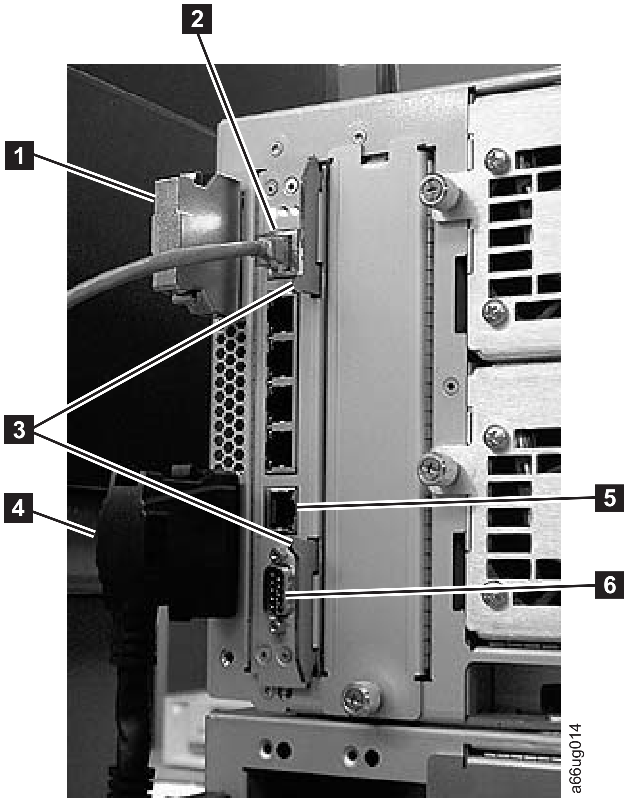
Table 7-1. Methods of Capturing Drive Logs

Type of Error Log	Operator Panel	Web User Interface	SCSI/Fibre Interface
Library	Not available	**Service Library->Capture Logs**	NTUTIL or TapeUTIL (For more information on these tools, refer to the device driver documentation shipped with your library.)

Table 7-1. Methods of Capturing Drive Logs (continued)

Type of Error Log	Operator Panel	Web User Interface	SCSI/Fibre Interface
Drive	Not available	**Service Library->Capture Drive Log**	• "Using the ITDT SCSI Firmware Update, Dump Retrieval and Drive Test Tool" on page 7-17 • NTUTIL or TapeUTIL (For more information on these tools, refer to the device driver documentation shipped with your library.)

Capturing a Library Log using the Service Port



1. Perform the steps in "Using the Service Port" on page 7-5.
2. From the Web User Interface, select **Library Tasks** → **Service Library** → **Capture Library Logs**.
3. Click the **Capture Log** button to begin downloading the library log.
4. Save the log file in a directory on your local hard drive and log out.
5. Establish your wireless network connection, and restart your firewall or reboot your computer so that your firewall is up and running.

E-mailing Logs

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

Capture current logs of the library both before and after you perform service. To e-mail current logs:

1. Ensure that no applications are accessing the library. If a **Progress Screen** is open, wait until it closes before attempting to generate the logs.
2. Capture a current library log. To capture a library log from the Web User Interface, select **Service Library** → **Capture Log**.
3. Attach the log to an email message and send it to IBM Technical Support for further diagnosis.

Interpreting LEDs

Light emitting diodes (LEDs) provide a visual indication about the status of certain library components. LEDs can sometimes communicate that a problem exists when operator interventions cannot. For example, an LED can indicate a firmware problem that prohibits the library from generating operator interventions.

The following components of the library have LEDs:

- "Power Button LEDs"
- "Library Control Blade LEDs" on page 7-9
- "Tape Drive LEDs" on page 7-11
- "Power Supply LEDs" on page 7-13
- "Picker LED" on page 7-14

Some of these components may also include a fibre port link LED.

Power Button LEDs

Two LEDs are located to the right of the library's power button (**1**) on the front panel of the control module.

Figure 7-1. Power button LEDs

- Green power ON LED (**2**) - When lit, this LED indicates that the library power is ON.
- Amber Operator Intervention Alert LED (**3**) - When lit, this LED indicates that there is a Library, Drives, or Media Operator Intervention available. To view the Operator Intervention, select **Tools** → **Operator Intervention** from the Operator Panel.

Library Control Blade LEDs

The library contains a Library Control Blade (LCB). LEDs are used to indicate the status of the LCB.

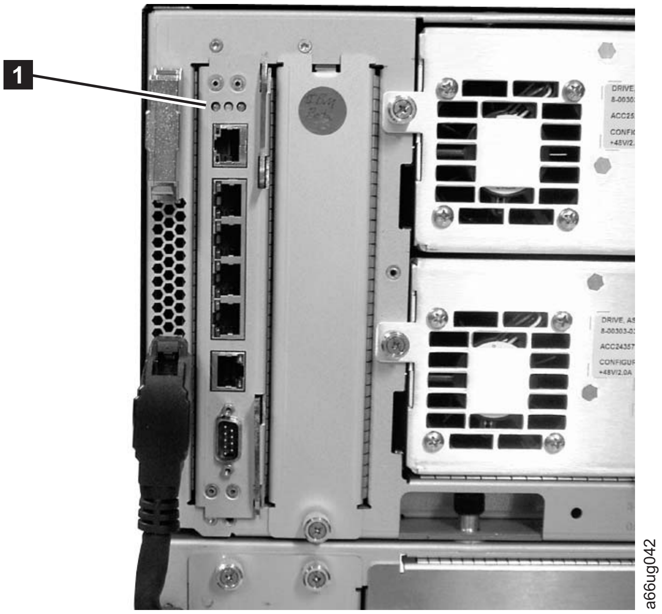


Figure 7-2. Library Control Blade LEDs

LCB LEDs (**1**) indicate status by the rate at which they blink. The color of the LED identifies the area of the component being reported.

Use the following table to interpret the current status of LCB LEDs:

Table 7-2. LCB LEDs

LED Color	Represents	Blade Status
Green	Processor status	• Solid ON - Processor not operating • Solid ON for 3 seconds, then blinks twice - LCB firmware is downloading • 1 blink per second - Normal: Processor operating • 10 blinks per second - Identify mode • Solid OFF - Processor not operating
Amber	Health status	• 1 blink per second - Main processor not operating • Solid OFF - Normal: Blade operational
Blue	Power control status	• Solid ON - Swap mode: LCB is powered down and can be removed • 1 blink per 10 seconds - Normal: LCB on • Solid OFF - LCB not receiving power

Note: If all three LEDs are solid ON for at least twenty minutes, suspect a bad or corrupt compact flash. See “Library Control Blade or Compact Flash Card” on page 8-36.

Amber LED on Library Control Blade

Under normal operating conditions, the amber LED on a Library Control Blade (LCB) is not lit. If you see that the amber LED on an LCB is either blinking continuously or solidly lit for at least 20 minutes, service the LCB as soon as possible. The library may or may not generate an operator intervention, depending on the source of the problem.

Attention: Never remove an LCB when its amber LED is solidly lit, unless it has been solidly lit for at least 20 minutes.

The following table indicates the actions you can take, based on the condition of the LED.

Table 7-3. Amber LED on an LCB

State of Amber LED	Suggested Service Action
Solid ON for 20+ minutes	Replace the LCB.
1 blink per second	Check the firmware for the LCB and make sure that you have the most current firmware available (visit **http://www.ibm.com/storage/lto**. Do not replace the LCB. It is unlikely that the LCB hardware is the source of the problem.

Servicing a Library Control Blade Based on LED Status

When servicing a blade based on the status of an LED:

1. Observe the blinking patterns of the LEDs for at least 30 seconds, and log your observations in both the operator intervention and the equipment failure report that you must return with the defective part. Accurate reporting of all LED states for the entire green, amber, and blue set of LEDs is critical for diagnosing the cause of the problem.
2. Generate a current log of the library, and send it to technical support for analysis.

Tape Drive LEDs

Operator interventions typically report all problems related to tape drives, including error codes and tape alerts. By observing the blinking pattern of LEDs on tape drives, however, you can discern which operation the tape drive is currently performing.

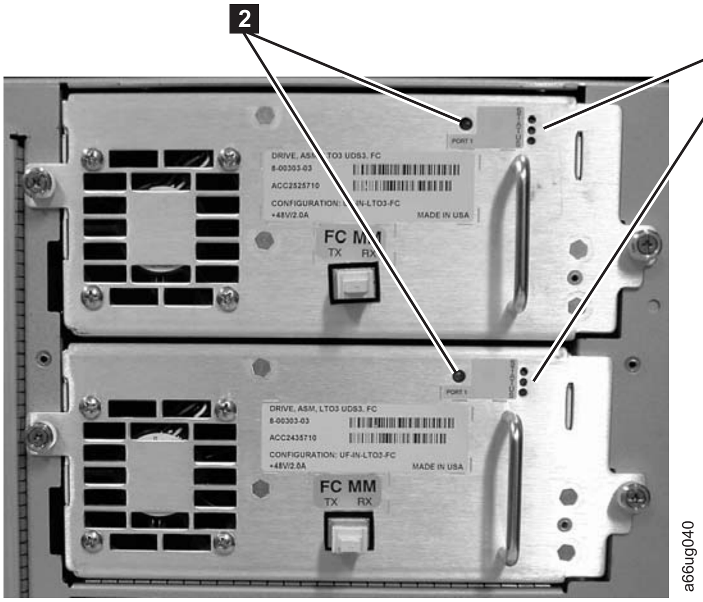


Figure 7-3. Tape drive LEDs

Use the following table to interpret tape drive activity by observing tape drive LEDs (**1** in Figure 7-3).

Table 7-4. Tape Drive Activity

LED Color	Represents	Drive Status
Green	Processor activity	• Solid ON - Drive's main processor is not operating • Solid ON for 3 seconds, then blinks twice - Drive firmware is downloading • 1 blink per second - Normal: Drive operational • Blinks 3 times in 3 seconds, then pauses (solid OFF), and then repeats - Drive is activating (varying online) • 10 blinks per second - Identify mode • Solid OFF - Drive's main processor is not operating
Amber	Health of the drive	• Solid ON - Drive has failed • Solid OFF - Normal: drive operational
Blue	Power control	• Solid ON - Drive is powered down and ready to be replaced or varied online • 1 blink per 10 seconds - Normal: Drive operational • Solid OFF - Drive is not receiving power

Fibre Port Link LED

The fibre port link LED (**2** in Figure 7-3) shows the current state of the fibre channel link and indicates whether or not the link is ready to transmit commands.

Use the following table to interpret fibre channel link activity.

Table 7-5. Fibre Port Link LED on Tape Drive

LED Color	Represents	Fibre Port Link Status
Green	LIP and activity	• Solid ON - Loop Initialization Protocol (LIP) has occurred. • Blinks at regular intervals - Host command/data activity is occurring.
Amber	Online and light detected	• Solid ON - The library has enabled the drive data bus, and it can detect light through a fiber optic cable.
No color	No activity or no light detected	• Solid OFF - Either the drive is off or the drive cannot detect light through a fiber optic cable (which is equivalent to a missing fibre cable). If the drive is varied OFF, the blue status LED will be solidly lit.

Power Supply LEDs

Operator interventions typically report all problems related to power supplies. You can also observe the blinking pattern of LEDs on power supplies to see if they are functioning appropriately.

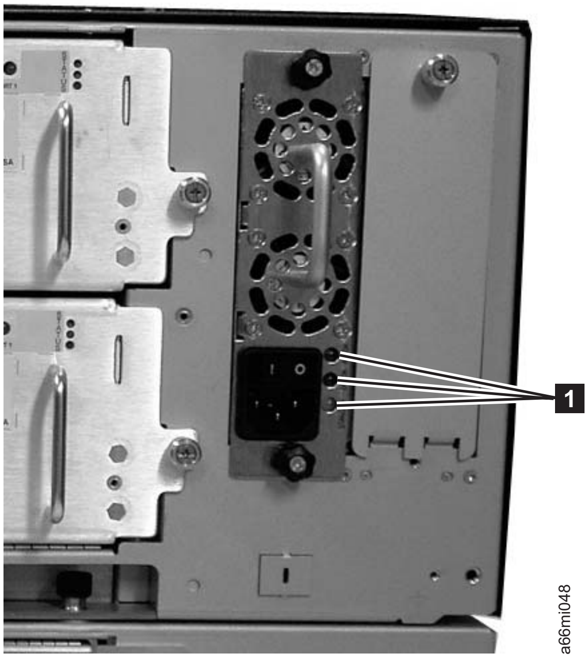


Figure 7-4. Power supply LEDs

Power supply LEDs indicate status by the rate at which they blink. The color of the LED identifies the area of the component being reported.

Table 7-6. Power Supply LEDs

LED Color	Represents	Power Supply Status
Green	AC OK (top)	• Solid ON - The power supply's AC input is above the minimum requirements to operate. • Solid OFF - The power supply's AC input is below the minimum requirements to operate.
Green	DC OK (middle)	• Solid ON - The power supply's output voltage is within regulation. • Solid OFF - The power supply's output voltage is not within regulation.
Blue	Fault (bottom)	• Solid ON - Indicates that one of the following faults has been detected: – Power supply is outside of specifications – Current limit has been exceeded – Temperature limit has been exceeded – Fan failed while AC input is present and above the minimum operating voltage – AC input is below the minimum operating voltage – The power supply is ON, the Power button ON, but the library's indicator panel is OFF • Solid OFF - Normal: No faults detected

In

Methods of Updating Firmware

Important: When updating firmware:
- Ensure all host applications are varied offline.
- Do not power-off the library until the update is complete, or the firmware may be lost.

Periodically check for updated levels of firmware by visiting the web at **http://www.ibm.com/storage/lto**. Update firmware using:

Type of Firmware	Operator Panel	Web User Interface	SCSI/Fibre Interface
Library	Not Available	**Service**	

Updating Library Firmware

From the Web User Interface: **Service Library** → **View/Update Library Firmware Level**

Administrative users can use the **Update Library Firmware Level** command to download firmware to the library. Updating library firmware can be performed only from the Web User Interface.

Important: Before updating firmware,

- Resolve and close all open Operator Interventions.
- Save the current system Configuration. See .

To update library firmware:

1. Download the latest level of library firmware to your host computer by visiting **http://www-1.ibm.com/servers/storage/tape/lto/**.
2. From the Web User Interface, select **Service Library** → **View/Update Library Firmware Level**.
3. Browse to the file on your computer, select the ″.tgz″ file that was downloaded from the IBM web site, then click **View/Update Library Firmware Level**. The Web User Interface will indicate that the operation has completed. This means that the firmware file has been successfully moved from the host computer to the library.
4. Wait for the library to reboot before resuming normal library operations. It will be several minutes before the library reboots.

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

Updating Drive Firmware

Drive firmware is best updated using the drive’s application interface, SCSI or fibre.

Important: Before updating firmware,

- Resolve and close all open Operator Interventions.
- Save the current system Configuration. See .

You can update drive firmware through the library’s Web User Interface. For more details, see “Updating Drive Firmware Using the Web User Interface” on page 7-17

Alternatively, you can update drive firmware with any of the readily available tools. For example, ITDT is available for multiple platforms and requires no special device drivers. You can download ITDT from the IBM web site (refer to “Using the ITDT SCSI Firmware Update, Dump Retrieval and Drive Test Tool” on page 7-17). Other tools, such as NTUTIL and TapeUTIL can also be used for drive firmware updates.

The library also supports drive firmware update by creating and using an FMR cartridge. However, to create an FMR cartridge with the latest drive firmware, one of the methods described above must be used to first download the firmware to one of the drives. An FMR cartridge can then be created and used to update the remaining drives for that drive type, SCSI or fibre. For more information on FMR cartridges, refer to “Updating Drive Firmware Using a Firmware (FMR) Cartridge” on page 7-18.

Updating Drive Firmware Using the Web User Interface

From the Web User Interface: **Service Library** → **View/Update Drive Firmware Levels**

Administrative users can use the **View/Update Drive Firmware Levels** command to download firmware to the drive.

To update drive firmware:

1. Download the latest level of drive firmware to your host computer by visiting **http://www-1.ibm.com/servers/storage/tape/lto/**.
2. From the Web User Interface, select **Service Library** → **View/Update Drive Firmware Levels**.
3. Select a drive media and interface type.
4. Select the drive(s) to be updated.
5. Browse to the file on your computer, select the ″.tgz″ file that was downloaded from the IBM web site, then click **Yes** to begin.

Using the ITDT SCSI Firmware Update, Dump Retrieval and Drive Test Tool

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 dump retrievals can be performed by the tool as well.

Below are some of the capabilities of this tool:

- Firmware update capability via SCSI to all IBM LTO Tape Drive products.
- The tool does not require any special device drivers.
- The tool is available for most major platforms (Windows®, AIX®, SUN, Linux™, NetWare).
- The tool is capable of uploading drive dump 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 SCSI 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/**.

Updating Drive Firmware Using a Firmware (FMR) Cartridge

A firmware (FMR) cartridge is a blank tape cartridge that is used to transfer updated drive firmware code to the library. The drive code image is copied onto the FMR cartridge, which can then be used to update the drive firmware on all of the specified drives within the library. See "Creating a Drive FMR (Firmware) Cartridge" for more information.

Note: A FMR tape for updating a LTO-4 drive must have been created on another LTO-4 drive with the same host interface type (e. g. SAS or Fibre Channel), and likewise, a FMR for updating a LTO-3 drive must have been created on another LTO-3 drive with the same host interface type (e. g. SCSI or Fibre Channel). Each generation of LTO and each attachment type of drive have different firmware images.

Important: Before you update drive firmware during this procedure, make sure that tapes are not mounted in any of the drives. If the cartridges are mounted in drives during the update process, the library loses track of the cartridge home cell in storage, resulting in library and host inventory issues.

Creating a Drive FMR (Firmware) Cartridge:

You must create an FMR cartridge, if you do not already have one, to update drive firmware with this method. FMR cartridges are created using a blank (scratch) data cartridge. To create an FMR cartridge of a drive firmware version already in use in your library, follow the steps below:

1. Select **Tools → Drive Mgmt→ Create Firmware Cartridge**.
2. When the Operator Panel displays the request, place a blank, scratch cartridge into the top slot of the empty I/O station. If other cartridges reside in the I/O Station, remove them before inserting the FMR cartridge.

   After the I/O Station door is closed, select **System** on the **I/O Assignment** screen. The library moves the media from the I/O station to the source drive and instructs the source drive to create an FMR cartridge from its current code version.

Updating Drive Firmware using a Firmware (FMR) Cartridge:

1. Load the FMR cartridge in the I/O Station.

   Important: Do not open the I/O Station until the update process finishes.
2. Select **Tools → Drive Mgmt → Use Firmware Cartridge**, then select the drive(s) you wish to be updated.
   - The library then successively moves this FMR cartridge into each of the specified drives to be updated.
   - The library automatically logs off all users so that they cannot perform library options while the drive firmware update operation is in progress.
   - The library updates the firmware on each targeted drive. After the update finishes, the FMR cartridge is returned to the I/O station. A message notifies you when the update operation is complete.

Other Methods for Updating Drive Firmware through the SCSI or Fibre Channel

Attention: Each drive connection type and each generation of drive (LTO3 or LTO4) requires a unique firmware image.

When updating drive firmware by using the SCSI or Fibre Channel interface, the procedure varies, depending on whether your server uses an IBM tape device driver or a non-IBM tape device driver (such as a driver from Sun, Hewlett-Packard, or Microsoft®).

For instructions about updating firmware from a server that uses an IBM tape device driver, refer to the *IBM Ultrium Device Drivers Installation and User's Guide*.

To update firmware from a server that uses a non-IBM tape device driver, refer to the documentation for that device.

Checking / Reseating Cables

External Cables

To check or reseat external library cables and terminators, perform the following steps:

1. Locate the cables and terminators by referring to the example figures below.

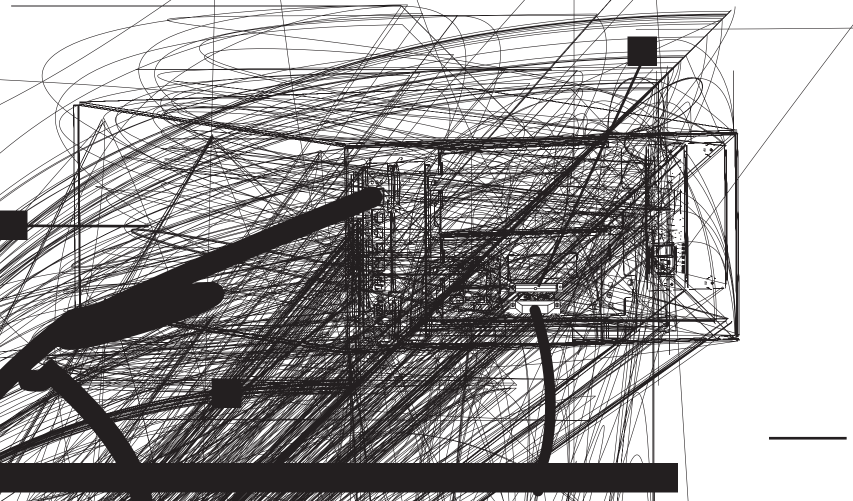


Figure 7-6. Cabling of a 5U Library with SCSI Drives

1	Module communication terminator	3	Module communication terminator	5	Power cord
2	Ethernet cable (customer supplied)	4	SCSI terminator	6	SCSI drive cable

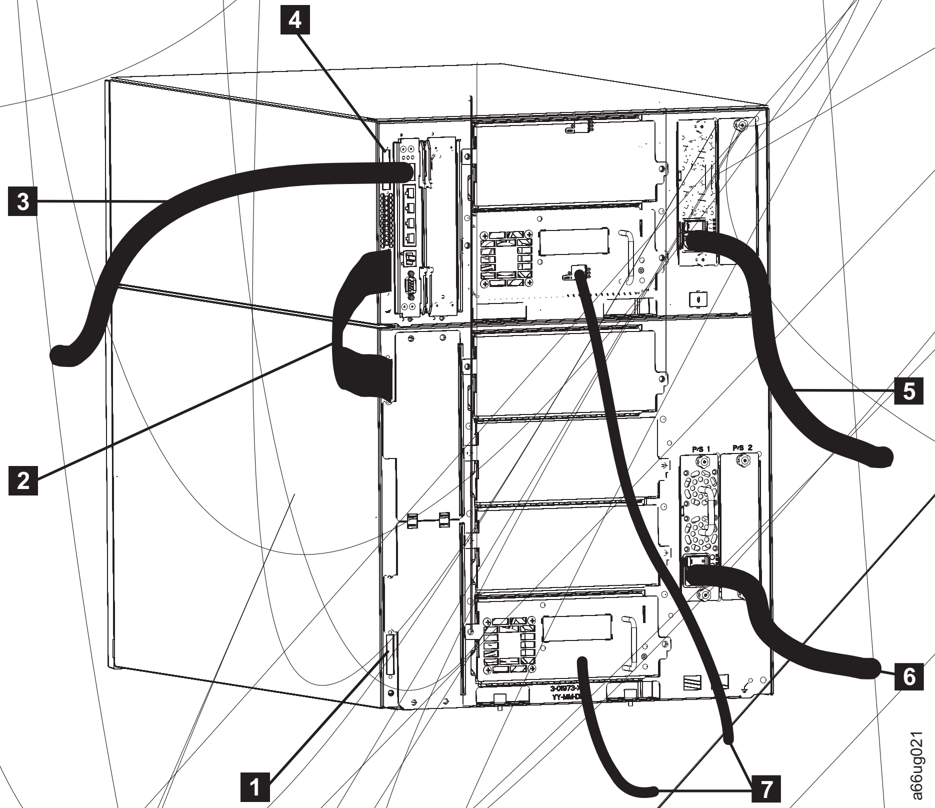


Figure 7-7. Cabling of a 14U Library with Fibre Drives

1	Module communication terminator
2	Module-to-module communication cable
3	Ethernet cable (customer supplied)
4	Module communication terminator
5	Power cord (upper module)
6	Power cord (lower module)
7	Fibre drive-to-network cables

2. Check and reseat, if necessary, all of the cables and terminators connected to your library.
3. Verify that there is no damage to any connector pins.

Internal Cables

1. Visually check, and reseat if necessary, all of the connectors on the back of the operator panel. See **1**, **3**, **4**, **5**, and **7** in Figure 7-9.

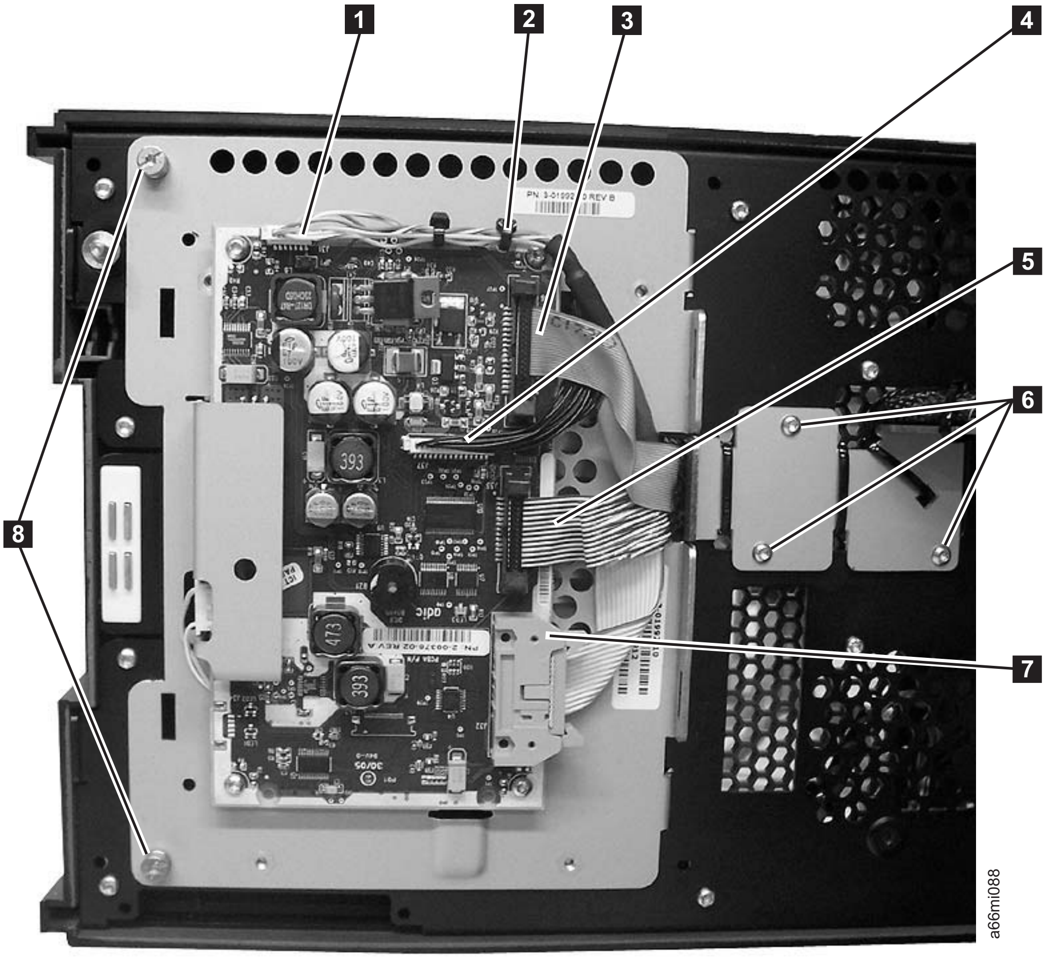


Figure 7-9. Operator panel connectors

2. Visually check, and reseat if necessary, the connector on the back of the I/O Station lock assembly. See **1** in Figure 7-10 on page 7-23.

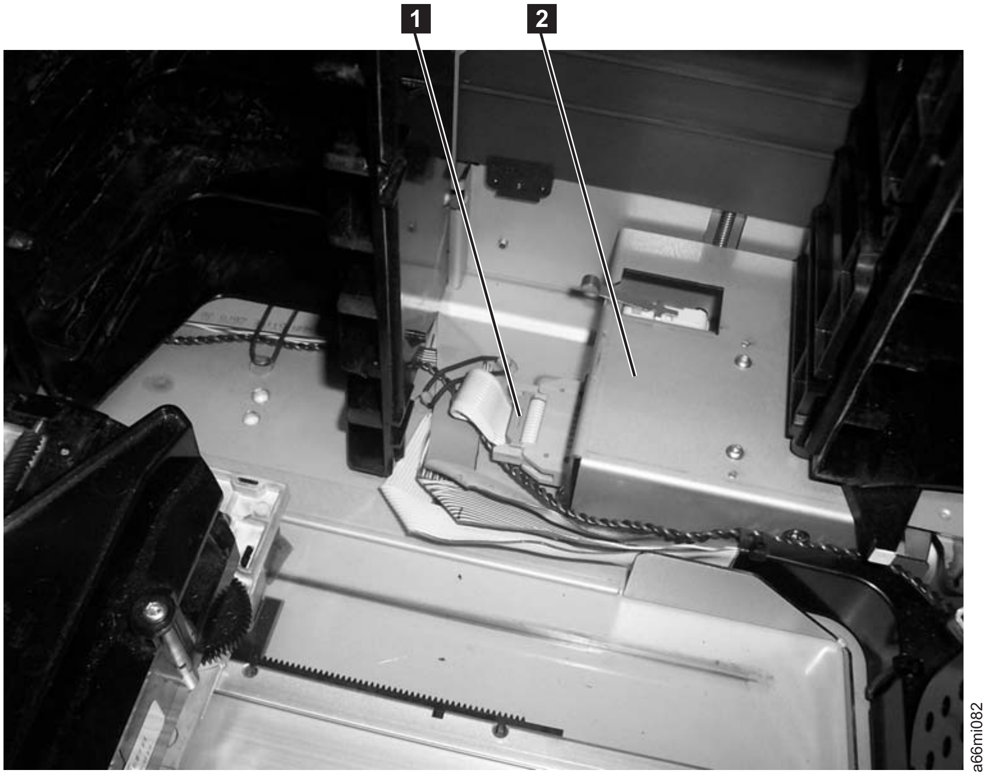


Figure 7-10. I/O Station lock assembly connector (top cover removed)

3. Visually check, and reseat if necessary, all of the connectors on the front of the Backplane Connect Board (BCB). See **1**, **2**, and **3** in Figure 7-11 on page 7-24.

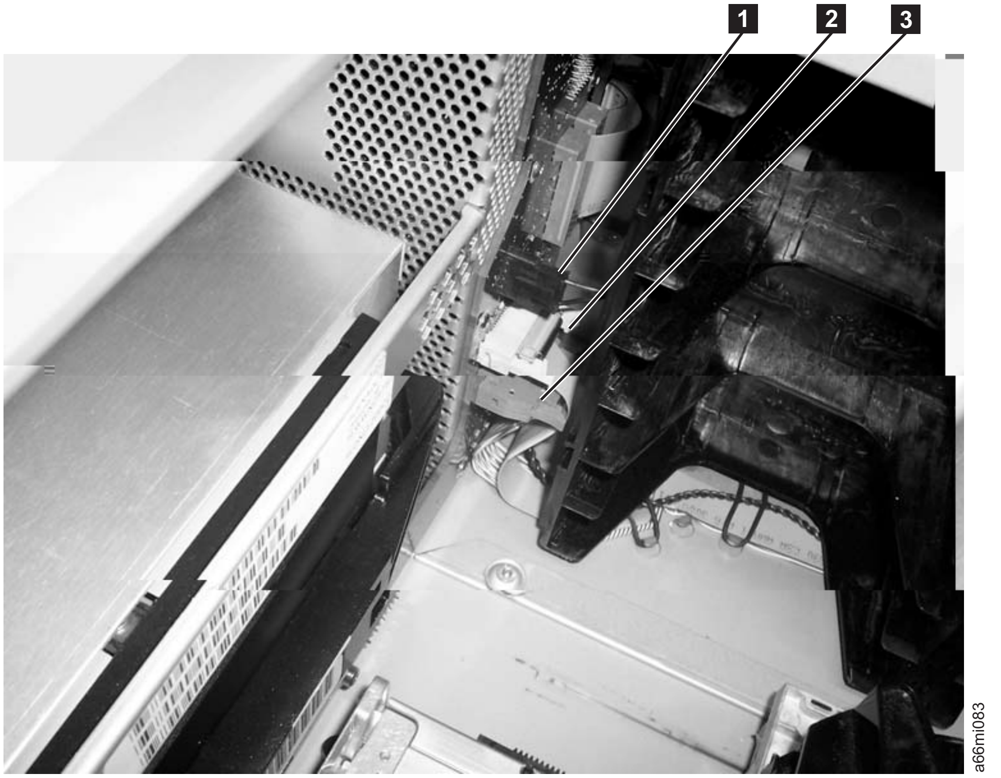


Figure 7-11. Backplane Connect Board connectors (front, top cover removed)

4. Visually check, and reseat if necessary, all of the connectors on the back of the Backplane Connect Board. See **1**, **2**, **3**, and **4** in Figure 7-12.

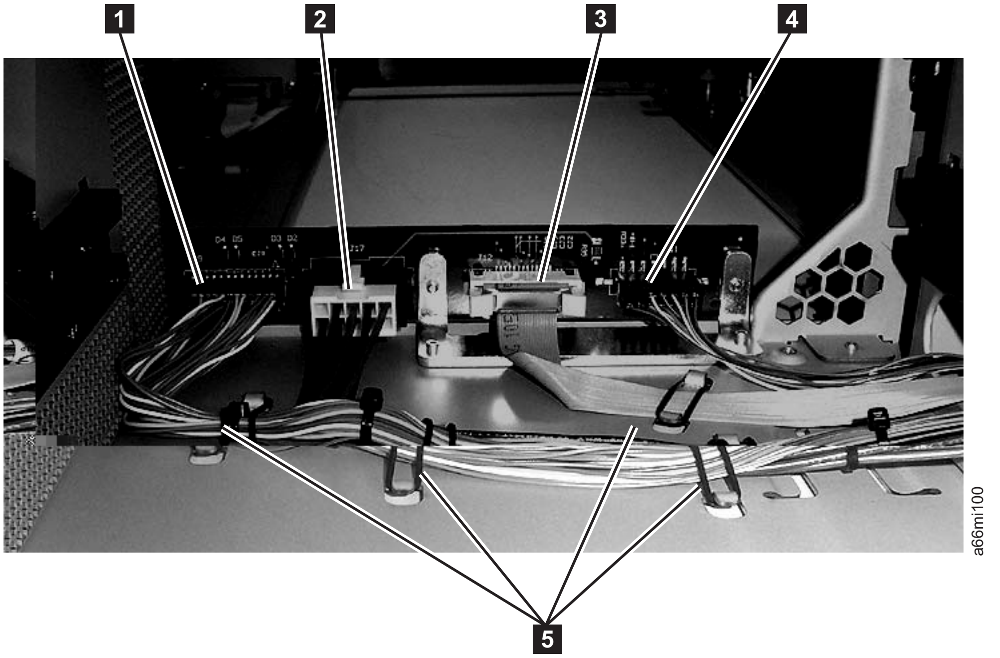


Figure 7-12. Backplane Connect Board connectors (back, drive sleds removed)

5. Visually check, and reseat if necessary, all of the connectors on the Drive Sled Interface Board (DSIB). See **7** and **8** in Figure 7-13.

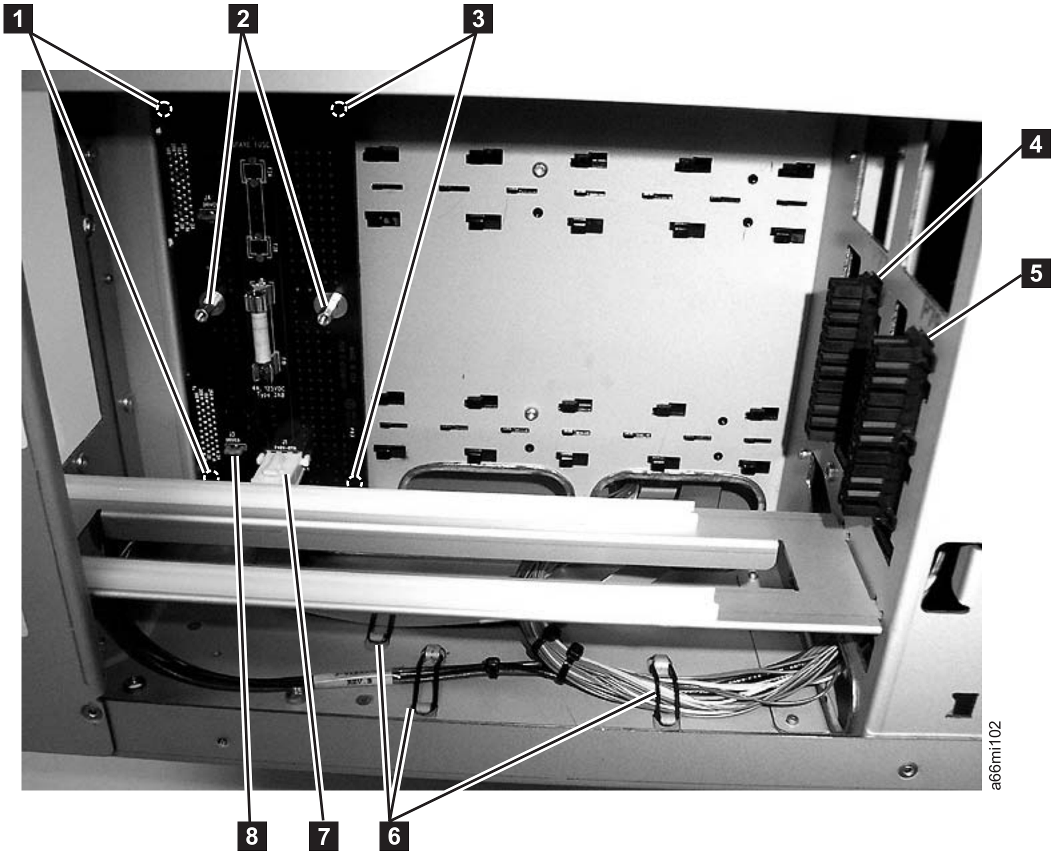


Figure 7-13. Drive Sled Interface Board connectors (side cover removed)

6. Visually check, and reseat if necessary, all of the connectors on the Y-axis assembly. See **1** , **2,** and **3** in Figure 7-14 on page 7-26, and also on the Picker Assembly. See **1** in Figure 7-15 on page 7-27.

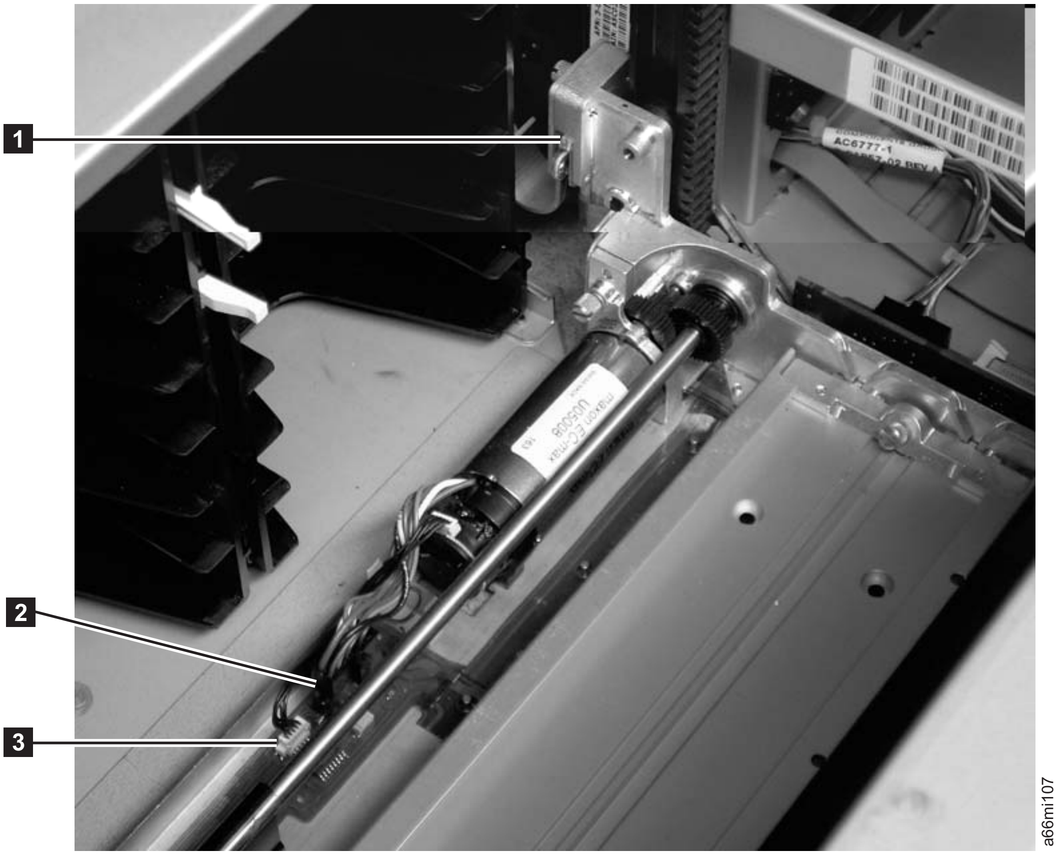


Figure 7-14. Y-axis and Y motor assembly connectors

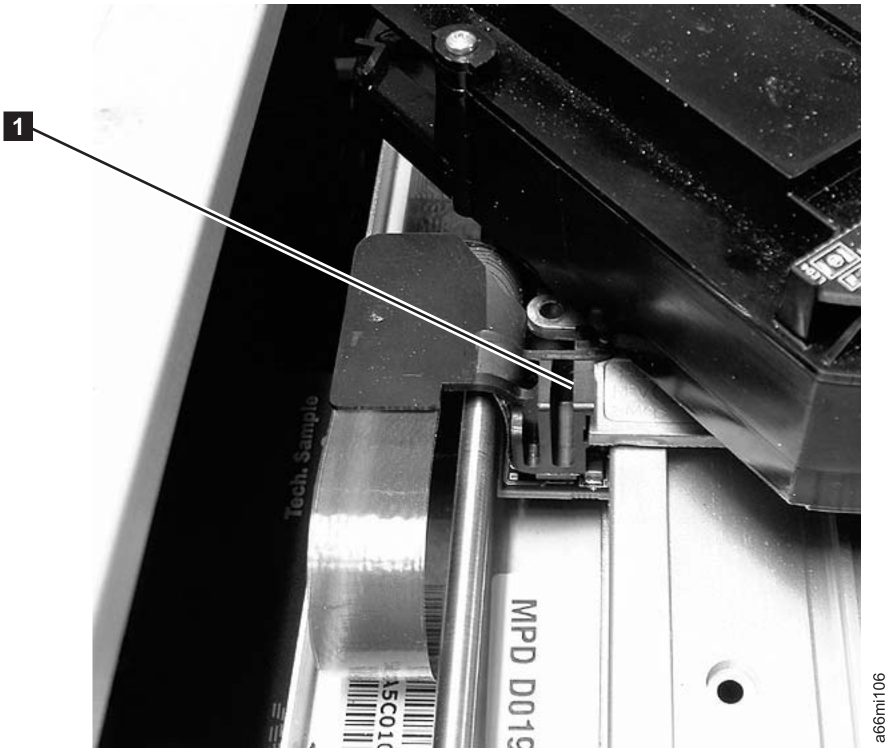


Figure 7-15. Picker assembly connector

Taking the Drives/Library Online/Offline

Taking the drives or a library/logical library online makes it accessible to host applications via the SAN. Taking the drives or a library/logical library offline makes it inaccessible to host applications via the SAN.

Servicing some components requires only that you take the library offline, while servicing other components requires that you power OFF the entire library. For details, see “Required Library State” on page 8-2.

Taking a Drive Online

1. Using the library’s Operator Panel, select **Operations** → **Change Drive Mode**. Using the library’s Web User Interface, select **Manage Drives** → **Change State of Drives**.
2. For each drive that you want to take online click **Online**.
3. Click **Apply**.

Taking a Drive Offline

1. Using the library’s Operator Panel, select **Operations** → **Change Drive Mode**. Using the library’s Web User Interface, select **Manage Drives** → **Change State of Drives**.
2. For each drive that you want to take offline, click **Offline**.
3. Click **Apply**.

Taking the Library Online

1. Using the library's Operator Panel , select **Operations → Logical Library Mode**. Using the Web User Interface, select **Manage Library → Logical Libraries**.
2. For each logical library that you want to take online click **Online**.
3. Click **Apply**.

Taking the Library Offline

1. Using the library's Operator Panel , select **Operations → Logical Library Mode**. Using the Web User Interface, select **Manage Library → Logical Libraries**.
2. For each logical library that you want to take offline, click **Offline**.
3. Click **Apply**.

Shutting Down/Restarting the Library

Shut down the library for servicing. Restart the library after servicing and for preparing it for use.

Shutting Down the Library

Servicing some components requires only that you take the library offline, while servicing other components requires that you power OFF the entire library. For details, see "Required Library State" on page 8-2. When library power is switched OFF, the Picker assembly slowly falls to rest at the bottom of the library.

Important: To completely remove all power before servicing or in an emergency, push the front power button, toggle each power supply switch to the OFF (O) position, and disconnect all power cords from their electrical source.

1. Using the library's Operator Panel, ensure that no applications are accessing the library. If a **Progress Screen** is open, wait until the operation completes.
2. Take the entire library (including all drives and logical libraries) offline.
   - To take each logical library offline using the Operator Panel, select **Operations → Logical Library Mode**.
   - To take each drive offline using the Operator Panel, select **Operations → Change Drive Mode**.
3. Shut down the library from the Operator Panel by selecting **Operations → Shutdown**. The **System Shutdown** window appears.
4. In the **System Shutdown** window, select **Shutdown** and click **Apply**.
5. In the **System Shutdown Confirmation** window, click **Yes**.
6. Press the power button located on the front of the control module.
7. Toggle each power supply switch to the OFF (O) position.
8. Disconnect the library's power cords from their electrical source.

Powering the Library ON

1. Connect all power cords to their electrical source.
2. Toggle the power switch on each power supply to the ON (|) position.
3. Press the power switch located on the front door of the library's control module (CM). The Operator Panel will display "Working" while the library performs the Power On Self Test (POST). The POST takes several minutes.

4. When the library is ready for operations, the login screen displays on the Operator Panel. See “Login Screen” on page 4-1.

Restarting the Library

1. Using the library’s Operator Panel, ensure that no applications are accessing the library. If a **Progress Screen** is open, wait until it closes before attempting to restart the library.
2. Take the entire library (including all drives and logical libraries) offline.
   - To take each logical library offline using the Operator Panel, select **Operations** → **Logical Library Mode**.
   - To take each drive offline using the Operator Panel, select **Operations** → **Change Drive Mode**.
3. From the **Operations** menu, click **Shutdown**. The **System Shutdown** window appears.
4. In the **System Shutdown** window, select **Restart** and click **Apply**.
5. In the **System Restart Confirmation** window, click

2. Rotate the large gear (**1**) with your thumb or finger, in the direction shown by the arrow.
3. Continue rotating the gear until the cartridge is ejected from the picker.

Manually Unlocking the I/O Station Door

If the I/O Station door fails to unlock, you can unlock it manually.

There are 2 styles of I/O Station Lock mechanisms. The early style uses a T10 Torx wrench to rotate the lock mechanism. The new style has a large push-button type mechanism behind the hole (**1** in Figure 7-17) in the I/O station door.

Manually Unlocking the Early Style I/O Station Door

If the I/O Station door fails to unlock, you can unlock it manually.

To manually unlock the early style I/O Station lock, follow these steps:

1. Insert a T10 Torx wrench in the hole (**1** in Figure 7-17) located on the front of the I/O Station door of the library module you wish to open.
2. Turn the wrench one-quarter turn counterclockwise to unlock the door.

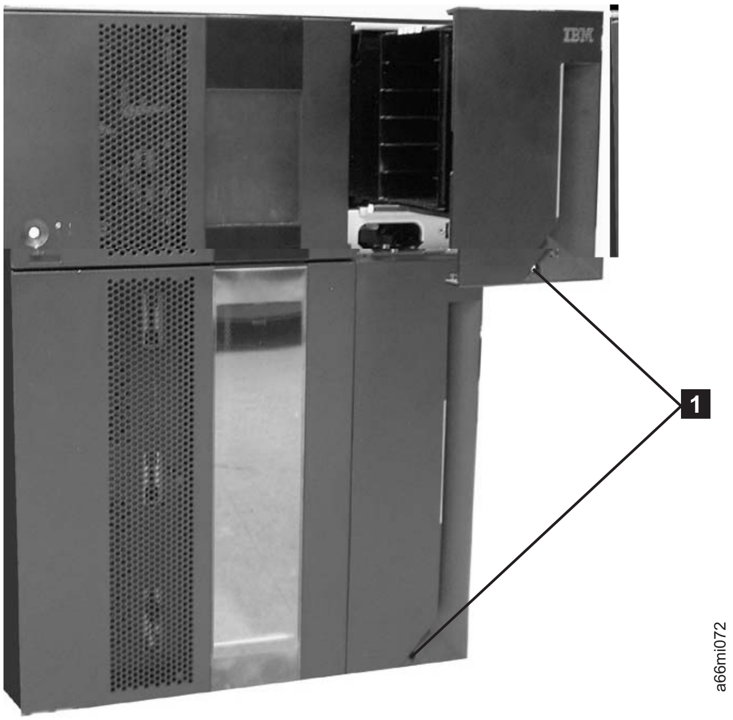


Figure 7-17. Access holes for manually unlocking I/O Station doors

3. To manually relock the I/O Station door:
   - From the Operator Panel, select **Operations** → **Lock I/O Station**
   - From the Web User Interface, select **Manage Cartridges** → **Lock/Unlock I/O Station Doors**

Manually Unlocking the New Style I/O Station Door

If the I/O Station door fails to unlock, you can unlock it manually.

To manually unlock the new style I/O Station lock, follow these steps:

1. Insert any straight tool (screwdriver, Torx wrench, etc.) into the hole (**1** in Figure 7-17 on page 7-30) in the front cover of the I/O station.
2. Push the tool in to unlock the I/O station door. There is a large, flat pushbutton type mechanism behind the hole in the cover that, when pushed toward the rear of the library, will release the I/O station lock mechanism.
3. To manually relock the I/O Station door:
   - From the Operator Panel, select **Operations** → **Lock I/O Station**
   - From the Web User Interface, select **Manage Cartridges** → **Lock/Unlock I/O Station Doors**

Setting the Write-Protect Switch

The position of the write-protect switch on the tape cartridge (**1**) determines whether you can write to the tape:

- If the switch is set to 🔒 (solid red), data cannot be written to the tape.
- If the switch is set to unlocked (black void), data can be written to the tape.

Advise your customer that it is better to use the host application software to write protect the cartridges instead of manually using the write protect switch. The host software will identify a cartridge that no longer contains current data. The host software will then make a scratch cartridge by removing the software generated write protect.

If you must manually set the write-protect switch (**1**), slide it left or right to the desired position.

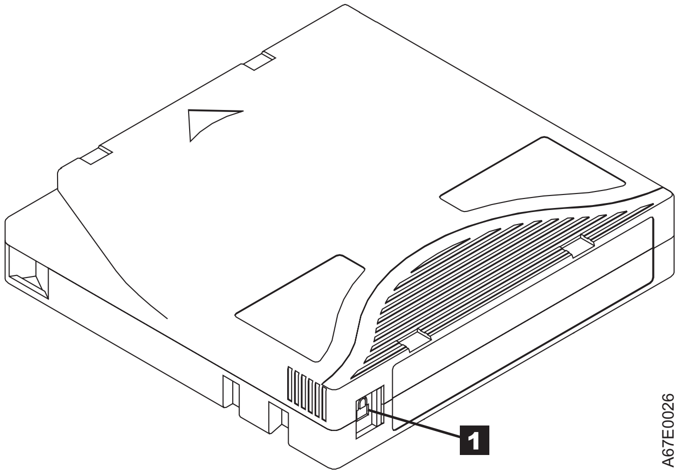
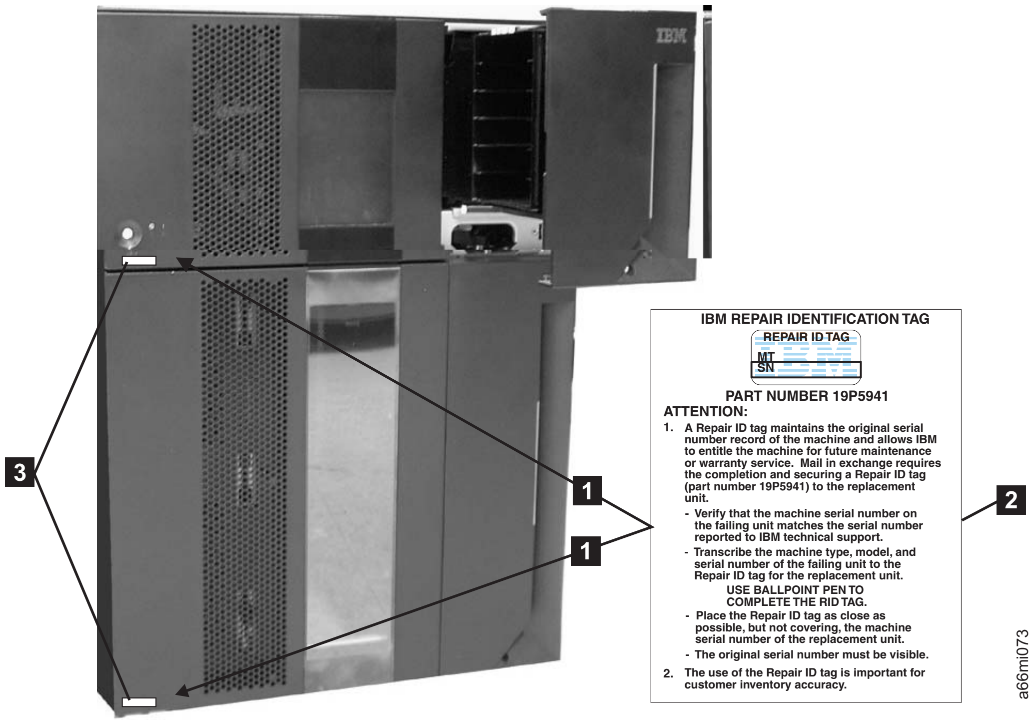


Figure 7-18. Cartridge Write-Protect Switch

Applying a RID Tag to a Library Module

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.



IBM REPAIR IDENTIFICATION TAG

PART NUMBER 19P5941

ATTENTION:

1. A Repair ID tag maintains the original serial number record of the machine and allows IBM to entitle the machine for future maintenance or warranty service. Mail in exchange requires the completion and securing a Repair ID tag (part number 19P5941) to the replacement unit.
   - Verify that the machine serial number on the failing unit matches the serial number reported to IBM technical support.
   - Transcribe the machine type, model, and serial number of the failing unit to the Repair ID tag for the replacement unit.

     USE BALLPOINT PEN TO
     COMPLETE THE RID TAG.
   - Place the Repair ID tag as close as possible, but not covering, the machine serial number of the replacement unit.
   - The original serial number must be visible.
2. The use of the Repair ID tag is important for customer inventory accuracy.

Figure 7-19. RID tag placement

1. Copy the serial number from the label in the lower left corner of the old enclosure onto the RID tag (**2** in Figure 7-19).
2. Place the RID tag to the right of, but not covering, the serial number label located in the lower left corner of the new library enclosure (**1** in Figure 7-19).

Applying an Agency Label to a Control Module

When a Control Module is replaced, an agency label must be applied to the new enclosure after it has been populated with all necessary library components.

1. On the new enclosure, open the I/O Station door, then open the Access Door.
2. Place the Agency Label (**3** in Figure 7-20 on page 7-33) on the enclosure frame underneath the Access Door opening.

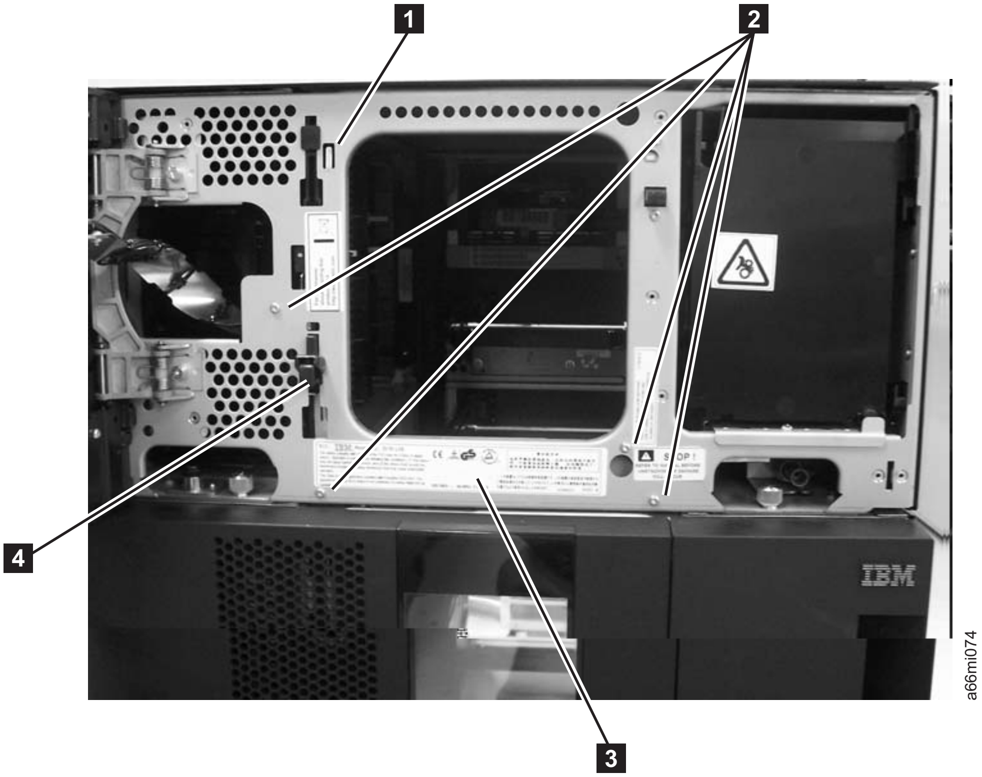


Figure 7-20. Agency Label placement

3. Close the Access Door, then close the I/O Station door.

End of Call

1. If any cartridges were removed from the library, give them to the customer.
2. Record your activity in "History of Service Activity" on page 9-1.
3. Return control of the library to the customer.

Check, Adjust, Remove, and Replace Procedures

Before you begin servicing the library, refer to "General Service Guidelines" on page 7-2.

CRUs and FRUs

All electrical and non-static mechanical components of the 3576 Tape Library are either customer replaceable units (CRU) or field replaceable units (FRU). A CRU is a component that customers can remove or replace themselves, whereas a FRU is a component that only service personnel should remove or replace.

When servicing a FRU, you may also need to service a CRU. Therefore, all CRUs and FRUs for the library are itemized in the following table.

Table 8-1. Library FRUs and CRUs

Part Name	CRU/FRU	Reference Information
Cable Spool	FRU	"Cable Spool Assembly" on page 8-55
Control Module enclosure	FRU	"Removing/Replacing a Control Module" on page 8-4
Expansion Module enclosure	FRU	"Installing a Replacement Expansion Module Enclosure" on page 8-13
Front Bezels	FRU	"Bezels" on page 8-17
I/O Station Lock Assembly	FRU	"I/O Station" on page 8-24
I/O Station Safety Flap	FRU	"I/O Station" on page 2-3
Operator Panel	FRU	"Operator Panel" on page 8-19
Picker Assembly	FRU	"Picker Assembly" on page 8-53

Table 8-1. Library FRUs

Table 8-2. Servicing library components: Library state required (continued)

Part	**Required Library Status**
Storage column	Power OFF
Tape drive sled	Power ON
Y-axis assembly	Power OFF
Y motor	Power OFF

For information on powering the library ON/OFF or taking the library ONLINE/OFFLINE, see:

- "Taking the Drives/Library Online/Offline" on page 7-27
- "Shutting Down/Restarting the Library" on page 7-28

Required Tools

Servicing the library requires the following tools:

- T10 TORX screwdriver with a static safe handle
- #1 and #2 Philips screwdrivers
- small flat blade screwdriver
- Electrostatic Discharge (ESD) Kit (P/N 93F2649)
- safety glasses

Preparing a Library or Library Module for Repairs

1. If necessary, vary drives and logical libraries offline.
2. Power OFF the library.
   - If the library is idle:
     a. Press the power button on the front panel of the control module.
     b. Toggle each power supply switch to the OFF (O) position.
   - If the library is processing:
     a. From the Operator Panel, select **Operations** → **Shutdown** to end the current library task and shut down the library's operating system.
     b. When the library becomes idle, press the power button on the front panel of the control module.
     c. Toggle each power supply switch to the OFF (O) position.

Returning a Library or Library Module to Normal Operations after Repairs

1. Power ON the library.
   a. Toggle each power supply switch to the ON (|) position.
   b. Press the power button on the front of the library.
2. If necessary, have the customer replace all tape cartridges in library or library module.
3. If necessary, vary drives and logical libraries online.

Removing/Replacing a Control Module

The Control Module enclosure (chassis) is not available as a FRU. If the Service Action Ticket (T code) or Diagnostic Resolution Procedure specifies replacement of the enclosure, it will be necessary to replace the Internal Cables and Boards Kit instead.

To make repairs to a control module, choose and perform one of these procedures:

- "Removing a Library Control Module from a Rack"
- "Replacing a 5U Library (Control Module) in a Rack"
- "Removing a Control Module from a Standalone or Rack-mounted Library (14U or larger)" on page 8-5
- "Replacing a Control Module in a Standalone or Rack-mounted Library (14U or larger)" on page 8-8

Removing a Library Control Module from a Rack

1. Perform "Preparing a Library or Library Module for Repairs" on page 8-3.
2. Unplug the customer-supplied Ethernet cable from the Library Control Blade (**2** in Figure 8-37 on page 8-37).
3. Remove these components from the control module to reduce the weight of the module.
   a. Power supplies (see "Power Supply (Primary and Redundant)" on page 8-42)
   b. Drive sleds (see "Drive Sled" on page 8-34)
4. Loosen the thumb screws securing the library to the rear flange on each Rack Kit rail.
5. Open the I/O Station door then the Access door on the control module.
6. From the front of the control module, remove the rack ears (see "Removing the Rack Ears" on page 8-13).
7. With a person standing on each side of the library, pull the control module out of the rack.
8. Place the library on a sturdy work surface.

Replacing a 5U Library (Control Module) in a Rack

1. With a person on each side of the library, pick it up from the work surface and slide it onto the Rack Kit rails in your rack.
2. Tighten the thumb screws that secure the library to the rear flange of each Rack Kit rail.
3. Install the rack ears on the front of the library to secure it to the rack (see "Replacing the Rack Ears" on page 8-14.
4. Reconnect the customer-supplied Ethernet cable to the Library Control Blade (**2** in Figure 8-37 on page 8-37).
5. Reinstall the following components removed for weight reduction.
   a. Drive sleds (see "Drive Sled" on page 8-34)
   b. Power supplies (see "Power Supply (Primary and Redundant)" on page 8-42)
6. Perform "Returning a Library or Library Module to Normal Operations after Repairs" on page 8-3.

Removing a Control Module from a Standalone or Rack-mounted Library (14U or larger)

1. Perform “Preparing a Library or Library Module for Repairs” on page 8-3.

Figure 8-1. Picker locking mechanism

2. Move the Picker into the control module.
    a. Gently push the Picker up until it is in the control module.
    b. Engage the Picker locking mechanism (**1** in Figure 8-1).

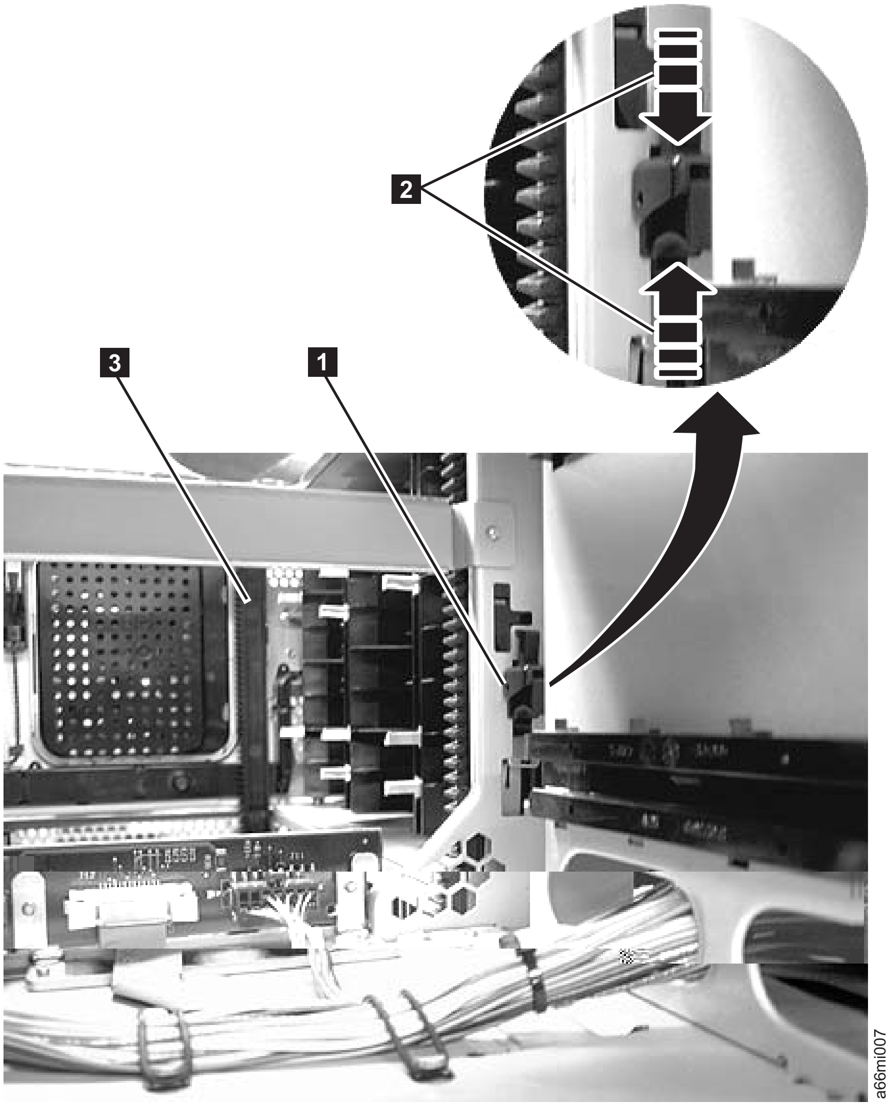


Figure 8-2. Gear racks and gear rack locking mechanism

3. Disengage the rear (**1** in Figure 8-2) and front (**3** in Figure 8-2) gear racks in the control module. While pinching the gear rack locking mechanism (**2** in Figure 8-2) , push the gear rack up until it locks in place.
4. Unplug the customer-supplied Ethernet cable from the Library Control Blade (**2** in Figure 8-37 on page 8-37).
5. Unplug the module-to-module communication cable from the control module (**4** in Figure 8-37 on page 8-37).
6. Remove the following components from the control module to reduce the weight of the module.
   a. Power supplies (see "Power Supply (Primary and Redundant)" on page 8-42).
   b. Drive sleds (see "Drive Sled" on page 8-34).

   Note: If not already done, have the customer remove all tape cartridges from the module being removed.

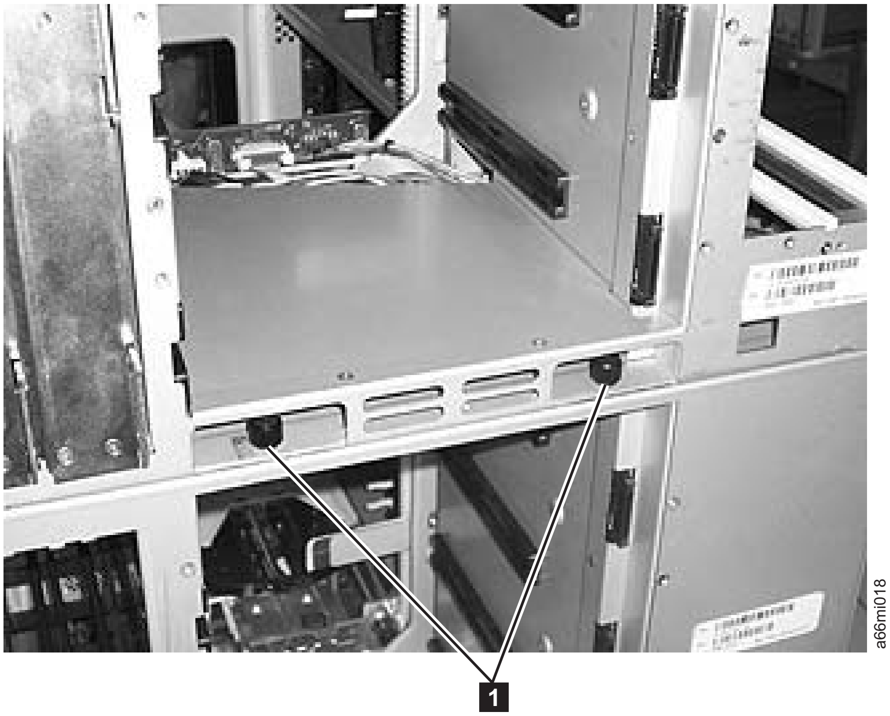


Figure 8-3. Control module rear thumb screws

7. Loosen the rear thumb screws (**1** in Figure 8-3) securing the control module to the lower expansion module.
8. If your library is installed in a rack, remove the rack ears (see “Removing the Rack Ears” on page 8-13) from the front of the control module.

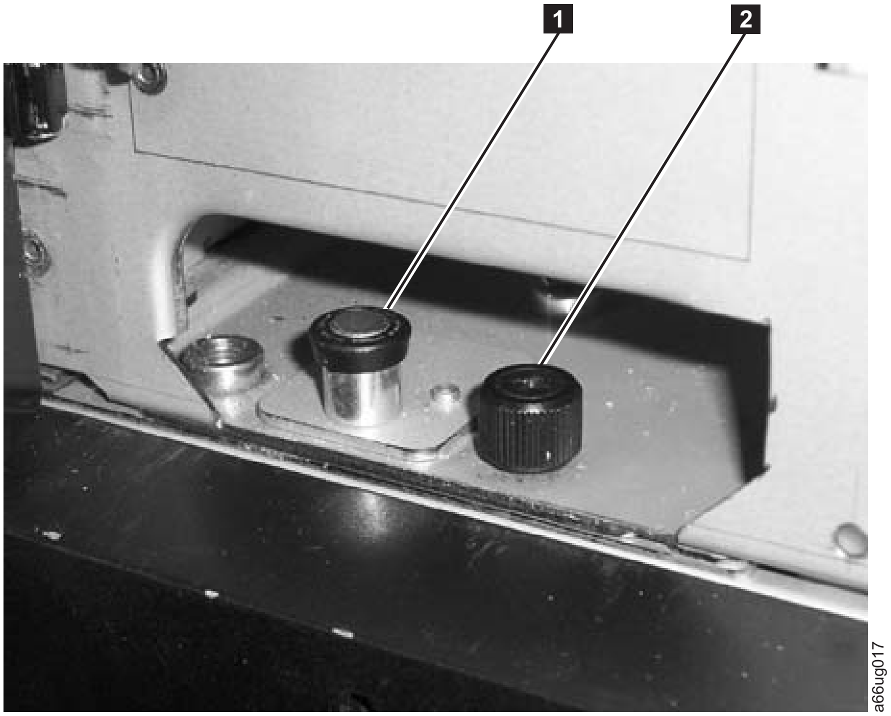


Figure 8-4. Alignment pin and front thumb screw

9. Open the I/O Station door then the Access Door of the control module to expose the control module alignment pin (**1** in Figure 8-4 on page 8-7) and front thumb screws (**2** in Figure 8-4 on page 8-7) behind the Access Door and behind the I/O Station door.
10. Loosen the front thumb screws.
11. Lift and rotate the control module alignment pin to lock the pin in an up position.
12. With a person standing on each side of the control module, pull it out of the rack.
13. Place the control module on a sturdy work surface.

Replacing a Control Module in a Standalone or Rack-mounted Library (14U or larger)

1. Ensure that the front and rear gear racks are in the upper position (see **2** in Figure 8-5).

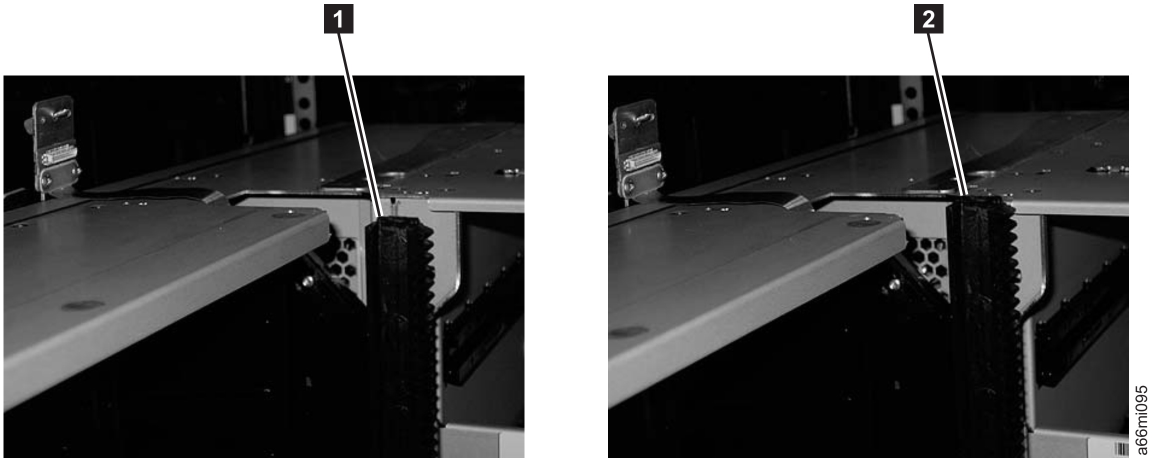


Figure 8-5. Gear racks (down and up)

2. Ensure that the module-to-module alignment pin (**1** in Figure 8-4 on page 8-7) is in the raised position. If necessary, raise the pin and rotate it half a turn to lock it in the raised position.
3. With a person on each side of the control module, pick the control module up from the work surface and slide it partway onto the expansion module in the rack using the guide slots on the top of the expansion module and the bottom of the control module.

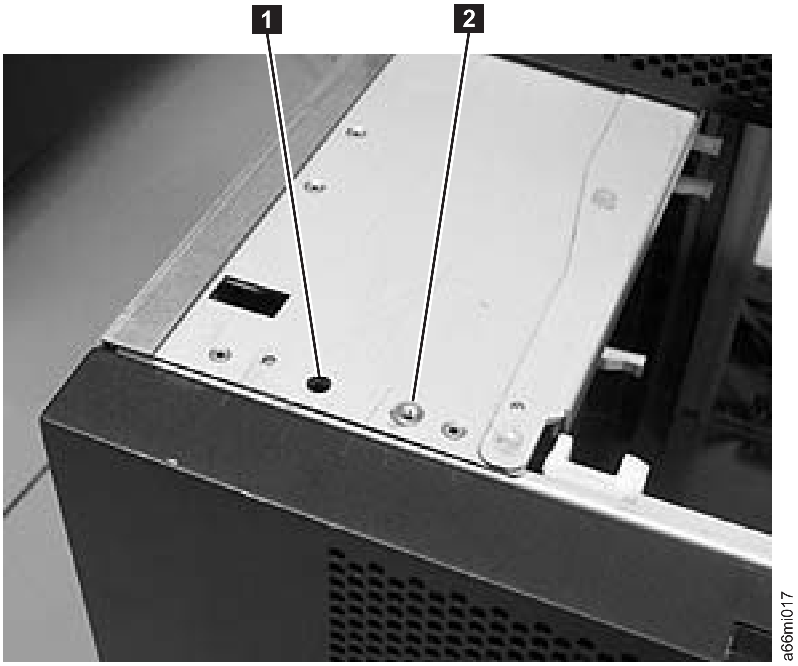


Figure 8-6. Alignment pin and front thumb screw receptacles

4. Open the I/O Station door then the Access Door of the control module to expose the control module alignment pin behind the Access Door.
5. Push the control module onto the lower expansion module.
6. Twist the control module alignment pin (**1** in Figure 8-4 on page 8-7) to unlock it from the up position.
7. Adjust the control module's position on top of the expansion module until the control module alignment pin drops into the alignment pin receptacle (**1** in Figure 8-6) in the lower expansion module.
8. Tighten the front thumb screw (**2** in Figure 8-4 on page 8-7) to secure the front of the control module to the lower expansion module (**2** in Figure 8-6).
9. Open the I/O Station door and tighten the other front thumb screw.

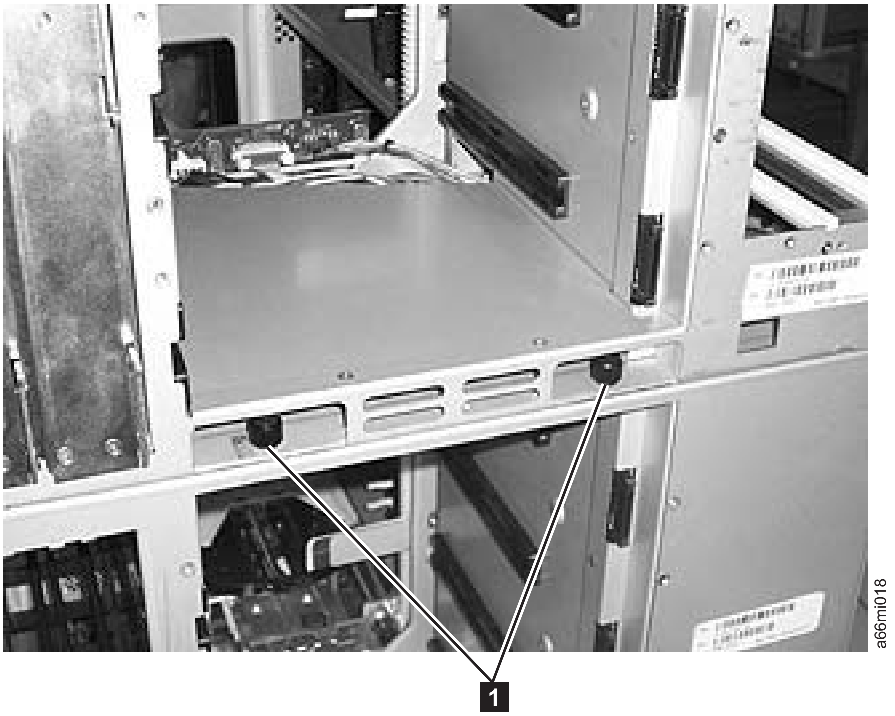


Figure 8-7. Control module rear thumb screws

10. Tighten the rear thumb screws (**1** in Figure 8-7) that secure the control module to the lower expansion module.
11. If your library is installed in a rack, reinstall the rack ears on the front of the control module to secure it to the rack (see “Replacing the Rack Ears” on page 8-14).

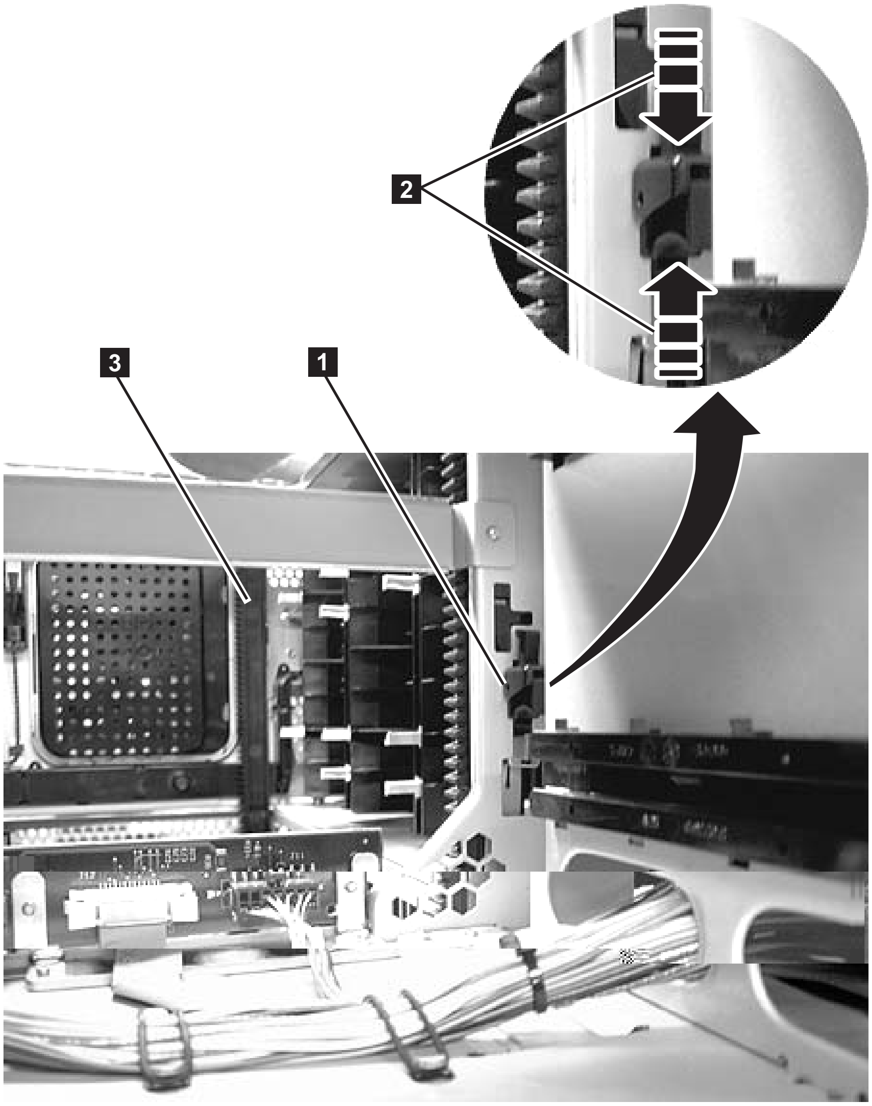


Figure 8-8. Gear racks and gear rack locking mechanism

12. Engage the rear (**1** in Figure 8-8) and front (**3** in Figure 8-8) gear racks in the control module. While pinching the gear rack locking mechanism (**2** in Figure 8-8), push the gear rack down until it locks in place and no gaps appear between the front and rear gear racks in the control module and expansion module.
13. Gently push the Picker assembly up high enough to release the Picker locking mechanism (see **1** in Figure 8-1 on page 8-5).
14. Release the Picker assembly and allow it to slowly drop to the bottom of the library.
15. Reinstall all control module components removed for weight reduction.
    a. Drive sleds (see “Drive Sled” on page 8-34)
    b. Power supplies (see “Power Supply (Primary and Redundant)” on page 8-42)
16. Reconnect the customer-supplied Ethernet cable to the Library Control Blade (for cable location, see **2** in Figure 8-37 on page 8-37).

17. Reconnect the module-to-module communication cable from the control module to the expansion module (**4** in Figure 8-37 on page 8-37).
18. Perform “Returning a Library or Library Module to Normal Operations after Repairs” on page 8-3.

Removing/Replacing an Expansion Module

An expansion module increases the number of drives and data cartridge storage slots available within your library.

To make repairs to an expansion module, perform one of the following procedures.

- “Removing an Expansion Module from a Library”
- “Replacing an Expansion Module in a Standalone or Rack-mounted Library (14U or larger)”

To install a replacement expansion module, perform the following procedure.

- “Installing a Replacement Expansion Module Enclosure” on page 8-13

Removing an Expansion Module from a Library

1. Remove the following components from the expansion module for weight reduction:
   a. All power supplies (see “Power Supply (Primary and Redundant)” on page 8-42)
   b. All drive sleds (see “Drive Sled” on page 8-34)

   Note: If not already done, have the customer remove all tape cartridges from the module being removed.
2. Loosen the thumb screws securing the expansion module to the rear flange on each Rack Kit rail.
3. Open the I/O Station door then the Access door on the expansion module.
4. From the front of the expansion module, remove the rack ears (see “Removing the Rack Ears” on page 8-13).
5. With a person on each side of the expansion module and a person in front of the expansion module, pull the module out of the rack.
6. Place the module on a sturdy work surface.

Replacing an Expansion Module in a Standalone or Rack-mounted Library (14U or larger)

1. If your library is to be reinstalled into a rack, perform the following:
   a. With a person on each side of the expansion module and one person in front of the expansion module, pick the module up from the work surface and slide it onto the Rack Kit rails installed in your rack.
   b. Tighten the thumb screw that secures the expansion module to the rear flange of each Rack Kit rail.
   c. Open the I/O Station door then the Access door on the expansion module.
   d. Reinstall the rack ears on the front of the expansion module to secure it to the rack (see “Replacing the Rack Ears” on page 8-14).
2. Reinstall the following expansion module components:
   a. All drive sleds (see “Replacing a Drive Sled” on page 8-35).

   b. All power supplies (see "Reinstalling/Replacing a Power Supply" on page 8-43).
3. Perform "Replacing a Control Module in a Standalone or Rack-mounted Library (14U or larger)" on page 8-8.

Installing a Replacement Expansion Module Enclosure

Important:

- Prior to removing and replacing an expansion module enclosure, visually check, and reseat if necessary, all of the internal connectors.
- On the initial power ON, you will get a T080 Service Action Ticket. Perform the suggested resolution action described in "T080: Control module serial number changed or chassis removed" on page 6-29.

Note:

1. Complete the following procedures on the old expansion module:
   - "Removing an Expansion Module from a Library" on page 8-12

   Note: Ensure that the drive sleds and power supplies are removed from the old expansion module. They will be reinstalled into the new expansion module later in this procedure.
2. Unpack the new expansion module enclosure and place it on the work surface near the old expansion module.
3. Perform "Applying a RID Tag to a Library Module" on page 7-32.
4. Transfer the following FRUs/CRUs from the old expansion module to the new expansion module:
   a. Module communication terminator (**1** in Figure 8-37 on page 8-37)
   b. Module-to-module communication cable (4 in Figure 8-37 on page 8-37)
5. Complete "Replacing an Expansion Module in a Standalone or Rack-mounted Library (14U or larger)" on page 8-12.

   Note: Ensure drive sled and power supplies are installed in the correct locations.

Removing/Replacing Rack Ears

Rack ears are installed on each module in a rack-mounted library for weight distribution.

Removing the Rack Ears

Complete these steps to remove the rack ears on all units of the library.

1. Grasp the I/O Station handle and pull it toward you until it locks in the open position.
2. Remove the right rack ear (**1** in Figure 8-9 on page 8-14).

   a. Remove the right rack ear thumb screws. If the screws are tight, use a #2 Phillips screwdriver to loosen them.
   b. Remove the right rack ear.
3. Remove the left rack ear (**3** in Figure 8-9).
   a. Open the left door of the library unit slightly.
   b. Grasp the hinged side of the door and, while pulling on the door, push right to expose the left rack ear.
   c. Remove the left rack ear thumb screws.
   d. Remove the left rack ear.
4. Repeat this process for all units in the library, if necessary.

Replacing the Rack Ears

Complete these steps to replace the rack ears on all units of the library.

1. Grasp the I/O Station handle and pull it toward you until it locks in the open position.
2. Replace the right rack ear (**1** in Figure 8-9).
   a. At the bottom right of the I/O Station position on each library unit, there is a slot (**2** in Figure 8-9). Insert the right rack ear into the slot.
   b. Position the right rack ear flush with the rack rail.
   c. Install and tighten the right rack ear thumb screws.
3. Replace the left

Verifying Front and Rear Gear Racks Alignment

In order for the picker to move from one unit to the next in a multi-module library, the front (**3** in Figure 8-10) and rear (**1** in Figure 8-10) gear racks in the control module must be properly aligned with the gear racks in the expansion module.

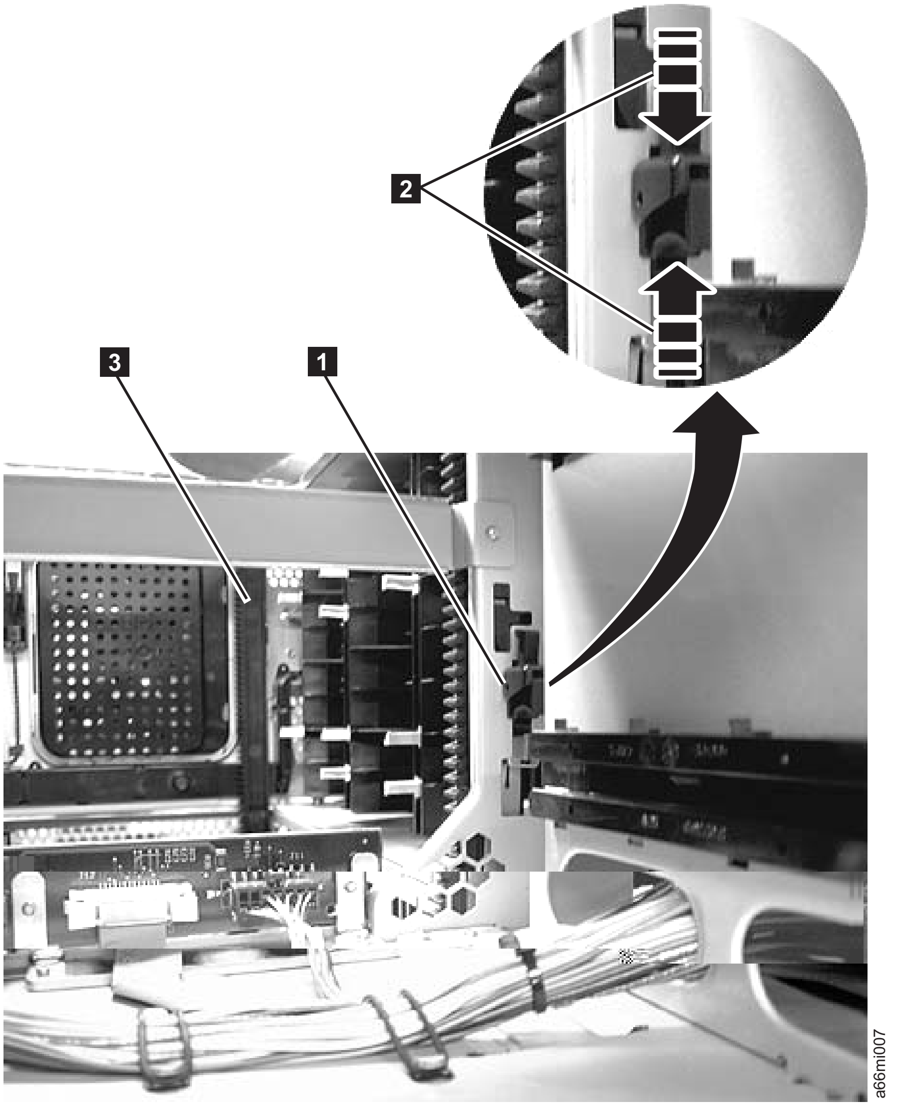


Figure 8-10. Gear rack

1	Rear gear rack locking mechanism	**2**	Magnification of rear gear rack locking mechanism	**3**	Front gear rack

Verify that the front (**3** in Figure 8-10) and rear (**1** in Figure 8-10) gear racks are properly aligned and positioned.

- In a control module, verify that the gear racks are in the down position. Pinch the gear rack locking mechanism (**2** in Figure 8-10 on page 8-15) and push the gear rack down. Ensure that the lock is not engaged in the hole in the frame.
- In an expansion module:
  - Verify that the gear racks are in the down position. Pinch the gear rack locking mechanism (**2** in Figure 8-10 on page 8-15) and push the gear rack down. Ensure that the lock is not engaged in the hole in the frame.
  - Verify that there are no gaps in the gear racks between library units.

To align the gear racks in a multi-module library:

1. Slightly push up and pinch the gear rack locking mechanism (**1** in Figure 8-10 on page 8-15) to unlock the gear rack in the control module.
2. While pinching the gear rack locking mechanism (**2** in Figure 8-10 on page 8-15), push the gear rack down until it aligns with the gear rack in the expansion module, then release your hold on the locking mechanism.
3. Manually inspect the track to ensure there are no gaps.
4. Repeat Steps 1 through 3 for the other gear rack.
5. Manually raise the picker and disengage the picker locking mechanism (**1** in Figure 8-11) if necessary. If the gear racks are properly aligned, the picker will slowly move to the bottom of the library.

Figure 8-11. Picker assembly locking mechanism

Front Panel Components

The library has the following front panel components:

- Bezels
- Operator Panel
- I/O Station
- I/O Station Lock Assembly
- I/O Station Safety Flap
- Power Switch/LED board

Bezels

The front bezels are the design panels on the front of both the control module and the expansion module.

These instructions explain how to replace the front bezels of your library. Bezels can be replaced on both the I/O Station door and the Access Door.

Required Tool: T10 TORX screwdriver

Removing the I/O Station Bezel

1. Perform "Preparing a Library or Library Module for Repairs" on page 8-3.
2. Open the I/O Station door.
3. Remove the cartridges from the I/O Station to access the screw located on the backside of the I/O Station door.
4. Remove the screw located on the backside of the I/O Station door.
5. Hold the I/O Station slide assembly in place with one hand and, using your other hand, pull the I/O Station door directly up to disengage the bolts, and then pull the door toward you.
6. Set aside the old front bezel.

Replacing the I/O Station Bezel

To replace the I/O Station bezel, perform the remove procedures in reverse order. For the last step, perform "Returning a Library or Library Module to Normal Operations after Repairs" on page 8-3.

Removing the Access Door Bezel

1. Perform "Preparing a Library or Library Module for Repairs" on page 8-3.
2. Open the module's I/O Station and Access Doors.

   Note: When you open the Access Door, the library becomes disabled (the Picker assembly does not function). When you later close the Access Door, the library will function normally.
3. Remove the screws located on the backside of the Access Door.
   - For the control module (11 screws), see **1** in Figure 8-12 on page 8-18.

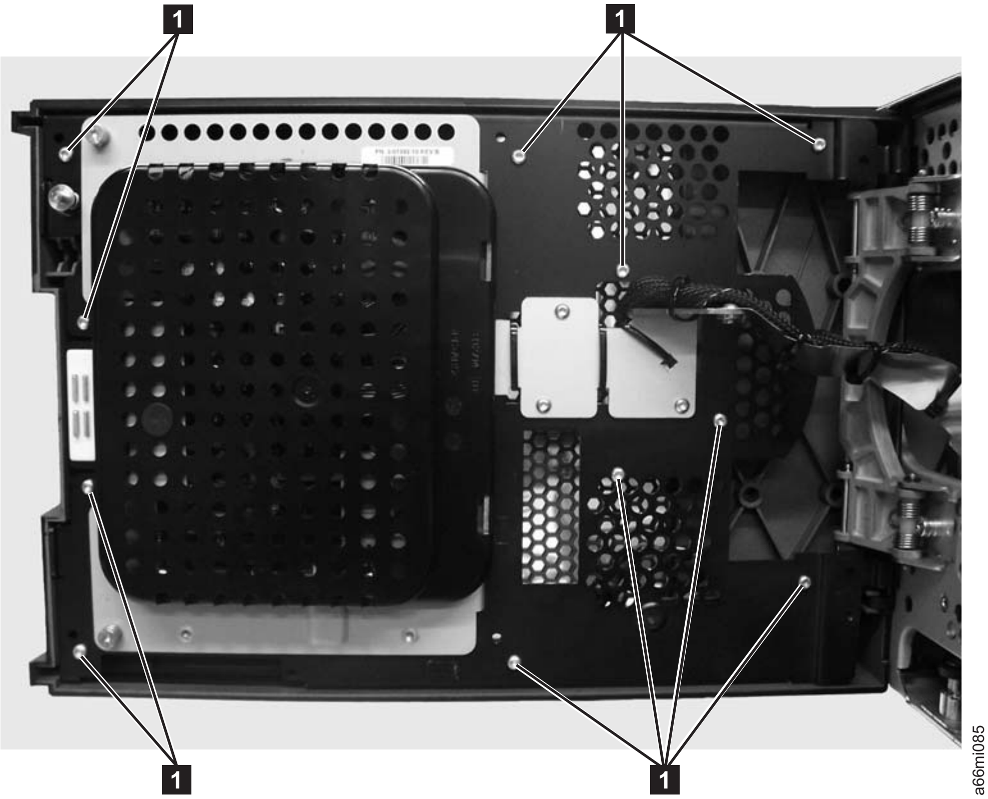


Figure 8-12. Control module Access Door screw locations

- For an expansion module (12 screws, see **1** in Figure 8-13 on page 8-19.

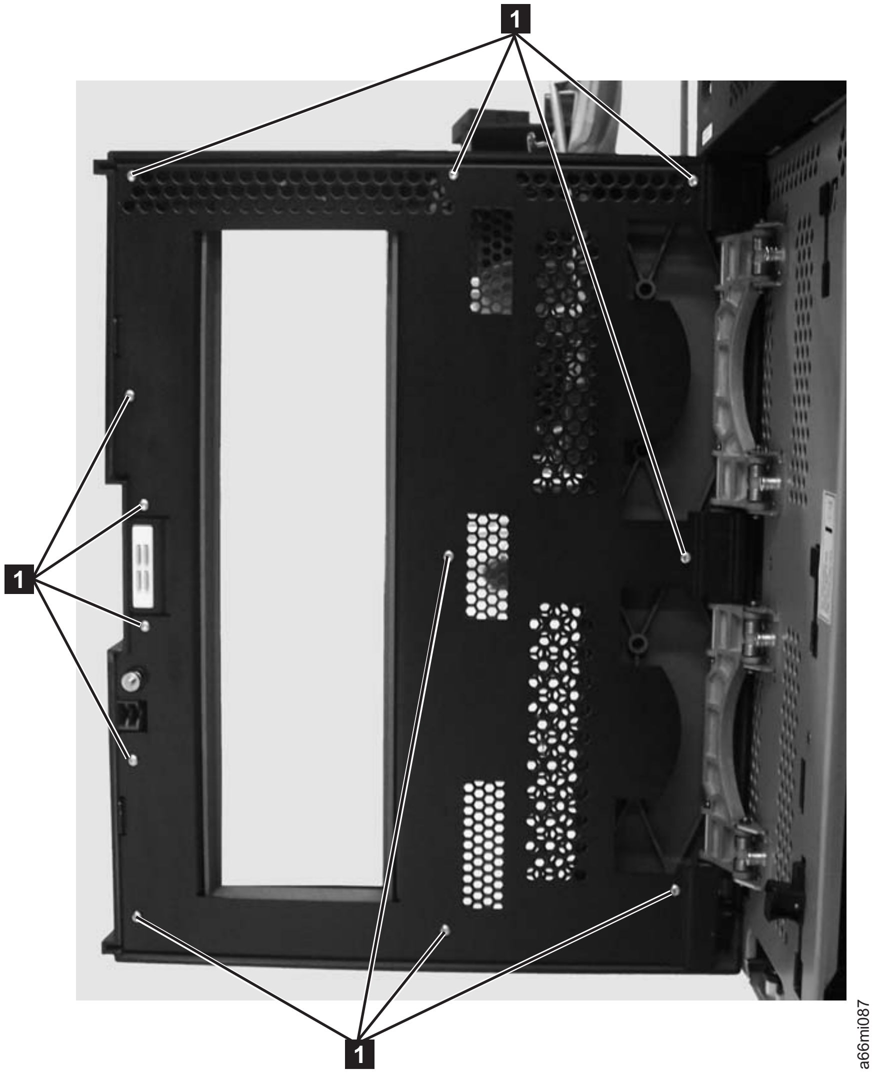


Figure 8-13. Expansion module Access Door screw locations

Replacing the Access Door Bezel

1. To install the new Access Door bezel, perform the steps in “Removing the Access Door Bezel” on page 8-17 in reverse order.
2. Copy the serial number on the label in the lower left corner of the old Access Door bezel onto the blank label supplied with the new Access Door bezel, then apply the new serial number label in the recess located in the lower left corner on the new Access Door bezel.
3. Perform “Returning a Library or Library Module to Normal Operations after Repairs” on page 8-3.

Operator Panel

The Operator Panel enables you to control the library using the LCD screen located on the Control Module (CM) Access Door.

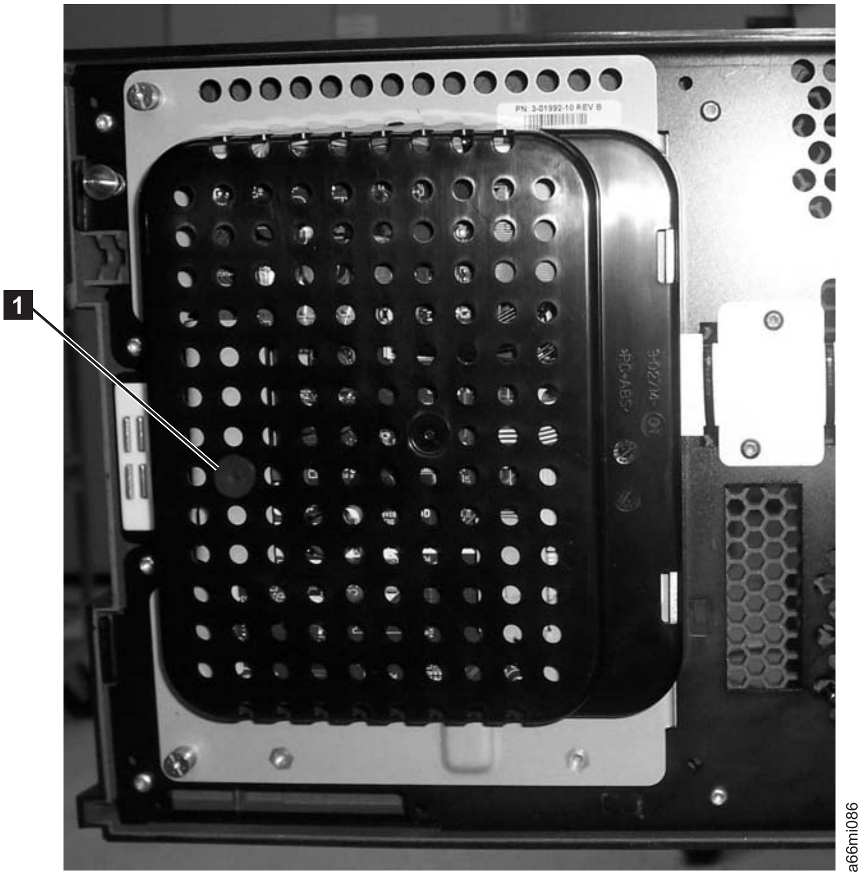


Figure 8-14. Operator Panel assembly

Before Removing / Replacing the Operator Panel

Operator panel problems may be caused by loose connectors. Visually check, and reseat if necessary, all of the connectors on the back of the operator panel (Figure 8-17 on page 8-22), the connector on the back of the I/O Station locking mechanism (**1** in Figure 8-15 on page 8-21), and the connectors that are located between the storage column 4 magazine and the back of the Library Control Blade (**2** and **3** in Figure 8-16 on page 8-21).

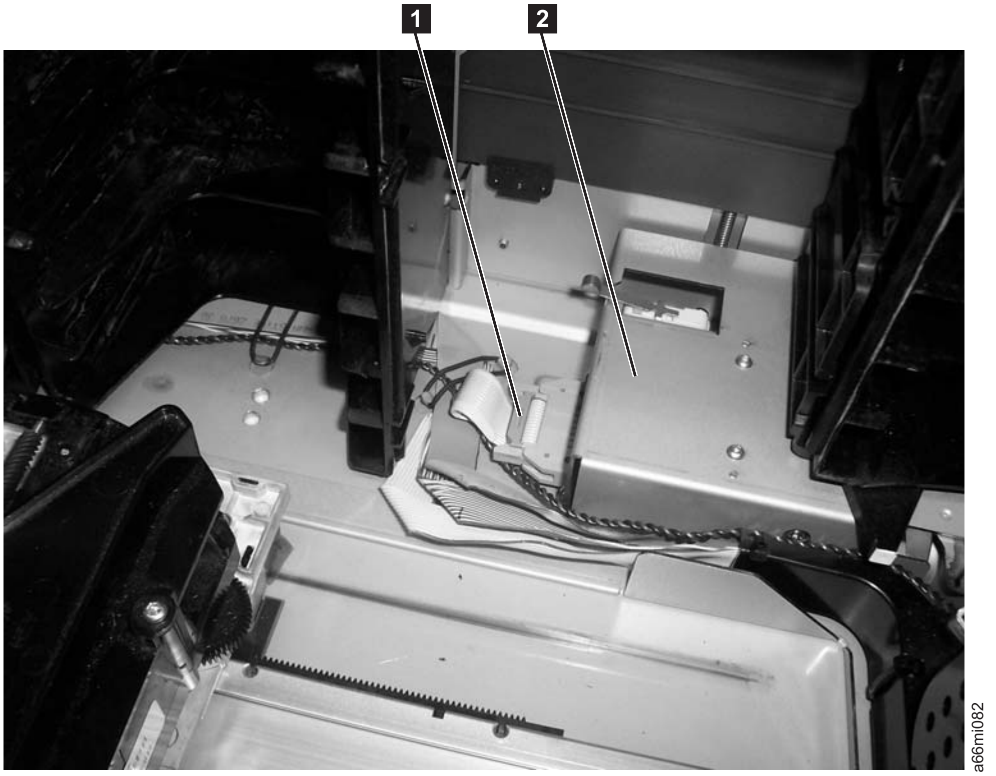


Figure 8-15. Connector on the back of the I/O Station locking mechanism

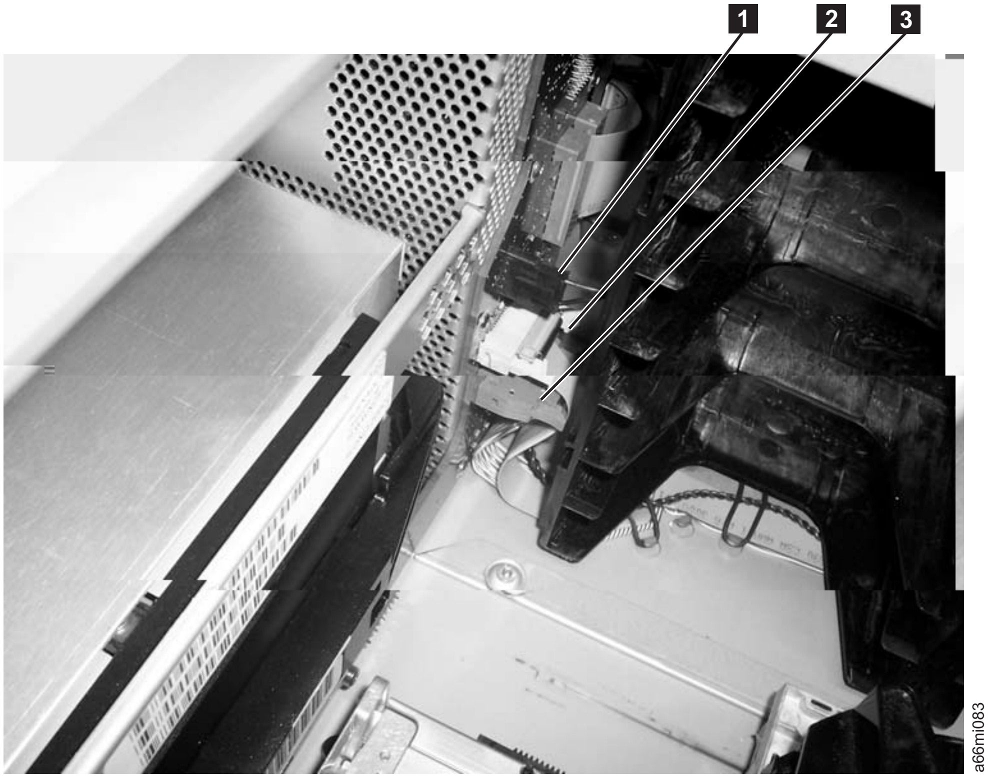


Figure 8-16. Connector between the storage column 4 magazine and Library Control Blade (top cover removed)

Removing the Operator Panel

1. Perform "Preparing a Library or Library Module for Repairs" on page 8-3.
2. Open the I/O Station door.
3. Open the Access Door. The Operator Panel is located on the backside of this door.
   a. Remove the black protective cover from the back of the Operator Panel.
   b. Use a flat blade screwdriver to pry up on the plastic retaining pin (**1** in Figure 8-14 on page 8-20).
   c. Squeeze the black plastic cover on both sides to remove it from the Access Door.
4. Disconnect the four cable connectors that are attached to the Operator Panel (see **1** , **3** , **5** , and **7** in Figure 8-17).

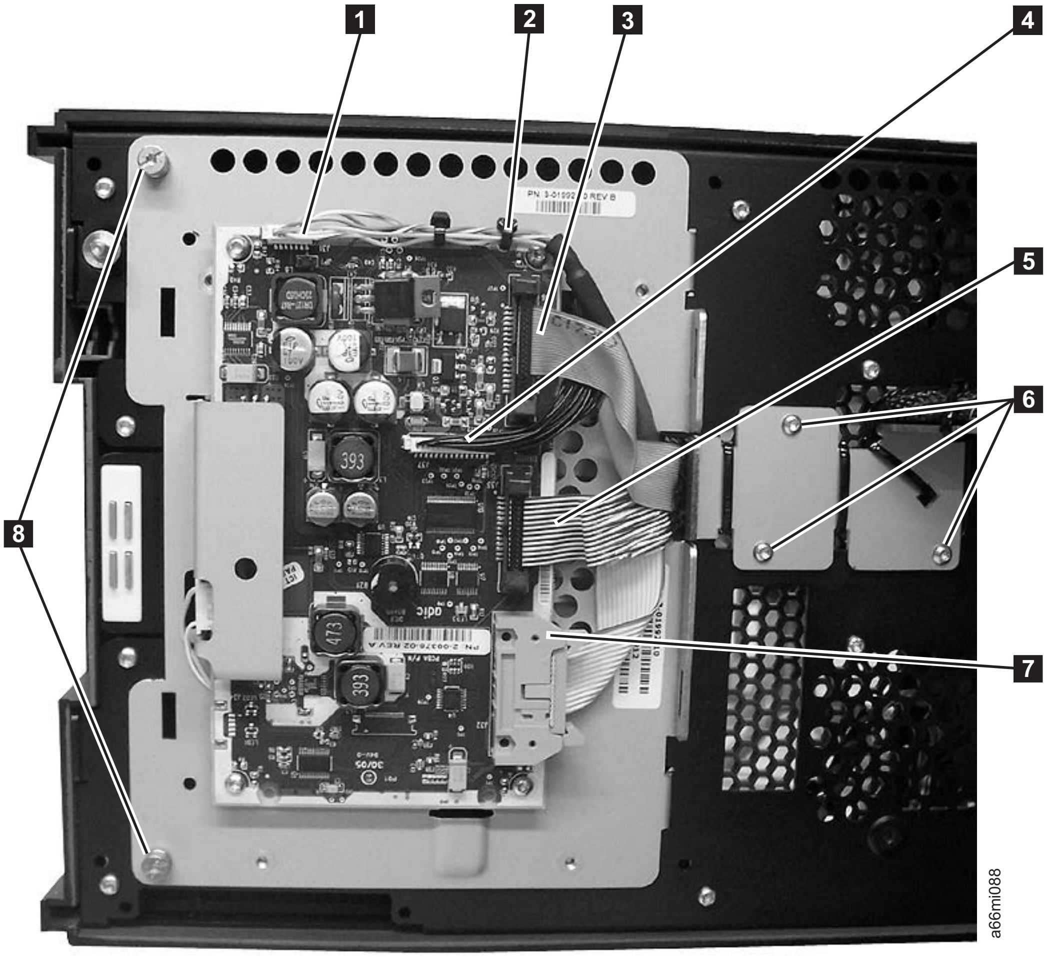


Figure 8-17. Operator Panel cabling

5. Cut the cable tie (**2** in Figure 8-17) if necessary.
6. Unscrew the two captivated screws (**8** in Figure 8-17) located on the left side of the Operator Panel.

   Important: When removing the final screw, hold the Operator panel to ensure it doesn't fall.
7. Swing the panel to the right then lift it from the Access Door.

Replacing the Operator Panel

To replace the Operator Panel, complete the removal procedure in reverse. For the last step, perform "Returning a Library or Library Module to Normal Operations after Repairs" on page 8-3.

Removing/Replacing the Power Switch/LED Board Assembly

The Power Switch/LED Board Assembly (**1** in Figure 8-18) contains the power ON/OFF button, power ON LED, and Operator Attention LED.

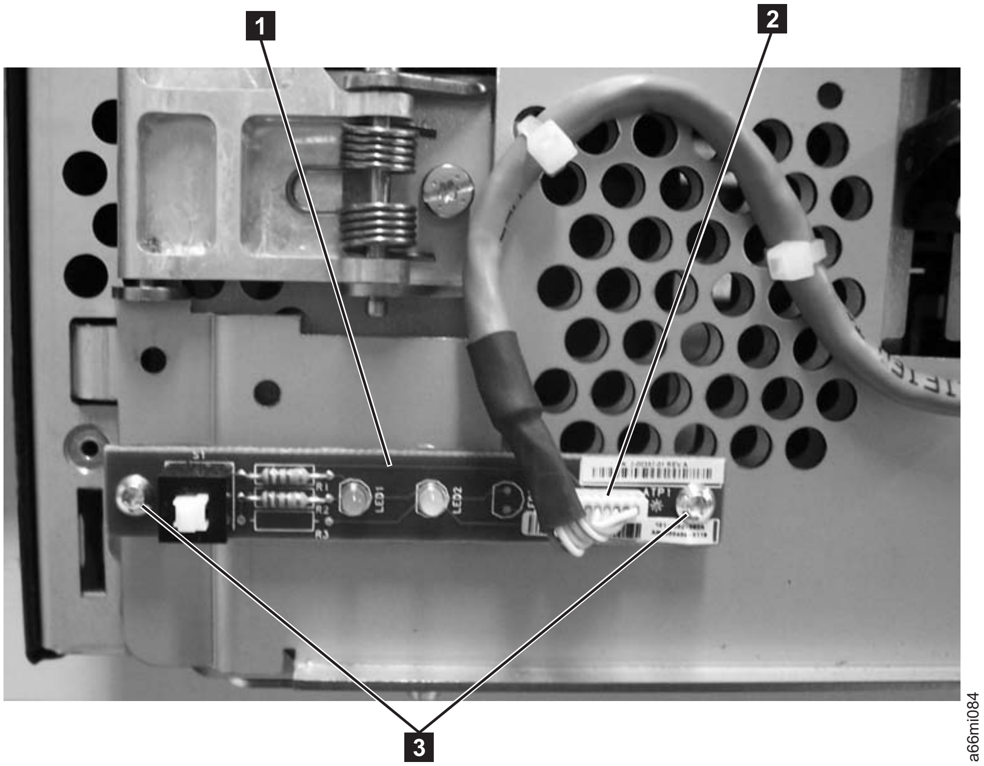


Figure 8-18. Power Switch/LED Board Assembly

Removing the Power Switch/LED Board Assembly

1. Perform "Preparing a Library or Library Module for Repairs" on page 8-3.
2. Perform "Removing the Access Door Bezel" on page 8-17.
3. Disconnect the small white connector (**2** in Figure 8-18).
4. Remove the two screws (**3** in Figure 8-18).
5. Remove the Power Switch/LED Board Assembly from the Control Module. Note that the FRU kit for this assembly contains the cable and cable ties. If you suspect the cable may be failing, replace it also.

Replacing the Power Switch/LED Board Assembly

1. Perform "Removing the Power Switch/LED Board Assembly" in reverse order.
2. Perform "Returning a Library or Library Module to Normal Operations after Repairs" on page 8-3.

I/O Station

Each control and expansion module has an I/O Station located on the right side of the front of the unit and is used for inserting/removing data and cleaning cartridges into and out of the library.

Figure 8-19. 14U library with control module I/O Station open

Figure 8-20. Control module I/O Station

Each module's I/O Station must be locked in order for the library to function properly. When the library is busy performing a task, such as retrieving a cartridge, the library locks all I/O Station doors. The doors cannot be opened until the library is no longer busy. If the library detects that an I/O Station door is either open or unlocked, the library cannot operate normally.

Manually Unlocking the I/O Station Door

If the I/O Station door fails to unlock, you can unlock it manually.

There are 2 styles of I/O Station Lock mechanisms. The early style uses a T10 Torx wrench to rotate the lock mechanism. The new style has a large push-button type mechanism behind the hole (**1** in Figure 8-21) in the I/O station door.

Manually Unlocking the Early Style I/O Station Door

If the I/O Station door fails to unlock, you can unlock it manually.

To manually unlock the early style I/O Station lock, follow these steps:

1. Insert a T10 Torx wrench in the hole (**1** in Figure 8-21) located on the front of the I/O Station door of the library module you wish to open.
2. Turn the wrench one-quarter turn counterclockwise to unlock the door.

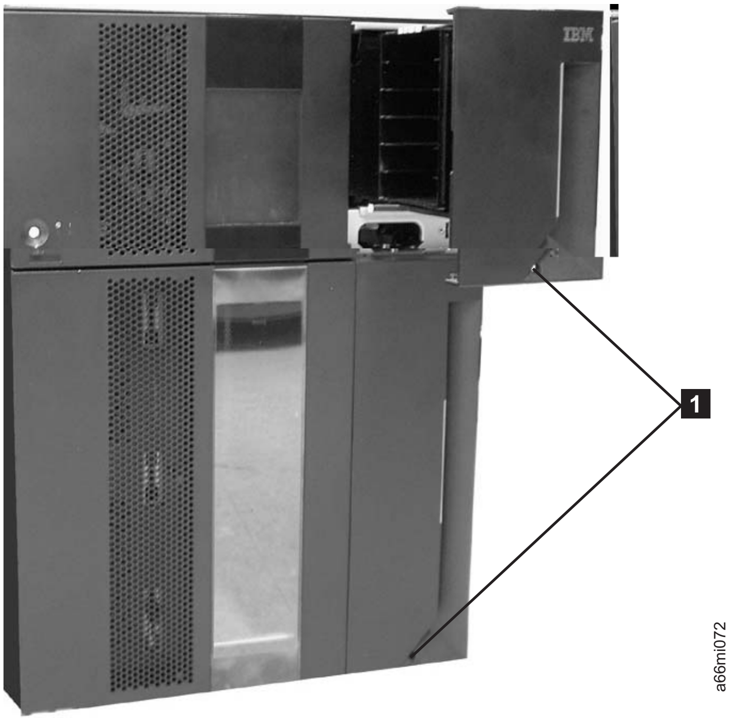


Figure 8-21. Access holes for manually unlocking I/O Station doors

3. To manually relock the I/O Station door:
   - From the Operator Panel, select **Operations** → **Lock I/O Station**
   - From the Web User Interface, select **Manage Cartridges** → **Lock/Unlock I/O Station Doors**

Manually Unlocking the New Style I/O Station Door

If the I/O Station door fails to unlock, you can unlock it manually.

To manually unlock the new style I/O Station lock, follow these steps:

1. Insert any straight tool (screwdriver, Torx wrench, etc.) into the hole (**1** in Figure 8-21) in the front cover of the I/O station.

2. Push the tool in to unlock the I/O station door. There is a large, flat pushbutton type mechanism behind the hole in the cover that, when pushed toward the rear of the library, will release the I/O station lock mechanism.
3. To manually relock the I/O Station door:
   - From the Operator Panel, select **Operations** → **Lock I/O Station**
   - From the Web User Interface, select **Manage Cartridges** → **Lock/Unlock I/O Station Doors**

Removing an I/O Station

1. Open the I/O Station door, then the Access Door.
2. Reaching through the Access Door opening, push up on the roller (**1** in Figure 8-22) located above the I/O Station slide and pull the I/O Station towards you until the slide is in front of the roller.

   Note: The I/O Station in an expansion module has two slides and two silver rollers. Push up on one of the rollers while you pull out on that part of the I/O Station, then push up on the other roller to release the I/O Station. If necessary, the silver rollers may be pushed up far enough to latch in the cutout hole in the side frame. Ensure that they are unlatched when the I/O station is reinstalled.

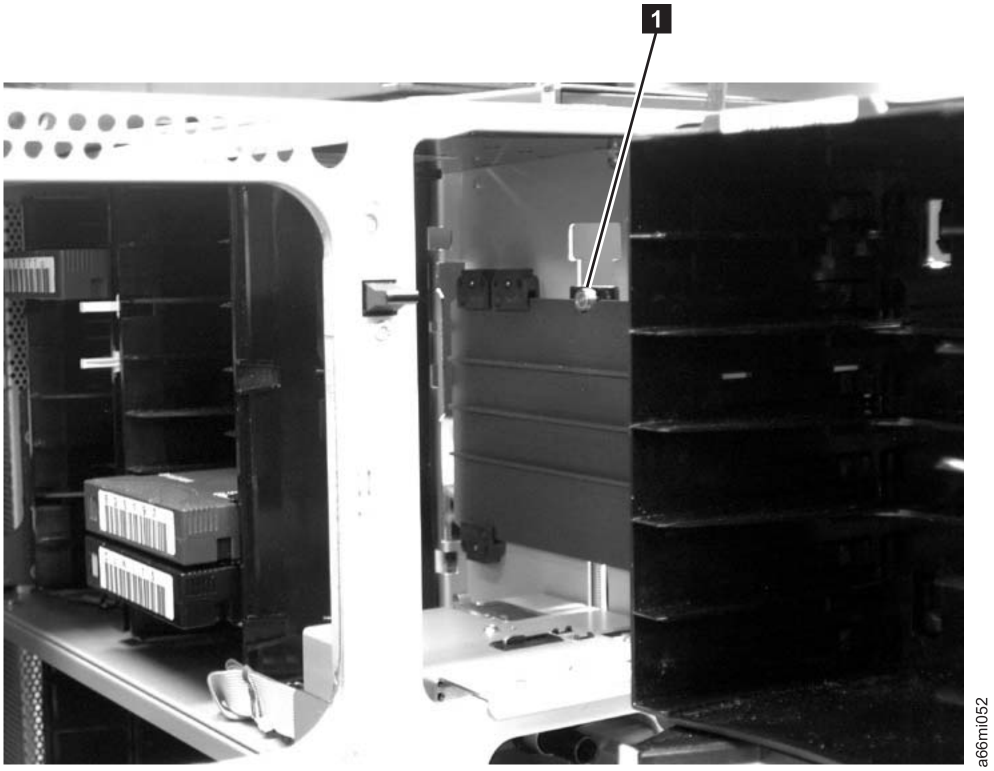


Figure 8-22. Silver roller locking the I/O Station slide in place

3. Supporting the I/O Station from underneath with your other hand, pull it out of the library module.
4. Place the I/O Station in a safe location.

Reinstalling an I/O Station

1. Supporting the I/O Station from underneath with your other hand, slide the I/O Station into the glide slots in the library unit.
2. Reaching through the Access Door, push up on the silver roller (**1** in Figure 8-22 on page 8-26) while continuing to push the I/O Station into the library module.

   Note: If you tilt the I/O station slide(s) down as they contact the roller(s), they will go under the rollers without the rollers being pushed up.
3. Release your hold on the silver roller to lock the I/O Station slide in place.
4. Close the Access Door, then close the I/O Station door.

Removing the I/O Station Lock Assembly

The I/O Station lock assembly (**1** in Figure 8-23) contains the lock sensor and lock solenoid.

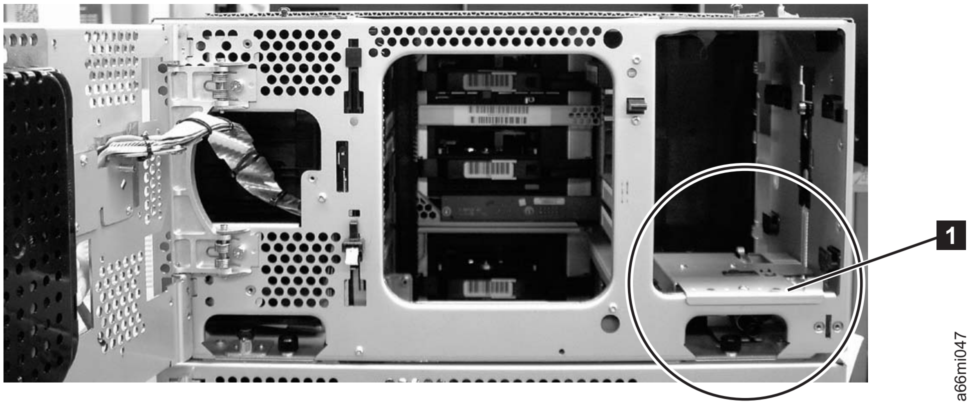


Figure 8-23. I/O Station Lock Assembly installed in library

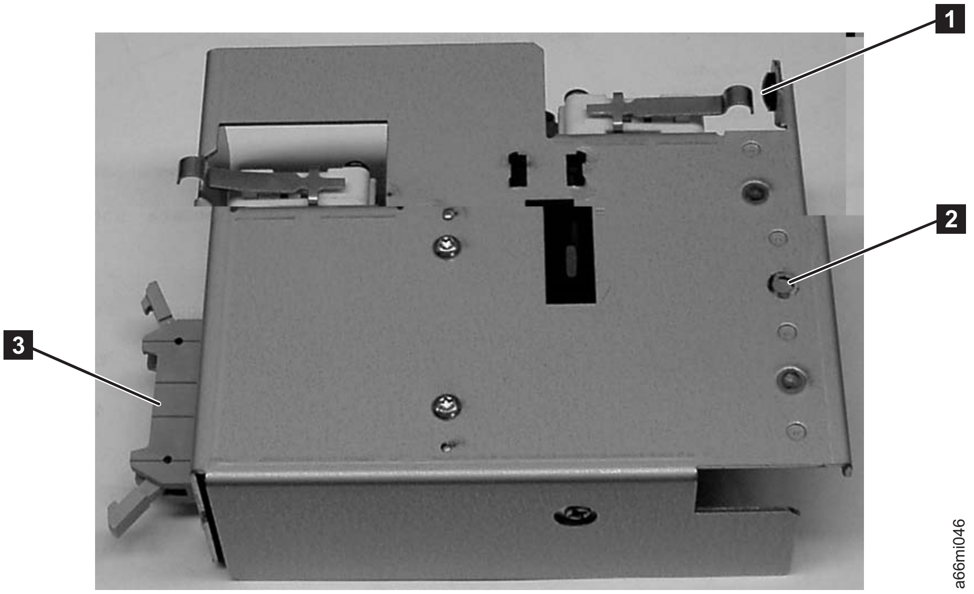


Figure 8-24. I/O Station Lock Assembly (top view)

1. Perform “Preparing a Library or Library Module for Repairs”

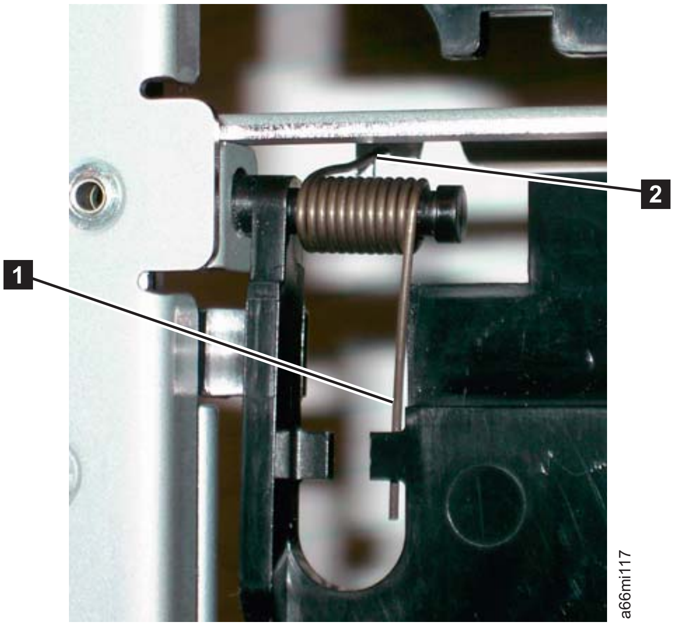


Figure 8-25. I/O Safety Flap Front Spring Wire

3. Push the upper right hand corner of the flap to the left to remove the pivot pin (**1** in Figure 8-26) from the pivot hole (**2** in Figure 8-26).

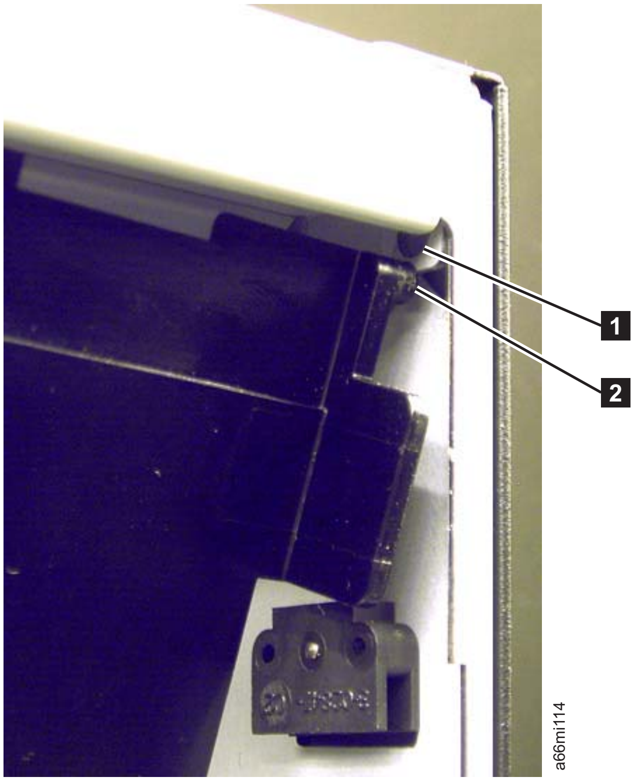


Figure 8-26. I/O Safety Flap Pivot Pin

4. Move the flap to the right to remove the pivot pin (**1** in Figure 8-27 on page 8-30) from the pivot hole (**1** in Figure 8-27 on page 8-30). The flap can now be

removed from the library.

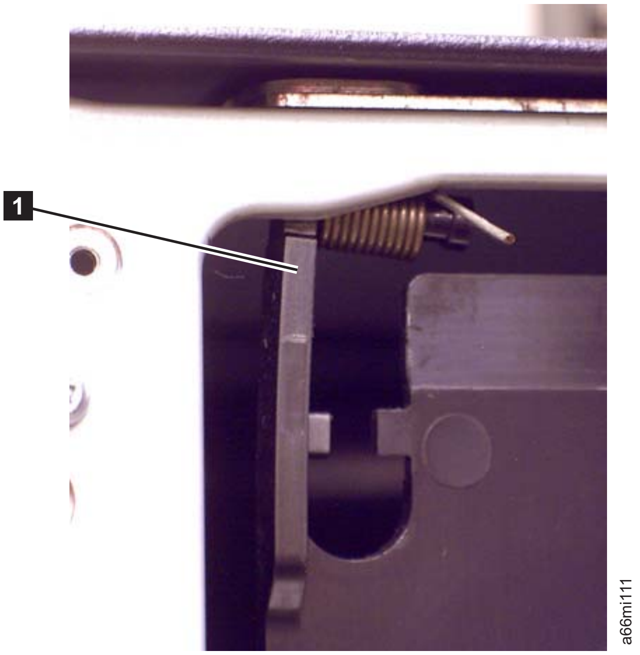


Figure 8-27. I/O Safety Flap Pivot Pin, Removed

Replacing the I/O Station Safety Flap in a Control Module (5U)

Perform “Removing the I/O Station Safety Flap from a Control Module (5U)” on page 8-28 in the reverse order. When installing the bottom flap, position the spring (**1** in Figure 8-28) as shown.

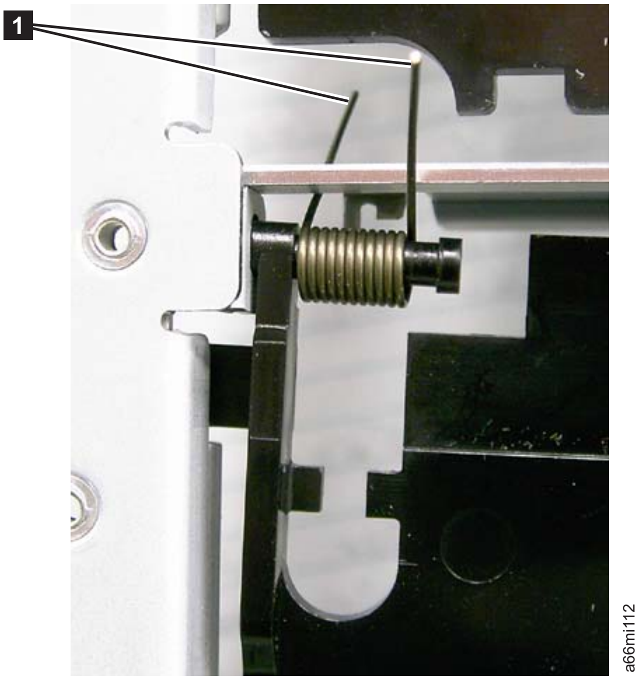


Figure 8-28. I/O Station Safety Flap Bottom Spring position

Removing the I/O Station Safety Flap from an Expansion Module (9U)

1. Perform "Removing an I/O Station" on page 8-26.
2. Unhook the front spring wire (**1** in Figure 8-29) from the tab on the I/O flap.

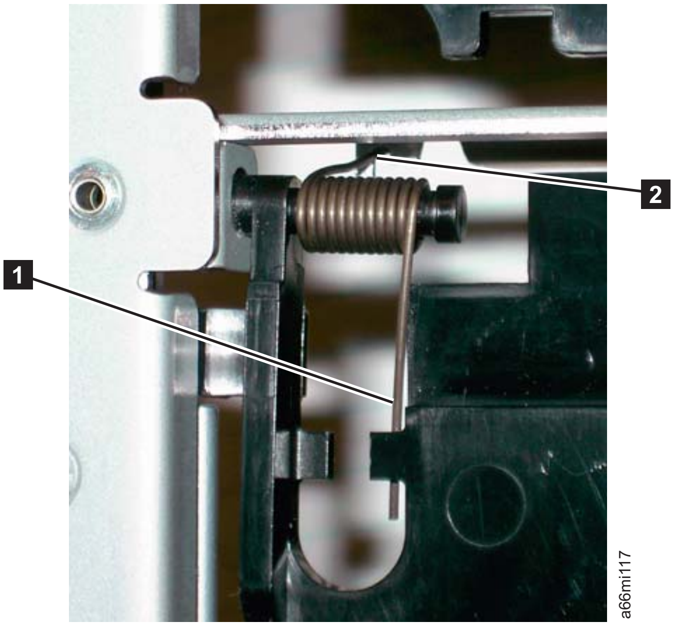


Figure 8-29. I/O Safety Flap Front Spring Wire

3. Unhook the rear spring wire (**2** in Figure 8-29) from the notch in the frame.
4. Disconnect the plastic link (**1** in Figure 8-30 on page 8-32) from the bottom flap (**3** in Figure 8-30 on page 8-32). Use a small screwdriver (**2** in Figure 8-30 on page 8-32) to pry the link out of the hole in the bottom flap.

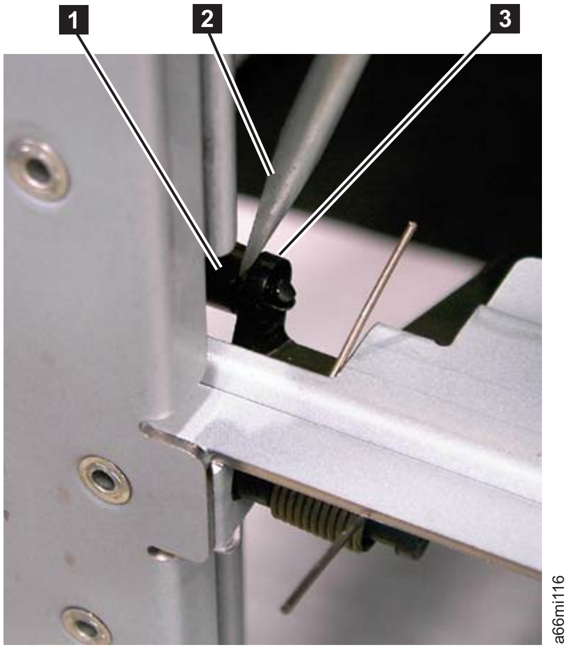


Figure 8-30. I/O Safety Flap Link

5. Push the upper right hand corner of the bottom flap to the left to remove the pivot pin (**1** in Figure 8-31) from the pivot hole (**2** in Figure 8-31).

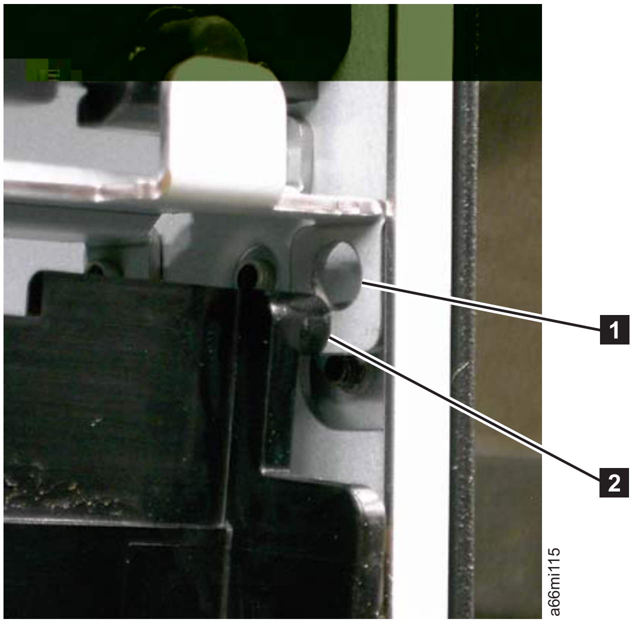


Figure 8-31. I/O Safety Flap Pivot Pin

6. Move the bottom flap to the right to remove the pivot pin (**1** in Figure 8-32 on page 8-33) from the pivot hole (**1** in Figure 8-32 on page 8-33). The bottom flap can now be removed from the library.

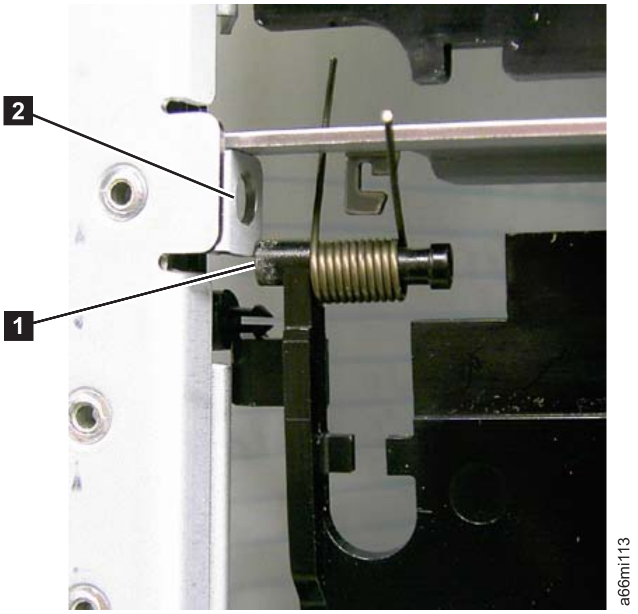


Figure 8-32. I/O Safety Flap Pivot Pin, Removed

7. Repeat steps 5 and 6 above to remove the top flap from the library.

Replacing the I/O Station Safety Flap in an Expansion Module (9U)

Perform “Removing the I/O Station Safety Flap from an Expansion Module (9U)” on page 8-31 in the reverse order. When installing the bottom flap, position the spring (**1** in Figure 8-33) as shown.

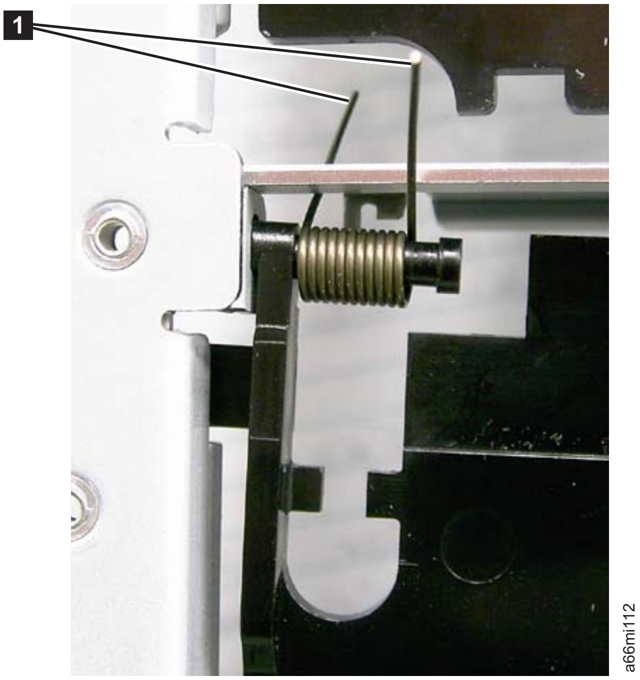


Figure 8-33. I/O Station Safety Flap Bottom Spring position

Rear Panel Components

The library has the following rear panel customer replaceable units (CRUs):

- Drive Sled
- Library Control Blade (LCB)
- Library Power Supply

Drive Sled

Tape drives mounted in sleds are installed into tape drive slots in the rear of the library.

Removing a Drive Sled

Important: If removing more than one drive sled at a time, record the locations of each drive before they are removed. Ensure that the drives are reinstalled in the correct location.

1. Vary all drives offline from the host.
   - From the Operator Panel, select **Operations** → **Change Drive Mode**.
   - From the Web User Interface, select **Manage Drives** → **State (Online/Offline)** .

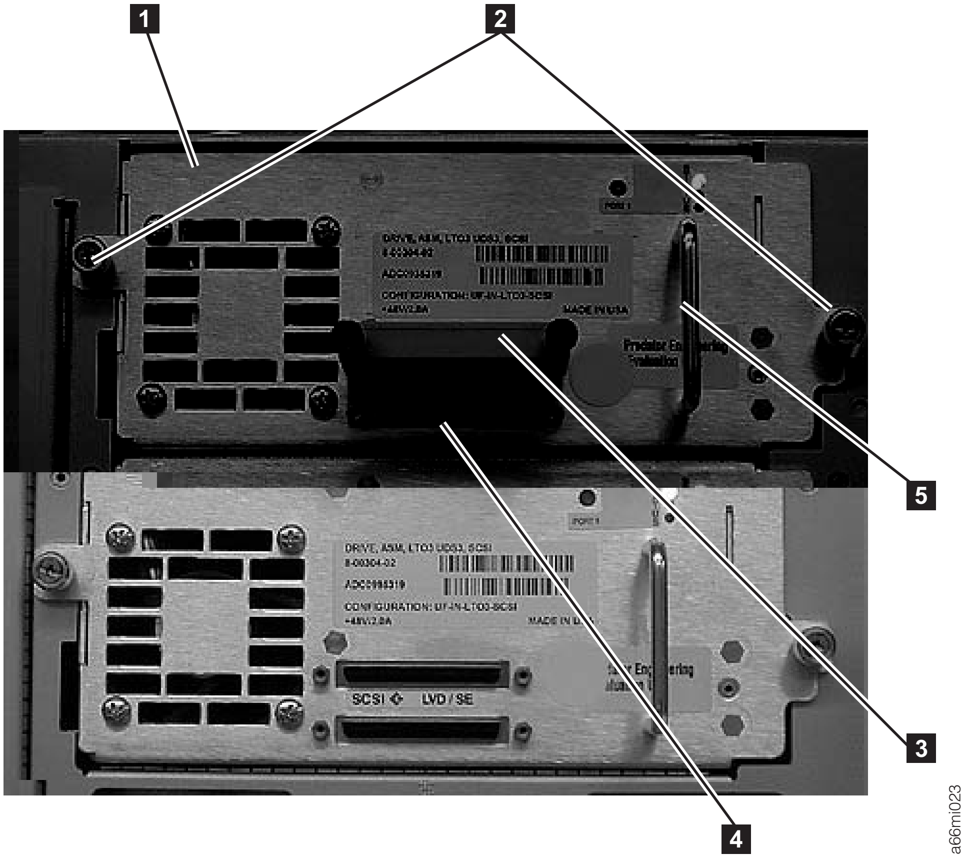


Figure 8-34. Drive sled (detail)

2. Disconnect the drive cable and place it on a flat surface in a secure location to avoid damaging the cable.

   a. For a SCSI drive, loosen the two thumb screws that hold the SCSI cable and terminator in place by turning them counterclockwise. Disconnect the cable and terminator from the drive being removed.
   b. For a Fibre Channel or SAS drive, unplug the host interface cable.
3. Loosen the two thumb screws (**2** in Figure 8-34 on page 8-34) that hold the drive in place by turning them counterclockwise.
4. Slide the drive out of the library module. Grasp the handle (**5** in Figure 8-34 on page 8-34) and slowly pull the drive toward you, while supporting the drive sled from underneath.

Replacing a Drive Sled

Attention: NEVER install a drive sled when a cartridge is in the drive in the eject position. Remove the cartridge first.

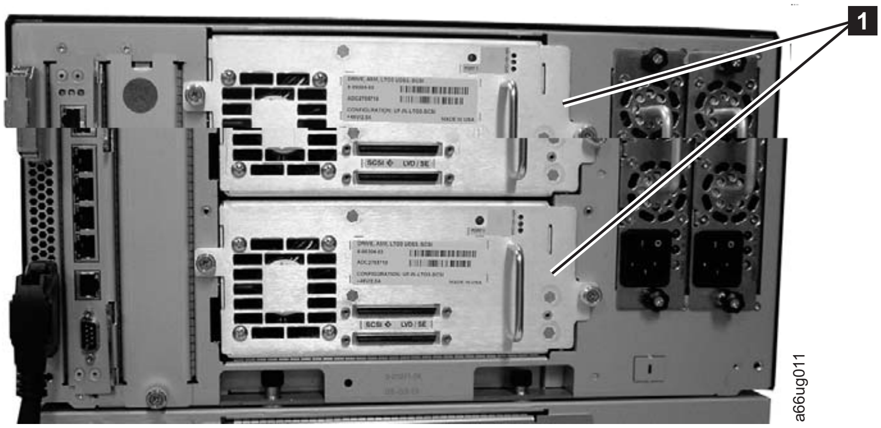


Figure 8-35. Control Module Drive Sled

1. Align the drive sled with the guide rails and guide slots along the tracks (**3** in Figure 8-36 on page 8-36) in the open drive sled slot (**2** in Figure 8-36 on page 8-36). Grasp the handle (**5** in Figure 8-34 on page 8-34) and slowly slide the drive sled into the library, while supporting the drive sled from underneath.

   Note: The thumb screws must be aligned with the screw holes in the module. If they are not aligned, the drive sled was not inserted correctly.

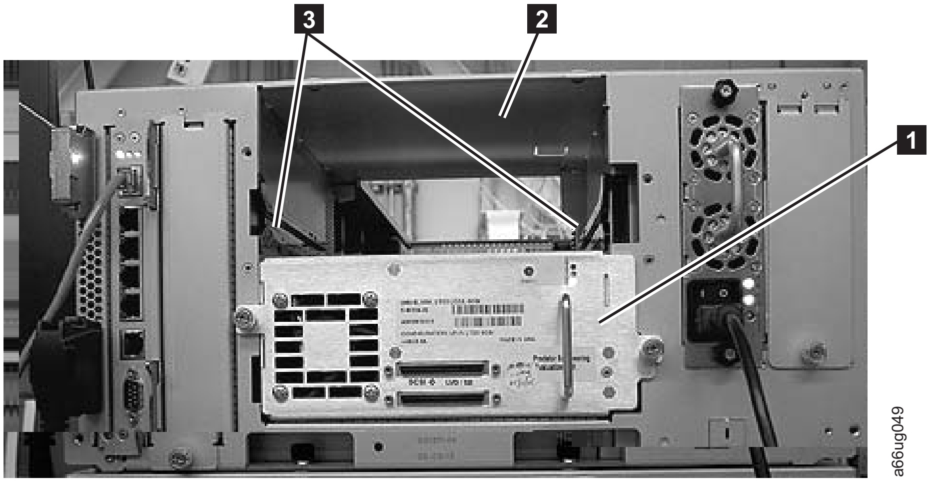


Figure 8-36. Drive sled slot

2. Tighten the two thumb screws (**2** in Figure 8-34 on page 8-34) that hold the drive sled in place by turning them clockwise.
3. Reconnect the drive sled cable.
   a. For a SCSI drive sled, plug the cable and terminator into the drive sled. Tighten the thumb screws that hold the SCSI cable (**4** in Figure 8-34 on page 8-34 shows the SCSI receptacle) and terminator (**3** in Figure 8-34 on page 8-34) in place by turning them clockwise.
   b. For a Fibre Channel or SAS drive sled, connect the host interface cable.
4. Repeat this procedure for all drives to be reinstalled in the library.
5. Vary all drives online from the host.

Library Control Blade or Compact Flash Card

The Library Control Blade (LCB) manages the entire library, including the Operator Panel and picker assembly. It also runs system tests to ensure that the library is functioning properly.

The Compact Flash (CF) Card is housed on the LCB and contains the library firmware and vital product data (VPD) such as configuration settings.

Replacement of either the LCB or the CF requires the removal of the LCB/CF Assembly from the library.

Removing the Library Control Blade/ Compact Flash Assembly

Important: Before removing the LCB/CF Assembly from the library, ensure that you have the current library configuration data available. If the CF card is replaced, you will need the following information to reconfigure the libary:

- IP address
- Subnet mask address
- Gateway address
- Library firmware level
- License keys, if applicable

See Appendix D of the TS3310 Setup and Operator Guide.

Important: When handling the LCB, you must wear an ESD anti-static wrist strap, or touch the library frame to discharge any static electricity in your body. Do not handle the LCB without taking appropriate ESD precautions.

1. Perform “Preparing a Library or Library Module for Repairs” on page 8-3.
2. On the LCB (Figure 8-37), disconnect the Ethernet cable (2 in Figure 8-37) by pinching the tab to disengage the cable, and then pull the connector out of the LCB.

   Note: Six slots reside below the Ethernet cable. The four topmost slots are reserved for future use. The two bottommost slots are designated as Ethernet (5 in Figure 8-37) and serial (6 in Figure 8-37) ports, and are reserved for use by IBM Service Personnel.

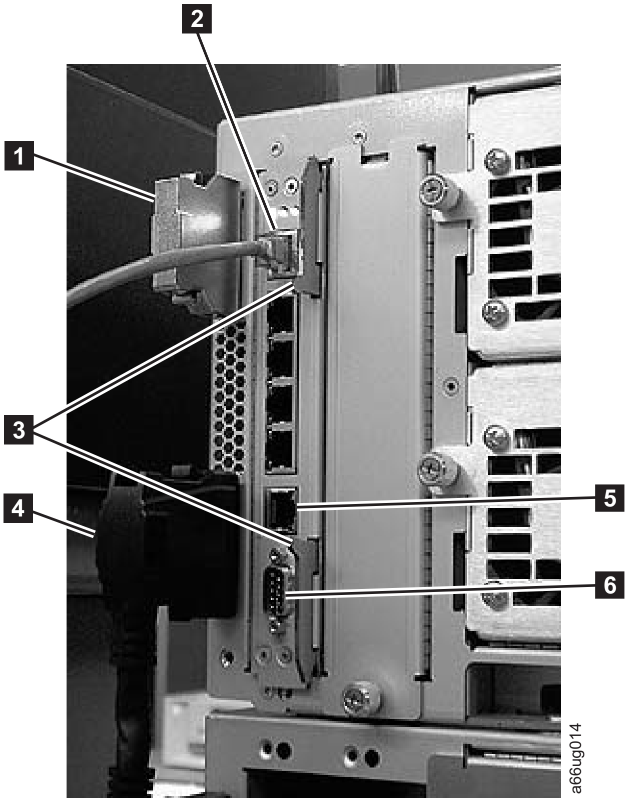


Figure 8-37. Library Control Blade (LCB)

1	Module communication terminator	4	Module-to-module communication cable
2	Ethernet cable (customer supplied)	5	Ethernet port (for IBM service personnel use)
3	Latches	6	Serial port (for IBM service personnel use)

3. Grasp the pair of latches (3 in Figure 8-37) near the top and bottom of the LCB. Simultaneously push the latches to the left, and then pull them out and away from the LCB.
4. Simultaneously grasp the same pair of latches again, and slowly pull them toward you. As the LCB begins to slide out of the control module, be sure to support the LCB from underneath, being careful to touch only the metal cover and the ground plane.

Important: DO NOT touch any components on the LCB firmware board. Hold it by the metal cover and support it by the metal ground plane along the bottom edge.

5. Once the LCB has been removed from the control module, carefully lay it (Figure 8-38) on a clean, flat surface.

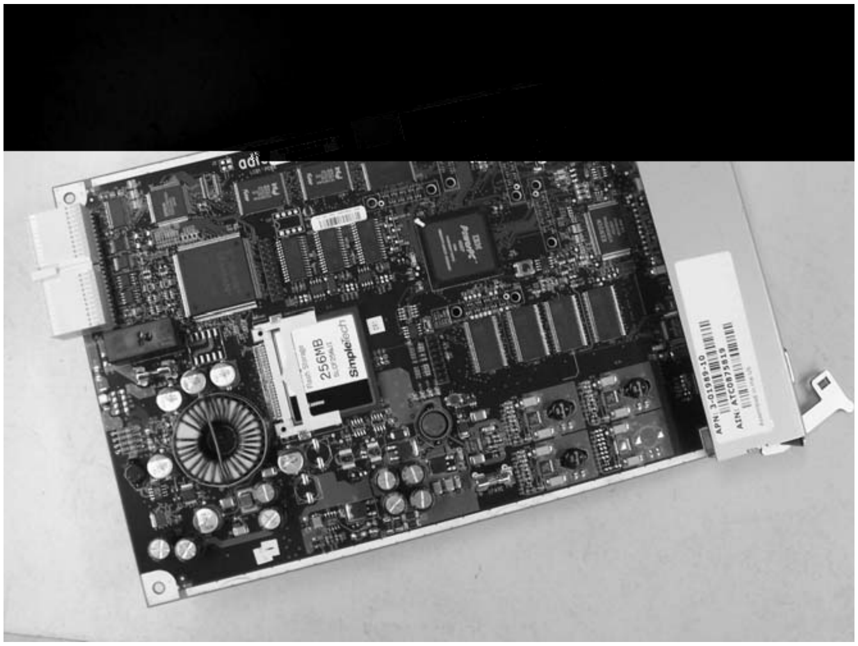


Figure 8-38. Library Control Blade (LCB)

6. Use one of the following procedures to complete the repair:
   - If you are replacing the LCB only, it will be necessary to transfer the CF card from the old LCB to the new LCB. Continue with “Removing/Replacing the Compact Flash Card.”
   - If you are replacing the CF card only, it will be necessary to remove the failing CF card from the LCB, replace it with the new CF card, and upgrade the CF card firmware. Continue with Step 3 of “Removing/Replacing the Compact Flash Card”.

Removing/Replacing the Compact Flash Card

Important: When handling the Compact Flash Card, you must wear an ESD anti-static wrist strap, or touch the library frame to discharge any static electricity in your body. Do not handle the Compact Flash Card without taking appropriate ESD precautions.

Selections made during library configuration reside on the Compact Flash Card. If you are replacing the CF card, you will need the following information to reconfigure the library:

- IP address
- Subnet mask address
- Gateway address
- Library firmware level
- License keys, if applicable

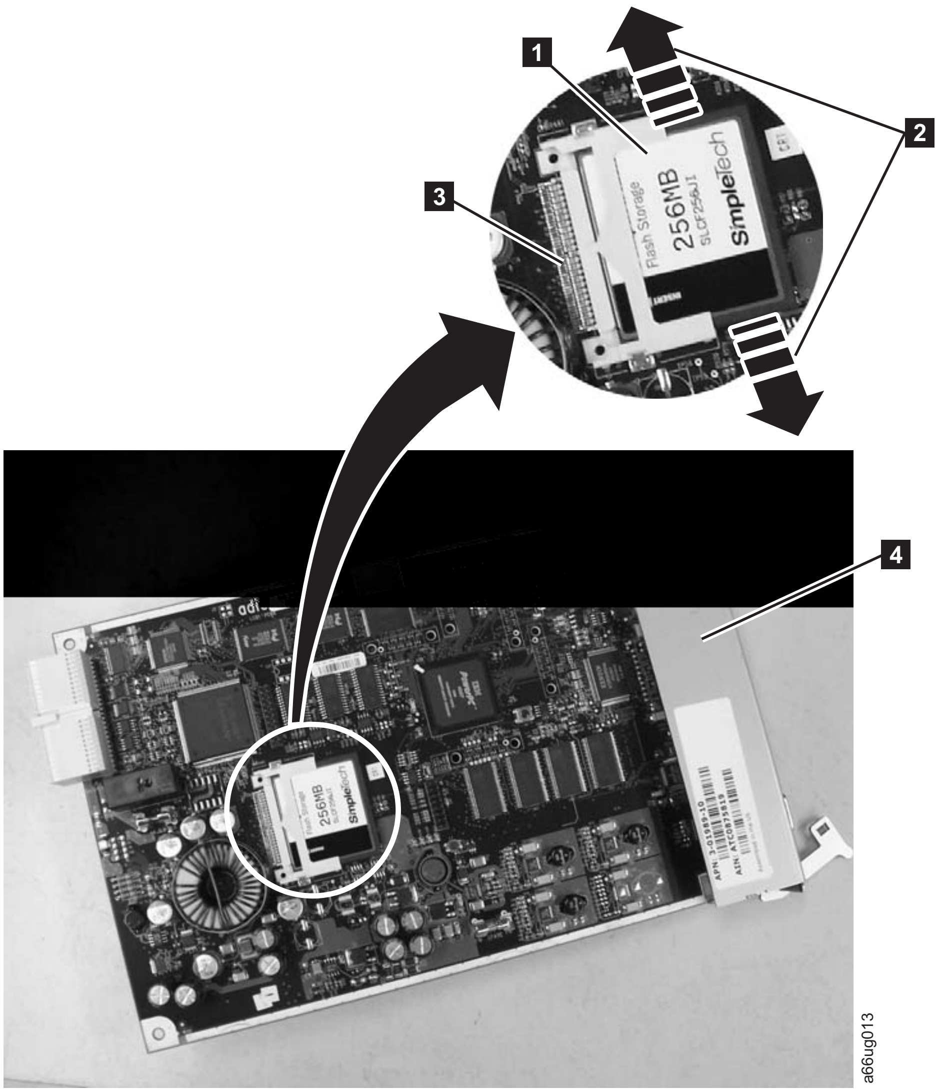


Figure 8-39. Removing the Compact Flash Card from the Library Control Blade

1. Locate the compact flash card component on the LCB board (**1** in Figure 8-39).
2. Without touching any other components on the LCB firmware board, carefully grasp the compact flash card and wiggle it using a gentle, side-to-side motion (**2** in Figure 8-39) until the pins on the compact flash card become disconnected from the pins on the LCB board (**3** in Figure 8-39). Then, slowly slide the compact flash card out of the guide slots.
3. Carefully lift the compact flash card out of the LCB board.
4. If you are installing a new LCB, continue by transferring the old CF to the new LCB. If you are installing a new CF card, continue by installing the new CF card in the old LCB. In either case, install the appropriate compact flash card to the LCB board you are installing with the label up, and pins aligned. Without touching any other components on the LCB board, carefully grasp the compact flash card, and slowly slide it into the guide slots. Continue to push the compact flash card into the guide slots until the pins start to connect. Then hold the LCB board metal connector shield (**4** in Figure 8-39) with one hand

and push the compact flash card into the connector with your other hand. The compact flash card should be firmly seated against the connector (**3** in Figure 8-39 on page 8-39).

Note: The card is properly connected when no gold pins are visible.

Replacing the Library Control Blade (LCB)

Important: When handling the LCB, you must wear an ESD anti-static wrist strap, or touch the library frame to discharge any static electricity in your body. Do not handle the LCB without taking appropriate ESD precautions. DO NOT touch any components on the LCB firmware board (see Figure 8-38 on page 8-38). Hold it by the metal cover and support it by the metal ground plane only.

1. Locate the empty LCB slot on the rear panel of the control module (CM). Then, carefully line up the new LCB board along the guide slots, and gently slide it into the control module until the connector seats.

   Important: As the LCB begins to slide into the control module, be sure to support the circuit board from underneath, being careful to touch only the metal cover and the ground plane along the bottom edge.
2. Grasp the pair of latches near the top and bottom of the LCB (**3** in Figure 8-40) by pushing them in until they click into place.

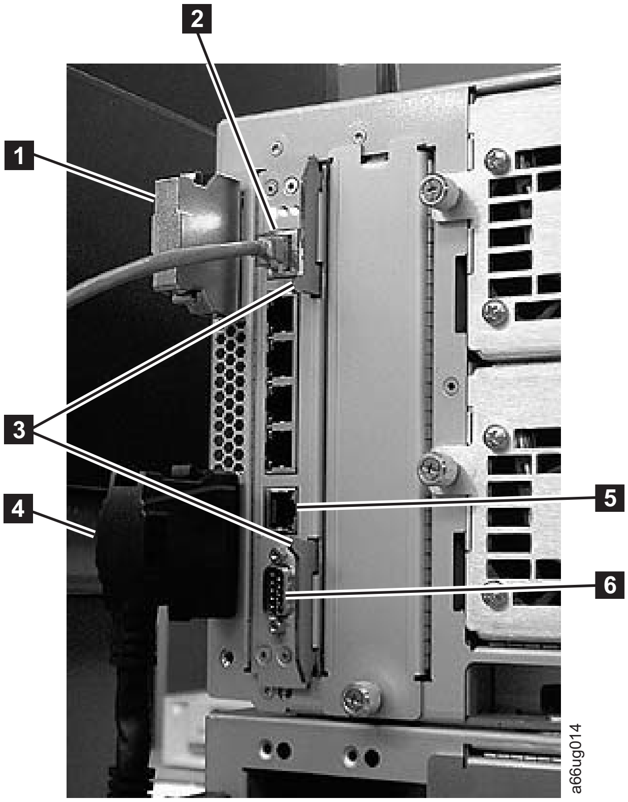


Figure 8-40. Library Control Blade (LCB)

1	Module communication terminator	**4**	Module-to-module communication cable

2	Ethernet cable (customer supplied)	5	Ethernet port (for IBM service personnel use)
3	Latches	6	Serial port (for IBM service personnel use)

3. Reconnect the Ethernet cable (2 in Figure 8-40 on page 8-40) by pinching the tab and pushing the connector into the LCB.

   Note: Six slots reside below the Ethernet cable. The four topmost slots are reserved for future use. The two bottommost slots are designated as Ethernet (5 in Figure 8-40 on page 8-40) and serial (6 in Figure 8-40 on page 8-40) ports, and are reserved for use by IBM Service Personnel.
4. Power ON the library and wait for it to initialize. This may take from 2 to 10 minutes, depending on the level of firmware on the Library. If the Compact Flash Card is new and has never been initialized, see “Upgrading the Compact Flash Card Firmware.”
5. Perform “Returning a Library or Library Module to Normal Operations after Repairs” on page 8-3.

Upgrading the Compact Flash Card Firmware

If the Compact Flash Card is new and has never been initialized, it contains a minimal level of library firmware which allows the library to boot up and display an Upgrade Notification message. In order to use the library, you must upgrade to the latest level of library firmware. Use the following steps to upgrade firmware the first time you use a new Compact Flash Card.

1. Log on to the local operator panel as ADMIN. The ″Network Configuration″ screen will appear.
2. Turn OFF the DHCP selection.
3. Enter the IP Address, Subnet Mask, and Default Gateway selections.
4. Verify the Library Name selection.
5. Select Apply.
6. When the SUCCESS message appears, select CANCEL. This will log OFF from the local operator panel.
7. Log ON to the remote web browser as ADMIN. The Upgrade Notification message should display on the web console.
8. Click on the upgrade firmware link provided, then browse to locate the firmware file. See “Updating Library Firmware” on page 7-16 for detailed instructions.

Power Supply (Primary and Redundant)

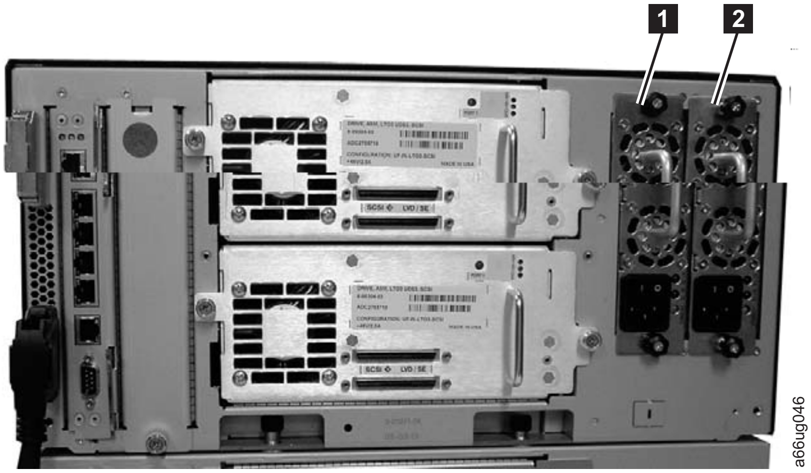


Figure 8-41. Power supplies in a control module

1	Primary power supply	**2**	Redundant power supply

Library power is controlled at the individual power supplies and at the front panel of the library. The switch on the rear of each power supply controls power for the module in which the power supply is installed. The button on the front of the control module controls power for all library modules in the library.

A second (redundant) power supply helps ensure that your library does not lose power (and become inaccessible) if the primary power supply should happen to fail. The library automatically switches to the redundant power supply if the primary power supply fails for any reason.

A redundant power supply should be connected to a different AC circuit from the primary power supply. Even better, the redundant power supply should be connected to a separate power distribution source. In the event that the primary power supply fails or becomes unstable, the redundant power supply will automatically power the library as long as it is turned ON.

If your library has a redundant power supply, you can replace the primary power supply without powering OFF the library. If your library does not have a redundant power supply installed, the empty slot will be covered by a metal plate.

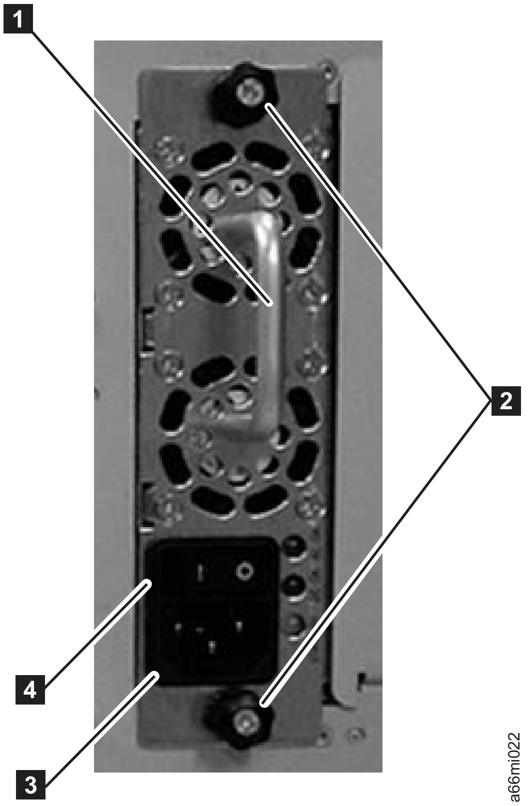


Figure 8-42. Power Supply

1	Handle	3	Power cord receptacle
2	Thumb screws	4	Power switch

Removing a Primary Power Supply

1. Perform "Preparing a Library or Library Module for Repairs" on page 8-3.
2. Unplug each end of the power cord in the proper sequence.

   Attention: First, disconnect the power cord from the power source. Then, disconnect the power cord from the power supply receptacle (3 in Figure 8-42).
3. Loosen the two thumb screws (2 in Figure 8-42) by turning them counterclockwise.
4. Grasp the handle (1 in Figure 8-42) and slowly pull the power supply toward you, while supporting it from underneath.
5. Install a metal cover plate over the vacant power supply slot if you are not immediately installing a replacement.

Reinstalling/Replacing a Power Supply

1. Ensure the library has been powered OFF using the power button on the front of the machine.
2. Grasp the power supply handle (1 in Figure 8-42) while supporting it from underneath. Then, line up the power supply with the guides in the slot, and carefully push the power supply into the library.
3. Tighten the two thumb screws (2 in Figure 8-42) on the power supply by turning them clockwise.

4. Connect the power supply by plugging in each end of the power cord in the proper sequence.

   Attention: First, connect the power cord to the power supply component (3 in Figure 8-42 on page 8-43). Then, connect the power cord to the power source.
5. Toggle the power switch (4 in Figure 8-42 on page 8-43) on the power supply to the I (ON) position.
6. Power ON the library using the power button on the front of the machine.

Removing a Redundant Power Supply

1. Locate the slot for the redundant power supply to be removed on the back of the library.
2. Toggle the redundant power supply power switch (4 in Figure 8-42 on page 8-43) to the **O** (OFF) position.
3. Unplug the power cord from the redundant power supply receptacle (3 in Figure 8-42 on page 8-43).
4. Loosen the two thumb screws (2 in Figure 8-42 on page 8-43) by turning them counterclockwise.
5. Grasp the handle (1 in Figure 8-42 on page 8-43) and pull the power supply toward you. Support the component from underneath with your other hand.
6. Install a metal cover plate over the vacant redundant power supply slot if you are not immediately installing a replacement.

Replacing a Redundant Power Supply

1. Locate the slot for the redundant power supply on the back of the library module.
2. Remove the cover plate over the vacant redundant power supply slot, if necessary.
3. Insert the redundant power supply by gripping the handle (1 in Figure 8-42 on page 8-43), sliding it into the guide slots, and pushing it into the empty slot.
4. Tighten the two thumb screws (2 in Figure 8-42 on page 8-43) that hold the redundant power supply in place.
5. Connect the power cord to the power supply (3 in Figure 8-42 on page 8-43) and to its source.
6. Turn ON power to the redundant power supply, using the switch (4 in Figure 8-42 on page 8-43) on the power supply.

Internal Components

The library has the following internal components:

- Y-axis Assembly
- Storage Column
- Picker Assembly
- Cable Spool
- Y Motor
- Gear Rack
- Internal cables and boards

Y-axis/Picker Assembly

The Y-axis/Picker Assembly houses the Y Motor and moves the Picker and Bar Code Scanner within the library.

Removing the Y-axis/Picker Assembly

1. Perform “Preparing a Library or Library Module for Repairs” on page 8-3.
2. Perform one of the following procedures:
   - “Removing a Library Control Module from a Rack” on page 8-4
   - “Removing a Control Module from a Standalone or Rack-mounted Library (14U or larger)” on page 8-5
3. Remove the top cover of the control module, if necessary.
4. Open the I/O Station door then the Access Door to access the Y-axis/Picker Assembly.
5. Optionally, remove the I/O Station from the control module for easier access. See “Removing an I/O Station” on page 8-26
6. Raise the Y-axis/Picker Assembly to the top of the library and carefully lift it out. Be careful not to damage the Cable Spool flat cable (**2** in Figure 8-43). Set the Y-axis/Picker Assembly on top of the control module and loosen the thumbscrew (**1** in Figure 8-43) to disconnect the cable spool.

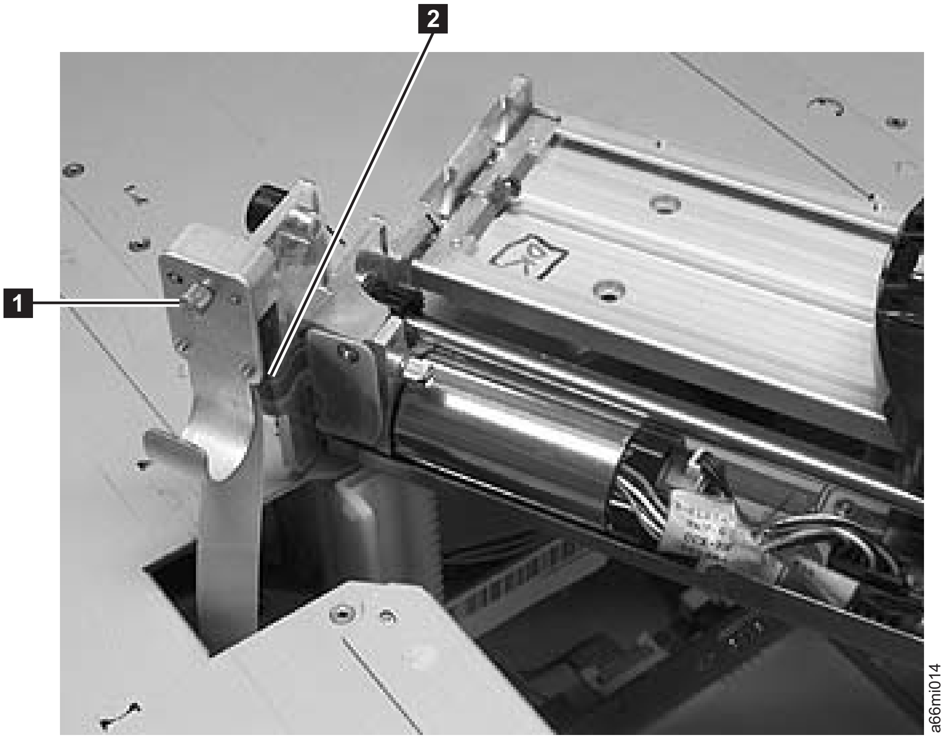


Figure 8-43. Thumb screw securing Cable Spool

7. Carefully lower the Cable Spool connector (**3** in Figure 8-44 on page 8-46) and hook it around the black plastic guide peg (**2** in Figure 8-44 on page 8-46).

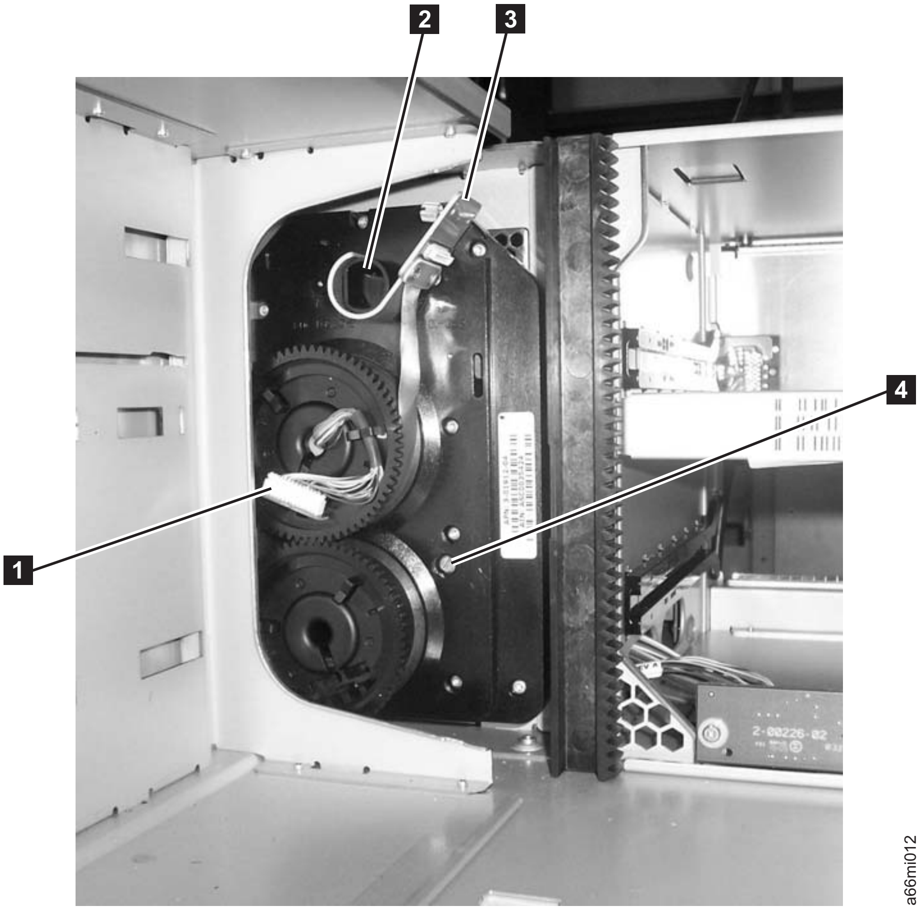


Figure 8-44. Cable Spool (with storage columns removed)

Replacing the Y-axis/Picker Assembly

1. Ensure all gear racks are properly positioned and that they contain **NO GAPS** between units in the library.
2. Set the Y-axis/Picker Assembly on top of the control module as shown in Figure 8-43 on page 8-45.
3. Remove the Cable Spool connector (**3** in Figure 8-44) from the black plastic peg (**2** in Figure 8-44).
4. Carefully lift the Cable Spool connector.

Figure 8-45. Thumbscrew securing Cable Spool

5. Tighten the thumb screw to connect the spooler cable to the Y-axis/Picker Assembly (**1** in Figure 8-45).
6. **Lower the Y-axis/Picker Assembly by tilting its gears at a 45° angle onto the top of the front and rear gear racks (see Figure 8-46 on page 8-48 and Figure 8-47 on page 8-49). BE VERY CAREFUL TO START BOTH Y-AXIS/PICKER ASSEMBLY GEARS TOGETHER TO ENSURE THE Y-AXIS/PICKER ASSEMBLY IS LEVEL. After lowering the Y-axis/Picker Assembly a few teeth, verify that the Y-axis/Picker Assembly is level with the library chassis. If it is not level, remove the Y-axis/Picker Assembly and reinsert.**

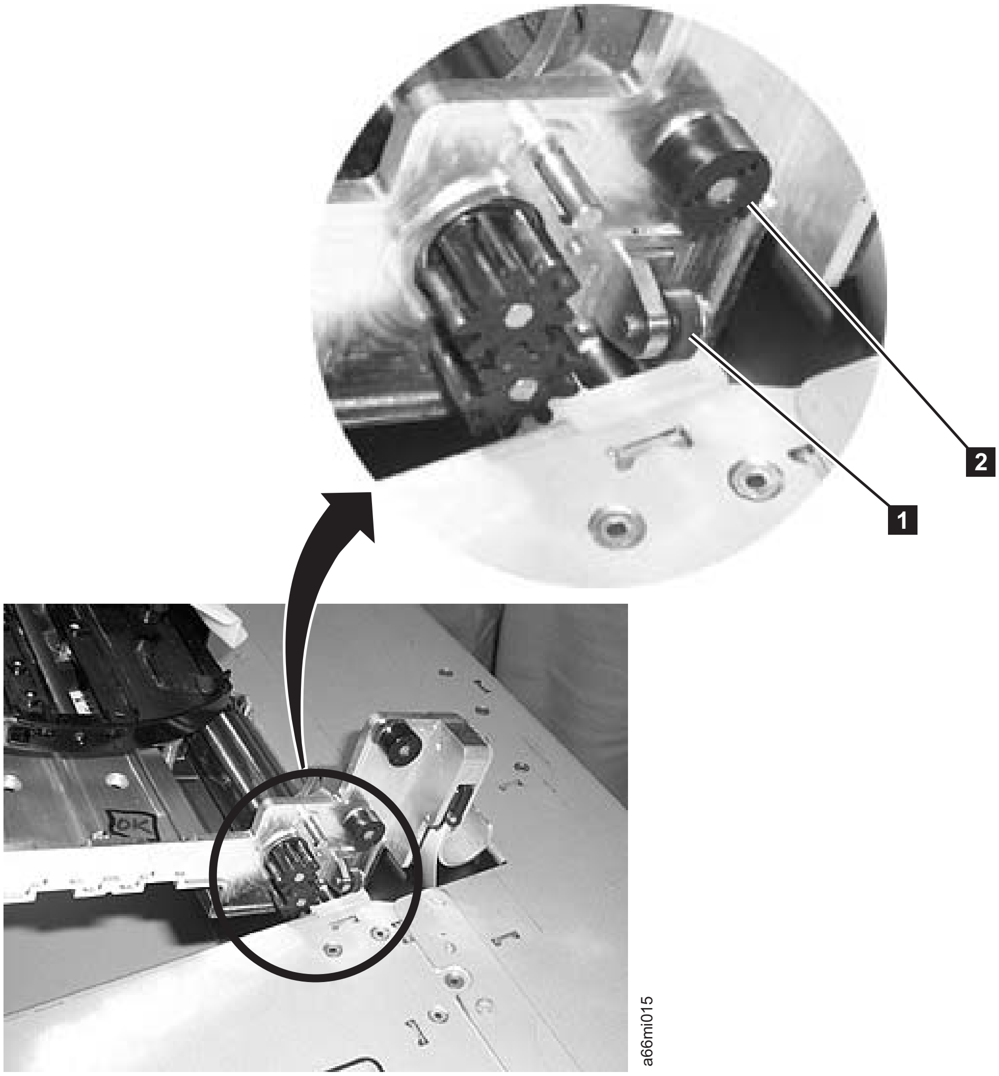


Figure 8-46. Guide rollers on Y-axis/Picker Assembly

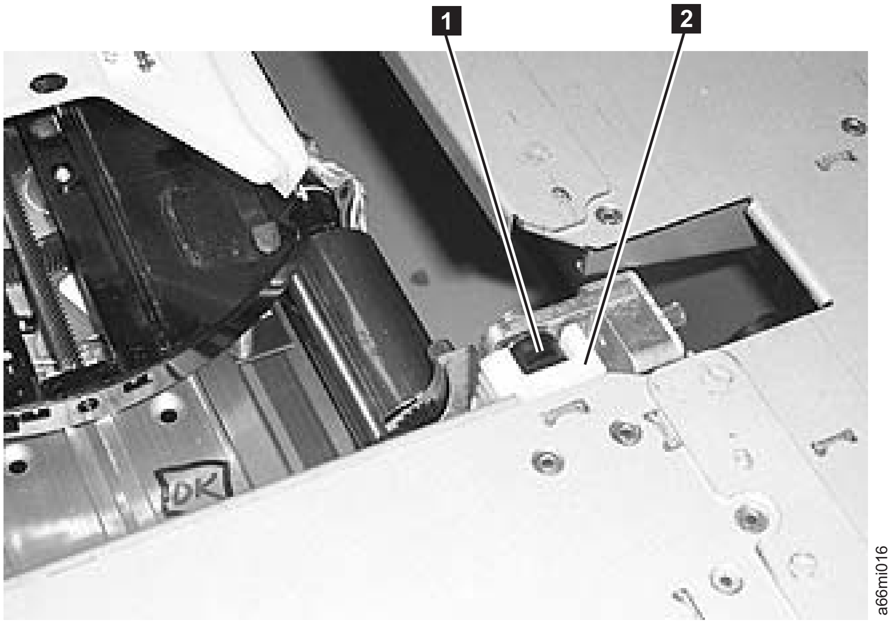


Figure 8-47. Y-axis/Picker Assembly rollers inserted in gear rack track

7. Replace the I/O Station (see “Removing an I/O Station” on page 8-26).
8. Close the Access Door then the I/O Station door.
9. Replace the top cover of the control module, if necessary.
10. If necessary, perform one of the following procedures:
    - “Replacing a 5U Library (Control Module) in a Rack” on page 8-4
    - “Replacing a Control Module in a Standalone or Rack-mounted Library (14U or larger)” on page 8-8
11. Perform “Returning a Library or Library Module to Normal Operations after Repairs” on page 8-3.

Removing/Replacing a Storage Column

Storage columns, like the cartridge magazine(s) in the I/O Station, store tape cartridges that are placed within the library.

Removing a Storage Column

1. Perform “Preparing a Library or Library Module for Repairs” on page 8-3.
2. Perform one of the following:
    - For a 5U library, perform “Removing the Y-axis/Picker Assembly” on page 8-45.
    - For a 14U library, position the Y-axis/Picker Assembly into the control module if you are removing storage columns from the expnasion modeul, or position the Y-axis/Picker Assembly into the expansion module if you are removing storage columns from the control module.
3. Firmly grasp the storage column. Always begin by removing the front column first. Then remove the remaining column(s).

   Important: Remember the order in which the columns were removed. Replace the columns in their original location.

4. Pull the storage column toward the front of the library (**1** in Figure 8-48) to disengage the locking tabs on the back of the column.

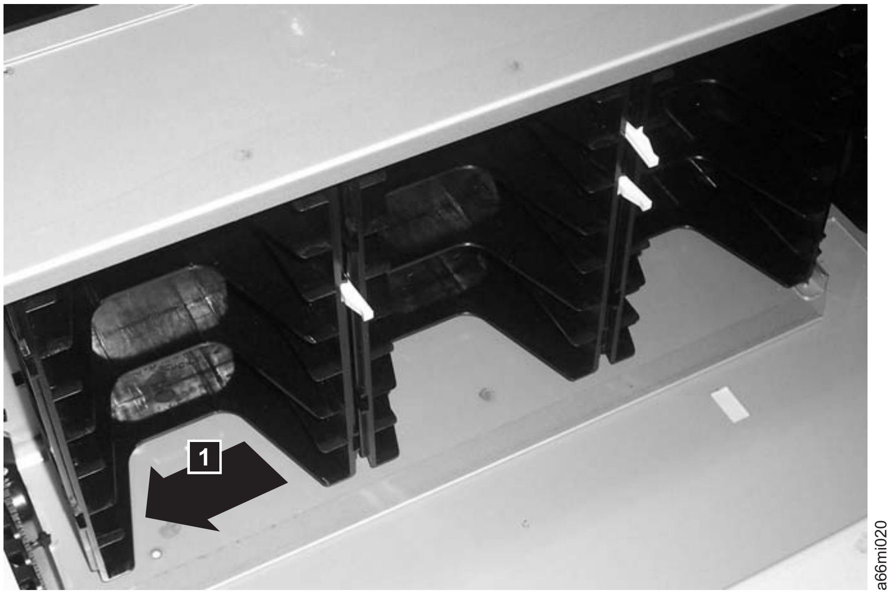


Figure 8-48. Removing a storage column

5. Pull the column straight out of the side wall of thechassis.
6. Repeat this procedure for each column.

Replacing a Storage Column

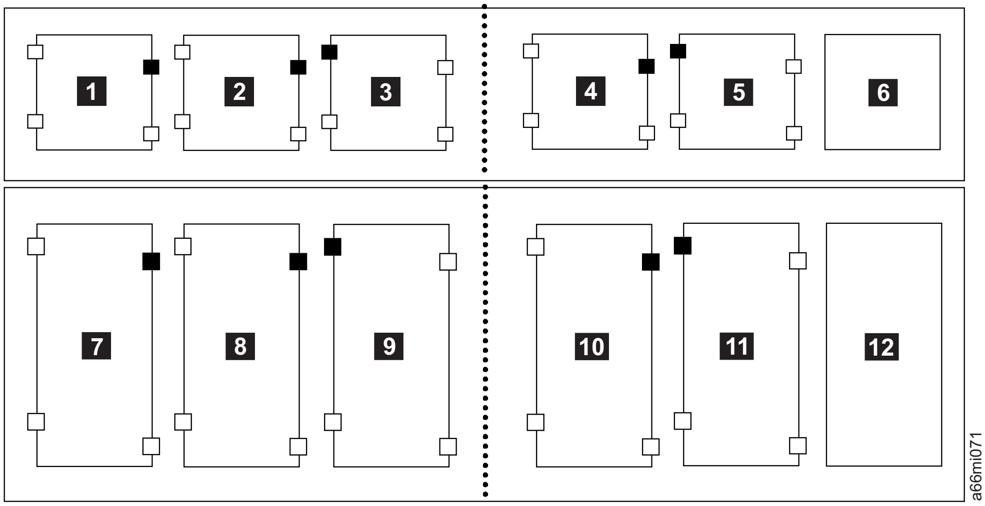


Figure 8-49. Correct fiducial placement

1	Control module/left front column	**7**	Expansion module/left front column
2	Control module/left middle column	**8**	Expansion module/left middle column
3	Control module/left rear column	**9**	Expansion module/left rear column

4	Control module/right rear column	**10**	Expansion module/right rear column
5	Control module/right middle column	**11**	Expansion module/right middle column
6	Control module/I/O Station	**12**	Expansion module/I/O Station

1. Install the new fiducial on the storage column.
   a. Verify the correct position for the fiducial on the storage column by referring to the small black squares on the larger rectangles in Figure 8-49 on page 8-50.
   b. Insert the new fiducial by sliding it into the slot until it locks into place (**1** in Figure 8-50).

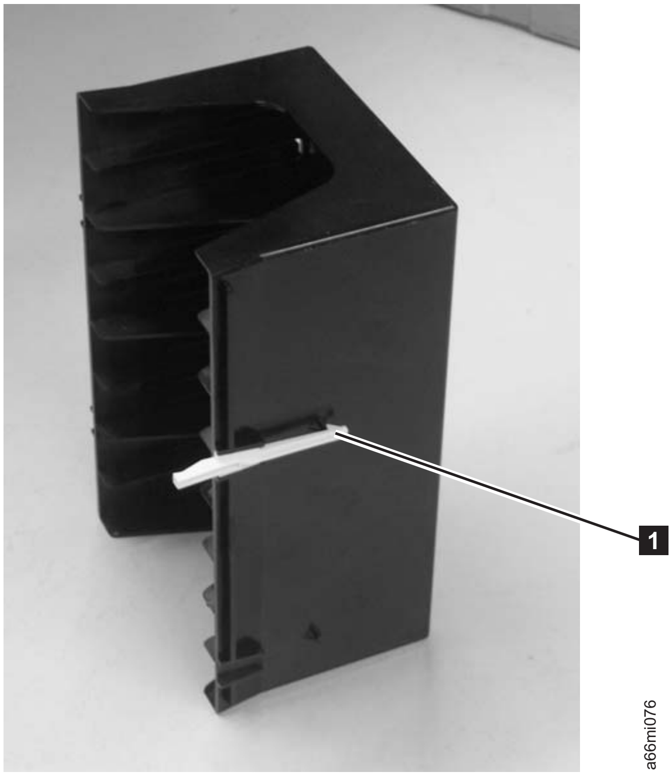


Figure 8-50. Fiducial on storage column

2. Insert the storage column straight into the side wall of the chassis.

   Important: Replace the columns in their original location. Always begin by replacing the rear column first. Then replace the middle and front columns.

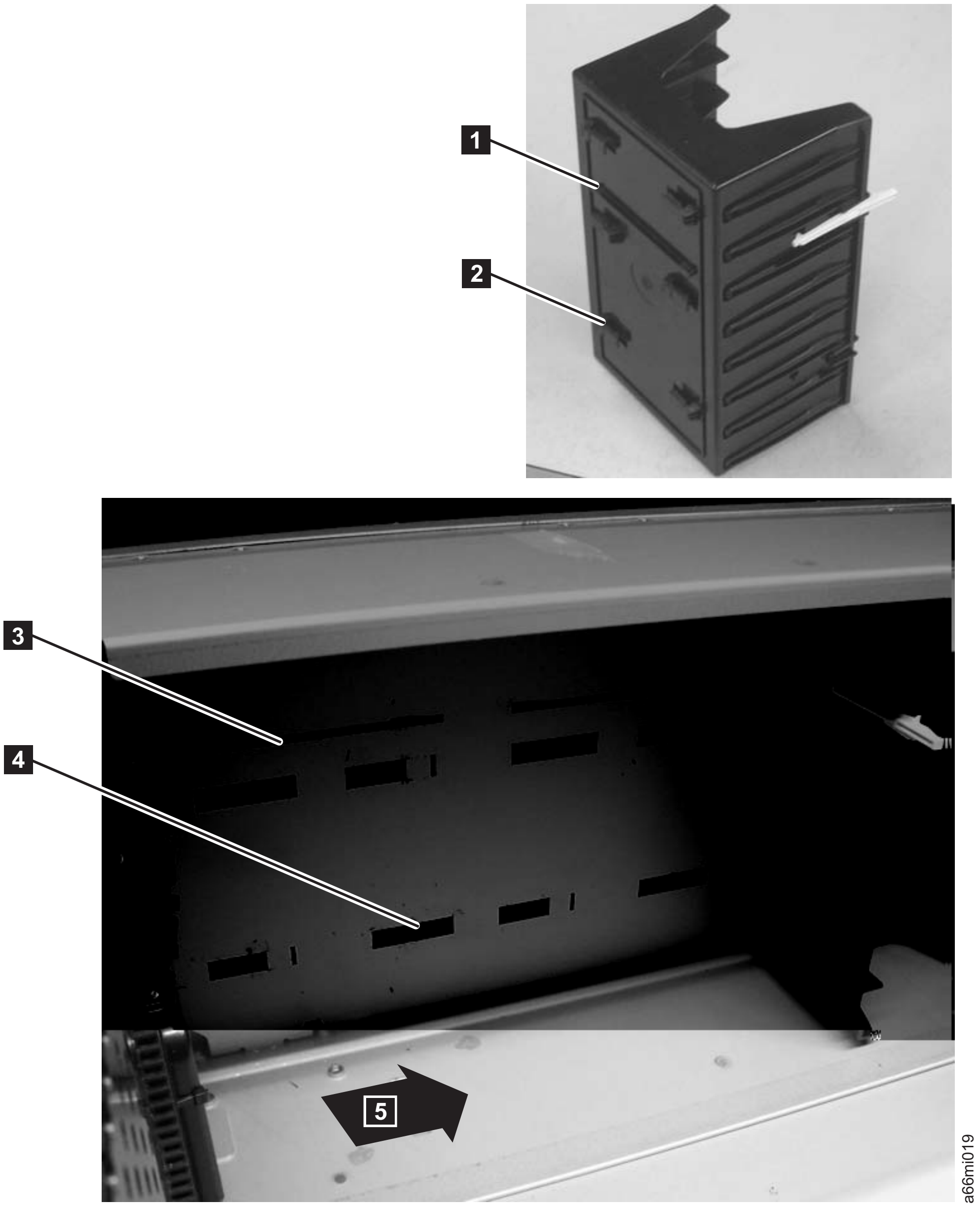


Figure 8-51. Replacing a Storage Column

1	Tab 1 on a storage column	3	Slot 1 in the library chassis wall in a storage column position
2	Tab 2 on a storage column	4	Slot 2 in the library chassis wall in a storage column position

3. Ensure correct orientation by inserting:
   a. Tab 1 (in Figure 8-51) into slot 3 (in Figure 8-51)
   b. Tab 2 (in Figure 8-51) into slot 4 (in Figure 8-51)
4. Push the column towards the rear of the library (5 in Figure 8-51) to engage the locking tabs on the back of the column.
5. Repeat this procedure for each column.
6. for a 5U library, perform “Replacing the Y-axis/Picker Assembly” on page 8-46.

Picker Assembly

The Picker moves media to and from storage slots and tape drives and positions the Bar Code Scanner to enable it to read bar code labels on cartridges and fiducials on cartridge magazines and tape drives. The Picker Assembly can be removed through the top of the library (recommended method) or through an Access Door opening in the library.

Removing the Picker Assembly from the Y-axis Assembly in a Stand-alone Library

1. If necessary, vary all drives offline, then power OFF the library.
2. Remove the top cover of the library.
3. Open the I/O Station door then the Access Door to access the Y-axis/Picker Assembly.
4. If necessary,remove the I/O Station from the expansion unit for easier access. See "Removing an I/O Station" on page 8-26.
5. Facing the library, rotate the Picker Assembly until the front of the Picker Assembly is oriented approximately 45 degrees right of center, as seen from the top of the library, to access the flat cable connector (**1** in Figure 8-52).

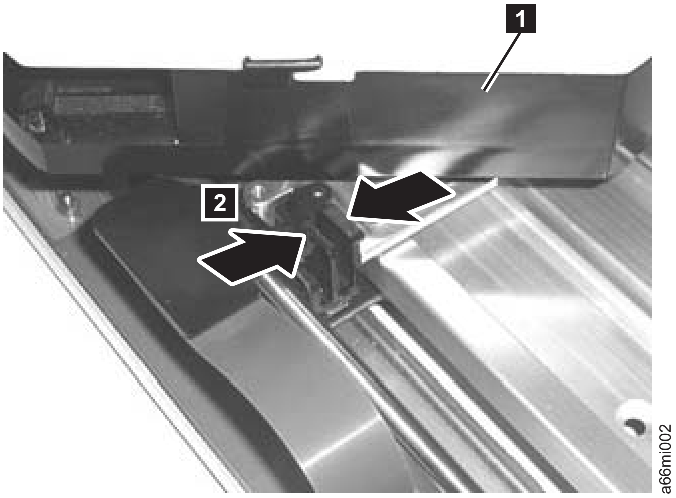


Figure 8-52. Flat cable connector

6. Pinch the top of the connector (**2** in Figure 8-52) and lift up to disconnect it.
7. Loosen the front and rear thumb screws (**1** in Figure 8-53 on page 8-54).

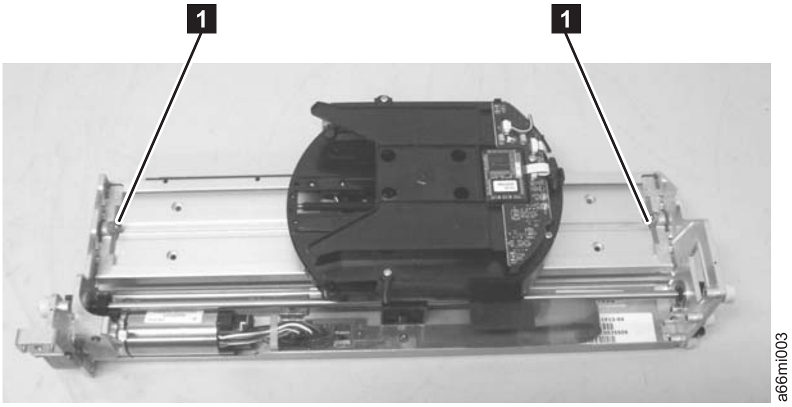


Figure 8-53. Thumb screws

8. Carefully lift the Picker Assembly and remove it through the top of the library.

Replacing the Picker Assembly on the Y-axis Assembly in a Stand-alone Library

1. Carefully insert the Picker Assembly and replace it through the top of the library.
2. Tighten the front and rear thumb screws (**1** in Figure 8-53).
3. Facing the library, rotate the Picker until the front of the Picker Assembly is oriented approximately 45 degrees right of center, as seen from the top of the library, to access the flat cable connector (**1** in Figure 8-52 on page 8-53).
4. Pinch the top of the connector (**2** in Figure 8-52 on page 8-53) and connect it.
5. Close the front door(s).
6. Replace the I/O Station (see “Reinstalling an I/O Station” on page 8-27).
7. Replace the top cover of the library.
8. Power ON the library.

Removing the Picker from the Y-axis Assembly in a Rack-mounted Library

Tool Required:

- Flashlight

1. If necessary, remove the I/O Station(s) from the library. See “Removing an I/O Station” on page 8-26.
2. Open the Access Door(s).
3. Reach through the Access Door and loosen the screws (**1** in Figure 8-53) on the front and rear of the Picker Assembly.
4. Rotate the Picker Assembly with the grippers pointing toward 11 o’clock (**1** in Figure 8-52 on page 8-53) to expose the flat cable connector.
5. Pinch the top of the connector (**2** in Figure 8-52 on page 8-53) and lift up to disconnect it.
6. Unplug and move the connector to the side of the Picker Assembly.
7. Move the Picker Assembly back to its normal position.
8. Lift the Picker Assembly, tilt it with the left side up, and carefully remove through the Access Door opening. Try to keep the Picker Assembly toward the top of the opening to prevent damaging the board underneath the assembly.

Replacing the Picker Assembly on the Y-axis Assembly in a Rack-mounted Library

1. Lift the Picker Assembly, tilt it with the left side up, and carefully insert it into the library through the Access Door opening. Try to keep the assembly toward the top of the opening to prevent damaging the board underneath the Picker Assembly.
2. Position Picker Assembly on the Y-axis Assembly with the larger extension of the Picker Assembly board to the right when facing the library from the front.
3. Reach through the I/O Station door and tighten the screws (**1** in Figure 8-53 on page 8-54) on the front and rear of the Picker Assembly.
4. Rotate the Picker Assembly with the grippers pointing toward 11 o'clock (**1** in Figure 8-52 on page 8-53) to expose the flat cable connector.
5. Plug in the connector (**2** in Figure 8-52 on page 8-53).
6. Move the Picker Assembly back to its normal position.
7. Close the Access Door(s).
8. Return the I/O Station flap to its normal position.
9. If necessary, replace the I/O Station(s) in the library. See "Reinstalling an I/O Station" on page 8-27.

Cable Spool Assembly

The movement of the Y-axis Assembly is controlled by the Cable Spool.

Removing the Cable Spool Assembly

1. If your library is installed in a rack, perform one of the following procedures:
   - "Removing a Library Control Module from a Rack" on page 8-4
   - "Removing a Control Module from a Standalone or Rack-mounted Library (14U or larger)" on page 8-5
2. Remove the left side cover from the control module.
3. Remove the Y-axis/Picker assembly. See "Removing the Y-axis/Picker Assembly" on page 8-45.
4. Remove the Storage Columns on the left side of the control module (see "Removing a Storage Column" on page 8-49.
5. Disconnect the Cable Spool Assembly connector (**1** in Figure 8-54 on page 8-56) from the J11 connector on the distribution board.

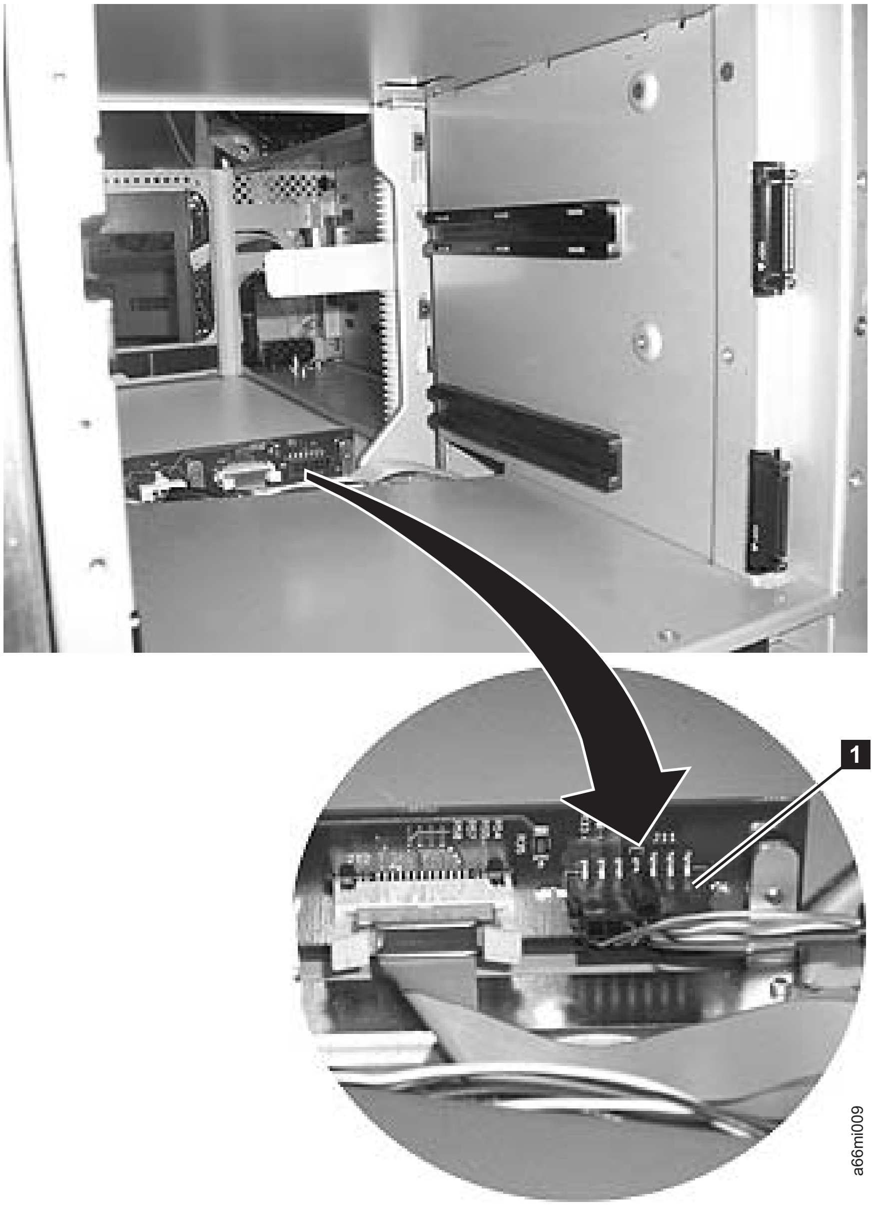


Figure 8-54. Unplugging the Cable Spool Assembly(library shown in upright position)

6. From the front of the control module, hook the Cable Spool flat cable handle (**3** in Figure 8-55 on page 8-57) around the black plastic guide peg (**2** in Figure 8-55 on page 8-57). This will rotate the small terminal board (**1** in Figure 8-55 on page 8-57) so that it will not contact the frame when the assembly is removed from the enclosure.

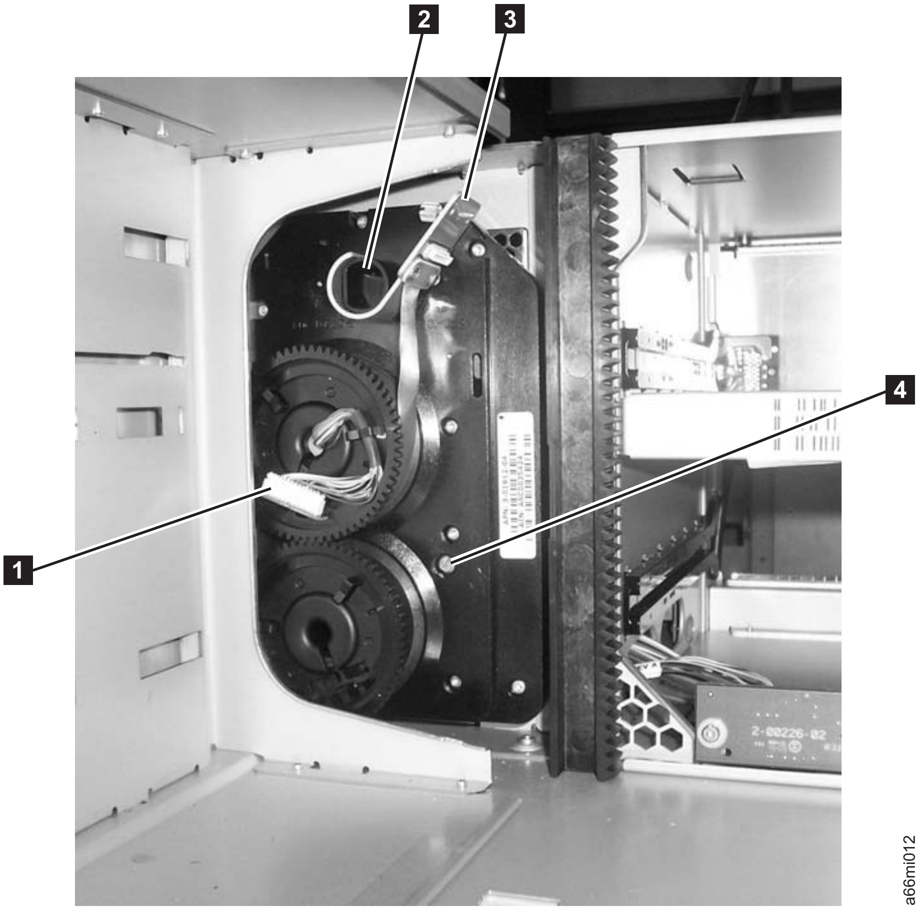


Figure 8-55. Securing Spooler flat cable

7. Loosen the T10 Torxretaining screw (**4** in Figure 8-55) until the Cable Spool Assembly is loosened from the enclosure.

   Note: Do not remove the screw, only loosen it.
8. Remove the Cable Spool Assembly from the control module. Carefully route the cable (**1** in Figure 8-56 on page 8-58) disconnected from the distribution board through the holes in the enclosure to avoid damage to the cable.

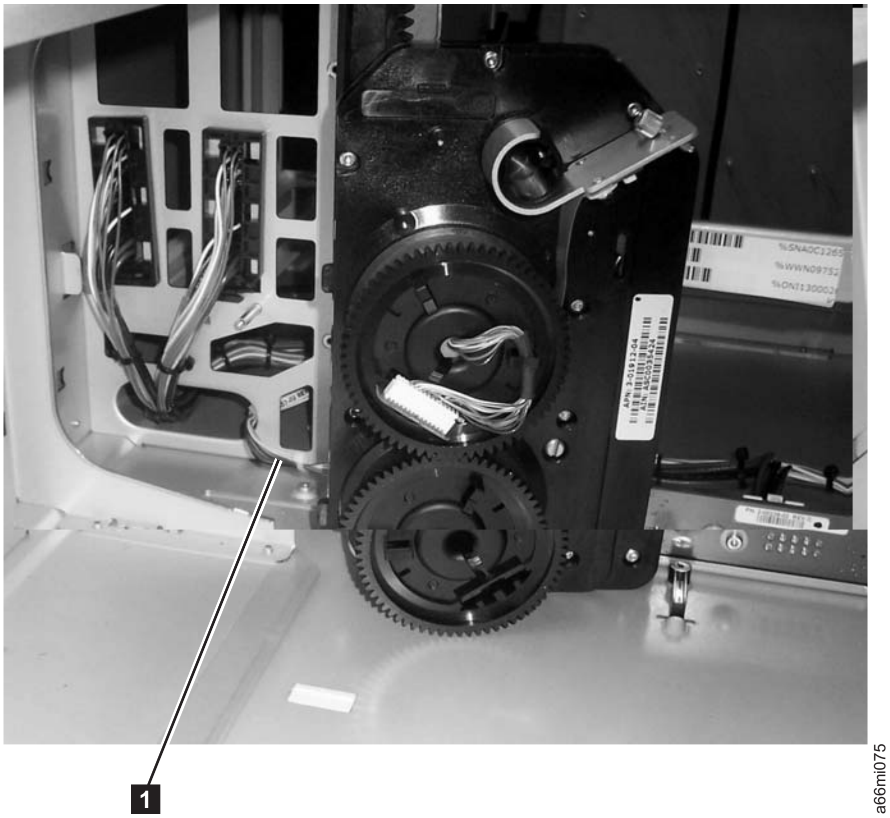


Figure 8-56. Cable Spool cable routing through enclosure wall

Replacing the Cable Spool Assembly

1. Insert the Cable Spool Assembly into the control module. Carefully route the cable disconnected from the distribution board through the holes in the enclosure (**1** in Figure 8-56) and to the left of the screw stand-offto avoid damage to the cable.
2. Carefully insert the plastic tabs (**1** in Figure 8-57 on page 8-59) on the Cable Spool Assembly into the slots (**2** in Figure 8-57 on page 8-59) in the enclosure sidewall.

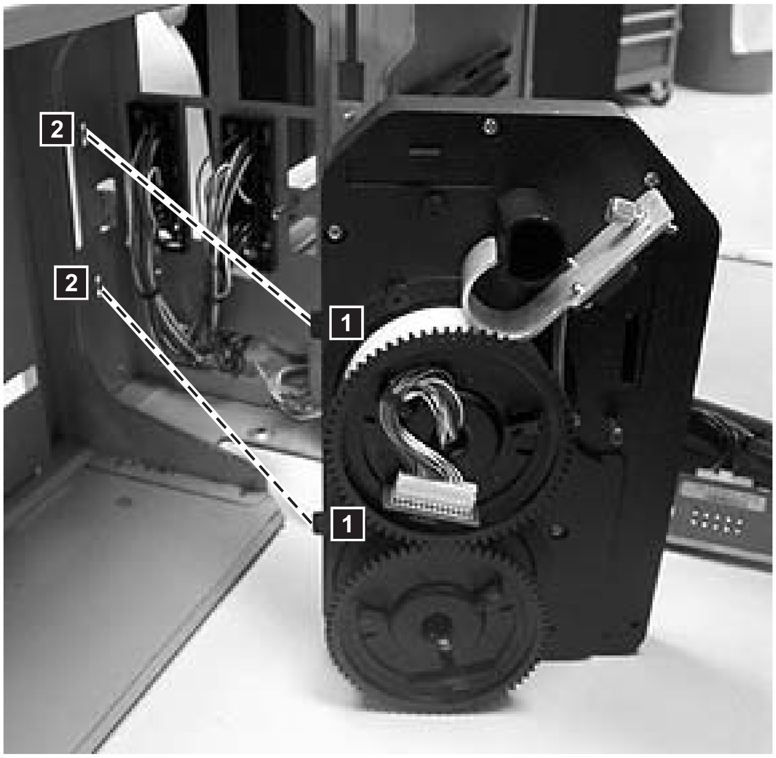


Figure 8-57. Cable Spool Assembly tabs

3. Tighten the T10 Torxretaining screw (**4** in Figure 8-55 on page 8-57) until the Cable Spool Assembly is secured to the enclosure.
4. Connect the Cable Spool connector (**1** in Figure 8-54 on page 8-56) to the J11 connector on thedistribution board.
5. Replace the Storage Columns. See “Replacing a Storage Column” on page 8-50.
6. Replace the Y-axis/Picker Assembly. See “Replacing the Y-axis/Picker Assembly” on page 8-46.
7. Replace the left side cover.
8. If your library is installed in a rack, perform one of the following procedures:
   - “Replacing a 5U Library (Control Module) in a Rack” on page 8-4
   - “Replacing a Control Module in a Standalone or Rack-mounted Library (14U or larger)” on page 8-8
9. Perform “Returning a Library or Library Module to Normal Operations after Repairs” on page 8-3.

Y Motor

The Y Motor controls movement of the Y-axis Assembly, Picker, and Bar Code Scanner in the Y axis.

Removing the Y Motor from the Y-axis/Picker Assembly in a Stand-alone Library

1. Perform “Preparing a Library or Library Module for Repairs” on page 8-3.
2. Perform “Removing the Y-axis/Picker Assembly” on page 8-45 first. Place the Y-axis/Picker Assembly on a flat work surface.
3. Disengage the cable retention clip.
4. See Figure 8-58 on page 8-60. Remove the large black connector.

a. Pinch the latch (**1** in Figure 8-58) on the cable connector.
b. Carefully lift up on the connector.

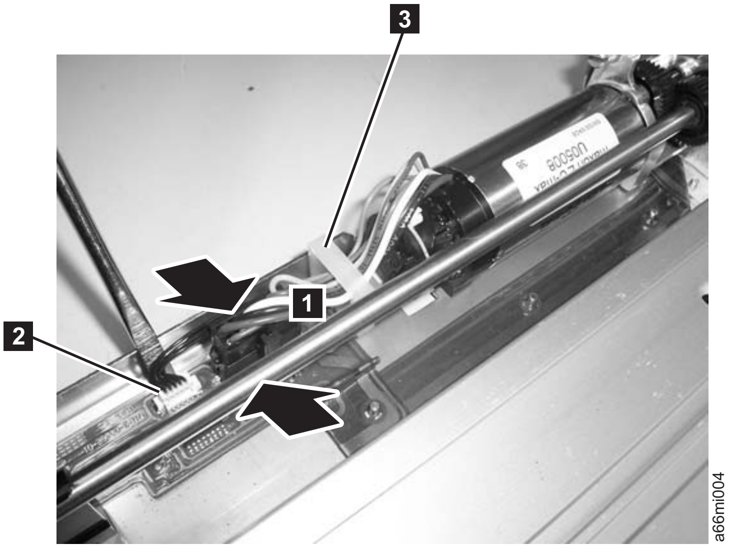


Figure 8-58. Y motor connector

5. Use a small flat blade screw driver to pry up on the small white connector (**2** in Figure 8-58) gently working the screw driver blade along the entire outside edge of the connector.

   Important: Be very careful not to damage the connector.
6. Loosen the thumb screw (**1** in Figure 8-59), slide the motor to the left, then lift the motor out of the Y-axis Assembly (**2** in Figure 8-59).

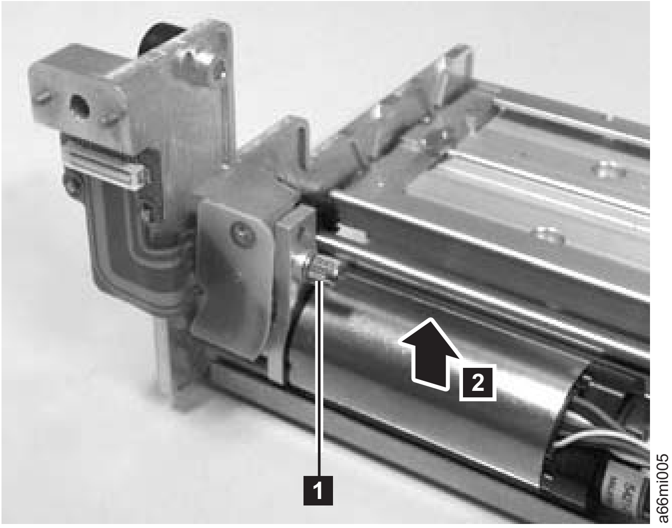


Figure 8-59. Y motor thumb screw

Replacing the Y Motor in the Y-axis/Picker Assembly in a Stand-alone Library

1. Ensure that the black plastic piece on the wiring end of the motor (**1** in Figure 8-60) fits into the slot in the base plate (**2** in Figure 8-60).

   Note: The top of the motor (**4** in Figure 8-60) must be parallel with the Picker guide rod (**5** in Figure 8-60).
2. Install the Y Motor in the Y-axis/Picker Assembly and tighten the thumb screw. The small gear on the Y Motor must connect with the larger gear on the Y-axis/Picker Assembly.
3. Connect the small white connector (**2** in Figure 8-61 on page 8-62).

   Important: Be very careful not to damage the connector.
4. Connect the large black connector. See Figure 8-61 on page 8-62.

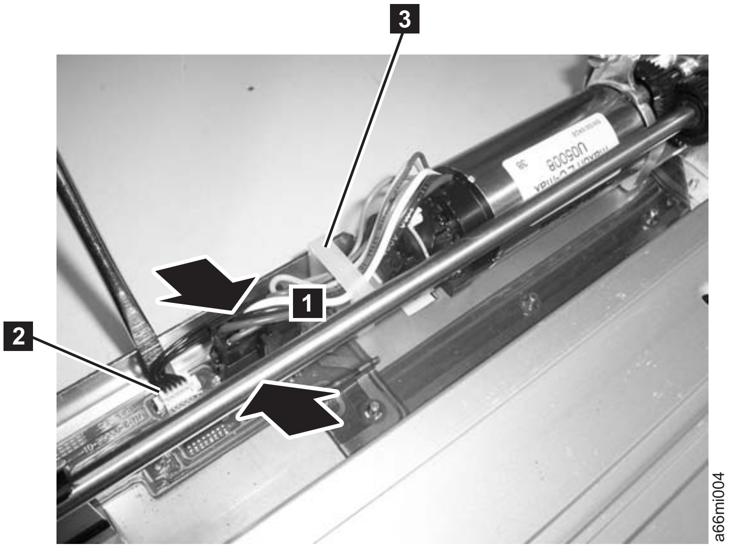


Figure 8-61. Y motor connector

   a. Pinch the latch on the cable connector (**1** in Figure 8-61).
   b. Carefully plug in the connector.
5. Engage the cable retention clip.
6. Perform "Replacing the Y-axis/Picker Assembly" on page 8-46.
7. Perform "Returning a Library or Library Module to Normal Operations after Repairs" on page 8-3.

Removing the Y Motor from the Y-axis/Picker Assembly in a Rack-mounted Library

Tools Required:

- Flashlight
- Small flat blade screwdriver

1. Perform "Preparing a Library or Library Module for Repairs" on page 8-3.
2. Perform one of the following procedures:
   - "Removing a Library Control Module from a Rack" on page 8-4
   - "Removing a Control Module from a Standalone or Rack-mounted Library (14U or larger)" on page 8-5
3. Remove the Y-axis/Picker Assembly. See "Removing the Y-axis/Picker Assembly" on page 8-45.
4. Disengage the cable retention clip.
5. See Figure 8-62 on page 8-63. Remove the large black connector.
   a. Pinch the latch (**1** in Figure 8-62 on page 8-63) on the cable connector.
   b. Carefully lift up on the connector.

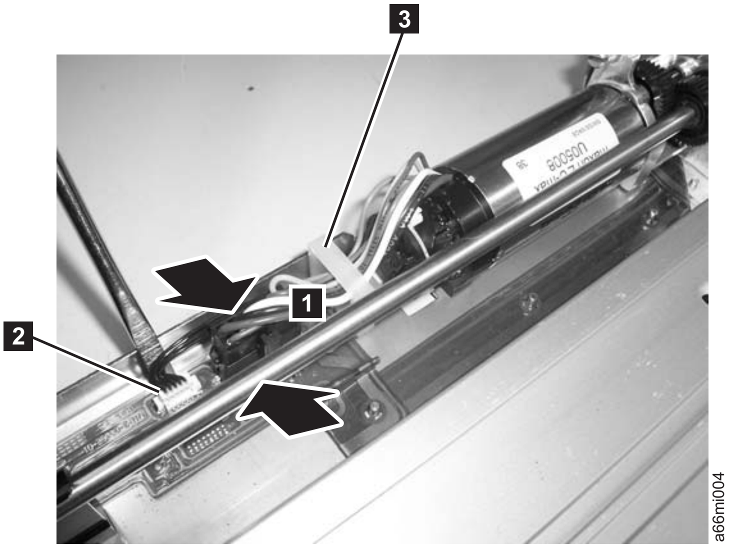


Figure 8-62. Y motor connector

6. Use a small flat blade screw driver to pry up the small white connector (**2** in Figure 8-62) gently working the screw driver blade along the entire outside edge of the connector.

   Important: Be very careful not to damage the connector.
7. Disengage the cable retention strap.
8. Using the screwdriver, lift the latch on the black connector then unplug the cable.
9. Loosen the thumb screw (**1** in Figure 8-63).

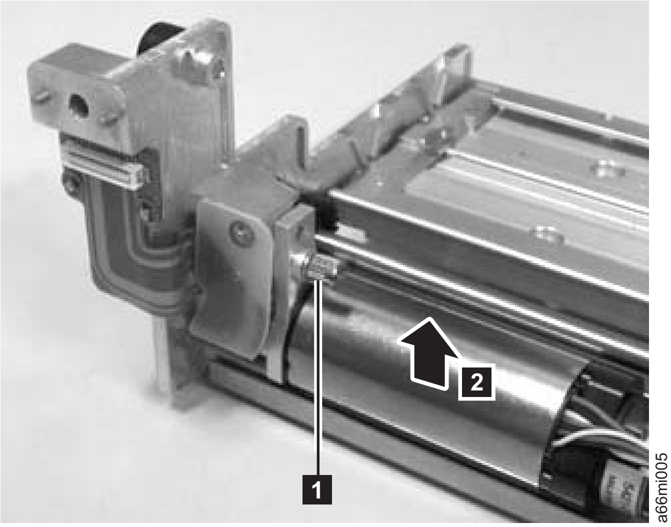


Figure 8-63. Y motor thumb screw

10. Tilt the Y Motor to the left and remove from the Y-axis/Picker Assembly (**2** in Figure 8-63).

Replacing the Y Motor on the Y-axis/Picker Assembly in a Rack-mounted Library

Tools Required:

- Flashlight
- Small flat blade screwdriver

1. Ensure that the black plastic piece on the wiring end of the motor (**1** in Figure 8-64) fits into the slot in the base plate (**2** in Figure 8-64).
   When the thumb screw (**3** in Figure 8-64) is tightened, the top of the motor (**4** in Figure 8-64) must be parallel with the Picker guide rod (**5** in Figure 8-64).

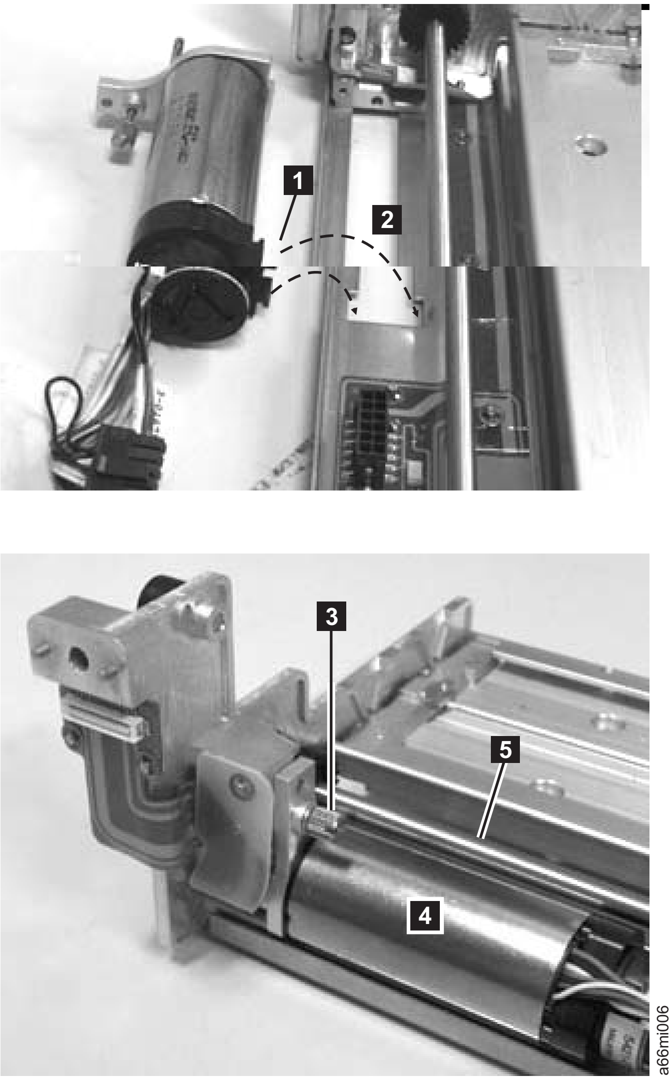


Figure 8-64. Correct Y motor position

2. Install the Y Motor in the Y-axis/Picker Assembly and tighten the thumb screw. The small gear on the Y Motor must connect with the larger gear on the Y-axis/Picker Assembly.
3. Connect the small white connector (**2** in Figure 8-65 on page 8-65).

Important: Be very careful not to damage the connector.

4. Connect the large black connector. See Figure 8-65.

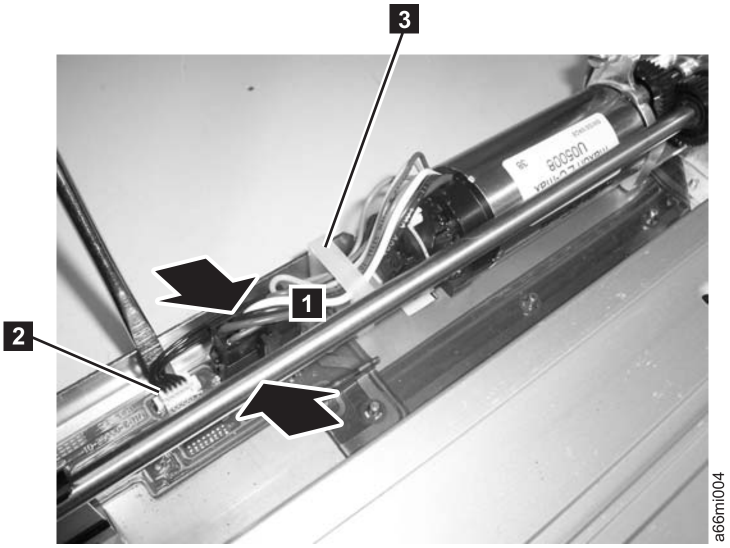


Figure 8-65. Y motor connector

   a. Pinch the latch on the cable connector (**1** in Figure 8-65).
   b. Carefully plug in the connector.
5. Engage the cable retention clip.
6. Perform “Replacing the Y-axis/Picker Assembly” on page 8-46.
7. Perform one of the following procedures:
   - “Replacing a 5U Library (Control Module) in a Rack” on page 8-4
   - “Replacing a Control Module in a Standalone or Rack-mounted Library (14U or larger)” on page 8-8
8. Perform “Returning a Library or Library Module to Normal Operations after Repairs” on page 8-3.

Gear Rack

The Y-axis Assembly uses the Gear Racks (one in front, one in back) to move the Picker and Bar Code scanner within the library.

Removing a Front Gear Rack

1. Lay the library module on the left side (from front).
2. Remove the bottom cover of the module, if necessary.
3. There is a small metal tab in the chassis frame (**1** in Figure 8-66 on page 8-66) that prevents the gear rack from falling down too far when the locking mechanism is released. Bend the tab out slightly so the gear rack can be removed.
4. Slightly push up and pinch the gear rack locking mechanism to unlock the front gear rack (**4** in Figure 8-66 on page 8-66).

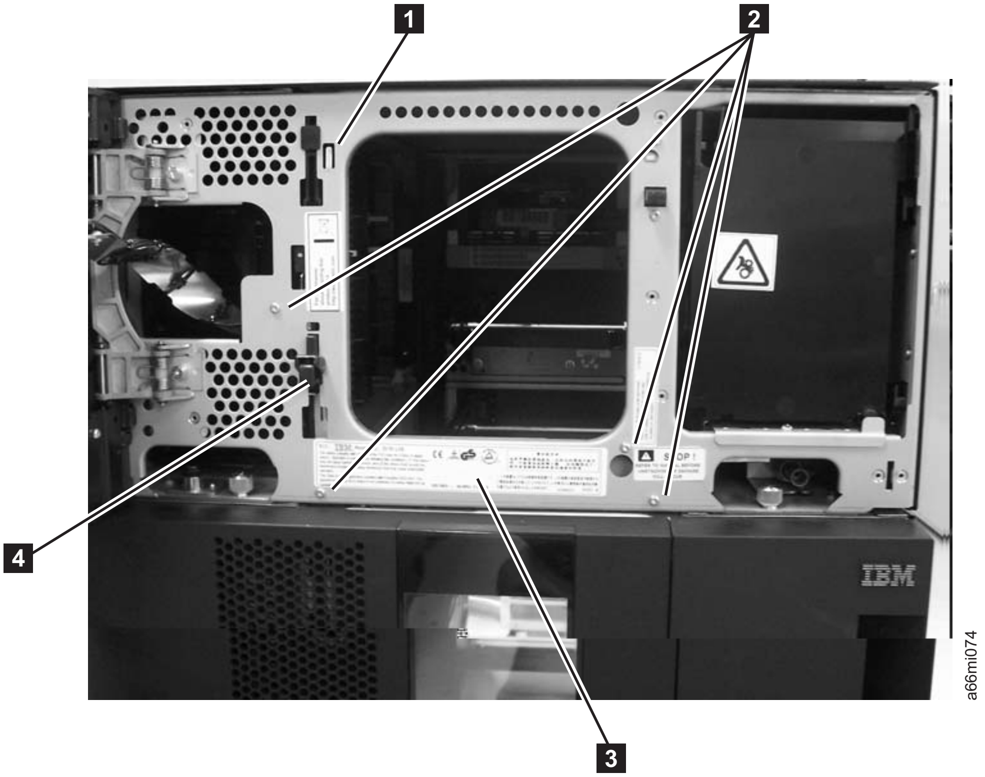


Figure 8-66. Front gear rack

5. While pinching the gear rack locking mechanism (**4** in Figure 8-66), push the gear rack down, then release your hold on the locking mechanism.
6. Remove the gear rack by pulling the black tab and the locking mechanism through the keyhole slots in the chassis frame.

   Note: Don't lose the spring (**2** in Figure 8-67 on page 8-67) that is recessed in the gear rack slot.

Replacing a Front Gear Rack

1. Lay the library module on the left side (from front).
2. Using your thumb, push the metal slide (**4** in Figure 8-67 on page 8-67) toward the gear rack locking mechanism (**3** in Figure 8-67 on page 8-67) and hold it in place while inserting the black tab (**1** in Figure 8-67 on page 8-67) and locking mechanism into the keyhole slots in the library chassis.

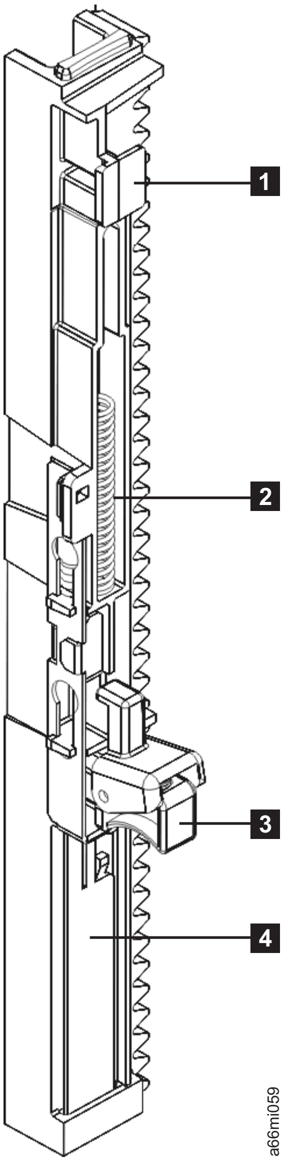


Figure 8-67. Gear rack (detail)

3. While pinching the gear rack locking mechanism, push up on the gear rack, then release your hold on the locking mechanism.
4. Replace the bottom cover of the module, if necessary.
5. Return the module to its correct, upright position.

Removing a Rear Gear Rack

1. Lay the library module on the left side (from front).
2. Remove the top and bottom covers of the module, if necessary.
3. There is a small metal tab in the chassis frame (**1** in Figure 8-66 on page 8-66) that prevents the gear rack from falling down too far when the locking mechanism is released. Bend the tab out slightly so the gear rack can be removed.
4. Slightly push up and pinch the gear rack locking mechanism (**1** in Figure 8-68 on page 8-68) to unlock the gear rack. The gear rack is spring-loaded against

the tab and will be removed through the bottom of the module.

5. While pinching the gear rack locking mechanism (2

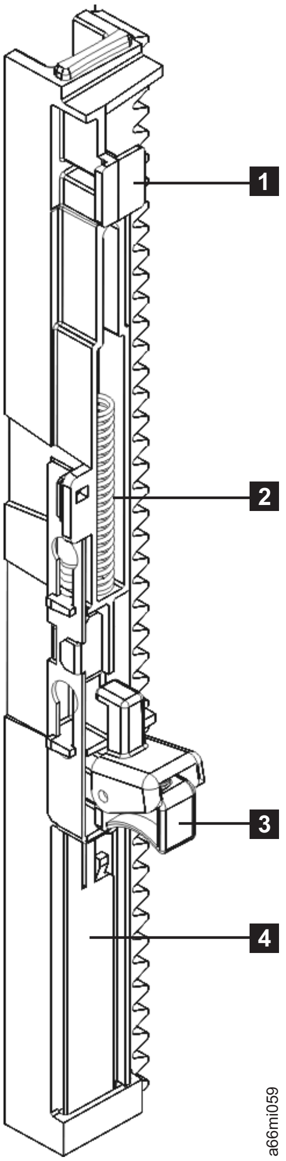


Figure 8-69. Gear rack (detail)

7. Return the module to its correct, upright position.

Replacing a Rear Gear Rack

1. Lay the module on the left side (from front).
2. Using your thumb, push the metal slide (**4** in Figure 8-69) toward the gear rack locking mechanism (**3** in Figure 8-69) and hold it in place while inserting the black tab (**1** in Figure 8-69) and locking mechanism into the keyhole slots in the library chassis.

Figure 8-70. Rear gear rack location on chassis

3. While pinching the gear rack locking mechanism, push up on the gear rack, then release your hold on the locking mechanism.
4. Replace the covers of the module, if necessary.
5. Return the module to its correct, upright position.

Removing Internal Cables and Boards

Special tools required for this procedure:
- T6 Torx wrench for D-Shell connectors on BCB cables
- T8 Torx wrench for BCB board
- 5 mm (3/16 inch) wrench for the stand-off behind cable spool assembly
- 4.5 mm (3/16 inch) wrench for DSIB board

Important:
- Prior to replacing all of the internal cables and boards you should visually check, and reseat if necessary, all of the internal connectors. (see “Internal Cables” on page 7-22).
- It may not be necessary to replace all of the cables and boards in this procedure. Depending on your failure symptoms and discussions with Technical Support, you may only have to replace a portion of these parts.

1. Perform “Preparing a Library or Library Module for Repairs” on page 8-3.
2. Perform the following CRU procedures using the control module:

   a. “Removing the Library Control Blade/ Compact Flash Assembly” on page 8-36
   b. “Removing a Drive Sled” on page 8-34
   c. “Power Supply (Primary and Redundant)” on page 8-42
3. Perform one of the following procedures:
   - “Removing a Library Control Module from a Rack” on page 8-4
   - “Removing a Control Module from a Standalone or Rack-mounted Library (14U or larger)” on page 8-5
4. Remove the top, side, and bottom covers, as necessary, from the control module.
5. Perform the following FRU procedures using the control module:
   a. “Removing an I/O Station” on page 8-26
   b. “Removing the I/O Station Lock Assembly” on page 8-27
   c. “Y-axis/Picker Assembly” on page 8-45
   d. All library magazines. “Removing/Replacing a Storage Column” on page 8-49
   e. “Removing a Front Gear Rack” on page 8-65
6. Remove the cable assembly from the Operator Control Panel (OCP) to the Backplane Connector Board (BCB).
   a. Remove the cable retainers (see **1** in Figure 8-71).

      Note: The cable retainers may be black rubber ’O’ rings as shown, or white plastic beaded cable ties. If they are the white cable ties, it will be necessary to cut them off and replace them with new cable retainers included in the new FRU kit.
   b. Remove the 2 screws from under the cable guide (see **2** in Figure 8-71) near the I/O Station lock assembly.

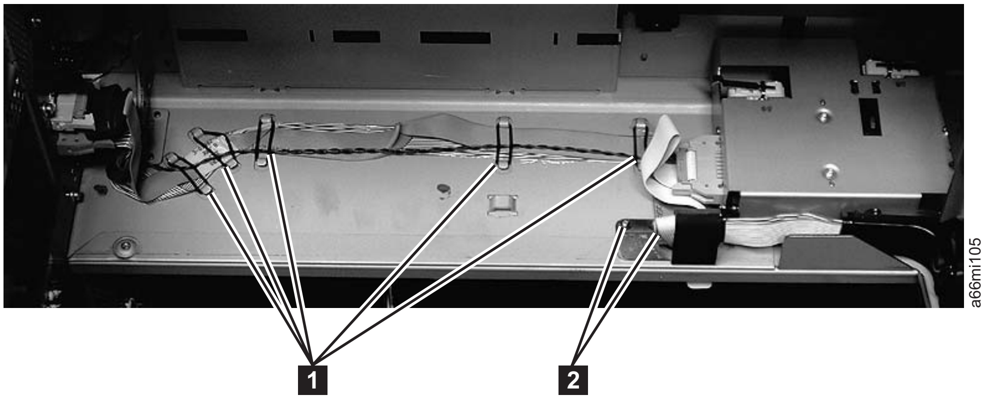


Figure 8-71. Cable assembly from the Operator Control Panel to the Backplane Connector Board

   c. Unplug cable connectors J9 (see **2** in Figure 8-72 on page 8-72), J16 (see **3** in Figure 8-72 on page 8-72), and J15 (see **4** in Figure 8-72 on page 8-72) from the BCB.

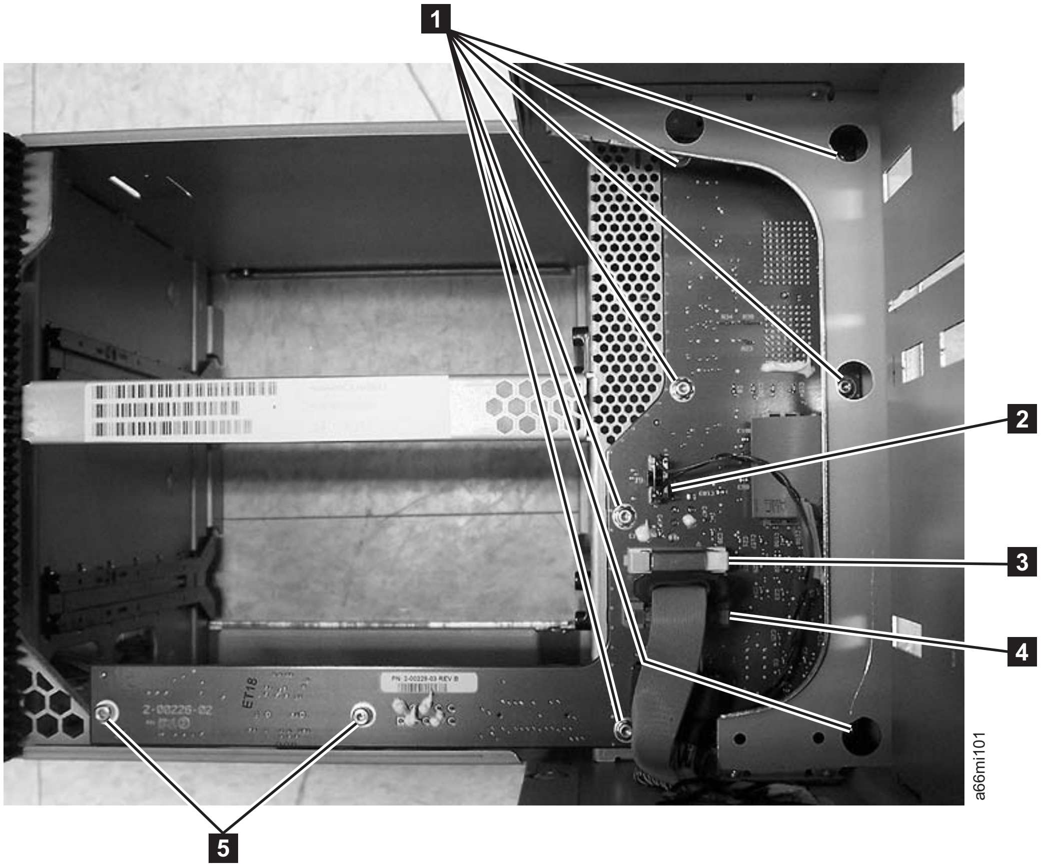


Figure 8-72. Backplane Connector Board (BCB), Front View

d. Remove the black protective cover from the back of the Operator Panel.

e. Remove cable connectors J36 (see **3** in Figure 8-73 on page 8-73), J35 (see **5** in Figure 8-73 on page 8-73), and J32 (see **7** in Figure 8-73 on page 8-73) from the Operator Panel board.

f. Remove the 3 screws (see **6** in Figure 8-73) from the cable retainer bracket on the back of the door.

g. Remove the 4 screws (see **2** in Figure 8-74 on page 8-74) from the front of the door, holding the long plastic cable guide to the door.

Note: The mounting holes in the new plastic cable guide may not match correctly with the screw holes in the door. If they do not match correctly, it will be necessary to transfer the plastic guide from the old cable assembly to the new cable assembly. Cut the cable ties to remove the plastic guides from both the old cable and the new cable. Use the new cable ties in the FRU

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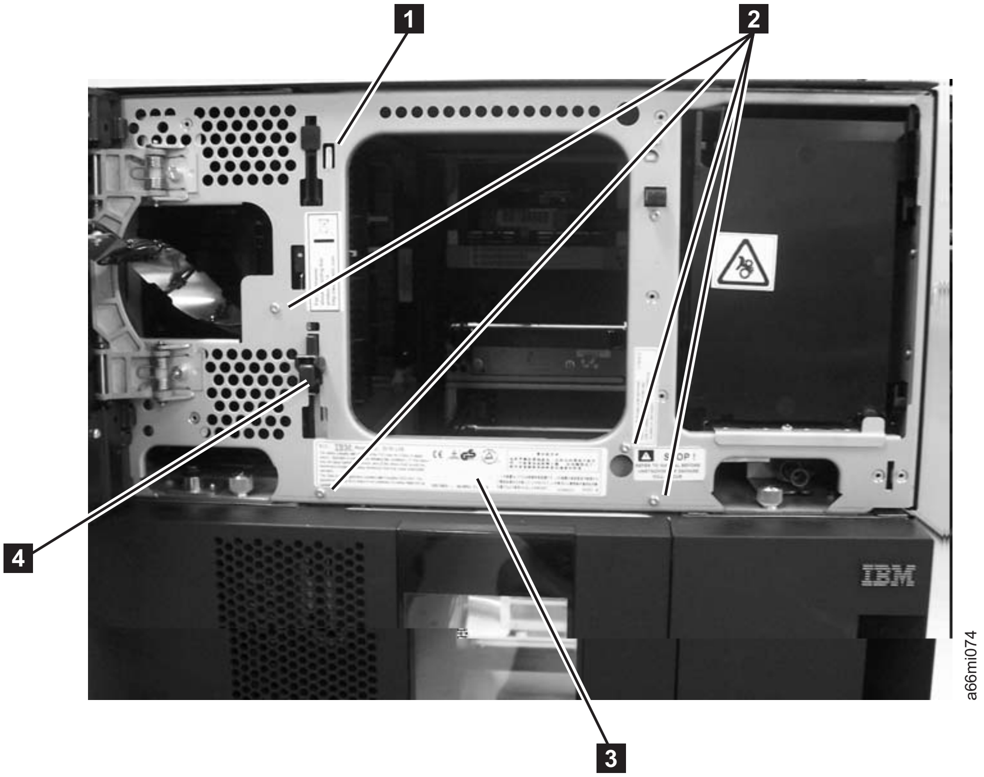

Figure 8-74. Four screws on front of door and plastic cable guide

   h. Carefully remove the cable assembly from the enclosure.

7. Remove the cable assemblies between the Power Supplies, the Drive Sled Interface Board (DSIB), and the Backplane Connector Board (BCB) by following these procedures:
   a. Remove the "Cable Spool Assembly" on page 8-55.
   b. Remove the hex stand-off (see **1** in Figure 8-75 on page 8-75) from behind the Cable Spool Assembly. This requires a 5 mm (3/16-inch) wrench.

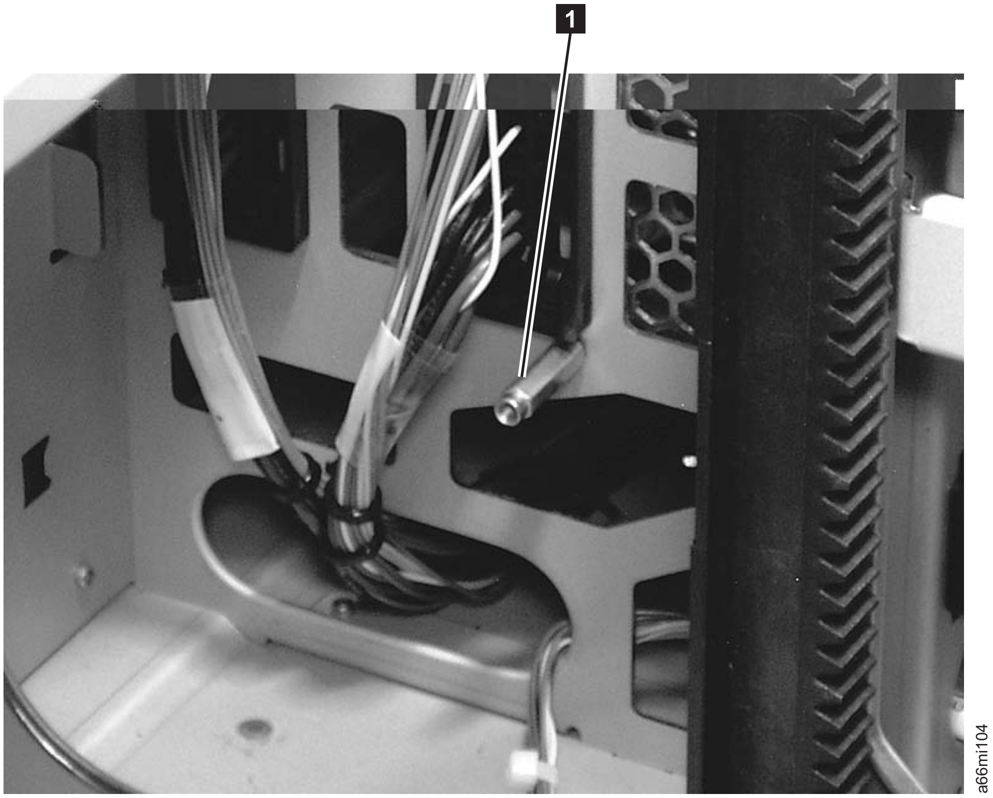

Figure 8-75. Hex stand-off behind the Cable Spool Assembly

c. Remove the cable retainers (**5** in Figure 8-76 on page 8-76 and **6** in Figure 8-77 on page 8-76).

Note: The cable retainers may be black rubber ’O’ rings as shown, or white plastic beaded cable ties. If they are the white cable ties, it will be necessary to cut them off and replace them with new cable retainers included in the new FRU kit.

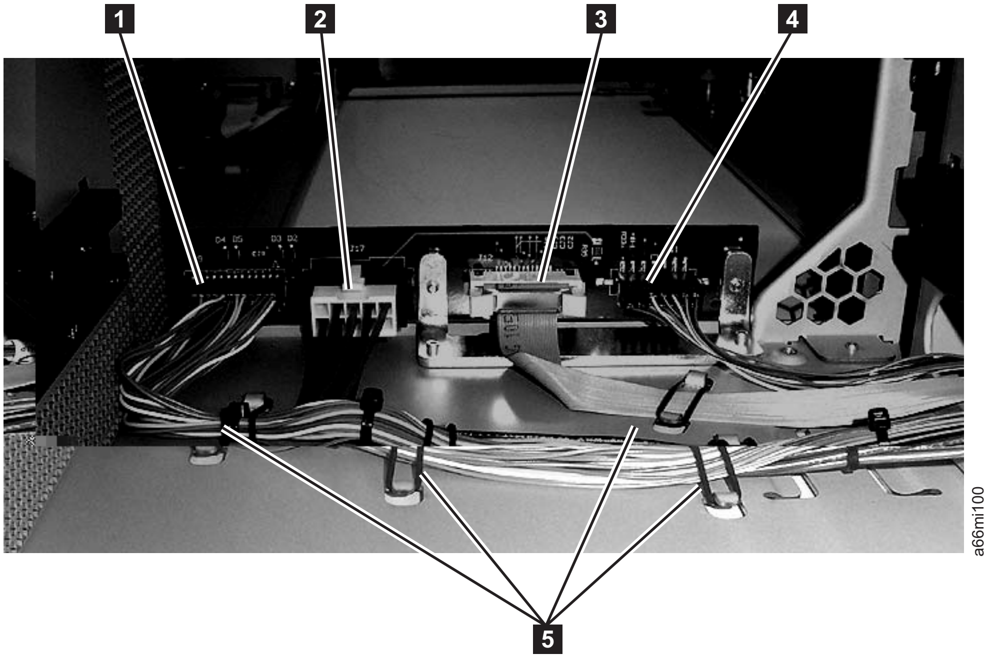

Figure 8-76. Backplane Connector Board (BCB), Rear View

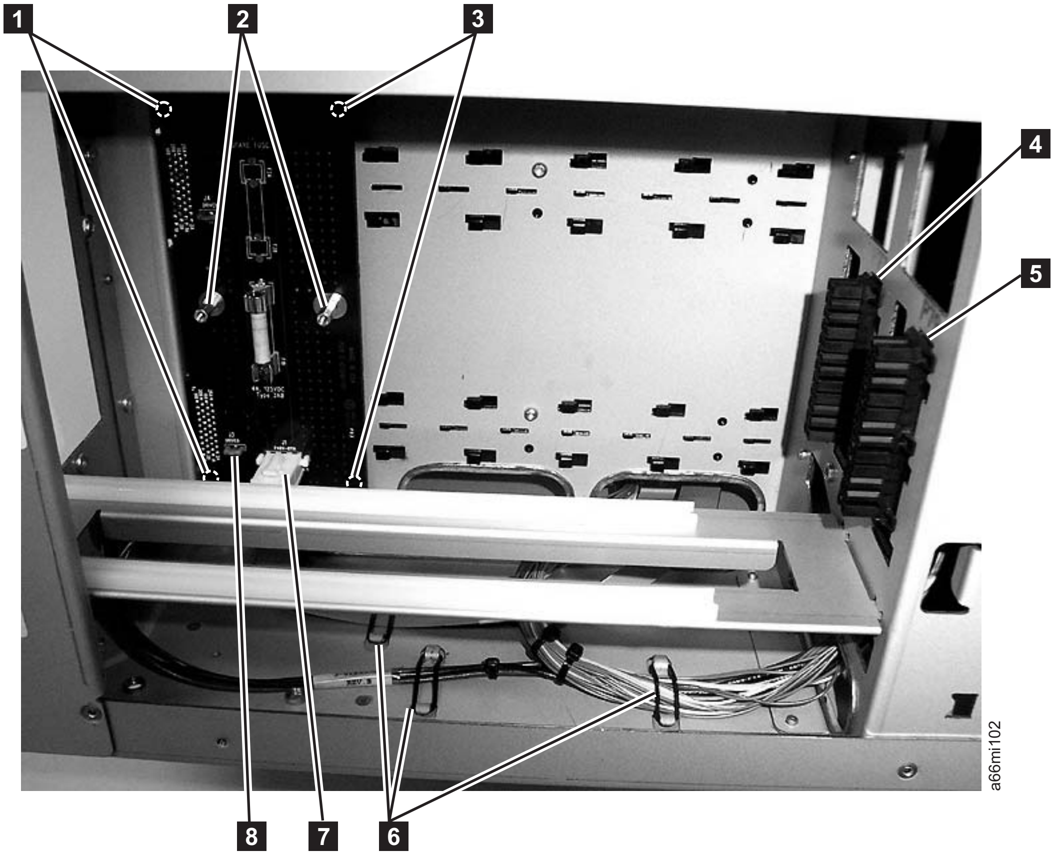

Figure 8-77. Drive Sled Interface Board (DSIB), Side Cover Removed

   d. Remove cable connectors J77 (**4** in Figure 8-77 on page 8-76) and J79 (**5** in Figure 8-77 on page 8-76). Pinch the lower part of the connector, press towards the front and slide down to remove the connector from the frame.
   e. Unplug the 2 connectors P17 and P19 from the BCB (see **2** and **1** in Figure 8-76 on page 8-76.
   f. Remove the 2 screws (**2** in Figure 8-77 on page 8-76) and remove the protective cover over the DSIB.
   g. Unplug the 1 power connector P1 (**7** in Figure 8-77 on page 8-76) from the DSIB.
   h. Carefully remove the cable assembly from the enclosure.
   i. Remove the flat cable from the DSIB to the BCB.
      1) Unplug connector P2 (**8** in Figure 8-77 on page 8-76) from the DSIB.
      2) Unplug connector P12 (**3** in Figure 8-76 on page 8-76) from the BCB.
      3) Remove the flat cable from the enclosure.

8. Remove the Drive Sled Interface Board (DSIB).
   a. Remove the 2 hex stand-offs (**2** in Figure 8-77 on page 8-76) from the DSIB. This requires a 4.5 mm (3/16-inch) wrench.
   b. The DSIB is held to the frame by slotted pins (**1** and **3** in Figure 8-77 on page 8-76) in all 4 corners of the board.
      1) Using a flat blade screwdriver, carefully pry the 2 front corners of the board (**3** in Figure 8-77 on page 8-76) from the mounting pins.
      2) Put finger pressure on the drive connectors on the back of the DSIB one at a time, while you move the board back and forth to pull it from the corner mounting pins (**1** in Figure 8-77 on page 8-76).
      3) Remove the Drive Sled Interface Board (DSIB) from the enclosure.

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9. Remove the Backplane Connector Board (BCB).
   a. Remove the 2 T8 Torx shoulder screws (**5** in Figure 8-72 on

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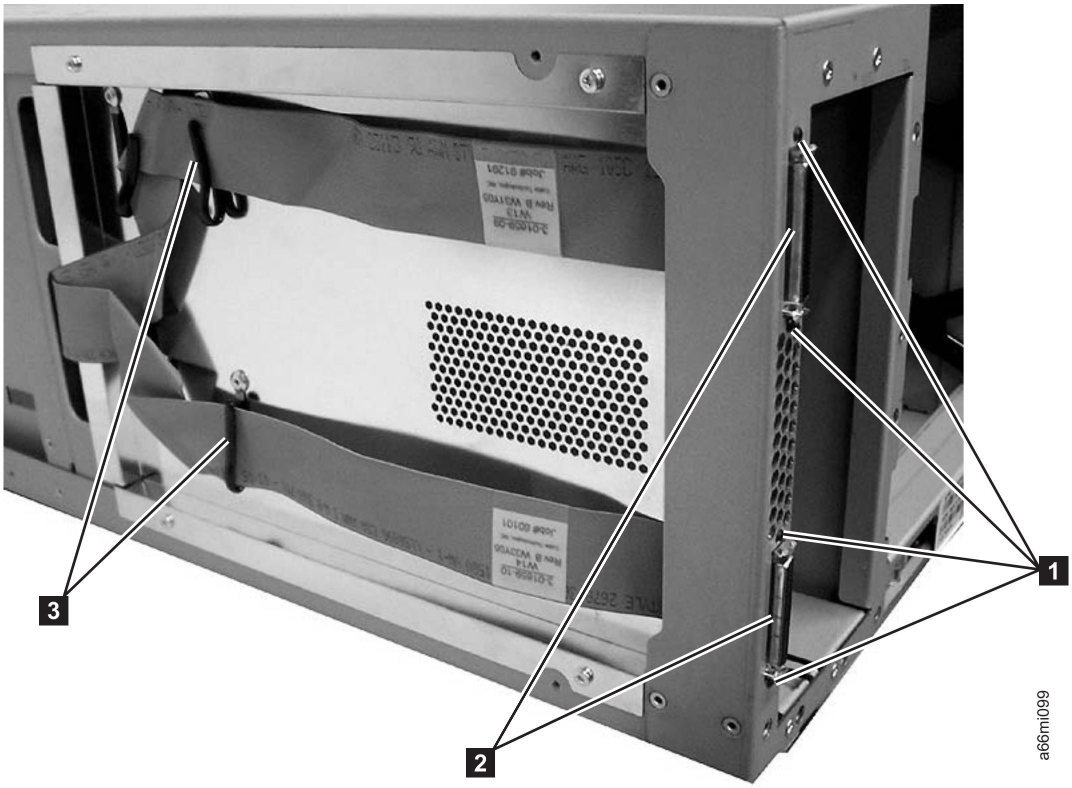


Figure 8-78. D-shell connectors and flat cables, side cover removed

d. Remove the 4 T6 Torx screws (**1** in Figure 8-78) holding the 2 D-shell connectors (**2** in Figure 8-78) on the back of the control module. Carefully remove the 2 flat cables (**3** in Figure 8-78) and D-shell connectors from under the cable retainers on the side of the enclosure.

e. Carefully remove the BCB and cable assembly from the enclosure.

Replacing Internal Cables and Boards

To install the new cables and boards, perform the remove procedure(s) in the reverse order.

Tip: When installing the new BCB it is easier to start the board mounting screws (**1** and **5** in Figure 8-72 on page 8-72) if you first stand the control module enclosure on end.

Remove and Replace Drive Power Fuse

Each library module has an external drive power overload fuse that serves as a protective device for all drive sleds installed in that module. The control module has a 4 amp fuse and a 9U expansion module has a 7 amp fuse. The external drive power overload fuse will blow if excessive current is being drawn by the drive sleds.

Removing a Drive Power Fuse

1. Perform “Preparing a Library or Library Module for Repairs” on page 8-3.
2. Remove all power supplies in the library module with the blown drive power overload fuse (see “Removing a Primary Power Supply” on page 8-43).

3. Remove the cover plate (**1** in Figure 8-79) inside the power supply slot.

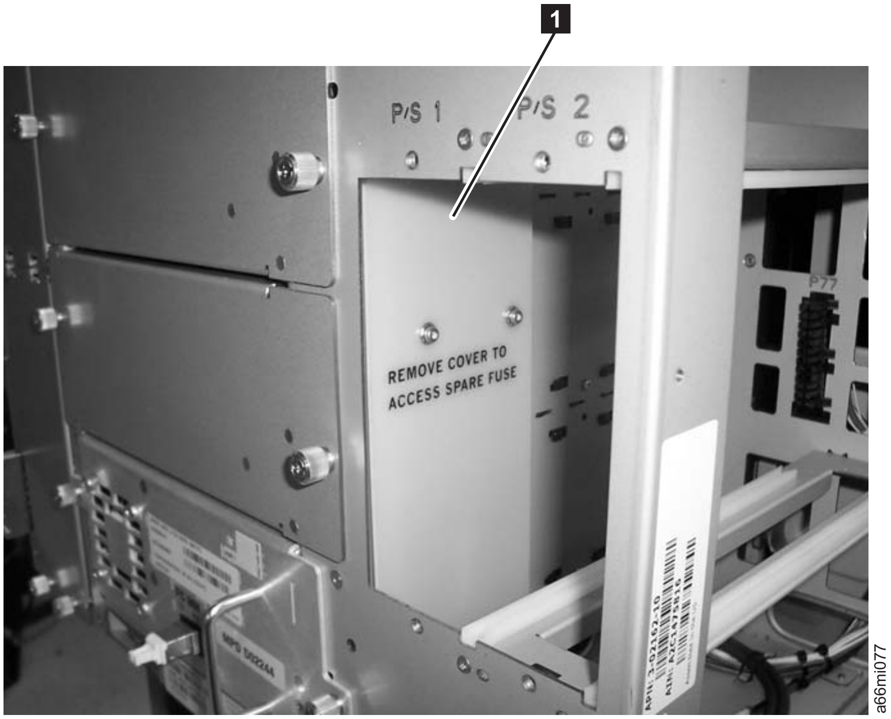


Figure 8-79. Drive power overload fuse cover plate

4. Using a fuse puller, gently remove the blown fuse (**1** in Figure 8-80).

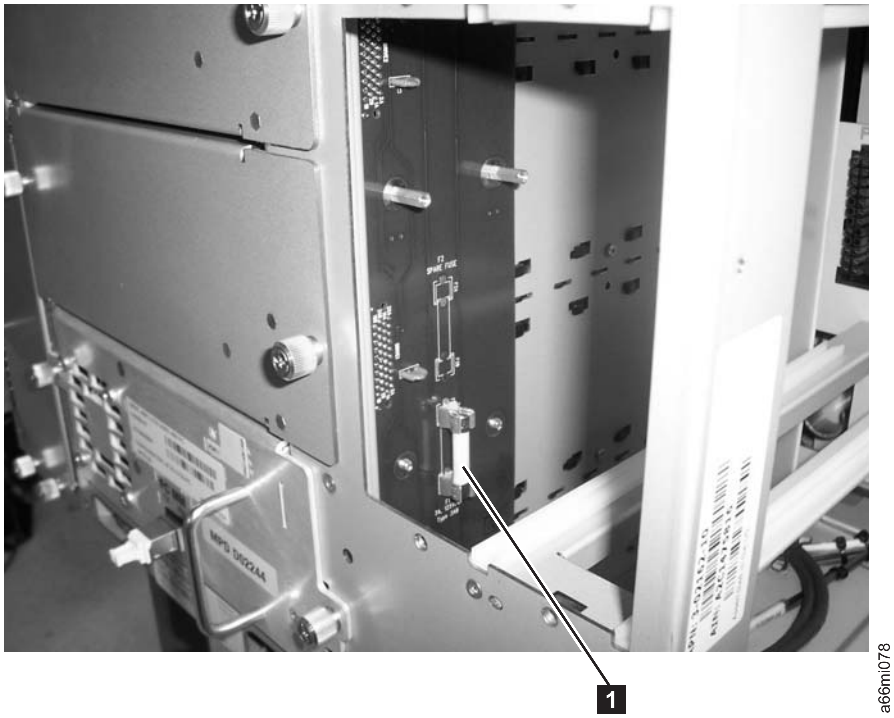


Figure 8-80. Drive power overload fuse

Installing a Drive Power Overload Fuse

1. To install a drive power overload fuse, perform the steps in “Removing a Drive Power Fuse” on page 8-78 in reverse order.
2. For the last step, perform “Returning a Library or Library Module to Normal Operations after Repairs” on page 8-3.

Removing/Installing Library Foot Pads

If your library is currently rack mounted, foot pads must be installed on the bottom of the library chassis before the library can be used as a desktop unit. If your library is currently being used as a desktop unit, foot pads will be installed on the bottom of the library. Foot pads must be removed before the library can be installed in a rack.

Removing Library Foot Pads

To remove the library foot pads:

1. Place the sling that was shipped with your library underneath the library halfway between the front and back feet. Ensure that both sling handles are an equal distance from the sides of the library. Use of the sling is strongly recommended for a 9U module. A 5U module is much lighter in weight, and it may not be necessary to use the sling.
2. Being very careful, lay the library on its side.
3. Using a #2 Phillips screwdriver, remove the foot pads attached to the bottom of the library. Store these parts for future use.
4. Carefully return the library to an upright position on top of the sling.

Installing Library Foot Pads

For a desktop installation, foot pads must be installed on the bottom module of your library. To install the library foot pads:

1. Being very careful, lay the module on its side.
2. Using a #2 Phillips screwdriver, install the foot pads on the bottom of the library chassis. See Figure 8-81 on page 8-81 for foot pad locations.

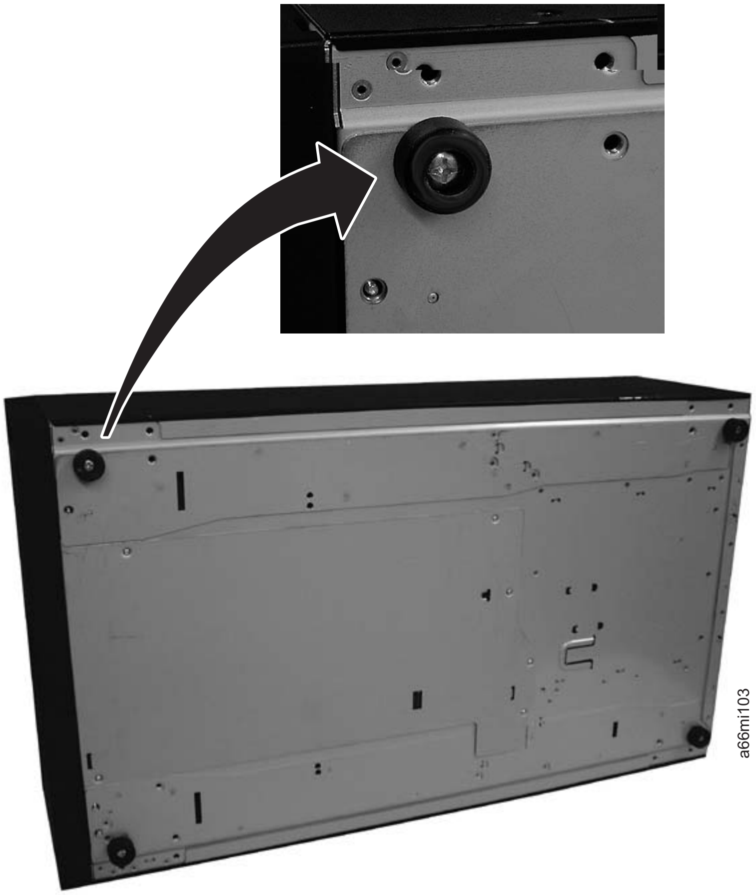


Figure 8-81. Foot pad Locations

3. Carefully return the library to an upright position.
4. Use the lifting sling to place the library module in the desktop location.
5. When you finish these desktop installation steps, store the installation sling in a secure location for possible future use.

Manual Cartridge Removal from a Drive

The purpose of this section is to assist you in determining the condition of the cartridge or the magnetic tape and to direct you to the procedure you must follow to remove the cartridge.

Note: If the cartridge in the drive is an INPUT tape containing ACTIVE or ’ONLY COPY’ data (i.e., there is no backup), and both eject commands issued at the host and power-cycling the drive fail to eject the cartridge, make no further attempts to unload this tape. Call Technical Support and open a PMR if one isn’t already open to initiate the process of sending the drive with the loaded cartridge in for recovery.

- Before using this procedure, you must have exhausted all other means of removing the tape cartridge from the drive. Use this procedure **only** if you cannot remove the tape cartridge by using any other means.
- Determine from the customer if the cartridge contains **critical customer data**. If the cartridge contains sensitive data that cannot leave the site, inform the customer that certain failure conditions diagnostics will be performed to test the drive for continued use.

- The following removal procedures **can destroy** customer data! Use **extreme care** when handling or removing the customer’s tape cartridges to minimize tape damage and lost data.
- **DO NOT TOUCH** the magnetic tape or tape path. Both are extremely sensitive to the oil and salt from your skin. Use clean, lint-free gloves when working around magnetic tape or the tape path components.
- Electrostatic-sensitive components: Consider using an ESD Kit.
- After you remove the tape cartridge, advise the customer to copy the data to another cartridge and to remove this tape cartridge from service.
- Do not use power tools or magnetic tools to perform this procedure.
- To avoid contamination and electrostatic-discharge damage to the drive, never touch the head or electronic components inside the drive.
- If you cannot remove the cartridge from the drive using the following procedures, contact your next level of support.

Before You Begin

1. If you have not already done so, attempt to remove the cartridge with the device power ON and using library manager, a host application, or the Unload Button.
2. If you have not already done so, attempt to remove the cartridge by power cycling the drive. Look for the drive to attempt a mid-tape recovery.

   Note: It can take as long as five minutes for the cartridge to rewind and unload.
3. If the cartridge unloads, inform the operator that the cartridge is unloaded. If the cartridge does not unload, continue with this procedure.

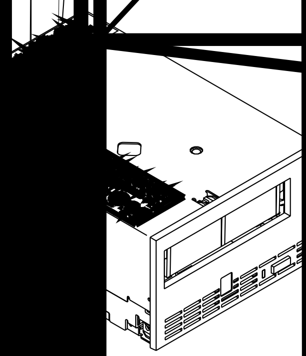
Recommended Tools

- 2.5 mm offset hex wrench (do not use magnetized wrench)
- #1 Phillips screwdriver
- ESD Kit
- Flashlight (optional)
- #1 Flathead screwdriver (optional)

Beginning Procedure

1. Remove the drive from the enclosure (see “Removing a Drive Sled” on page 8-34.
2. Place the drive on a nonslip, sturdy work surface.
3. Remove the drive from the sled (see “Removing a Drive from a Sled” on page 8-83).
4. Ground yourself to the drive by using an ESD Kit.
5. Remove the cover of the drive by performing the following steps:
   a. Using a Phillips screwdriver, remove the three screws and washers (see **1** in Figure 8-82 on page 8-83) that secure the bezel (see **2**) to the internal drive, then remove the bezel.
   b. Remove the cover of the internal drive by performing the following steps:
      1) Remove the four cover-mounting screws and washers (see **3**).

2) Re[illegible] cover by lifting it up.



6. Inspect the [illegible]e which of the fo[illegible]onditions most closely matches th[illegible] the drive:
   - **Tape sp[illegible]upply reel** - All t[illegible]ppears to be on the take up reel and [illegible]he supply reel (in[illegible]cartridge). Test the drive after the[illegible]ompleted.
   - **Tape pu[illegible]er pin (or broken[illegible]ont end)** - All the tape appears[illegible]pply reel (inside[illegible]dge) and very little or no tape app[illegible]he take up reel. T[illegible] block is positioned in the take up[illegible] drive after the p[illegible] is completed.
   - **Tape br[illegible]pe** - Tape appears[illegible] both the supply reel (inside t[illegible]d take up reel. T[illegible]ive after the procedure is complet[illegible]
   - **Tape tan[illegible]e path** - Tape app[illegible]e tangled and damaged but in tact. [illegible]8000.0028208.921[illegible]2.7798Tm()Tj/F71Tf9.978009.97867.7672132

5. Remove the two screws from the barcode bracket (make note of the barcode orientation for replacement).
6. Slide the drive forward approximately two inches.
7. Remove the power and interface connectors from the drive.
8. Remove the RS422 connector from the sled board (keyed).
9. Lift or slide the drive out of the sled housing.

Tape Spooled off Supply Reel

1. With the front of the drive facing you, pull an arm’s length of tape out of the take up reel from the left side of the drive.
2. From the take up reel, thread tape around the rear of the tape path and over the head rollers on the left side of the drive.
3. Set the drive on its left side with the head and tape path facing up.
4. Moisten a cotton swab with water and wet approximately 13 mm (0.5 in.) of the tape end and feed it onto the supply reel (inside the cartridge).
5. From the bottom of the drive, insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle.
6. Turn the supply reel clockwise, allowing the moistened tape to adhere to the hub as it winds around the supply reel (inside the cartridge).
7. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.
8. Reassemble

9. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, the cartridge ejects automatically.

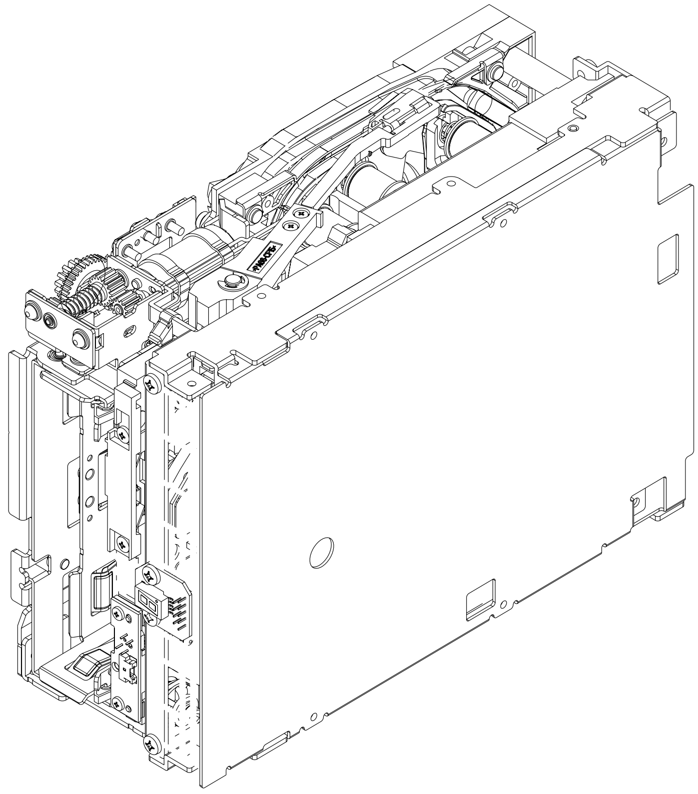
a. Use your finger to rotate the threader motor worm gear and slowly rotate the threader mechanism gear (**6** in Figure 8-84 on page 8-85) clockwise; or

b. Use a #1 flathead screwdriver to turn the threader worm gear (**9** in Figure 8-84 on page 8-85) clockwise.

This rotates the threader motor worm gear (**4** in Figure 8-84 on page 8-85) clockwise, drawing the tape leader block assembly (LBA) into the cartridge.

4. As the LBA is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear (**4** in Figure 8-84 on page 8-85) stops. The LBA is in the correct position.

   Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench (**1**) in Figure 8-85.



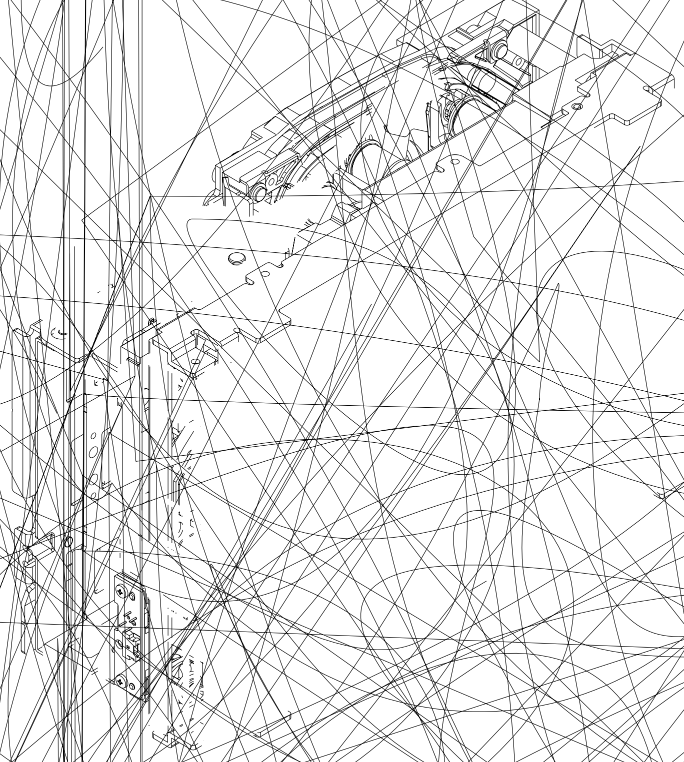
5. Notice the following:
   a. Loader mechanism gear (**8** in Figure 8-84 on page 8-85) nearest the front of the drive that actuates the cartridge loader mechanism
   b. Position of the rotator stub (**3** in Figure 8-84 on page 8-85).
   c. Front loader motor worm gear (**1** in Figure 8-84 on page 8-85). Rotating this gear allows the loader mechanism gear (**8** in Figure 8-84 on page 8-85) to turn.

6. Rotate the loader motor worm gear (**1** in Figure 8-84 on page 8-85) to turn the loader mechanism gear (**6** in Figure 8-84 on page 8-85) counterclockwise. Continue turning until the rotator stub (**3** in Figure 8-84 on page 8-85) loses contact with the lever (**7** in Figure 8-84 on page 8-85). This releases the LBA leader pin.
7. Rotate the threader motor worm gear (**4** in Figure 8-84 on page 8-85) to turn the threader mechanism gear (**6** in Figure 8-84 on page 8-85) counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive (**1** in Figure 8-86).
8. Continue rotating the loader motor worm gear (**1** in Figure 8-84 on page 8-85) until the rotate stub (**3** in Figure 8-84 on page 8-85) is positioned as shown. Notice that the rotator stub (**3** in Figure 8-84 on page 8-85) is nearly aligned with the cartridge loader tray guide bearing (**2** in Figure 8-84 on page 8-85).
9. Remove the cartridge from the cartridge loader tray.
10. Reassemble the drive by reversing the procedure in Step 5 in “Beginning Procedure” on page 8-82.
11. Refer to the appropriate procedure to install the new drive and return the failed drive.

Tape Broken in Mid-tape

1. With the front of the drive facing you, pull an arm’s length of tape out of the take

6. From the bottom of the drive, locate the access hole (**1** in Figure 8-87) in the bottom cover. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. begin spooling tape back into the cartridge by turning the hex wrench clockwise.



7. Turn the supply reel clockwise, carefully guiding the mended portion of the tape to wind around the hub of the supply reel located inside the cartridge. Continue spooling into the cartridge until the tape is taut. The tape must remain within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.
8. Reassemble the drive by reversing the procedure in Step 5 in “Beginning Procedure” on page 8-82.
9. Allow the drive to perform mid-tape recovery. This takes several minutes. When this activity completes, the cartridge ejects automatically.
10. Test the drive to determine if it should be replaced.

Tape Tangled along Tape Path

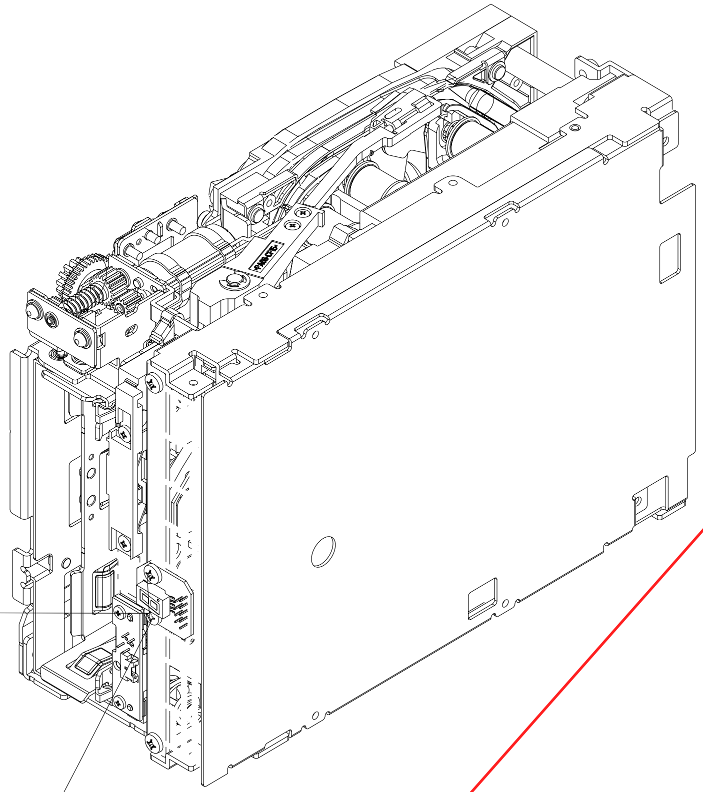
1. Carefully pull out excess tape and untangle.

   Note: If you find the tape to be broken, go to one of the following appropriate procedures:
   - “Tape Spooled off Supply Reel” on page 8-84
   - “Tape Pulled from or Broken near Leader Pin” on page 8-85

     --OR--

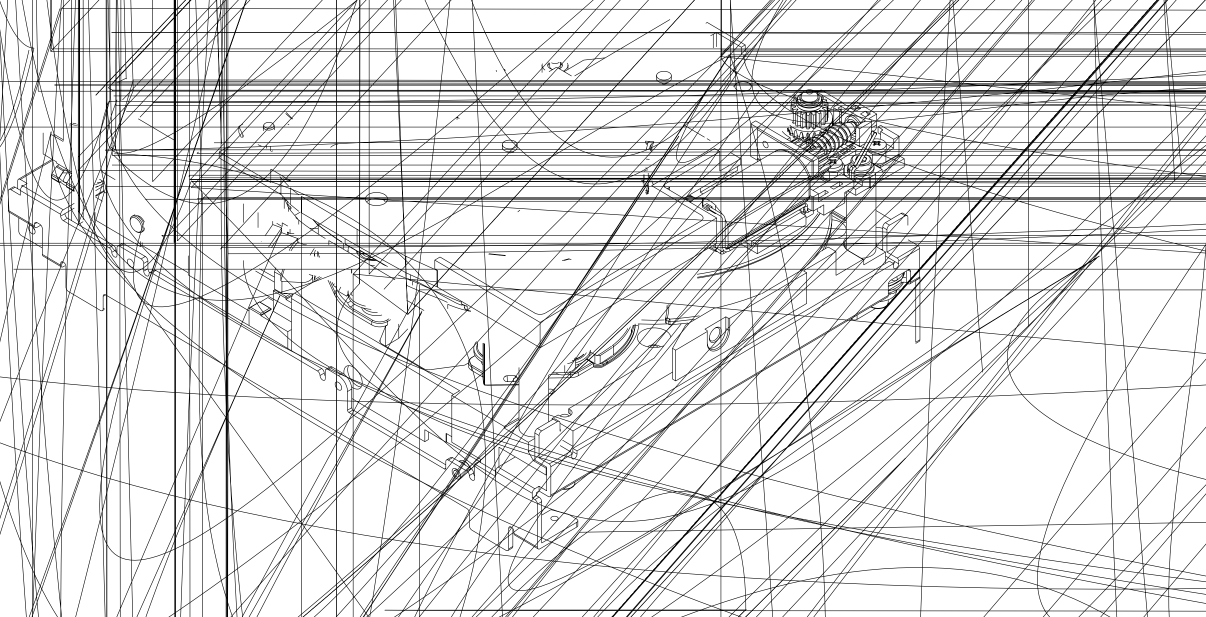
     “Tape Broken in Mid-tape” on page 8-87

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



3. From the bottom of the drive, locate the access hole (**1** in Figure 8-88).
4. Insert a 2.5 mm offset hex wrench through the bottom cover access hole and into the reel motor axle. Begin spooling the tape back into the cartridge by turning the hex wrench clockwise.
5. Continue spooling into the cartridge until the tape is taut and remains within the flanges of the tape guiding rollers. Ensure that you do not stretch the tape.
6. Locate the threader motor worm gear (**4** in Figure 8-89 on page 8-90) on the rear of the drive. You can either:
   a. Use your finger to rotate the treader motor worm gear and slowly rotate the threader mechanism gear (**6** in Figure 8-89 on page 8-90) clockwise; OR
   b. Use a #1 flathead screwdriver to turn the worm gear (**9** in Figure 8-89 on page 8-90) clockwise.

   This rotates the threader motor worm gear (**4** in Figure 8-89 on page 8-90) clockwise, drawing the LBA into the cartridge.



1	Loader motor worm gear	6	Threader mechanism gear
2	Cartridge loader tray guide bearing	7	Lever
3	Rotator stub	8	Loader mechanism gear
4	Threader motor worm gear	9	Threader worm gear
5	Threader intermediate gear		

7. As the tape leader block assembly (LBA) is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear (4 in Figure 8-89) stops. The LBA is in the correct position.

   Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench as shown in Figure 8-88 on page 8-89.

8. Notice the:
   a. Loader mechanism gear (6 in Figure 8-89) nearest the front of the drive that actuates the cartridge loader mechanism.
   b. Position of the rotate stub (3 in Figure 8-89).
   c. Front loader motor worm gear (1 in Figure 8-89). Rotating this gear allows the loader mechanism gear (8 in Figure 8-89) to turn.

9. Rotate the loader motor worm gear (**1** in Figure 8-89 on page 8-90) to turn the threader mechanism gear (**6** in Figure 8-89 on page 8-90) counterclockwise. Continue turning until the rotator stub (**3** in Figure 8-89 on page 8-90) loses contact with the lever (**7** in Figure 8-89 on page 8-90). This releases the LBA leader pin.
10. Rotate the threader motor worm gear (**4** in Figure 8-89 on page 8-90) to turn the threader mechanism gear (**6** in Figure 8-89 on page 8-90) counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive shown as **1** Figure 8-90.

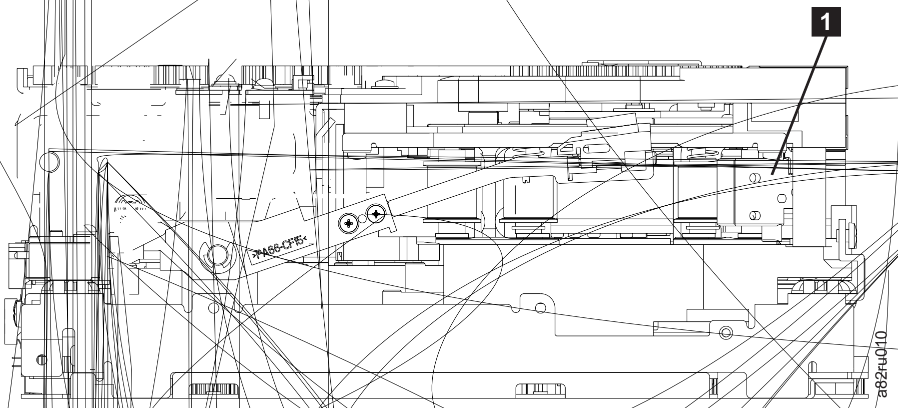
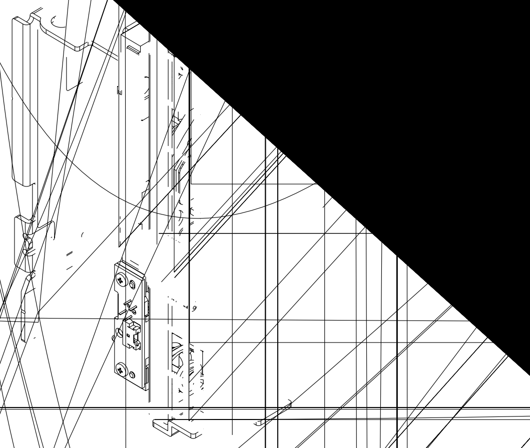


Figure 8-90. Leader Block Assembly (LBA)

11. Continue rotating the loader motor worm gear (**1** in Figure 8-89 on page 8-90) until the rotator stub (**3** in Figure 8-89 on page 8-90) is positioned as shown. Notice that the rotator stub (**3** in Figure 8-89 on page 8-90) is nearly aligned with the cartridge loader tray guide bearing (**2** in Figure 8-89 on page 8-90).
12. Remove the cartridge from the cartridge loader tray.
13. Reassemble the drive by reversing the procedure in Step 5 in “Beginning Procedure” on page 8-82.
14. Refer to the appropriate procedure to install the new drive and return the failed drive.

No Apparent Failure or Damage to Tape

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

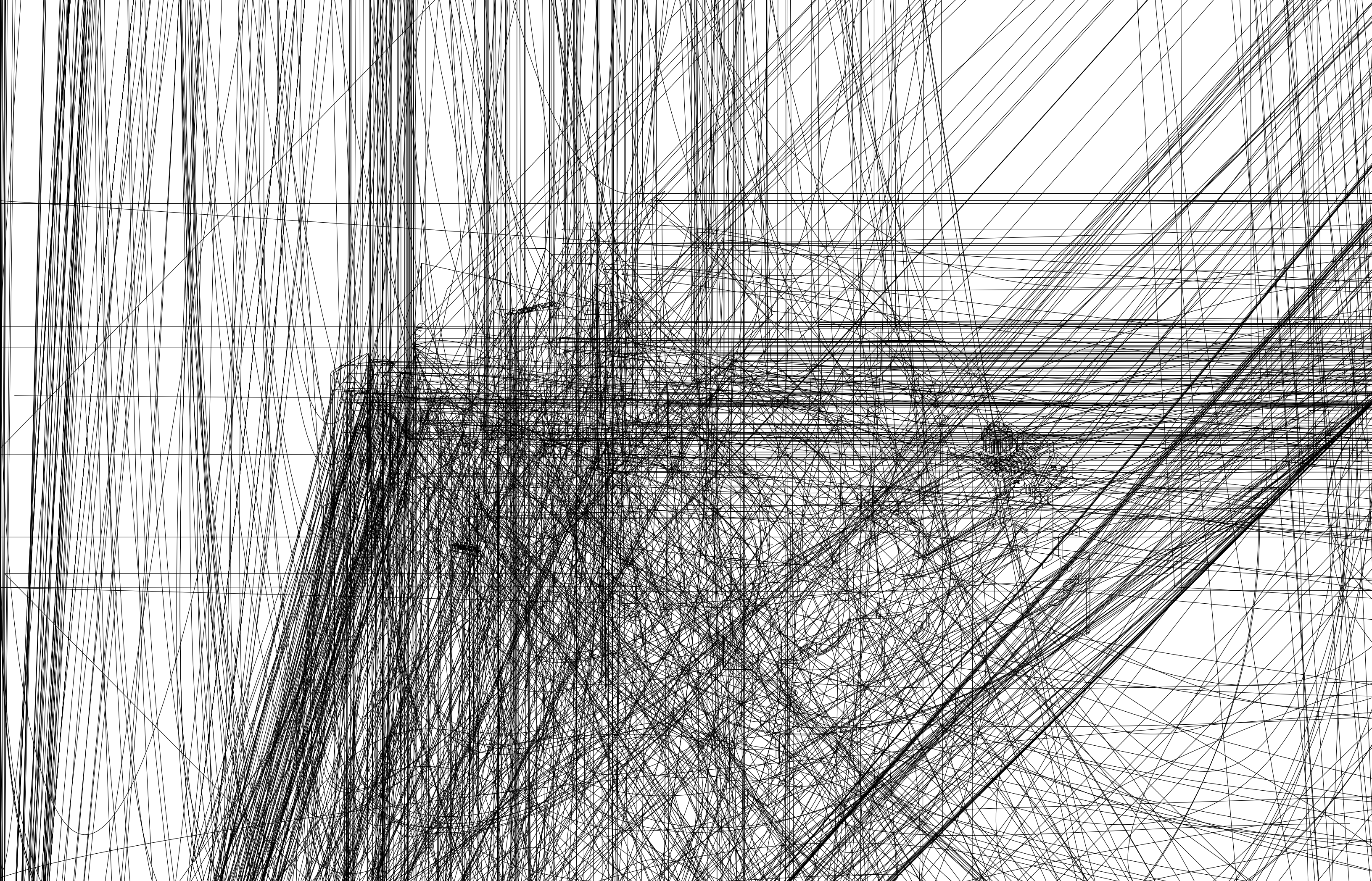


2. From the bottom of the drive, locate the access hole (**1**
3. Insert a 2.5 mm offset hex wrench through the bottom cover into the reel motor axle. Begin spooling the tape back into the ca turning the hex wrench clockwise.
4. Continue spooling into the cartridge until the tape is taut and remains the flanges of the tape guiding rollers. Ensure that you do not stretch the
5. Locate the threader motor worm gear (**4** in Figure 8-92 on page 8-93) on the rear of the drive. You can either:
   a. Use your finger to rotate the threader motor worm gear and slowly rotate the threader mechanism gear (**6** in Figure 8-92 on page 8-93) clockwise;

      --OR--

   b. Use a #1 flathead screwdriver to turn the threader worm gear (**9** in Figure 8-92 on page 8-93) clockwise.

   This rotates the threader motor worm gear (**4** in Figure 8-92 on page 8-93) clockwise, drawing the LBA into the cartridge.



1	Loader motor worm gear	6	Threader mechanism gear
2	Cartridge loader tray guide bearing	7	Lever
3	Rotator stub	8	Loader mechanism gear
4	Threader motor worm gear	9	Threader worm gear
5	Threader intermediate gear		

6. As the tape leader block assembly (LBA) is secured in the cartridge, you should hear the LBA retention spring clips click into place. If you do not hear the click, continue rolling until the threader motor worm gear (4 in Figure 8-92) stops. The LBA is in the correct position.

   Note: Be sure to keep tension on the tape as the LBA is drawn into the cartridge by using a hex wrench as shown in Figure 8-91 on page 8-92.

7. Notice the:
   a. Loader mechanism gear (6 in Figure 8-92) nearest the front of the drive that actuates the cartridge loader mechanism.
   b. Position of the rotate stub (3 in Figure 8-92).
   c. Front loader motor worm gear (1 in Figure 8-92). Rotating this gear allows the loader mechanism gear (8 in Figure 8-92) to turn.

8. Rotate the loader motor worm gear (**1** in Figure 8-92 on page 8-93) to turn the threader mechanism gear (**6** in Figure 8-92 on page 8-93) counterclockwise. Continue turning until the rotator stub (**3** in Figure 8-92 on page 8-93) loses contact with the lever (**7** in Figure 8-92 on page 8-93). This releases the LBA leader pin.
9. Rotate the threader motor worm gear (**4** in Figure 8-92 on page 8-93) to turn the threader mechanism gear (**6** in Figure 8-92 on page 8-93) counterclockwise. This moves the LBA out of the cartridge and past the read/write head. Stop this rotation when the LBA is near the tape guide roller nearest the rear of the drive shown as **1** Figure 8-93.

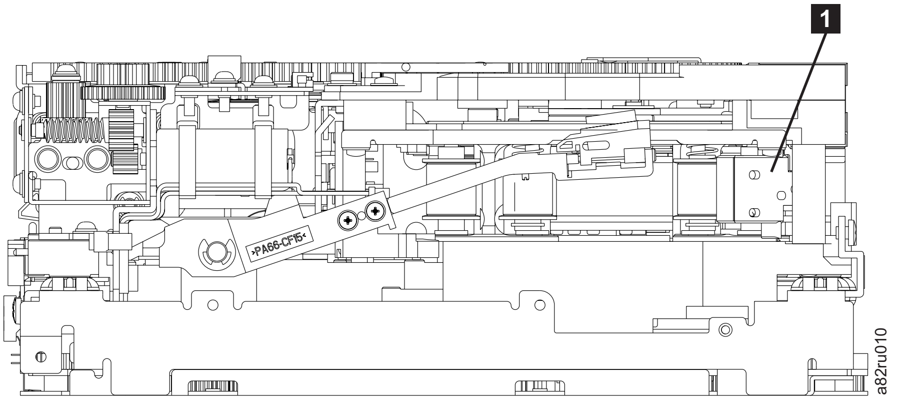


Figure 8-93. Leader Block Assembly (LBA)

10. Continue rotating the loader motor worm gear (**1** in Figure 8-92 on page 8-93) until the rotator stub (**3** in Figure 8-92 on page 8-93) is positioned as shown. Notice that the rotator stub (**3** in Figure 8-92 on page 8-93) is nearly aligned with the cartridge loader tray guide bearing (**2** in Figure 8-92 on page 8-93).
11. Remove the cartridge from the cartridge loader tray.
12. Reassemble the drive by reversing the procedure in Step 5 in “Beginning Procedure” on page 8-82.
13. Refer to the appropriate procedure to install the new drive and return the failed drive.

History of Service Activity

Table 9-1. Service activity

Date	Service Representative	Parts Exchanged	Description of Service Activity

Table 9-1. Service activity (continued)

Date	Service Representative	Parts Exchanged	Description of Service Activity

Table 9-1. Service activity (continued)

Date	Service Representative	Parts Exchanged	Description of Service Activity

Parts List

Field Replaceable Unit (FRU) parts list

FRU Type	Description	FRU Part Number
Assemblies	Display (Operator Panel)	23R6174
	I/O Station for control module	23R2587
	I/O Station for 9U expansion module	23R2588
	Expansion module enclosure	23R6168
	I/O Station Lock Assembly	23R2589
	Y-axis Assembly	23R6186
	Y Motor	23R7285
	Picker with Bar Code Scanner	23R6171
	Cable Spool	23R2583
	Power Button	23R3348
	Front Bezels for control module	23R2597
	Front Bezels for 9U expansion module	23R2598
Miscellaneous	5U drive power overload fuse	23R6178
	9U drive power overload fuse	23R6185
	Storage magazine (8 slot with fiducial)	23R7286
	Storage magazine (16 slot with fiducial)	23R7287
	I/O Station magazine	23R3640
	Gear Racks (front and back) for L5B control module	23R9476
	Gear Racks for E9U expansion module	23E9477
Kits	Kit 1, Door Interlock Switch	23R6179
	Kit 2, Power Switch/LED Board and Cable	23R6180
	Kit 3, Internal Cables and Boards, 5U Control Module	23R6181
	Kit, Misc. parts (’Y’ home flag, door Inlk., cover screws)	95P4564
	Kit, I/O Safety Flap, 5U Control Module	95P5424
	Kit, I/O Safety Flap, 9U Expansion Module	95P5425

Customer Replaceable Unit (CRU) parts list

Important: 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.

Before ordering a replacement CRU, ensure that the following criteria is met:

- The failure is repeatable.

- A dump is captured for emailing to IBM Service.
  - Use the Web User Interface (**Service Library** → **Capture Library Log**) for library dumps.
  - Use the Web User Interface (**Service Library** → **Capture Drive Log**) for drive dumps.

CRU Type	Description	Feature Code	CRU Part Number
Assemblies	LTO Ultrium Gen 3 LVD Ultra160 drive sled	8037	23R6182
	LTO Ultrium Gen 3 2 Gb Fibre drive sled	—	23R2601
	LTO Ultrium Gen 3 4 Gb Fibre drive sled	8042	23R6450
	LTO Ultrium Gen 4 Fibre drive sled	8142	95P4824
	LTO Ultrium Gen 4 SAS drive sled	8139	95P4825
	Power Supply	1900	23R2582
	Library Control Blade (LCB) without Compact Flash (CF) Card	—	23R6165
	Compact Flash Card	—	23R9610
	Rack Mount Kit	7003	—
License Keys	Capacity Expansion	1640	—
	Path Failover	1682	—
	Transparent LTO Encryption	5900	—
Terminators & Wrap Plugs	Terminator, LVD multi-mode	—	23R5841
	Terminator, Module Communication	—	23R2603
	LVD SCSI Wrap Tool	—	23R5840
	Fibre Wrap Tool	—	12R9314
Interposers	Interposer, LC-SC fibre cable	5096	12R9321
	Interposer, VHDCI/HD68 SCSI cable	—	12R9321
	Interposer, SAS/550x 4x	5400	95P4994
	Interposer, MiniSAS/550x 4x	5500	95P4996
Miscellaneous	Cable, Module-to-Module Communication	—	23R2602
	Cable, RJ45 Ethernet Crossover	—	23R3663
	Cover, top for control module and expansion module	—	23R2594
	Cover, side for 5U control module	—	23R2595
	Covers, side for 9U expansion module	—	23R2596
	Cover plate for empty slot next to LCB	—	23R2604
	Cover plate for empty Power Supply slot	—	23R2606
	Cover plate for empty drive slot	—	23R2605
	Library and Drive Firmware Update (by an IBM Service Representative)	0500	—
	Rack ears kit	—	23R3349
	Rack Power Distribution Unit (PDU) power cord	9848	39M5378
	Foot pads kit	—	23R2599
SCSI Cables, HD68/HD68	0.4 m	8037	23R6408

CRU Type	Description	Feature Code	CRU Part Number
SCSI Cables, VHDCI/HD68	2.5 m	5602	23R3841
	4.5 m	5604	23R3594
	10 m	5610	23R3593
Fibre Cables, LC-LC	5 m	6005	39M5700
	13 m	6013	39M5701
	25 m	6025	12R9915
SAS Cables, SAS to MiniSAS 1x	2 m	5402	95P4587
	5.5 m	5406	95P4588
SAS Cables, Mini SAS to MiniSAS 1x	2 m	5502	95P4488
	5.5 m	5506	95P4494

Power Cords and Receptacles

Figure 10-1 on page 10-4 shows the plugs that are used by the power cords in Table 10-1 on page 10-4. Match the index number that is beside each plug to the index number in the table.

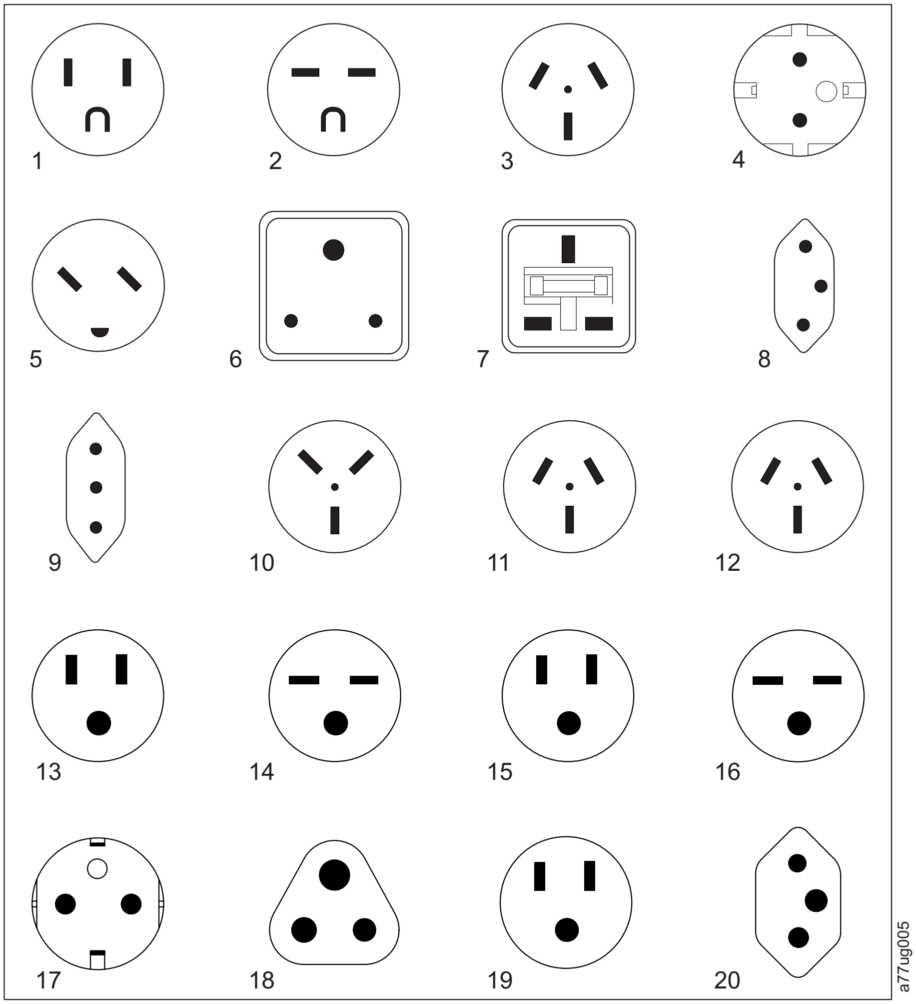


Figure 10-1. Types of Power Cord Receptacles

Table 10-1. Power Cords

Description, Feature Code (FC), and Part Number (PN)	Plug Standard Reference	Country or Region	Index Number in Figure 10-1
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 10-1. 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 10-4
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 10-1. 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 10-4
Denmark • 2.8 m, 250V • FC 9821 • PN 39M5130	DK2-5A	Denmark	5
South Africa • 2.8 m, 250V • FC 9829 • PN 39M5144	SABS 164	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka	6
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 10-1. 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 10-4
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			

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 Tape Drives.

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. If Flag Number 4 is not set, see Error Code 6 in "Drive Error Codes and Messages" on page D-21.

Table A-1. TapeAlert Flags Supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	Description	Action Required
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. If Flag Number 4 is also set, the cartridge is defective. Replace the tape cartridge. If Flag Number 4 is not set, see Error Code 6 in "Drive Error Codes and Messages" on page D-21.
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.
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. If this error occurs on multiple cartridges, see Error Code 6 in "Drive Error Codes and Messages" on page D-21.
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.
20	Clean now	Set when the tape drive detects that it needs cleaning.	Clean the tape drive the section about cleaning drives in the *IBM TotalStorage 3576 Modular Tape Library Setup and Operator Guide*).
21	Clean periodic	Set when the drive detects that it needs routine cleaning.	Clean the tape drive as soon as possible. The drive can continue to operate, but you should clean the drive soon. See the section about cleaning drives in the *IBM TotalStorage 3576 Modular Tape Library Setup and Operator Guide*.
22	Expired clean	Set when the tape drive detects a cleaning cartridge that has expired.	Replace the cleaning cartridge.

Table A-1. TapeAlert Flags Supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	Description	Action Required
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.	If resetting the drive does not recover the error, note the error code on the single-character display and see Error Code 6 in "Drive Error Codes and Messages" on page D-21 for the appropriate instructions.
31	Hardware B	Set when the tape drive fails its internal Power-On Self Tests.	Note the error code on the single-character display and see Error Code 6 in "Drive Error Codes and Messages" on page D-21 for the appropriate instructions.
32	Interface	Set when the tape drive detects a problem with the SCSI, Fibre Channel, or RS-422 interface.	Locate Error Code 8 or 9 in "Drive Error Codes and Messages" on page D-21
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.	See Error Code 6 in "Drive Error Codes and Messages" on page D-21
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 (see "Specifications" on page 2-20).	See Error Code 6 in "Drive Error Codes and Messages" on page D-21
39	Diagnostics required	Set when the drive detects a failure that requires diagnostics for isolation.	See Error Code 6 in "Drive Error Codes and Messages" on page D-21
51	Tape directory invalid at unload	Set when the tape directory on the tape cartridge that was previously unloaded is corrupted. The file-search performance is degraded.	Use your backup software to rebuild the tape directory by reading all the data.
52	Tape system area write failure	Set when the tape cartridge that was previously unloaded could not write its system area successfully.	Copy the data to another tape cartridge, then discard the old cartridge.
53	Tape system area read failure	Set when the tape system area could not be read successfully at load time.	Copy the data to another tape cartridge, then discard the old cartridge.

Table A-1. TapeAlert Flags Supported by the Ultrium Tape Drive (continued)

Flag Number	Flag	Description	Action Required
55	Loading Failure	When loading a tape into the drive, a hardware malfunction can prevent the tape from being loaded, or the tape may get stuck in the drive.	Perform "DR078: Resolve Tape Load/Unload Failure" on page 6-57.
56	Unload Failure	When attempting to unload a tape, a drive hardware malfunction can prevent the tape from being ejected or the tape may be stuck in the drive.	Perform "DR078: Resolve Tape Load/Unload Failure" on page 6-57.

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 *Ultrium Device Drivers Installation and User's Guide* contains information about how to obtain sense data after an error has occurred.

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

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

In addition to device drivers, other methods exist for obtaining sense data and error information. The sections that follow describe alternatives for gathering such information from the IBM AS/400, eServer iSeries, RS/6000®, and eServer pSeries® servers.

Library Sense Data

The following table lists the Additional Sense Codes (ASC) and Additional Sense Code Qualifiers (ASCQ) associated with the reported Sense Keys.

A sense key of 00h (no sense) has no ASC/ASCQ associated with it. A few ASC/ASCQs can be associated with more than one sense key. The sense keys that can give a particular ASC/ASCQ are indicated within the Sense Key column. ASC/ASCQs that can indicate an abnormal element state as part of element descriptor.

Table 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

Table B-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description
Hardware Error (04)	81h	80h	Cannot initialize bar code reader
	81h	81h	No response from bar code reader
	81h	82h	No response from EEPROM
	81h	83h	Slave robotic generic problem
	81h	84h	Setting of gripper pic value failed
	81h	85h	Setting of slider pic value failed
	81h	86h	Setting of elevator pic value failed
	81h	87h	Setting of rotation pic value failed
	81h	88h	Setting of sled pic value failed
	81h	89h	Gripper blocked
	81h	8Ah	Slider blocked
	81h	8Bh	Elevator blocked
	81h	8Ch	Rotation blocked
	81h	8Dh	Sled

81h

81h

81h

81h

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

Table B-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description

Table B-1. Library Sense Keys, ASC and ASCQ (continued)

Sense Key	ASC	ASCQ	Description
Command Aborted (0Bh)	3Fh	0Fh	ECHO buffer overwritten
	43h	00h	SCSI message error
	47h	00h	SCSI parity error
	49h	00h	SCSI invalid message
	4Eh	00h	Overlapped command attempt

Drive Sense Data

LTO Ultrium 4 drives contain hardware which performs user data write encryption and read decryption, protecting all user data written to the medium from unauthorized use, provided it is integrated into a secure system design.

Table 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 04 00 - Cause not reportable - A cartridge is present in the drive, but it is in the process of being unloaded 04 01 - Becoming Ready - A media access command was received during a front panel initiated load or an immediate reported load command 04 02 - Initializing Command Required - A cartridge is present in the drive, but is not logically loaded. A Load command is required 04 03 - Manual Intervention Required - A cartridge is present in the drive but could not be loaded or unloaded without manual intervention 0C 00 - Write Error - A Write operation has failed. This is probably due to bad media, but may be hardware related 14 10 - Not Ready - Auxiliary memory not accessible. The drive is not able to become ready because it is unable to access the Auxiliary Memory in a WORM cartridge. 11 00 - Unrecovered Read Error - A Read operation failed. This is probably due to bad media, but may be hardware related 11 12 - Auxiliary memory read error. The drive reported that it is unable to read the Auxiliary Memory in a WORM cartridge. 14 00 - Recorded Entity Not Found - A space or Locate command failed because a format violation prevented the target from being found. 14 03 - End Of Data not found - A Read type operation failed because a format violation related to a missing EOD data set 1A 00 - Parameter list length error - The amount of parameter data sent is incorrect 20 00 - Invalid Command Operation Code - The Operation Code in the command was not a valid Operation Code 24 00 - Invalid field in CDB - An invalid field has been detected in a Command Descriptor Block 25 00 - LUN not supported - The command was addressed to a non-existent logical unit number 26 00 - Invalid Field in Parameter List - An invalid field has been detected in the data sent during the data phase 27 00 - Write Protect - A Write type operation has been requested on a cartridge which has been write protected 28 00 - Not Ready to Ready Transition - A cartridge has been loaded successfully into the drive and is now ready to be accessed 29 00 - Reset - The drive has powered on, received a reset signal or a bus device reset signal since the initiator last accessed it 2A 01 - Mode Parameters Changed - The Mode parameters for the drive have been changed by an initiator other than the one issuing the command								

Table 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) (Continued) **Byte 12 Byte 13** **ASC ASCQ** 30 00 - Incompatible Media Installed - A write type operation could not be executed because it is not supported on the cartridge type that is loaded. 30 01 - Unknown Format - An operation could not be carried out because the cartridge in the drive is of a format not supported by the drive 30 02 - Incompatible Format - An operation could not be completed because the Logical Format is not correct 30 03 - Cleaning Cartridge Installed - An operation could not be carried out because the cartridge in the drive is a cleaning cartridge 30 07 - Cleaning Failure - A cleaning operation was attempted, but could not be completed for some reason 30 0C - Data Protect - WORM overwrite attempted. The drive rejected a write operation because it would have resulted in an overwrite. Overwrite is not allowed on WORM media. 30 0D - Medium Error - WORM integrity check. The drive rejected a Read or Write operation because the cartridge is a suspicious WORM cartridge. 31 00 - Media format corrupted - Data could not be read because the format on tape is not valid, but is a known format. A failure occurred attempting to write the FID 37 00 - Rounded parameter - A Mode Select command parameter has been rounded because the drive can not store it with the accuracy of the command. 3A 00 - Media Not Present - A media access command has been received when there is no cartridge loaded 3B 00 - Sequential Positioning Error - A command has failed and left the logical position at an unexpected location 3D 00 - Invalid bits in identify Message - An illegal Identify Message has been received at the drive at the start of a command 3E 00 - Logical Unit has not Self-Configured - The drive has just powered on and has not completed its self test sequence and can not process commands 3F 01 - Code Download - The firmware in the drive has just been changed by a Write Buffer command 40 xx - Diagnostic failure - A diagnostic test has failed. The xx (ASCQ) is a vendor specific code indicating the failing component. 43 00 - Message Error - A message could not be sent or received due to excessive transmission errors 44 00 - Internal target failure - A hardware failure has been detected in the drive that has caused the command to fail 45 00 - Select/Reset Failure - An attempt to reselect an initiator in order to complete the command has failed 4B 00 - Data Phase Error - A command could not be completed because too many parity errors occurred during the Data phase 4E 00 - Overlapped Commands - An initiator selected the drive even though it already had a command outstanding in the drive 50 00 - Write Append Error - A write type command failed because the point at which to append data was unreadable 51 00 - Erase failure - An Erase command failed to erase the required area on the media								

Table 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) (Continued) **Byte 12 Byte 13** **ASC ASCQ** 52 00 - Cartridge fault - A command could not be completed due to a fault in the tape cartridge 53 00 - Media Load/Eject Failed - (Sense Key 03) An attempt to load or eject the cartridge failed due to a problem with the cartridge. 53 00 - Media Load/Eject Failed - (Sense Key 04) An attempt to load or eject the cartridge failed due to a problem with the drive 53 02 - Media Removal Prevented - An Unload command has failed to eject the cartridge because media removal has been prevented 5D 00 - Failure Prediction Threshold - Failure Prediction thresholds have been exceeded indicating that a failure may occur soon 5D FF - Failure Prediction False - A Mode Select command has been used to test for Failure Prediction system. 82 82 - Drive requires cleaning - The drive has detected that a cleaning operation is required to maintain good operation 82 83 - Bad Code Detected - The data transferred to the drive during a firmware upgrade is corrupt or incompatible with drive hardware							

Table 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) (Continued) **Byte 12 Byte 13** **ASC ASCQ** **Sense Key 0 (No Sense)** EE 13 - Encryption - Key Translate EF 13 - Encryption - Key Translate EKM **Sense Key 3 (Medium Error)** 30 02 - Encryption - Encryption feature is not enabled so format/processing is not supported EE 60 - Encryption - Proxy Command Error EE D0 - Encryption - Data Read Decryption Failure EE D1 - Encryption - Data Read after Write Decryption Failure EE E0 - Encryption - Key Translation Failure EE E1 - Encryption - Key Translation Ambiguous EE F0 - Encryption - Decryption Fenced (Read) EE F1 - Encryption - Encryption Fenced (Write) **Sense Key 4 (Hardware Error)** EE 0E - Encryption - Key Service Timeout EE 0F - Encryption - Key Service Failure 40 00 - Encryption - Failure Hardware, POST or Module Failure **Sense Key 5 (Illegal Request)** EE 00 - Encryption - Key Service Not Enabled EE 01 - Encryption - Key Service Not Configured EE 02 - Encryption - Key Service Not Available EE 10 - Encryption - Key Required EE 20 - Encryption - Key Count Exceeded EE 21 - Encryption - Key Alias Exceeded EE 22 - Encryption - Key Reserved EE 23 - Encryption - Key Conflict EE 24 - Encryption - Key Method Change EE 25 - Encryption - Key Format Not Supported EE 26 - Encryption - Unauthorized Request - dAK EE 27 - Encryption - Unauthorized Request - dSK EE 28 - Encryption - Unauthorized Request - eAK EE 29 - Encryption - Authentication Failure EE 2A - Encryption - Invalid RDKi EE 2B - Encryption - Key Incorrect EE 2C - Encryption - Key Wrapping Failure EE 2D - Encryption - Sequencing Failure EE 2E - Encryption - Unsupported Type EE 2F - Encryption - New Key Encrypted Write Pending EE 30 - Encryption - Prohibited Request EE 31 - Encryption - Key Unknown EE 42 - Encryption - EKM Challenge Pending EE E2 - Encryption - Key Translation Disallowed EE FF - Encryption - Security Prohibited Function EF 01 - Encryption - Key Service Not Configured 26 11 - Encryption - Incomplete Key - Associate Data Set 26 12 - Encryption (T10) - Vendor Specific Reference Key Not Found 55 08 - Encryption (T10) - Maximum Number of Supplemental Keys Exceeded							

Table B-2. LTO Tape Drive Sense Data (continued)

Byte	Bit Address or Name							
	7	6	5	4	3	2	1	0
12-13	**Sense Key 6 (Unit Attention)** EE 12 - Encryption - Key Change Detected EE 18 - Encryption - Changed (Read) EE 19 - Encryption - Changed (Write) EE 40 - Encryption - EKM Identifier Changed EE 41 - Encryption - EKM Challenge Changed EE 50 - Encryption - Initiator Identifier Changed EE 51 - Encryption - Initiator Response Changed 2A 11 - Encryption - Data Encryption Parameters Changed by Another I_T Nexus 2A 12 - Encryption - Data Encryption Parameters Changed by Vendor Specific Event **Sense Key 7 (Data Protect)** EF 10 - Encryption - Key Required EF 11 - Encryption - Key Generation EF 13 - Encryption - Key Translate EF 1A - Encryption - Key Optional EF C0 - Encryption - No Operation 26 10 - Encryption - Data Decryption Key Fail Limit 2A 13 - Encryption - Data Encryption Key Instance Counter Has Changed 74 00 - Security Error 74 01 - Encryption - Unable to Decrypt Data 74 02 - Encryption - Unencrypted Data Encountered While Decrypting 74 03 - Encryption - Incorrect Data Encryption Key 74 04 - Encryption - Cryptographic Integrity Validation Failed 74 05 - Encryption - Error Decrypting Data							
14	FRU code							
15	SKSV	C/D	Reserved		BPV When set to 1, the bit pointer is valid.	Bit pointer		
16 -17	SKSV = 0: First Error Fault Symptom Code (FSC). SKSV = 1: Field Pointer							
18-19	First Error Flag Data							
20	Reserved (0)							
21					CLN	Reserved	Reserved	VolValid
22-28	Volume Label							
29	Current Wrap							
30-33	Relative LPOS							
34	SCSI Address							
35	Frame number				Drive number			

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

Note:

1. The Error Code field (Byte 0) is set to 70h to indicate a current error, that is one associated with the most recently received command. It is set to 71h to indicate a deferred error which is not associated with the current command.
2. The segment number (Byte 1) is zero since the Copy, Compare, and Copy and Verify commands are not supported.
3. The File Mark flag (Byte 2, bit 7) is set if a Space, Read, or Verify command did not complete because a file mark was read.
4. The End of Media (EOM) flag (Byte 2, bit 6) is

Appendix C. Library Diagrams

The library power system includes redundant +48 VDC power supplies with current sharing outputs. The same power system is used in both control modules (CM) and expansion module (EM). The redundant configuration power supplies may be hot swapped without interrupting library operation. Each supply in a CM and EM includes its own input AC line cord. During redundant operation, each supply carries one-half the power load. If a line cord or power supply fails, the second supply sources the complete power load. Optionally, a single power supply and line cord may be installed if redundant power is not required. The second power supply slot is physically covered in this configuration. The library may be upgraded to redundant power at a later time.

The power supply output voltage tolerance is from 48.2 to 53.0 volts. The power supply has an over voltage shut down set at 59 volts providing a 1 volt margin below the maximum allowable UL low voltage limit of 60 volts.

Library power is controlled in two places. A switch on the rear of each power supply shuts down power at the input of the individual power supplies. A front panel power enable switch controls the power supply output for all CM and EM power supplies. A library connected to AC line voltage will be in standby mode with power supply on but outputs turned off when the front panel power enable switch is turned off. When the power enable switch is turned on, the power supply output and the library electronics power are on. The Library Control Blade (LCB) may turn the power system off using the PC interface.

Power Requirements

The tables below summarizes the library power requirements. Each library modules uses a 350 watt power supply. Two 350 watt supplies are used when redundant power is selected.

Table C-1. Control module (CM) power requirements

Item	Volts	Amps	DC Watts	AC Watts
Servo PCB			9.41	11.07
Accessor Motors	48	4*0.75	144	169.41
Door/Display			11.76	13.84
Drive Sleds - 2x50			100	117.65
Drive Sled 1x1 (10w)			20	23.5
LCB			47.06	55.36

Table C-1. Control module (CM) power requirements (continued)

- Receives power and monitors the power supply status using the I^2C (inter-integrated) interface to report any error conditions
- Controls the user interface (LCD display and touch screen) and input/output (I/O) station via the DIEB
- Controls media movement and monitors tape drive status

Backplane Connect Boards (BCBs)

The Backplane Connect Board (BCB) is an interconnect device for various library components. BCBs are found in both the control module and any expansion module. There are three versions of BCB:

- BCB1 - control module
- BCB3 - 9U expansion module

The "Control Module and Expansion Module Electrical System" on page C-6 illustrates the key communication and power paths between BCB boards and other library components:

- LCB1 attaches to the BCB1 board
- BCB1 carries signals from the LCB1 to the servo control and motor driver board (SMD1)
- The drive and display board (DIEB) signals from the I/O Station pass through the BCB1 to the LCB1. BCB2 and BCB3 function similarly in supporting the expansion module's I/O Station.
- The door and display board (DIEB) signals from the I/Oh the BCB1CB1C2 and BCB3 function similarly in supporting the expansion module's I/O Station.

Power Supplies

There is always at least one power supply in the control module, which provides _48 volts DC power to the library. If there is one or more drives in the expansion module, then this module also must have a power supply. Each module's power supply consists of an AC cable supplying electrical current from a wall outlet and a +48 V DC power supply. The power supply in the control module powers all library components within the control module including its drives. The expansion module's power supply provides power for the drives and BCB boards within the expansion module.

In the control module, the power supply's rear panel switch provides power to the library. This power supply connects with the BCB1 board in the library, which interconnects with the LCB1 in communicating the library's power status. The BCB1 board in the control module channels power to the Servo & Motor Driver Boards (SMD1 & SMD2), which operate the robotics assembly. The power supplies in both the control and expansion modules connect with that module's Drive Sled Interconnect Board (DSIB) in providing power to the drive sleds.

The control module's front power enable switch is located near the operator panel on the front of the library. It is connected to the Door & Import/Export Board (DIEB), which is only found in the control module. This front power switch enables power to the operator panel interface and the library firmware and robotics assembly. The control module's power supply provides power to the DIEB via the BCB interconnect.

Servo & Motor Driver Boards (SMDs)

There are two Servo & Motor Driver Boards (SMDs) in the control module that perform key functions in operating the robotics assembly for selecting and moving barcode labeled cartridges. The SMD1 board is a logical device that communicates with the LCB1 in moving media within the library. The SMD2 board is an interconnect device between the SMD1 board and the barcode scanner and sensors. This topic further describes these SMD boards.

The SMD1 board controls and drives the 4 motors of the library robotics:

- • X motor - controls horizontal motion
- • Y motor - controls vertical motion
- • Theta motor - pivots the picker assembly for media selection
- • Reach motor - extends and contracts the picker arm assembly in moving media into and out of a slot or drive

Note: Although the X, Y, and Theta (pivot) motors can move concurrently, the reach motor cannot operate while other motors operate.

The picker assembly contains the X, Theta, and Reach motors. Also, the picker assembly contains the SMD1 and SMD2 boards as well as the barcode scanner and target sensors.

The motion processor chip is the ”heart” of the SMD1 board, performing these functions:

- • This chip supports the 4 servo motion axes using AC brushless motors, which extend the library’s life over motors with brushes.
- • It controls the motion velocity and acceleration and calculates the trajectory for moving media.
- • A barcode scanner connected to SMD1 via the SMD2 interconnect card allows reading cartridge barcodes and specifies the EM type barcode (5U or 9U). The SMD1 controls the barcode scanner and receives barcode label data.
- • It417.2769Tm(data.)Tj/F21Tf0.088513312.3099Tm()Tj/F71Tf9.978009.97838017507312.3099Tmartgg

ﬁThe

- • Controls the local (operator panel) interface.
- • Interfaces the LCB1 with the LCD touch-screen interface.
- • Controls the import/export station using the I2C interface with the LCB1. Then the LCB1 registers output to control the on-board buzzer that provides audio feedback for the library operator.
- • The DIEB as well as the LCB1 provide critical environmental monitoring.
- • Sends voltage information to the LCB1 using the I2C interface. This interface also reads the card's version to identify existing hardware and firmware version. Then if hardware changes, the firmware can be updated too.
- • Power conversion hardware on DIEB converts the +48 VDC input voltage to the required voltage levels of components on this board.
- • The front panel power switch interfaces with the control module's Backplane Connect Board (BCB1), providing power for enable/disable commands.

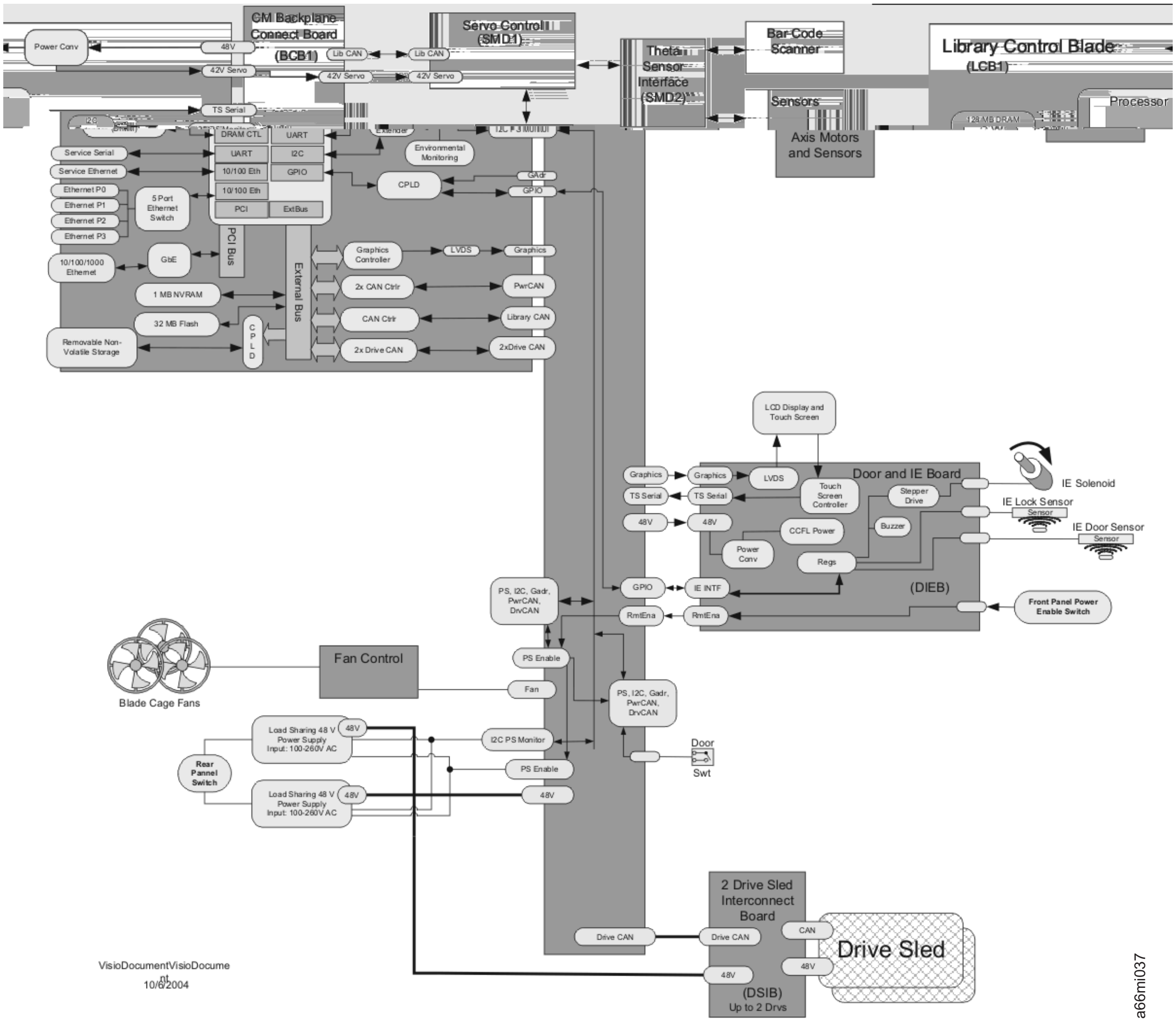
Drive Sled Interconnect Board (DSIB)

The Drive Sled Interconnect Board (DSIB) functions as an interconnect board between drive sleds and the library for power and drive communications. A DSIB board is required in all modules, regardless of whether the module contains drive sleds. The Predator library only supports full-height drive slots, such as LTO drives.

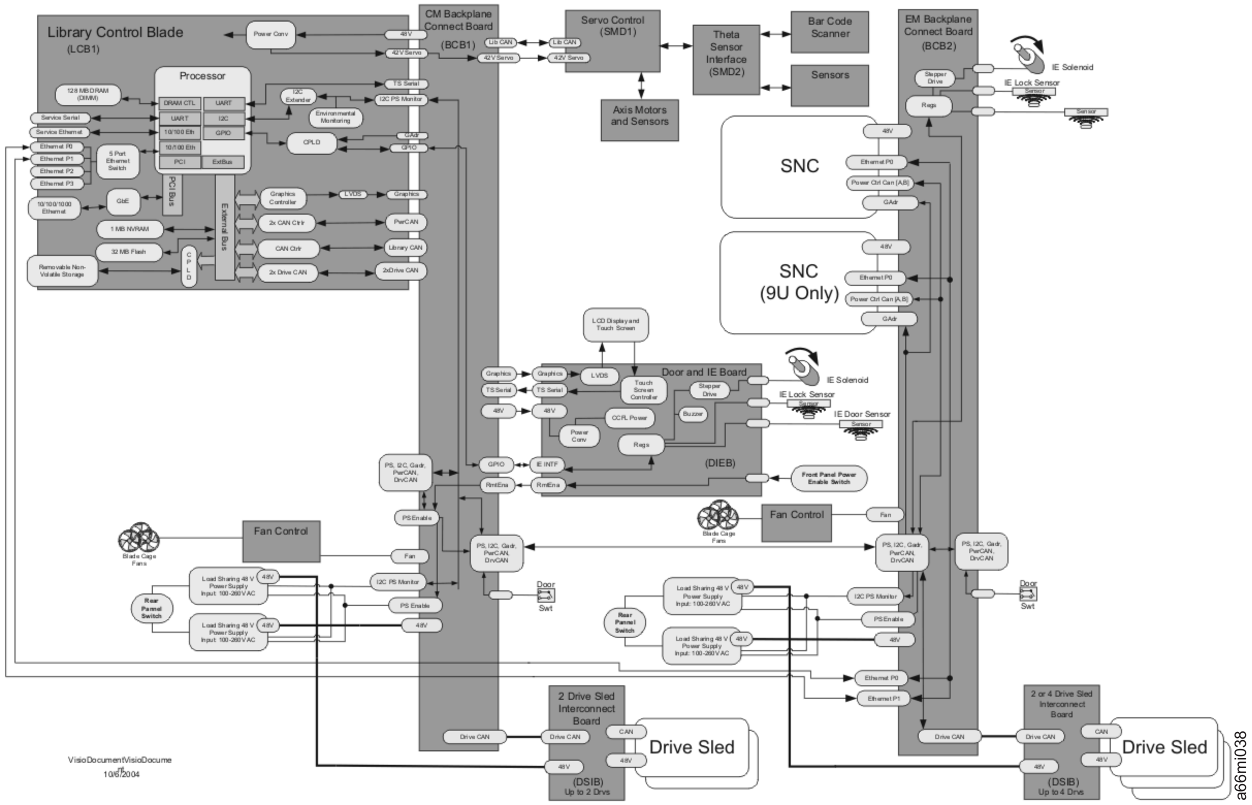
Here are some considerations regarding the DSIB:

- • Connects with the LCB1 in receiving tape drive commands and routing status and error messages, with signals being routed through the BCB1 (control module) or BCB2/BCB3 (expansion module).
- • Drive input power is supplied from the module power supply and current is limited on the DSIB.
- • There are two versions of DSIB boards:
  - o DSIB1 supports 2 drive sleds and is utilized in the 5U CM.
  - o DSIB2 supports 4 drive sleds and is utilized in the 9U EM.
  - o For a 14U library with 6 drive sleds, both DSIB1 and DSIB2 boards are required.

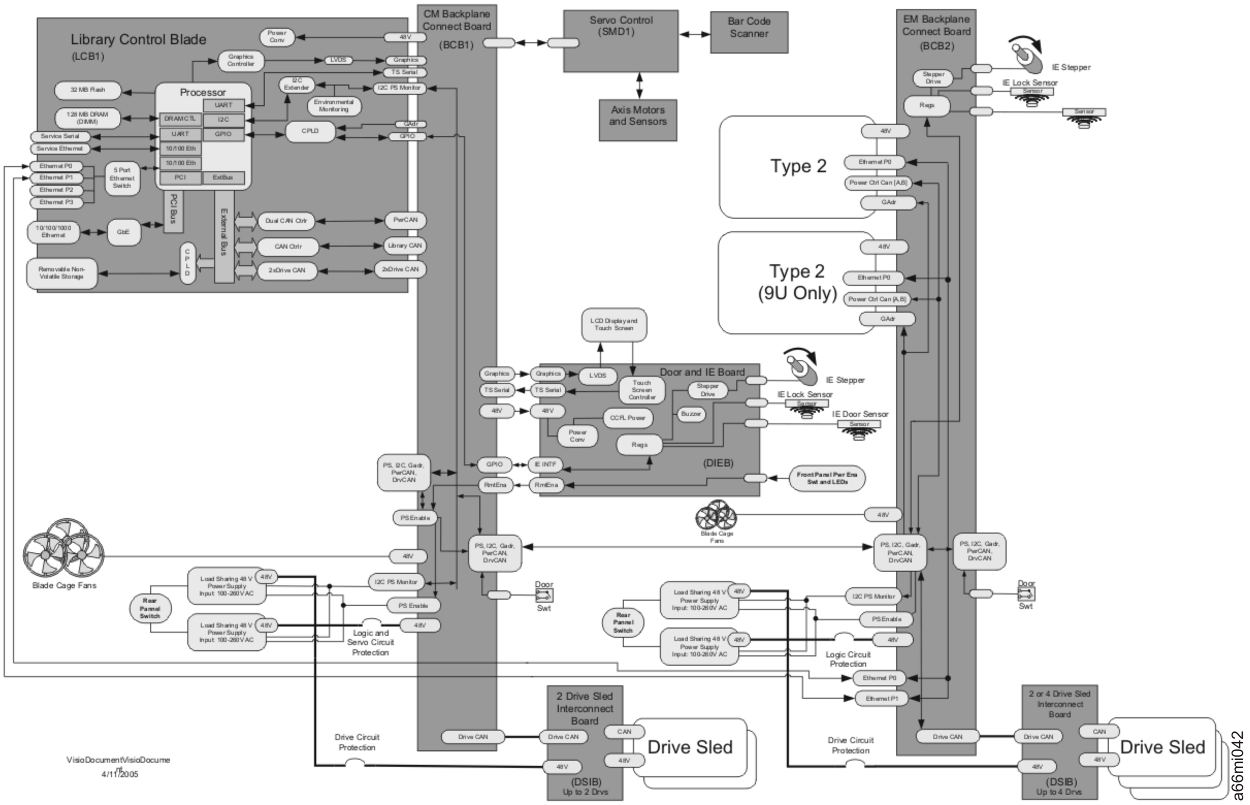
Control Module Electrical System



Control Module and Expansion Module Electrical System

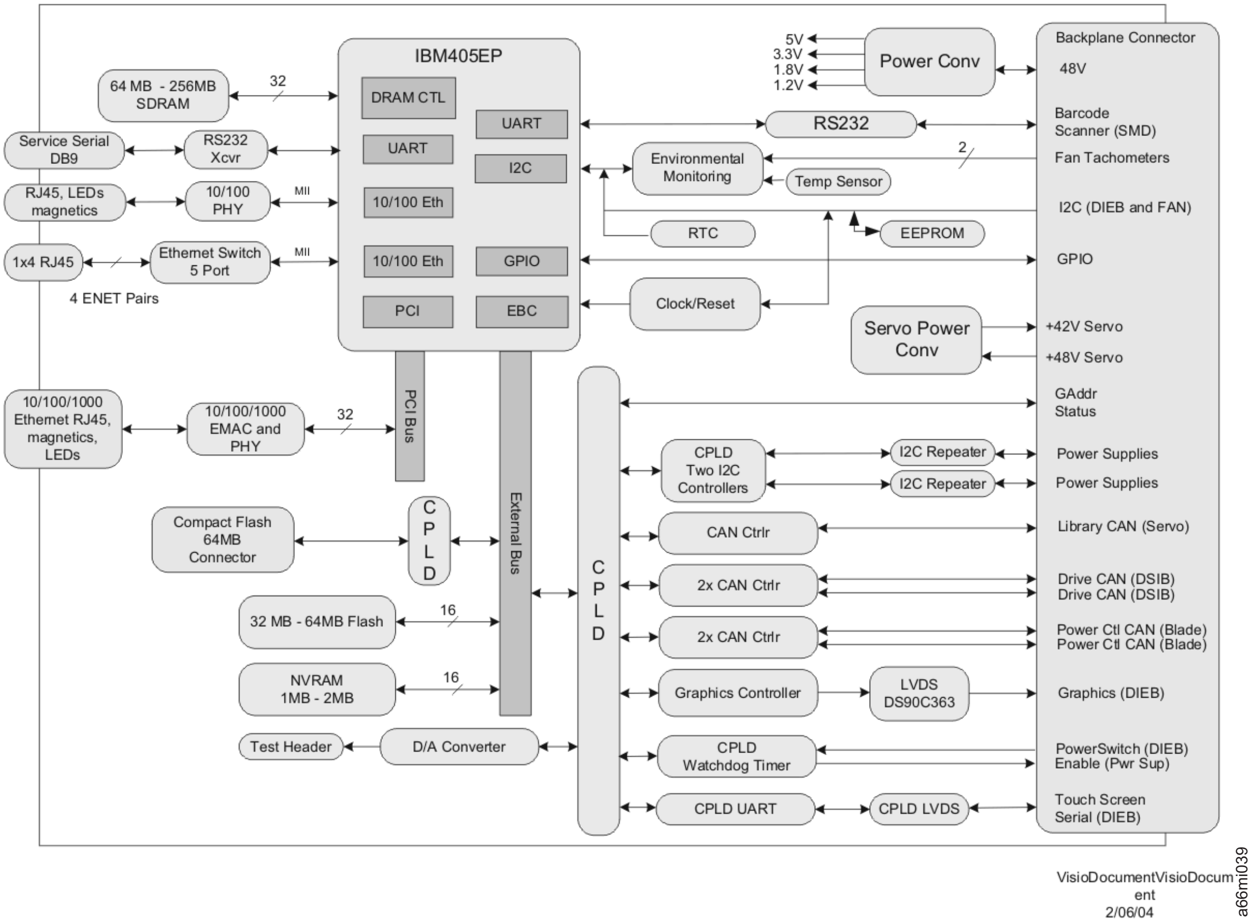


Library Electrical Block

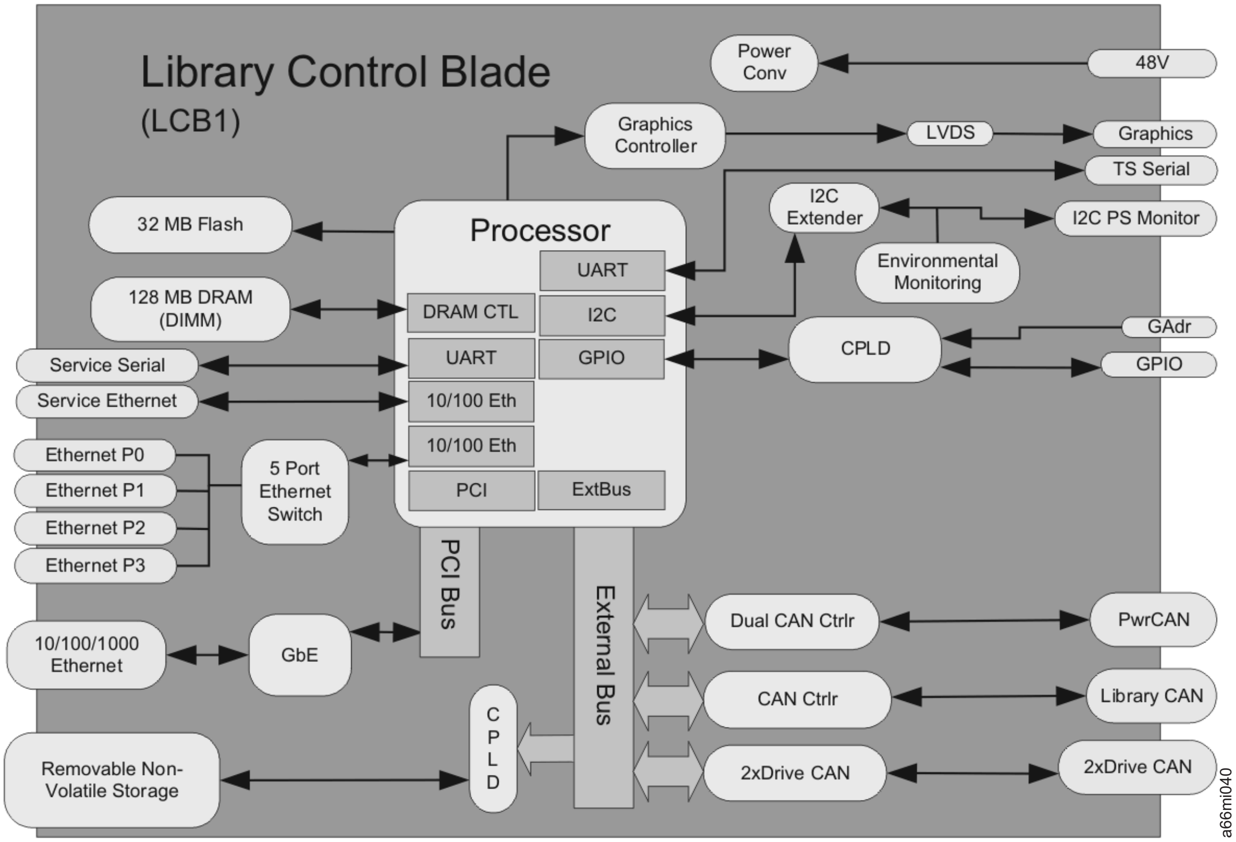


Library Control Blade

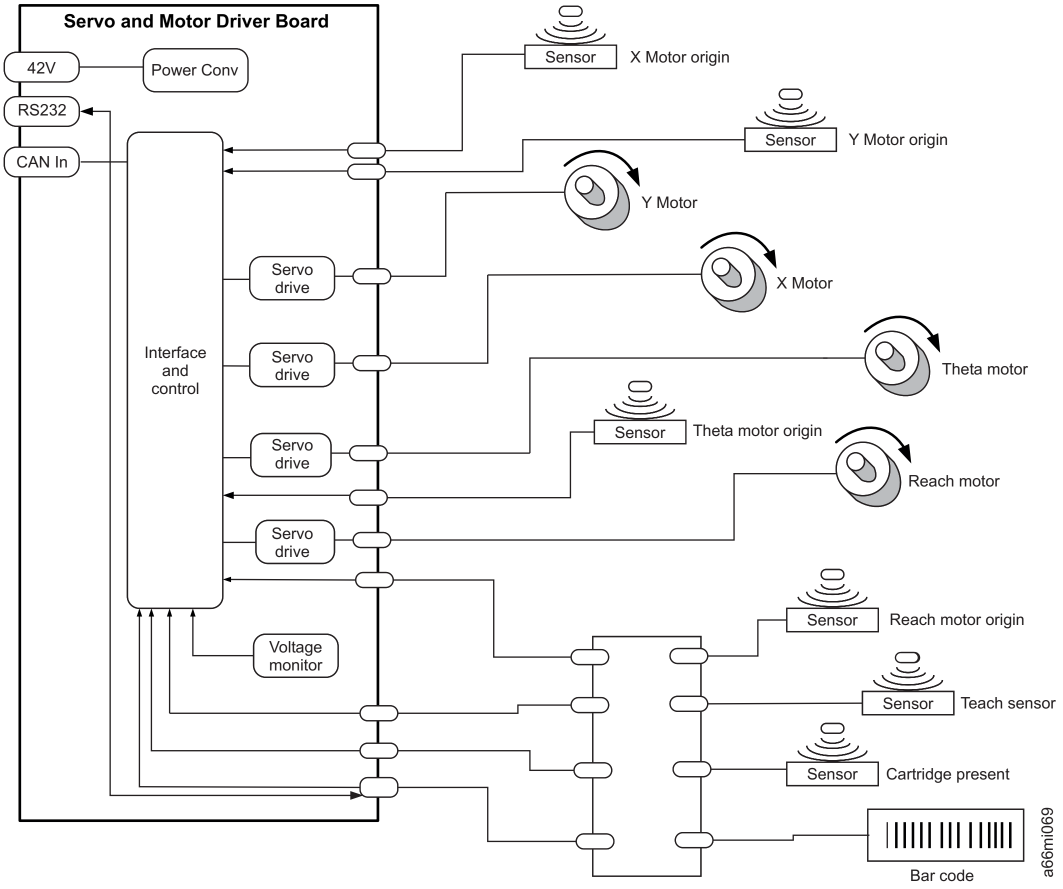
Library Control Blade



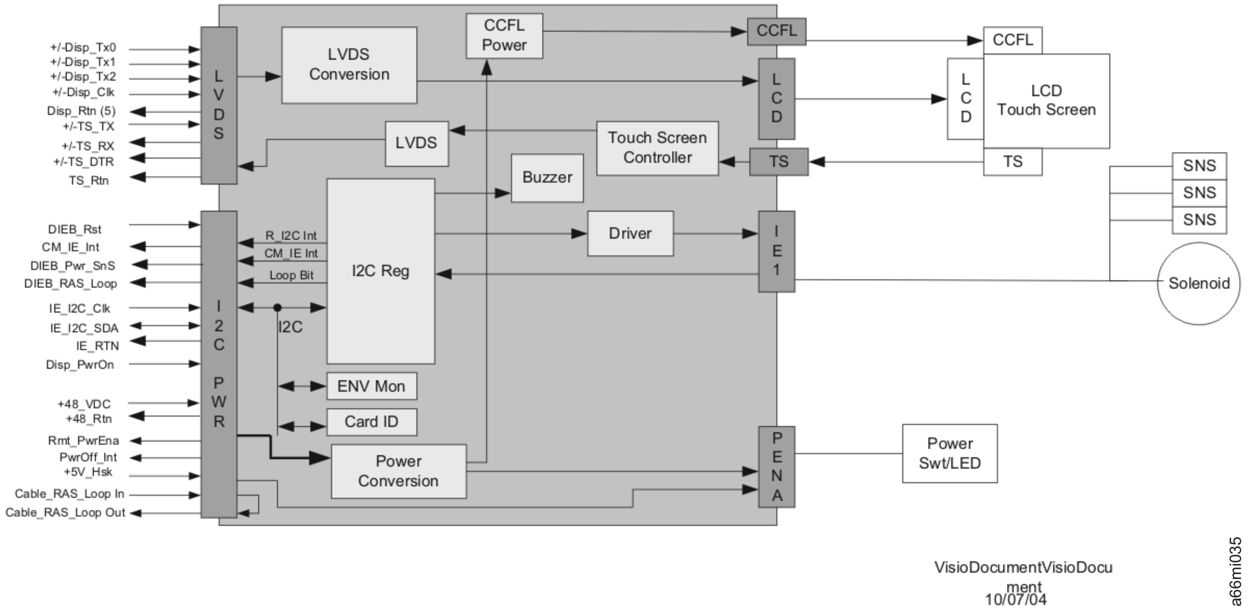
Library Control Blade Functions



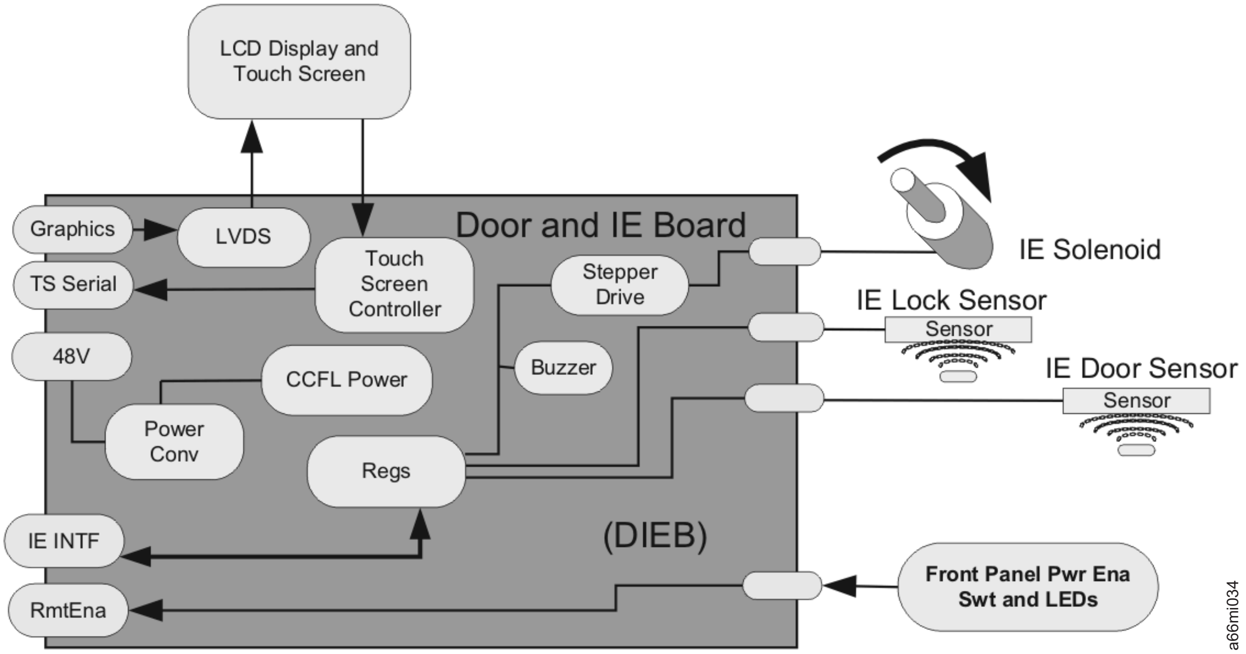
Accessor Control Block



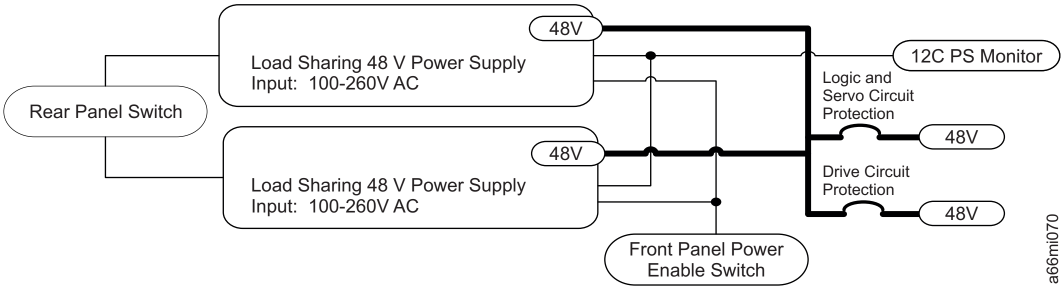
Door and Import/Export Board (DIEB)



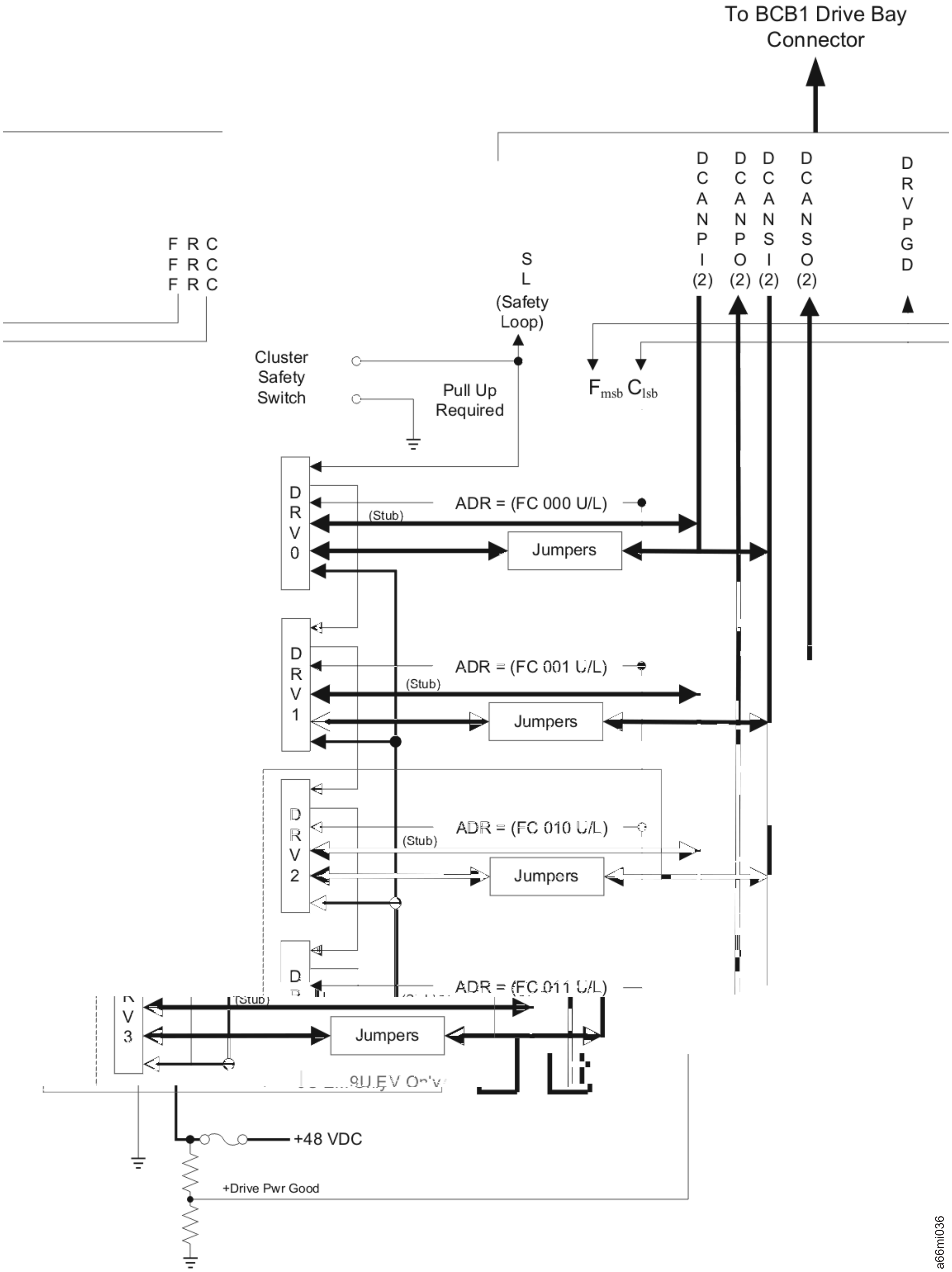
Door and Display Block



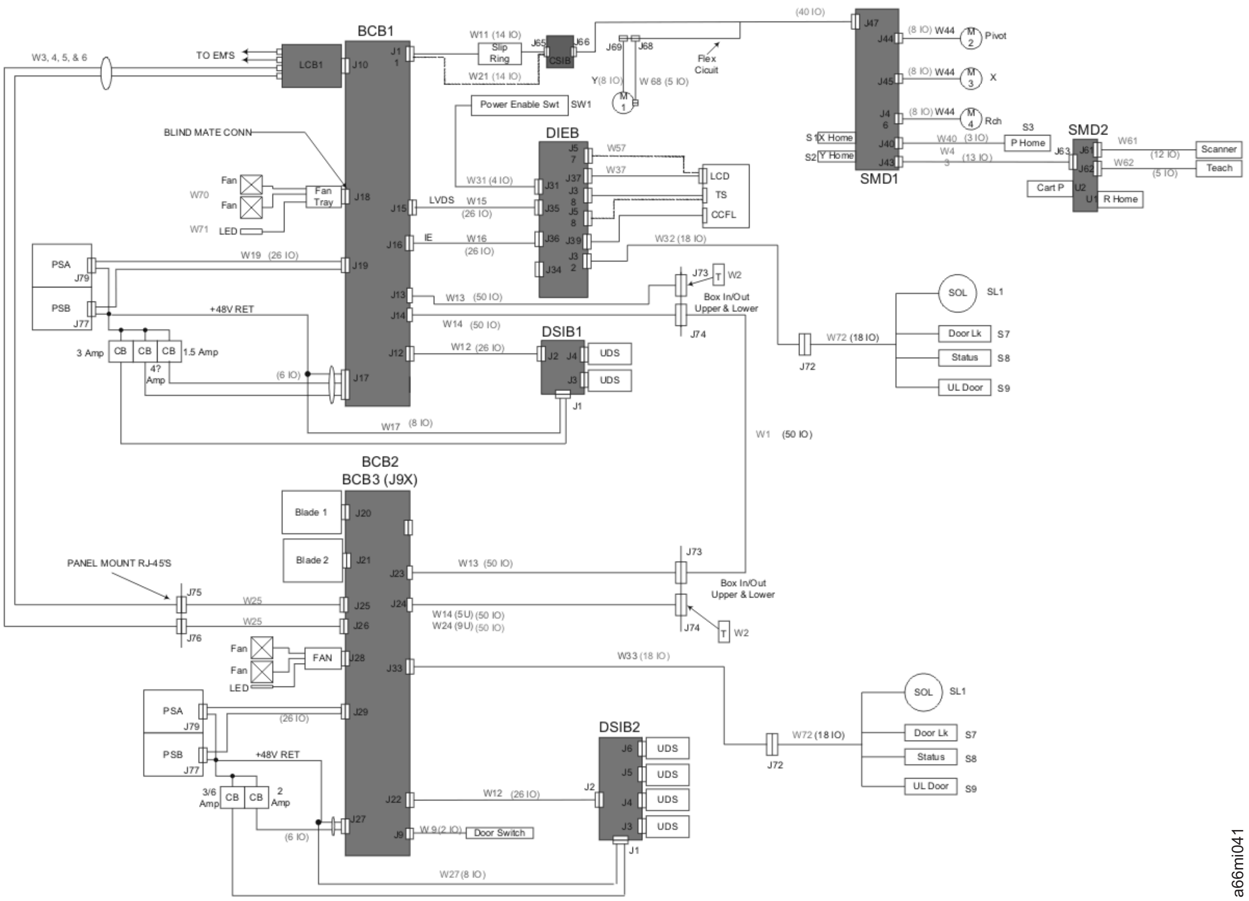
Power System Block Diagram



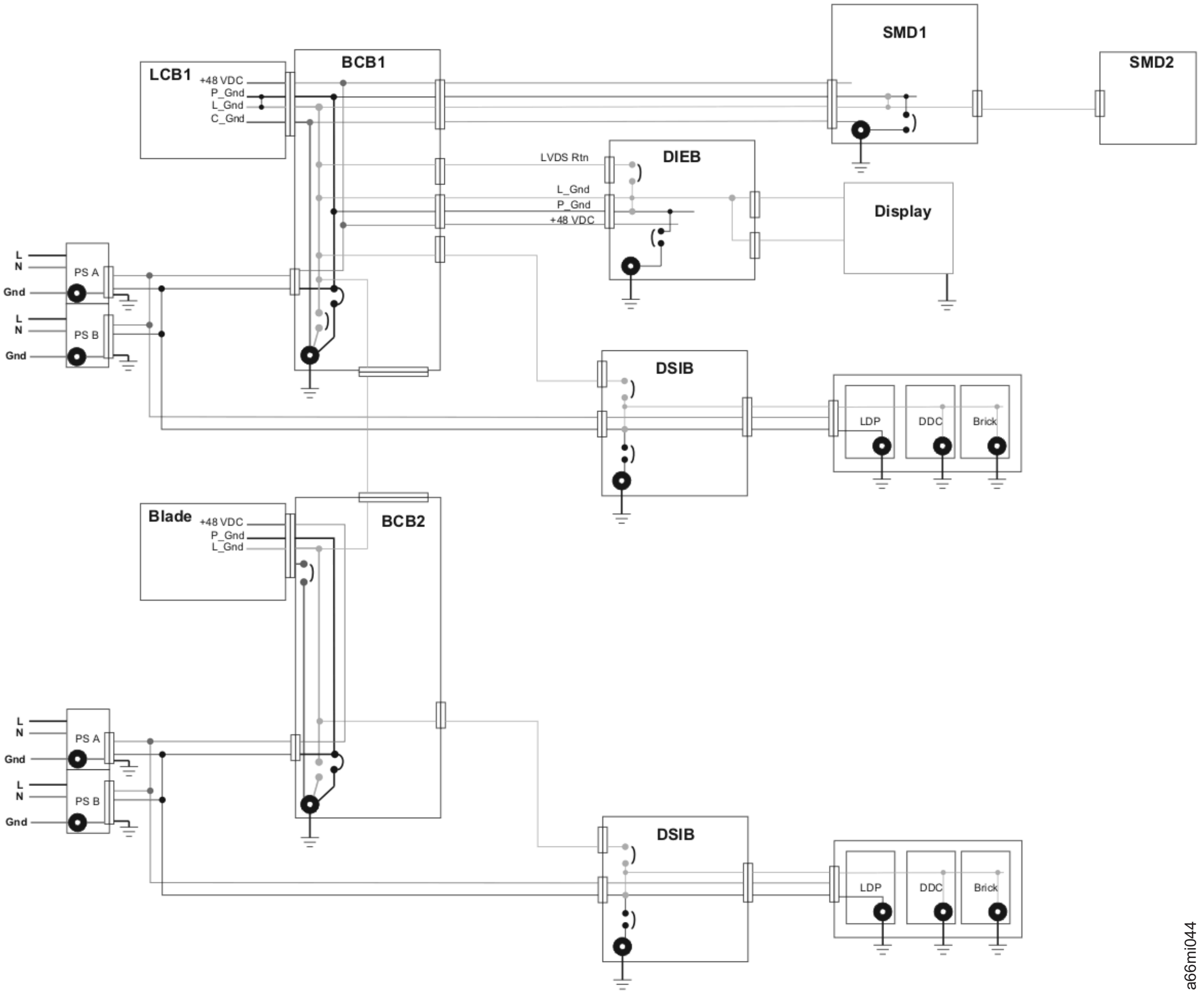
Drive Sled Interconnect Board (DSIB)


To BCB1 Drive Bay Connector
F R C
F R C
F R C
S L (Safety Loop)
D C A N P I (2)
D C A N P O (2)
D C A N S I (2)
D C A N S O (2)
D R V P G D
Cluster Safety Switch
Pull Up Required
F_{msb} C_{lsb}
DRV 0
ADR = (FC 000 U/L)
(Stub)
Jumpers
DRV 1
ADR = (FC 001 U/L)
(Stub)
Jumpers
DRV 2
ADR = (FC 010 U/L)
(Stub)
Jumpers
ADR = (FC 011 U/L)
V 3
(Stub)
Jumpers
+48 VDC
+Drive Pwr Good
a66mi036

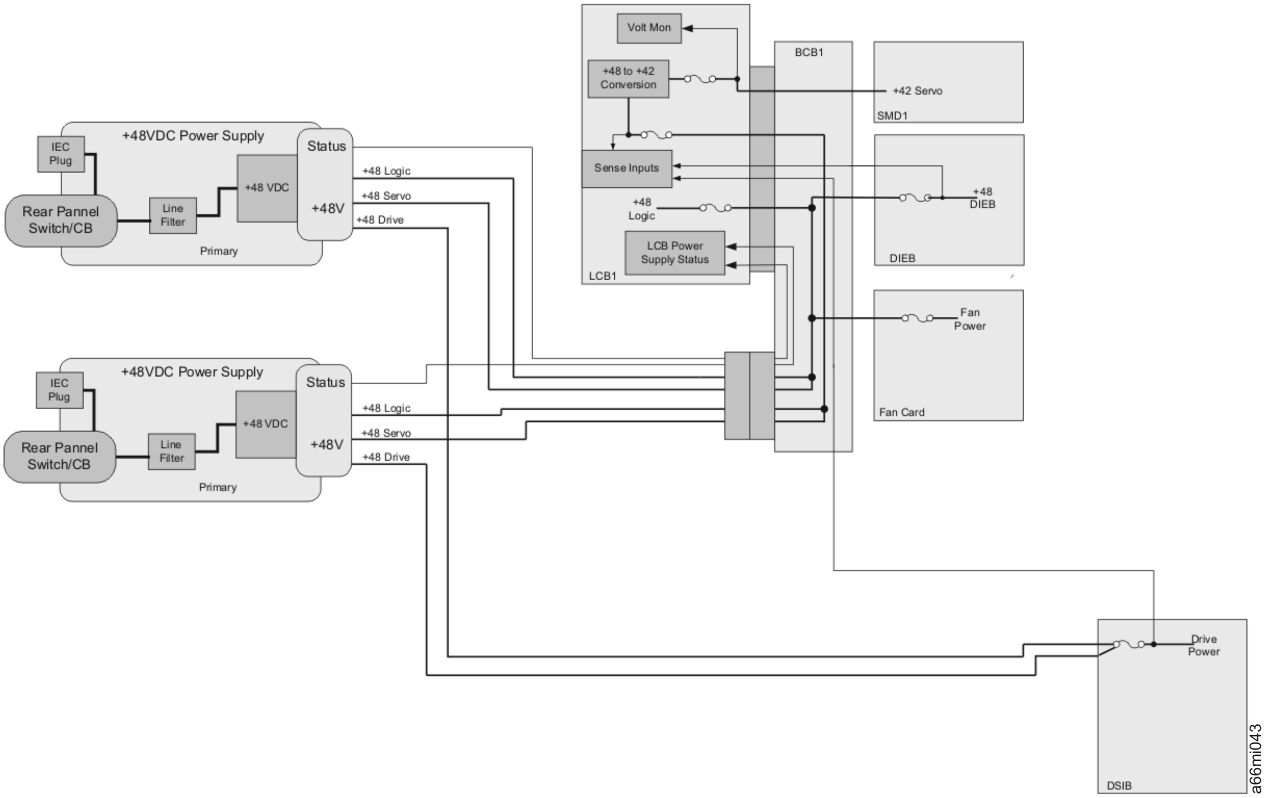
Library Cables



Library System Grounding



Library Power System


Volt Mon
+48 to +42 Conversion
BCB1
+42 Servo
SMD1
Sense Inputs
+48 Logic
LCB Power Supply Status
LCB1
+48 DIEB
DIEB
Fan Power
Fan Card
+48VDC Power Supply
IEC Plug
Rear Pannel Switch/CB
Line Filter
+48 VDC
Status
+48V
+48 Logic
+48 Servo
+48 Drive
Primary
+48VDC Power Supply
IEC Plug
Rear Pannel Switch/CB
Line Filter
+48 VDC
Status
+48V
+48 Logic
+48 Servo
+48 Drive
Primary
Drive Power
DSIB
a66mi043

Appendix D. Using Ultrium Drives

The 3576 Tape Library supports Ultrium SCSI, SAS, and Fibre Channel tape drives.

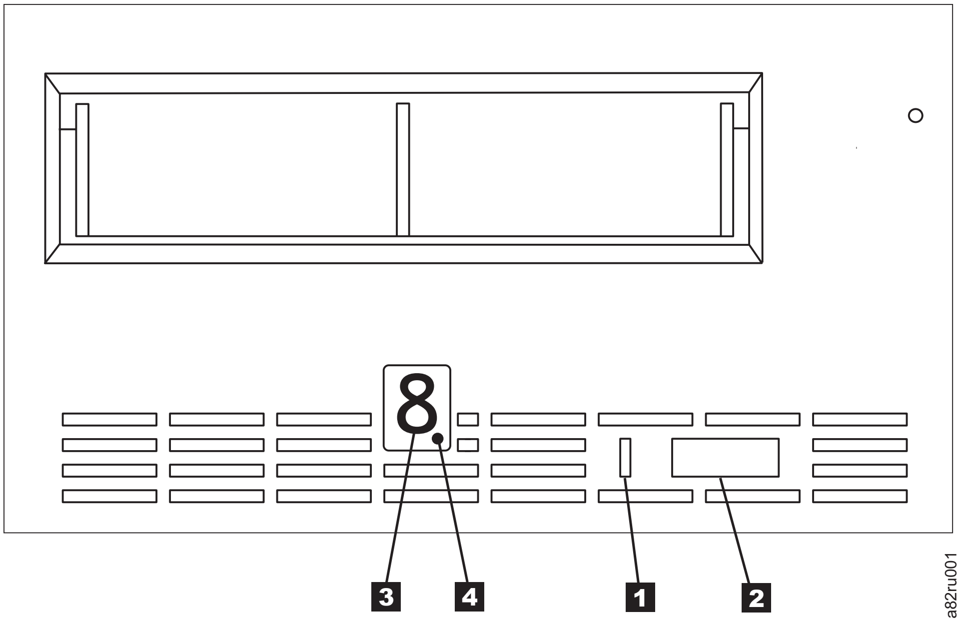


Figure D-1. Front panel of the drive

1	Status Light	**3**	Single-character Display (SCD)
2	Unload Button	**4**	SCD Dot

Single-character Display (SCD)

The Single-character Display (SCD) (**3** in Figure D-1) presents a single-character code for:

- Error conditions and informational messages
- Diagnostic or maintenance functions (while in maintenance mode only)

"Drive Error Codes and Messages" on page D-21 lists the codes for error conditions and informational messages. If multiple errors occur, the code with the highest priority (represented by the lowest number) displays first. When the error is corrected, the code with the next highest priority displays, and so on until no errors remain.

"Diagnostic and Maintenance Functions" on page D-6 lists the single-character codes that represent diagnostic or maintenance functions. To initiate a function the unit must be in maintenance mode.

The SCD is blank during normal operation.

SCD Dot

If a drive dump is present while the drive is in maintenance mode, a single red dot illuminates in the lower right corner of the SCD (**4** in Figure D-1 on page D-1). To copy the dump, see "Function Code 5: Copy Drive Dump" on page D-11.

The SCD Dot is on solid if the dump is in ROM memory. The SCD Dot flashes if the dump is in FLASH memory.

The SCD Dot turns off when you obtain a dump (by using ITDT, a library command, or a SCSI command) or update the drive firmware.

Note: If the drive dump is stored in ROM memory (SCD Dot on solid), the dump will be lost when you turn OFF the power or reset the drive.

Status Light

The Status Light (**1** in Figure D-1 on page D-1) is a light-emitting diode (LED) that provides information about the state of the drive. The light can be green or amber, and (when lit) solid or flashing. Table D-1 lists the conditions of the Status Light and Single-character Display (SCD) and provides an explanation of what each condition means.

Table D-1. Meaning of Status Light and Single-character Display (SCD)

If the Status Light is...	and the SCD is...	Meaning
Off	Off	The drive has no power or is powered off.
Green	Off	The drive is powered on and in an idle state.
Flashing Green	Off	The drive is reading from the tape, writing to the tape, rewinding the tape, locating data on the tape, loading the tape, or unloading the tape.
Flashing Green	Off	The drive contains a cartridge during the power-on cycle. In this case, the drive completes POST and slowly rewinds the tape (the process may take up to ten minutes). The light stops blinking and becomes solid when the drive completes the recovery and is ready for a read or write operation. To eject the cartridge, press the unload button.
Flashing Amber	Displaying Error Code	The drive is displaying error code(s) from the error code log on the SCD. For more information, see "Function Code 9: Display Error Code Log" on page D-14 and "Diagnostic and Maintenance Functions" on page D-6.
Amber	Red numbers, letters, or segments	During the power-on/initialization and POST (Power-On Self Test), the SCD briefly displays 8, then becomes blank (not lit) when POST is complete and there are no POST errors. If a POST error has been detected, an error code will be displayed in the SCD and the Status Light will flash amber.

Table D-1. Meaning of Status Light and Single-character Display (SCD) (continued)

If the Status Light is...	and the SCD is...	Meaning
Amber	Flashing 0	The drive is exiting from maintenance mode. For more information, see "Function Code 0: Maintenance Mode" on page D-8.
Amber	Flashing selected function	The drive is executing the selected function while in maintenance mode.
Flashing Amber once per second	Displaying error code	An error occurred and the drive or media may require service, or it may require cleaning. Note the code on the SCD, then go to "Diagnostic and Maintenance Functions" on page D-6 to determine the action that is required.
Flashing Amber once per second	Displaying C	The drive needs cleaning.
Flashing Amber twice per second	Displaying Function Code 2 or Off	The drive is updating firmware.[1] The SCD will display a 2 if using an FMR cartridge. The SCD will be off if using the SCSI, SAS, or Fibre Channel interface. For more information, see "Methods of Updating Firmware" on page 7-15.
Flashing Amber twice per second	Off	The drive detected an error and is performing a firmware recovery. It will reset automatically.
Flashing Amber twice per second	Flashing C	The drive is requesting a cartridge to be loaded.
Flashing Amber twice per second	Off	There is a drive dump in flash memory.

[1] Power should not be removed from the drive until the microcode update is complete. The drive indicates that the update is complete by resetting and performing POST.

Unload Button

The Unload Button (**2** in Figure D-1 on page D-1) performs the following functions:

Table D-2. Functions that the Unload Button performs

Unload Button Function	How to Initiate the Function
Rewind the tape into the cartridge and eject the cartridge from the drive	Press the Unload Button once. The Status Light flashes green while the drive is rewinding and unloading. **Note:** During a rewind and eject operation, the drive does not accept SCSI commands from the server.

Table D-2. Functions that the Unload Button performs (continued)

Unload Button Function	How to Initiate the Function
Place the drive in maintenance mode	Ensure that the drive is unloaded. Then, within two seconds, press the Unload Button three times. The drive is in maintenance mode when the Status Light becomes solid amber and 0 appears in the SCD. **Note:** While in maintenance mode, the drive does not accept SCSI interface commands.
Scroll through the maintenance functions	While in maintenance mode, press the Unload Button once per second to increment the display characters by one. When you reach the character of the diagnostic or maintenance function that you want (see "Diagnostic and Maintenance Functions" on page D-6), press and hold the Unload Button for three seconds.
Exit maintenance mode	Press the Unload Button once per second until 0 displays. Then press and hold the Unload Button for three seconds. Maintenance mode is exited when the Status Light becomes solid green and the SCD becomes blank.
Force a drive dump (part of the maintenance mode)	**Attention:** If the drive detects a permanent error and displays an error code, it automatically forces a drive dump (also known as a save of the firmware trace). If you force a drive dump, the existing dump will be overwritten and data will be lost. After you force a drive dump, do not turn off the power to the drive or you may lose the dump data. Choose one of the following procedures: • If the drive is in maintenance mode (Status Light is solid amber), refer to "Function Code 4: Force a Drive Dump" on page D-11. • If the drive is in operating mode (Status Light is solid or flashing green), press and hold the Unload Button for ten seconds. If captured dump data exists, the drive places it into a dump area.
Reset the drive	Press and hold the Unload Button until the drive begins the reset procedure (SCD will display random patterns and the Status Light will be amber) **Note:** If a tape cartridge is loaded in the drive the drive will unload the tape. Repeat the ″Reset the drive″ procedure after the tape is unloaded. The drive saves a dump of the current drive state, then reboots to allow communication. Do not cycle power as this will erase the contents of the dump.

Inserting a Tape Cartridge

To insert a tape cartridge:

1. Ensure that the drive is powered-on.
2. Ensure that the write-protect switch on the tape cartridge is properly set.
3. Grasp the cartridge so that the write-protect switch faces you (see **1** in Figure D-2 on page D-5).
4. Slide the cartridge into the tape load compartment.

   Note:

   a. If the cartridge is already in an ejected position and you want to reinsert it, remove the cartridge then insert it again.
   b. If the cartridge is already loaded and you cycle the power (turn it off, then on), the tape will reload.

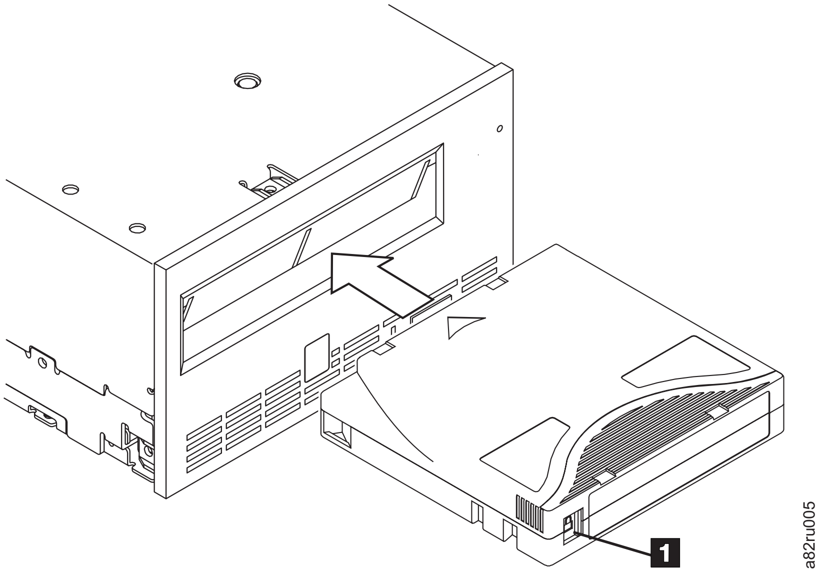


Figure D-2. Inserting a cartridge into the drive

Removing a Tape Cartridge

To remove a tape cartridge:

1. Ensure that the drive is powered-on.
2. Press the Unload Button. The drive rewinds the tape and partially ejects the cartridge. The Status Light flashes green while the tape rewinds, then goes out before the cartridge partially ejects.
3. After the cartridge partially ejects, grasp the cartridge and remove it.

Whenever you unload a tape cartridge, the drive writes any pertinent information to the cartridge memory.

Cleaning Cartridge

With each drive, a specially labeled IBM LTO Ultrium Cleaning Cartridge is supplied to clean the drive head. The drive itself determines when a head needs to be cleaned. It alerts you by displaying C on the Single-character Display. To clean the head, insert the cleaning cartridge into the tape load compartment . The drive performs the cleaning automatically. When the cleaning is finished, the drive ejects the cartridge.

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

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

ntenance Functions

rive can:

- diagnostics
- write and read functions
- a suspect tape cartridge
- late its own firmware
- form other diagnostic and maintenance functions

rive must be in maintenance mode to perform these functions.

ion: Maintenance functions cannot be performed concurrently with read or operations. While in maintenance mode, the tape drive does not accept SCSI ands from the server. The tape drive does accept LDI or RS-422 commands.

D-3 describes each diagnostic and maintenance function that the drive can m, gives the function code which appears on the Single-character Display and directs you to the instructions for performing the function. It is mended that you use a customer-supplied scratch (blank) data cartridge for ostic testing.

tenance functions

nostic or Maintenance Function	**Instructions Location**
ce Mode: Causes the drive to	

Table D-3. Diagnostic and maintenance functions (continued)

Function Code	Diagnostic or Maintenance Function	Instructions Location
9	**Display Error Code Log:** Displays the last 10 error codes, one at a time (the codes are ordered; the most recent is presented first and the oldest (tenth) is presented last).	"Function Code 9: Display Error Code Log" on page D-14
A	**Clear Error Code Log:** Erases the contents of the error code log.	"Function Code A: Clear Error Code Log" on page D-15
C	**Insert Cartridge into Tape Drive:** This function cannot be selected by itself, but is a part of other maintenance functions (such as Run Tape Drive Diagnostics and Create FMR Tape) that require a tape cartridge to be loaded.	"Function Code C: Insert Cartridge into Tape Drive" on page D-15
E	**Test Cartridge & Media:** Performs tests to ensure that a suspect cartridge and its magnetic tape are acceptable.	"Function Code E: Test Cartridge & Media" on page D-15
F	**Write Performance Test:** Performs tests to ensure that the drive can read from and write to tape.	"Function Code F: Write Performance Test" on page D-16
H	**Test Head:** Performs tests to ensure that the tape drive's head and tape-carriage mechanics are working correctly.	"Function Code H: Test Head" on page D-17
J	**Fast Read/Write Test:** Performs tests to ensure that the drive can read from and write to tape.	"Function Code J: Fast Read/Write Test" on page D-18
L	**Load/Unload Test:** Tests the drive's ability to load and unload a tape cartridge.	"Function Code L: Load/Unload Test" on page D-19
P	**Enable Post Error Reporting:** When selected, deferred-check conditions are reported to the host.	"Function Code P: Post Error Reporting Enabled" on page D-20
U	**Disable Post Error Reporting:** When selected, deferred-check conditions are NOT reported to the host.	"Function Code U: Post Error Reporting Disabled" on page D-21

Entering Maintenance Mode

The drive must be in maintenance mode to run drive diagnostics or maintenance functions. To place the unit in maintenance mode:

1. Make sure that no cartridge is in the drive.
2. Press the Unload Button three times within two seconds. 0 appears in the Single-character Display (SCD), and the Status Light turns amber.

   Note: If a cartridge is in the tape drive, it will eject the first time that you press the Unload Button and the drive will not be placed in maintenance mode. To continue placing the drive in maintenance mode, perform the preceding step.

Maintenance functions cannot be performed concurrently with read or write operations. While in maintenance mode, the drive does not receive SCSI commands from the server.

Exiting Maintenance Mode

The drive must be in maintenance mode to run drive diagnostics or maintenance functions. To place the unit in maintenance mode:

1. Press and hold the Unload Button for 3 or more seconds to take the drive out of maintenance mode. If no error is detected, [0] temporarily appears in the SCD, then goes blank. The drive then exits maintenance mode and the Status Light will return to Green.
2. If an error is detected, the SCD shows an error code but still exits maintenance mode.To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. To clear the error, turn the power off, then on again.

   Note: The drive also exits maintenance mode automatically after it completes a maintenance function or after 10 minutes if no action has occurred.

Function Code 0: Maintenance Mode

Function Code 0 makes the drive available for reading and writing data.

1. Place the drive in Maintenance Mode. For instructions, see“Entering Maintenance Mode” on page D-7.
2. To exit Maintenance Mode, see “Exiting Maintenance Mode” on page D-7.

The drive exits Maintenance Mode automatically after it completes a maintenance function or after 10 minutes if no action has occurred.

Function Code 1: Run Drive Diagnostics

Approximate Run Time = 20 minutes per loop

Total Number of Loops = 10

Function Code 1 runs tests that determine whether the drive can properly load and unload cartridges and read and write data.

Press the Unload Button to stop the diagnostic and exit maintenance mode. Pressing the Unload Button once will abort the test at the end of the current test loop. Pressing the Unload Button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Once you begin

drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until 1 appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select function 1. Wait for the SCD to change to a flashing C.
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing 1 and the test begins.
   - If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code 2: Update Drive Firmware from FMR Tape

Attention: When updating drive firmware, do not power-off the drive until the update is complete or the firmware may be lost.

Function Code 2 loads drive firmware from a field microcode replacement (FMR) tape. The LTO-4 FMR tape must have been created from a LTO Gen4 tape drive with the same host interface (e.g. SAS, Fibre Channel), and the LTO-3 FMR tape must have been created with the same host interface (e.g., SCSI, Fibre Channel).

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until 2 appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert the FMR tape cartridge. The SCD changes to a flashing 2. The tape drive loads the updated firmware from the FMR tape into its erasable programmable read-only memory (EPROM) area.

- During the reboot the SCD presents a series of random characters. The SCD briefly displays 8 , then becomes blank (not lit) when POST is complete, The Status Lights will be amber during the reboot and change to green after a successful reboot.
- If the update completes successfully, the tape drive rewinds and unloads the FMR tape, resets itself, and is ready to use the new firmware. The drive automatically reboots.
- If the update fails, the tape drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The drive then unloads the FMR tape and exits maintenance mode after the cartridge is removed. Contact IBM Technical Support for problem determination or machine replacement.

Function Code 3: Create FMR Tape

Function Code 3 copies the drive’s field microcode replacement (FMR) data to a scratch data cartridge. The resulting FMR tape can only be used to update the firmware on other LTO tape drives with the same generation family and host interface. For example, the LTO-4 FMR tape must have been created from a LTO Gen4 tape drive with the same host interface (e.g. SAS, Fibre Channel), and the LTO-3 FMR tape must have been created with the same host interface (e.g., SCSI, Fibre Channel).”

Attention: For this function, insert only a scratch (blank) data cartridge or a cartridge that may be overwritten. During the test, the drive overwrites the data

- If the tape drive fails to create the FMR tape, it displays an error code. To determine the error, see “Drive Error Codes and Messages” on page D-21. The tape drive then unloads the FMR tape, and exits Maintenance Mode after the cartridge is removed.

Function Code 4: Force a Drive Dump

Function Code 4 performs a dump of data collected by the drive (this process is also known as saving a microcode trace).

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until 4 appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The drive performs the dump. The SCD shows 0, then goes blank. To access the contents of the dump, see “Function Code 5: Copy Drive Dump.”

   Note: You can also force a drive dump when the tape drive is in normal operating mode. Simply press and hold the Unload Button for ten seconds. This causes the drive to reboot.

Function Code 5: Copy Drive Dump

Function Code 5 copies data from a drive dump (captured in Function Code 4) to the beginning of a scratch (blank) data cartridge.

Attention: For this function, insert only a scratch (blank) data cartridge or a cartridge that may be overwritten. During the test, the drive overwrites the data on422Tmd8/F71

- 5 - 3 : erase flash memory

   If you cycle past the desired code, press the Unload Button once per second until the code reappears.

3. Press and hold the Unload Button for three or more seconds, then release it to select one of the above functions.
4. If you selected 5 - 0 the drive will exit Maintenance Mode. If you selected 5 - 2 or 5 - 3 the SCD will change to a flashing 5 while the procedure is being performed. After the procedure is completed the drive will exit Maintenance Mode. If you selected 5 - 1 the SCD will change to a flashing C indicating that a data cartridge is to be inserted.
5. Insert a scratch (blank) data cartridge that is not write protected (or the tape drive exits maintenance mode). The SCD flashes the selection number while performing the function.
   - If the copy operation completes successfully, the tape drive rewinds and unloads the tape, and exits Maintenance Mode after the cartridge is removed.
   - If the copy operation fails, an error code appears in the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed.

Function Code 6: Run Host Interface Wrap Test

Approximate Run Time = 10 seconds per loop

Number of Loops = This test runs until stopped by pressing the Unload Button.

Function Code 6 performs a check of the host interface circuitry and host connector on the drive.

Note: This test requires that SCSI drives be terminated by either the terminator on the connector or at the end of the bus. Before you select this function, disconnect the SCSI cable of the drive that is closest to the server. Then attach the SCSI wrap plug to that SCSI connector.

1. Make sure that the host interface wrap plug is connected to the host interface connector at the rear of the drive.
2. If the drive is a SCSI drive, make sure that the drive is terminated at its SCSI connector or at the SCSI bus.
3. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
4. Press the Unload Button once per second until 6 appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
5. Press and hold the Unload Button for three or more seconds, then release it to select the function. The drive automatically starts the test. The SCD will display a flashing 6 during the test.

- If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
- If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code 7: Run RS-422 Wrap Test

This test causes the drive to perform a check of the circuitry and connector for the RS-422 interface. This connector supports the Library Drive Interface (LDI) and the Automation Drive Interface (ADI).

Before selecting this function, attach an LDI or RS-422 wrap plug to the drive’s LDI or RS-422 connector (in place of the LDI or RS-422 cable).

1. Make sure that no cartridge is in the drive, and the appropriate wrap plug is attached to the RS-422 connector.
2. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
3. Press the Unload Button once per second until 7 appears in the Single-character Display (SCD). If you cycle past 7, continue to press the Unload Button until it displays again.
4. To select the function, press and hold the Unload Button for three seconds.

   After you select the function, 7 flashes and the drive automatically starts the test.
   - If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code 8: Unmake FMR Tape

Function Code 8 erases the field microcode replacement (FMR) data and rewrites the cartridge memory on the tape. This converts the cartridge into a valid scratch (blank) data cartridge.

1. Place the drive in maintenance mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until 8 appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select function 8. The SCD changes to a flashing C.
4. Insert the FMR data cartridge (or the tape drive exits maintenance mode). The SCD changes to a flashing 8. The tape drive erases the firmware on the tape and rewrites the header in the cartridge memory to change the cartridge to a valid scratch (blank) data cartridge:

   Note: If you inserted an invalid tape cartridge (e.g. Gen1 or WORM media), error code 7 appears in the SCD. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen1 media for LTO-3 tape drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

   - If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code 9: Display Error Code Log

Function Code 9 displays the last ten error codes, one at a time (the codes are ordered; the most recent is presented first and the oldest is presented last). If there are no errors in the log, function code 0 displays in the Single-character Display (SCD) and exits Maintenance Mode.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until 9 appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to view the most recent error code.

4. Press the Unload Button again to view successive error codes. Let two to three seconds pass between each depression. The SCD will display 0 when all the error codes have been displayed.
5. After viewing all error codes, exit this function by pressing the Unload Button again. The SCD will display 0 and exit Maintenance Mode.

Function Code A: Clear Error Code Log

Function Code A erases the contents of the error code log.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until A appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. A flashes in the SCD, followed by 0. The tape drive erases all errors from the error code log and exits Maintenance Mode.

Function Code C: Insert Cartridge into Tape Drive

This function cannot be selected by itself, but is part of other maintenance functions (such as Run Tape Drive Diagnostics and Create FMR Tape) that require a tape cartridge to be inserted.

Function Code E: Test Cartridge & Media

Approximate Run Time = 15 minutes per loop

Total Number of Loops = 10

Function Code E performs tests that determine whether a suspect cartridge and its magnetic tape are acceptable.

Press the Unload Button to stop the diagnostic and exit maintenance mode. Pressing the Unload Button once will abort the test at the end of the current test loop. Pressing the Unload Button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: When you perform this test, data on the suspect tape will be overwritten.

Note: If you inserted an invalid tape cartridge (e.g. Gen1 or WORM media), error code 7 appears in the SCD. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen1 media for LTO-3 tape drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until E appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Ensure that the write-protect switch on the suspect cartridge is off, then insert the cartridge (or the tape drive exits maintenance mode). The SCD changes to E. The tape drive runs the tests.
   - If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code F: Write Performance Test

Approximate Run Time = 5 minutes

Total Number of Loops = 10

Function Code F performs tests to ensure that the drive can read from and write to tape.

Press the Unload Button to stop the diagnostic and exit maintenance mode. Pressing the Unload Button once will abort the test at the end of the current test loop. Pressing the Unload Button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: For this test, insert only a scratch (blank) data cartridge or a cartridge that may be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen1 or WORM media), error code 7 appears in the SCD. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen1 media for LTO-3 tape drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

1. Place the drive in Maintenance mMode. For instructions, see “Entering Maintenance Mode” on page D-7.

2. Press the Unload Button once per second until F appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing F and the tape drive runs the tests.

   Note: If you inserted an invalid tape cartridge (e.g. Gen1 or WORM media), error code 7 appears in the SCD. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen1 media for LTO-3 tape drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

   - If <u>no</u> error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code H: Test Head

Approximate Run Time = 10 minutes

Total Number of Loops = 10

Function Code H performs tests to ensure that the tape drive’s head and tape-carriage mechanics work correctly.

Once you begin this test, the diagnostic begins the loop sequence. Time the first loop by pressing the Unload Button once to stop the diagnostic after the completion of the first loop, then record the time it takes for the test to complete. Compare the recorded time with the ″Approximate Run Time″ above. If the test runs successfully but the execution time is significantly longer than the ″Approximate Run Time″, run “Function Code F: Write Performance Test” on page D-16. If the Write Performance Test fails, replace the media and exit maintenance mode.

Press the Unload Button to stop the diagnostic and exit maintenance mode. Pressing the Unload Button once will abort the test at the end of the current test loop. Pressing the Unload Button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: For this test, insert only a scratch (blank) data cartridge or a cartridge that may be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen1 or WORM media), error code 7 appears in the SCD. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen1 media for LTO-3 tape drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until H appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing H. The tape drive runs the tests.
   - If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code J: Fast Read/Write Test

Approximate Run Time = 5 minutes

Total Number of Loops = 10

Function Code J performs tests to ensure that the drive can read from and write to tape.

Once you begin this test, the diagnostic begins the loop sequence. Time the first loop by pressing the Unload Button once to stop the diagnostic after the completion of the first loop, then record the time it takes for the test to complete. Compare the recorded time with the ″Approximate Run Time″ above. If the test runs successfully but the execution time is significantly longer than the ″Approximate Run Time″, run “Function Code F: Write Performance Test” on page D-16. If the Write Performance Test fails, replace the media and exit maintenance mode.

Press the Unload Button to stop the diagnostic and exit maintenance mode. Pressing the Unload Button once will abort the test at the end of the current test loop. Pressing the Unload Button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: For this test, insert only a scratch (blank) data cartridge or a cartridge that may be overwritten. During the test, the drive overwrites the data on the cartridge.

Note: If you inserted an invalid tape cartridge (e.g. Gen1 or WORM media), error code 7 appears in the SCD. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen1 media for LTO-3 tape drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until J appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing J and the tape drive runs the tests.
   - If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code L: Load/Unload Test

Approximate Run Time = 15 seconds per loop

Total Number of Loops = 10

Function Code L tests the drive’s ability to load and unload a tape cartridge.

Press the Unload Button to stop the diagnostic and exit maintenance mode. Pressing the Unload Button once will abort the test at the end of the current test loop. Pressing the Unload Button twice will abort the test immediately. Wait for the drive to rewind the tape and unload the cartridge.

Attention: Even though no data is written during this test, it is recommended that you use a blank (scratch) cartridge for this test.

Note: If you inserted an invalid tape cartridge (e.g. Gen1 or WORM media), error code 7 appears in the SCD. If you inserted a write-protected cartridge, or the media has read-only compatibility (e.g., Gen1 media for LTO-3 tape drives and Gen2 media for LTO-4 drives), error code P appears in the SCD. In either case, the tape drive unloads the cartridge and exits Maintenance Mode after the cartridge is removed.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until L appears in the SCD. (If you cycle past the desired code, press the Unload Button once per second until the code reappears.)
3. Press and hold the Unload Button for three or more seconds, then release it to select the function. The SCD changes to a flashing C.
4. Insert a scratch (blank) data cartridge. The SCD changes to a flashing L and the tape drive runs the tests.
   - If no error is detected, the diagnostic will loop and begin again. To stop the loop, press the Unload Button for one second and release. When the loop ends, 0 temporarily appears in the SCD. The drive rewinds and unloads the cartridge, and then exits Maintenance Mode when the cartridge is removed.
   - If an error is detected, the Status Light flashes amber and the drive posts an error code to the SCD. To determine the error, locate the code in “Drive Error Codes and Messages” on page D-21. The tape drive unloads the tape cartridge and exits Maintenance Mode after the cartridge is removed. To clear the error either turn the power off and then on again, or reboot the drive by pressing and holding the Unload Button for 10 seconds.

Function Code P: Post Error Reporting Enabled

When Post Error Reporting is enabled, deferred-check conditions are reported to the host and temporary errors are reported in the sense data. Function Code P will be displayed in Maintenance Mode when the drive has Post Error Reporting enabled.

This selection is normally used as a request from support personnel.

1. Place the drive in Maintenance Mode. For instructions, see “Entering Maintenance Mode” on page D-7.
2. Press the Unload Button once per second until either P or U appears in the SCD. P or U will appear in the SCD to indicate the current setting for Post Error Reporting. If you cycle past the desired code, press the Unload Button once per second until the code reappears.

3. Exit Maintenance Mode if you do not want to change the current setting for Post Error Reporting. For instructions, see "Exiting Maintenance Mode" on page D-7.
4. To disable Post Error Reporting, Press and hold the Unload Button for three seconds while P appears in the SCD. The SCD changes to U after you release the Unload Button.
5. Press the Unload Button once per second to select another Maintenance Mode Function. To exit Maintenance Mode, refer to "Exiting Maintenance Mode" on page D-7.

Function Code U: Post Error Reporting Disabled

When Post Error Reporting is disabled, deferred-check conditions are not reported to the host and temporary errors are not reported in the sense data. This is the normal (default) setting for the drive. When the drive has Post Error Reporting disabled, Function Code U will be displayed in Maintenance Mode. The drive will default to Post Error Reporting disabled after a reboot or power off/on cycle.

1. Place the drive in Maintenance Mode. For instructions, see "Entering Maintenance Mode" on page D-7.
2. Press the Unload Button once per second until either P or U appears in the SCD. P or U will appear in the SCD to indicate the current setting for Post Error Reporting. If you cycle past the desired code, press the Unload Button once per second until the code reappears.
3. Exit Maintenance Mode if you do not want to change the current setting for Post Error Reporting. For instructions, see "Exiting Maintenance Mode" on page D-7.
4. To disable Post Error Reporting, Press and hold the Unload Button for three seconds while P appears in the SCD. The SCD changes to U after you release the Unload Button.
5. Press the Unload Button once per second to select another Maintenance Mode Function. To exit Maintenance Mode, refer to "Exiting Maintenance Mode" on page D-7.

Drive Error Codes and Messages

Drive error codes are displayed on the Operator Panel, the Web User Interface, and the Single-character Display on the front panel of the tape drive. Each error code has an associated cause and action.

Attention: If the drive detects a permanent error and displays an error code other than 0, it automatically performs a drive dump. If you force a drive dump, the existing dump will be overwritten and data will be lost. After you force a drive dump, do not turn off the power to the drive or you may lose the dump data.

Table D-4. Error codes on the Single-character Display. To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
0	**No error occurred and no action is required.** This code displays: • When power is cycled (turned off, then on) to the tape drive. • When diagnostics have finished running and no error occurred. **Note:** The Single-character Display is blank during normal operation of the tape drive.
1	**Cooling problem.** The tape drive detected that the recommended operating temperature was exceeded. Perform one or more of the following actions: • Ensure that the cooling fan is rotating and is quiet. If not, refer to your enclosure documentation. • Remove any blockage that prevents air from flowing freely through the tape drive. • Ensure that the operating temperature and airflow is within the specified range (see "Specifications" on page 2-20). • If the operating temperature is within the specified range and the problem persists, replace the drive. The error code clears when you power-off the tape drive or place it in maintenance mode.
2	**Power problem.** The tape drive detected that the externally supplied power is approaching the specified voltage limits (the tape drive is still operating) or is outside the specified voltage limits (the tape drive is not operating). Perform the following action: 1. Ensure that the power connector is properly seated. 2. Ensure that the proper dc voltages are being applied within the tolerances allowed (see "Specifications" on page 2-20). 3. If the proper voltages are not being applied, replace the power supply. 4. If the proper voltages are being applied but the problem persists, replace the tape drive. The error code clears when you power-off the tape drive or place it in maintenance mode.
3	**Firmware problem.** The tape drive determined that a firmware error occurred. Perform the following action: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; the tape drive has already created one. • Server's host interface by using a device driver utility or system tool (for instructions about reading a drive dump from tape, visit the Web at **http://www.ibm.com/storage/lto**) • Ultrium Tape Drive (to copy and read a drive dump, use "Viewing the Drive Error Log" on page D-29). 2. Power the tape drive off and on, then retry the operation that produced the error. 3. If the problem persists, download new firmware and retry the operation. 4. If the problem persists, send the drive dump collected to your IBM Support Center. The error code clears when you power-off the tape drive or place it in maintenance mode.

Table D-4. Error codes on the Single-character Display (continued). To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
4	**Firmware or tape drive problem.** The tape drive determined that a firmware or tape drive hardware failure occurred. Perform the following action: 1. Collect a drive dump from one of the following: **Note:** Do not force a new dump; one already exists. • Server's host interface by using a device driver utility or system tool (for instructions about reading a drive dump from tape, visit the Web at **http://www.ibm.com/storage/lto**) • Ultrium Tape Drive (to copy and read a drive dump, use "Methods of Capturing Logs" on page 7-6) 2. Power the tape drive off and on, then retry the operation that produced the error. The error code clears when you power-off the tape drive or place it in maintenance mode. 3. If the problem persists, download new firmware and retry the operation; if new firmware is not available, replace the drive.
5	**Tape drive hardware problem.** The drive determined that a tape path or read/write error occurred. To prevent damage to the drive or tape, the tape drive will not allow you to insert a cartridge if the current cartridge was successfully ejected. The error code may clear when you cycle power to the tape drive or place it in maintenance mode. If the problem persists, replace the drive. **Note:** Copy the drive dump to flash memory before returning the drive. For instructions, refer to "Function Code 5: Copy Drive Dump" on page D-11.

Table D-4. Error codes on the Single-character Display (continued). To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
6	**Tape drive or media error.** The tape drive determined that an error occurred, but it cannot isolate the error to faulty hardware or to the tape cartridge. Perform the following action: **For Problems with Writing Data:** If the problem occurred while the tape drive was writing data to the tape, and if you know the volume serial number (located on the cartridge label) of the tape cartridge that was loaded in the drive when the problem occurred, retry the operation with a different cartridge: • If the operation succeeds, the original cartridge was defective. Have your customer copy data from the defective cartridge and discard it. • If the operation fails and another tape drive is available, insert the cartridge into the other unit and retry the operation. – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch data cartridge into the first unit and run “Function Code 1: Run Drive Diagnostics” on page D-8. - If the diagnostics fail, replace the tape drive. - If the diagnostics succeed, the error was temporary. • If the operation fails and another tape drive is not available, insert a scratch data cartridge into the unit and run “Function Code 1: Run Drive Diagnostics” on page D-8. – If the diagnostics fail, replace the tape drive. – If the diagnostics succeed, discard the cartridge. If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge’s volume serial number, run “Function Code 1: Run Drive Diagnostics” on page D-8: • If the diagnostics fail, replace the tape drive. • If the diagnostics succeed, run “Function Code H: Test Head” on page D-17. – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, replace the cartridges that caused the problem. The error code clears when you remove the tape cartridge or place the tape drive in maintenance mode. **For Problems with Reading Data:** If the problem occurred while the tape drive was reading data from the tape, and if you know the volume serial number of the tape cartridge, perform one of the following procedures: • If another tape drive is available, insert the cartridge into the other unit and retry the operation: – If the operation fails, discard the defective cartridge. – If the operation succeeds, insert a scratch data cartridge into the first unit and run “Function Code 1: Run Drive Diagnostics” on page D-8: - If the diagnostic fails, replace the tape drive. - If the diagnostic succeeds, the error was temporary. • If another tape drive is not available, insert a scratch data cartridge into the unit and run “Function Code 1: Run Drive Diagnostics” on page D-8: – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, discard the cartridge. If the problem occurs with multiple tape cartridges or if you do not know the tape cartridge’s volume serial number, run “Function Code 1: Run Drive Diagnostics” on page D-8: • If the diagnostic fails, replace the tape drive. • If the diagnostic succeeds, run “Function Code H: Test Head” on page D-17. – If the diagnostic fails, replace the tape drive. – If the diagnostic succeeds, replace the cartridges that caused the problem. The error code clears when you remove the tape cartridge or place the tape drive in maintenance mode.

Table D-4. Error codes on the Single-character Display (continued). To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
7	**A high probability of media error.** The tape drive determined that an error occurred because of a faulty tape cartridge. Try another tape cartridge. If the problem occurs with multiple tape cartridges, use the following procedure: **Attention:** When you run the Test Cartridge & Media diagnostic, data on the suspect tape is overwritten. Use only a scratch data cartridge to run the test. 1. If possible, run the tape cartridge in a different tape drive. If the operation in the other unit fails and 6 or 7 displays, replace the media. If the operation succeeds, run “Function Code E: Test Cartridge & Media” on page D-15. • If the diagnostic fails, replace the media. • If the diagnostic succeeds, clean the drive (select **Operations->Drive->Clean**) and run “Function Code 1: Run Drive Diagnostics” on page D-8. – If the drive diagnostic fails, replace the drive. – If the drive diagnostic succeeds, perform the operation that produced the initial media error. The error code clears when you remove the tape cartridge or place the tape drive in maintenance mode.
8	**For SCSI drive:** Tape drive or SCSI bus failure. The tape drive determined that a failure occurred in the tape drive’s hardware or in the SCSI bus. See “Fixing SCSI Bus Problems” on page D-29. The error code clears 10 seconds after the drive detected the error or when you place the drive in maintenance mode.
	For Fibre Channel drive: Tape drive or Fibre Channel failure. The tape drive determined that a failure occurred in the tape drive’s hardware or in the Fibre Channel. It detects light through the fiber cable but cannot perform data communication properly. The length of the cable between the devices should not exceed 600 m (1649 ft). See “Fixing Fibre Channel Errors” on page D-32. The error code clears when the drive detects light and can communicate, or when the drive is placed in maintenance mode.
	For SAS drive: Tape drive or SAS interface failure. The tape drive determined that a failure occurred in the tape drive’s hardware or in the SAS interface between the drive and the HBA at the host. See “Fixing SAS Interface Problems” on page D-35. The error code clears when the drive detects that it can once again communicate, or when the drive is placed in maintenance mode.
9	**Tape drive or RS-422 error.**The tape drive determined that a failure occurred in the tape drive’s hardware or in the RS-422 connection. Replace the tape drive. The error code clears 10 seconds after the drive detected the error or when you place the tape drive in maintenance mode.

Table D-4. Error codes on the Single-character Display (continued). To clear error and cycle power, press the Unload Button for ten seconds. A drive dump will be created.

Error Code	Cause and Action
A	**Tape drive hardware problem.**The tape drive determined that a problem occurred which degraded the operation of the tape drive, but it did not restrict continued use. If the problem persists, determine whether the problem is with the drive or the media. **Note:** The drive is usable, though the Single-character Display continues to indicate an error and the Status Light flashes amber. The error code may clear when you cycle power to the tape drive or place it in maintenance mode. To determine if the problem is with the drive hardware, or the tape media, perform the following procedures: 1. If possible, run the tape cartridge in a different drive. If the operation in the other drive fails and 6 or 7 displays, replace the media. If the operation succeeds, run the Test Cartridge & Media diagnostic (see “Function Code E: Test Cartridge & Media” on page D-15). 2. If the Test Cartridge & Media diagnostic fails, replace the media. If it runs successfully, clean the failing drive and run the drive diagnostics (select **Operations->Drive->Clean** and see “Function Code 1: Run Drive Diagnostics” on page D-8). If the drive diagnostics run successfully, perform the operation that produced the initial drive error. 3. If the problem persists replace the drive. If it is not possible to run the tape cartridge in a different drive, perform the following procedures: 1. Clean the failing drive and run the drive diagnostics (select **Operations->Drive->Clean** and see “Function Code 1: Run Drive Diagnostics” on page D-8). If the drive diagnostics run successfully, run the Test Cartridge & media diagnostic (see “Function Code E: Test Cartridge & Media” on page D-15). 2. If the Test Cartridge & Media diagnostic fails, replace the media. If it runs successfully, perform the operation that produced the initial drive error. 3. If the problem persists replace the drive.
b	**No error or message is assigned.**See error code 8 in this table.
C	**The tape drive needs to be cleaned.** Clean the tape drive (select **Operations->Drive->Clean**). The error code clears when you clean the tape drive or place it in maintenance mode.
d	**No error or message assigned.** See error code 0 in this table.
=	**The Unload Button is depressed.** Verify that the button pushes freely.

Resolving Tape Drive Problems

If you encounter problems when running the Ultrium Tape Drive, refer to the table below. If the problem is not identified, refer to “Methods of Receiving Errors and Messages” on page D-27.

Table D-5. Troubleshooting Tips for the Ultrium Tape Drive

If the problem is this....	Do this....
A code displays on the single-character display.	The Ultrium Tape Drive detected an error or is directing you to an informational message. See “Drive Error Codes and Messages” on page D-21.

Table D-5. Troubleshooting Tips for the Ultrium Tape Drive (continued)

If the problem is this....	**Do this....**
The status light or single-character display never turns on.	The Ultrium Tape Drive has not been properly terminated or has no power. If the SCSI bus is terminated externally, try a different terminator or use the drive's internal termination. If the SCSI bus is terminated properly, check the power at the power source. Ensure the tape drive sled is connected properly, (see "Drive Sled" on page 8-34). If the problem persists, replace the tape drive sled.
The Ultrium Tape Drive won't load a tape cartridge.	One of the following has occurred: • A tape cartridge is already inserted. To remove the cartridge, press the unload button. If the cartridge does not eject, turn off the power to Ultrium Tape Drive, then turn it back on and press the unload button. • The tape cartridge was inserted incorrectly. • The tape cartridge was defective. Insert another tape cartridge. If the problem persists, replace the tape drive sled (see "Drive Sled" on page 8-34). • The Ultrium Tape Drive has no power. Ensure the drive sled is plugged into the Library correctly. (See "Drive Sled" on page 8-34.) If there are multiple drives in the library and the other drives are powered up correctly, suspect the power cable or power distribution card. • If the problem exists for multiple cartridges, the Ultrium Tape Drive is defective. Replace the tape drive (see "Drive Sled" on page 8-34).
The Ultrium Tape Drive won't unload the tape cartridge.	The tape cartridge is stuck or is broken. Press the unload button. If the cartridge does not eject, turn off the power to Ultrium Tape Drive, then turn it back on. If the cartridge still does not eject, manually remove it (see "Manual Cartridge Removal from a Drive" on page 8-81).
The host received TapeAlert messages.	See Appendix A, "TapeAlert Flags," on page A-1.
The host reported SCSI problems (such as selection or command time-outs, or parity errors).	See Appendix E, "Message Retrieval at the Host," on page E-1.
A library reported an interface problem.	Run drive diagnostics. The drive sled or RS-422 circuitry may be defective. Refer to the section about running drive diagnostics "Diagnostic and Maintenance Functions" on page D-6.
Codes display on the single-character display, but the status light doesn't turn on.	The Ultrium Tape Drive is defective. Replace the tape drive sled, (see "Drive Sled" on page 8-34).

Methods of Receiving Errors and Messages

Use the table below as a guide for identifying error and message codes reported to the Ultrium Tape Drive, library, or host.

Note: The codes on the single-character display have different meanings, depending on whether they display during normal operations or while the drive is in maintenance mode. Codes that occur during normal operations are defined in "Drive Error Codes and Messages" on page D-21. Codes that occur while in maintenance mode are defined in "Diagnostic and Maintenance Functions" on page D-6.

Table D-6. Methods of Receiving Errors and Messages for the Ultrium Tape Drive

If the error or message was presented by....	Do this....
The library's display (if the tape drive is enclosed in a library or autoloader)	See "Start Service" on page 1-1.
The tape drive's single-character display and the status light flashes yellow	See "Drive Error Codes and Messages" on page D-21. To determine the meaning of status light activity, see "Status Light" on page D-2.
The tape drive's single-character display and the status light is solid yellow	See "Diagnostic and Maintenance Functions" on page D-6.
SCSI log sense data (such as TapeAlert flags) or request sense data at the host console	See: • Appendix A, "TapeAlert Flags," on page A-1 • "Drive Error Codes and Messages" on page D-21 • Appendix E, "Message Retrieval at the Host," on page E-1 • Appendix B, "Sense Data," on page B-1 • "Using Host Sense Data"
Drive sense data sent to a library (if the tape drive is enclosed in a library)	See: • "Start Service" on page 1-1 • Appendix E, "Message Retrieval at the Host," on page E-1 • Appendix B, "Sense Data," on page B-1 Then see "Drive Error Codes and Messages" on page D-21.
The tape drive's error log	See: • "Drive Error Codes and Messages" on page D-21 • "Viewing the Drive Error Log" on page D-29

Using Host Sense Data

The table below lists the hosts to which the Ultrium Tape Drive attaches. It gives the operating system for each host and describes how the host records errors from the drive.

To determine the meaning of host sense data, see Appendix E, "Message Retrieval at the Host," on page E-1 and Appendix B, "Sense Data," on page B-1. Also refer to the *IBM Ultrium Device Drivers Installation and User's Guide* or visit the web at **http://www.ibm.com/storage/lto**.

Table D-7. Host Method of Recording Tape Drive Errors

Host	Operating System	Method of Recording Tape Drive Errors
IBM AS/400 or iSeries	OS/400	Records tape drive errors and associated sense data in the AS/400 problem and error logs. View the logs by using the System Service Tools application and the userid QSRV.
IBM RS/6000, RS/6000/SP, or pSeries	AIX	Uses the IBM Atape device driver (provided with the Ultrium Tape Drive) to record tape drive errors and sense data in the host error log. View the host error log by using one or more of the following utilities: tapeutil, diag, smit, or errpt.
HP	HP-UX	Uses the IBM device driver for HP. Error and trace logging are proprietary to Hewlett-Packard.

Table D-7. Host Method of Recording Tape Drive Errors (continued)

Host	Operating System	Method of Recording Tape Drive Errors
Sun Microsystems	Solaris	Uses the IBM device driver for Solaris to post sense information to the Solaris host-wide messages file */var/adm/messages*.
Intel-based PCs	Windows-based operating systems	Uses the NTUTIL device driver to log some sense data in the Event Viewer host log.

Viewing the Drive Error Log

The Ultrium Tape Drive keeps an error log that you can use to identify and correct errors. The log contains the 10 most recent error codes, which appear (one at a time) on the single-character display.

To view the drive error log:

1. Make sure that no cartridge is in the drive.
2. Within a 1 second interval press the unload button 3 times. The status light becomes solid amber, indicating that the drive is in maintenance mode.

   Note: If a cartridge is in the drive, it will eject the first time that you press the unload button and the drive will not be placed in maintenance mode. To continue placing the drive in maintenance mode, perform the preceding step.
3. Press the unload button once per second until **9** appears in the single-character display.

   Note: If you cycle past the desired code, press the unload button once per second until the code redisplays.
4. Press the unload button to view the most recent error code.
5. Refer to "Drive Error Codes and Messages" on page D-21 to determine the meaning of the code and the action to take.
6. Press the unload button to view the next error code. (The codes are ordered; the most recent is presented first and the oldest (tenth) is presented last. Each time you press the unload button to view an error, the single-character display turns on, the error displays, then the single-character display turns off.)
7. Continue to press the unload button until the 10 error codes have been displayed. After you display the tenth error code, the Ultrium Tape Drive automatically exits maintenance mode.

To re-display the error codes, repeat steps 1-7.

This function is also available from the Operator Panel by selecting **Tools** → **All Operator Interventions**.

Fixing SCSI Bus Problems

If this is a new installation, or the customer has updated their host hardware or software, verify that the SCSI device driver is installed properly. Refer to device driver documentation.

Attention: In the following procedures you need to know the module (control module or expansion unit) and location number(s) of the failing drive(s).

Table D-8. SCSI Bus Problems

For Error Type...	See...
Solid Error - One Drive	"Fixing a Solid Error with One Drive on a SCSI Bus"
Solid Error - Multiple Drives	"Fixing a Solid Error with Multiple Drives on a SCSI Bus" on page D-31
Intermittent Error - One Drive	"Fixing an Intermittent Error with One Drive on a SCSI Bus" on page D-31
Intermittent Error - Multiple Drives	"Fixing an Intermittent Error with Multiples Drives on a SCSI Bus" on page D-32

Fixing a Solid Error with One Drive on a SCSI Bus

1. Verify that the power is on to the drive:
   a. Verify that the library is powered ON.
   b. Verify that the power supplies (in the module containing the failing drive) are on.
   c. Verify that the drive is fully seated in the library chassis.
2. Determine if the drive is experiencing a hang condition.
   a. If a tape cartridge is in the drive, press the unload button.
      - If the cartridge ejects, the drive does not have a hang condition, go to step 5.
      - If the cartridge does not eject, go to step 3.
   b. If there is no cartridge in the drive, manually load a scratch cartridge into the failing drive. If the cartridge loads, the drive does not have a hang condition. Press the unload button to unload the scratch cartridge and go to step 5.
3. Press and hold the unload button for 20 seconds. The drive will save a dump and go into a reboot, which allows communication to the drive. do not cycle power (power off then power on) or you will lose the dump contents.
4. Obtain a drive dump (see "Using the ITDT

If the failure still exists, it probably is caused by the host system hardware or software. Refer to the service documentation for the host system.

Fixing a Solid Error with Multiple Drives on a SCSI Bus

1. Verify that the power is on to the drives:
    a. Verify that the library is powered ON.
    b. Verify that all the circuit protectors on all Power Supplies are on.
2. Verify that the SCSI cables are plugged in and tightened.
3. Ensure that the drive SCSI address is the same as the SCSI address being used by host system. From the Operator Panel, select **Reports** → **Library Configuration**. View the SCSI ID for the affected drive. If the SCSI ID is different then expected, you must either change the drive SCSI ID or reconfigure the host.
4. If only one drive is failing on this SCSI bus, go to step 5. If more than one drive is failing on this SCSI bus, go to 6.
5. Replace the following CRU:
    - Drive sled

    If the problem is corrected, return to the procedure that sent you here or go to "End of Call" on page 7-33. If the failure still exists, go on to step 6.
6. Verify that the SCSI cable from the host system to the first drive is connected.
7. Disconnect the drive-to-drive SCSI cable from the first drive and replace with the terminator.
8. Run a utility (such as ITDT) to determine whether you can communicate with the first drive. If you cannot communicate with the drive, perform "Function Code 6: Run Host Interface Wrap Test" on page D-12.
    - If the SCSI Wrap Test runs successfully, replace the following:
        - SCSI terminator
        - SCSI host-to-host cable
        - Interposer (if installed)
        - Drive-to-drive SCSI cable (except for the first drive)

        If the failure still exists, it

2. Check host error logs to determine if a specific cartridge is causing the problem. Replace the cartridge that is listed as being faulty.
3. If the problem still exists, replace the following:
   - SCSI terminator
   - SCSI host cable
   - Drive sled

   If the failure still exists, it probably is caused by the host system hardware or software. Refer to the service documentation for the host system.

Fixing an Intermittent Error with Multiples Drives on a SCSI Bus

1. Verify that the latest level firmware is installed on the drive. Update the firmware, if necessary.

   Required library firmware and drive firmware can be downloaded by visiting http://www.ibm.com/storage/lto.
2. Check host error logs to determine if a specific cartridge is causing the problem. Replace the cartridge that is listed as being faulty.
3. If the problem still exists, replace the following:
   - SCSI terminator
   - SCSI host cable
   - SCSI drive-to-drive cables

   If the failure still exists, it probably is caused by the host system hardware or software. refer to the service documentation for the host system.

Fixing Fibre Channel Errors

If you are connected to a Fibre Channel Storage Area Network (SAN) by using a SAN Data Gateway, use the *IBM Storage Area Network Gateway Module Setup, Operator, and Service Guide* to determine whether the problem is occurring between the drive and the SAN Data Gateway. If you are using a SCSI drive and are having SCSI problems, see “Fixing SCSI Bus Problems” on page D-29.

Supported Topologies

The Ultrium 3 and Ultrium 4 tape drives can be attached in a two-node configuration, either directly to a switch as a public device (switched fabric) or directly to a host bus adapter (HBA) as a private device. It can do so in a Point-to-Point topology (through an N_port or F_port) or Arbitrated Loop topology (through an L_port or FL_port).

The Ultrium 3 and Ultrium 4 tape drives automatically configure to an L_port or an N_port when it boots. The type of port to which it configures depends on whether the drive recognizes the connection as a loop or a point-to-point connection:

- An L_port supports a Fibre Channel Arbitrated Loop connection to an NL_port or FL_port.
- An N_port supports direct connection to another N_port or to an F_port (for example, a director-class switch) in a point-to-point topology.

Regardless of the port to which you connect the drive, it automatically configures to a public device (through an F_port or FL_port to a switch) or to a private device (through an N_port or L_port by using direct attachment to a server).

The table below lists the topologies in which the Ultrium 3 and Ultrium 4 tape drives can operate,028000.0028219.7516707.43682.655719.4104Tm()Tj/F71T5ives

  - If the test fails, replace the fiber cable.
  - If the test is successful, go to step 6.
6. Check the Fibre Channel cable connection at the server.
7. Using a device driver utility such as *ntutil* or *tapeutil*, verify that the drive is properly configured and available at the server.
8. If the problem persists, the fault may be with the server's hardware or software. Refer to your server's service manual.
9. When the problem is corrected (or determined to be a server problem), restore all of the fiber cables to their correct position.

Fixing a Consistent Error with Multiple Drives on a Fibre Channel Loop

Use the following procedure to determine if all of the drives on the Fibre Channel have the problem:

1. Use a device driver utility (such as *ntutil* or *tapeutil*) to verify that the drive is available and properly configured at the server.
2. Determine the type of Fibre Channel topology that you are using.
3. Using this guide or the service guides of associated switch, hub, or fiber products, try to isolate which part of the Fibre Channel Storage Area Network (SAN) is experiencing problems.
4. Perform one of the following:
   - If the problem exists on a small number of drives, go to "Fixing a Consistent Error with a Single Drive on a Fibre Channel Loop" on page D-33.
   - If the problem exists with a large number of drives, perform the following steps:
     a. Disconnect all except one failing drive on the Fibre Channel.
     b. Run the Fibre Channel wrap test to determine if a failure occurs on that drive (see Function Code 6 in "Function Code 6: Run Host Interface Wrap Test" on page D-12). If it does, perform the procedure in "Fixing a Consistent Error with a Single Drive on a Fibre Channel Loop" on page D-33.
     c. Continue to connect one drive at a time to the Fibre Channel loop.
5. When the problem is corrected, restore all of the Fibre Channel cables to their correct position.

Fixing a Consistent Error in a Point-to-Point Topology

1. Ensure that the tape drive is powered on.
2. Verify that the tape drive's serial number is the same as the drive serial number that the server program is using.
3. Ensure that the drive is connected to the host or switch. The drive must be able to detect light and communicate with the server.
4. Run the Fibre Channel wrap test at the drive's Fibre Channel connector (see Function Code 6 in "Function Code 6: Run Host Interface Wrap Test" on page D-12).
   - If the test fails, replace the tape drive.
   - If the test is successful, go to step 5.
5. Run the Fibre Channel wrap test at the end of the fiber cable (see Function Code 6 in "Function Code 6: Run Host Interface Wrap Test" on page D-12).
   - If the test fails, replace the fiber cable.

- If the test is successful, go to step 6.
6. Check the Fibre Channel cable connection at the server.
7. Using a device driver utility such as *ntutil* or *tapeutil*, verify that the drive is properly configured and available at the server.
8. If the problem persists, the fault may be with the server's hardware or software. Refer to your server's service manual.
9. When the problem is corrected (or determined to be a server problem), restore all of the fiber cables to their correct position.

Fixing Intermittent Fibre Channel Errors

1. Determine the type of Fibre Channel topology that you are using.
2. Ensure that the configuration and software levels are supported.
   a. Determine the current software levels by selecting **Reports->Library Configuration**.
   b. Download the latest levels of software by visiting **http://www.ibm.com/storage/lto**.
3. Check that each Fibre Channel cable does not exceed 500 m (1640 ft).
4. Ensure that all Fibre Channel cables are installed correctly.
5. Using this guide or the service guides of associated switch, hub, or fiber products, determine that a problem exists between the drive, drive cable, and the device to which they attach. Try to isolate which part of the Storage Area Network (SAN) is experiencing problems.
6. Using this guide or the service guides of associated switch, hub, or fiber products, verify that the SAN configurations are correct (such as switch zoning for drive sharing).
7. Obtain all errors reported by the drive to the server (see "Using Host Sense Data" on page D-28), then contact your OEM Product Application Engineer (PAE) for error analysis.

Fixing SAS Interface Problems

If your drive is attached to the host through a SAS cable to a host bus adapter (HBA), the following procedures will assist you isolation and correction of any interface problems. SAS attachment requires no topology changes as is found in fibre channel attachment, and requires no external termination as is required in SCSI attachment. In addition, SAS drives are attached individually to the HBA, either through a one-to-one connection or through an interposer. You need not worry about another drive causing this drive to fail. As such, SAS attachment is by far the easiest interface to understand and to correct problems.

Currently, the SAS interface provides 3 Gb/s maximum speed over the interface. In the future, the ability to perform a diagnostic wrap of the signal will be provided. In the meantime, isolation will depend upon whether the problem is solid or intermittent. If the problem you are having is solid, refer to "Fixing a Solid Error with One Drive on a SAS Connection". If the problem you are having is intermittent, refer to "Fixing an Intermittent Error with One Drive on a SAS Connection".

Fixing a Solid Error with One Drive on a SAS Connection

1. Verify that the power is on to the drive.
   a. Verify that the library is powered ON.

   b. Verify that the power supplies (in the module containing the failing drive) are on.
   c. Verify that the drive is fully seated in the library chassis.
2. Determine if the drive is experiencing a hang condition.
   a. If a cartridge is in the drive, press the unload button.
      - If the cartridge ejects, the drive does not have a hang condition, go to step 5.
      - If the cartridge does not eject, go to step 3.
   b. If there is no cartridge in the drive, manually load a scratch cartridge into the failing drive. If the cartridge loads, the drive does not have a hang condition. Press the unload button to unload the scratch cartridge and go to step 6.
3. Press and hold the unload button for 20 seconds. The drive will save a dump and go into a reboot, which allows communication to the drive. Do not cycle power (power off then power on) or you will lose the dump contents.
4. Copy the Drive Dump with one of the following procedures
   - If the drive is no longer hung (cartridge can be unloaded), refer to “Function Code 5: Copy Drive Dump” on page D-11 and collect the dump on a scratch (blank) cartridge.
   - If the drive is still hung, refer to “Using the ITDT SCSI Firmware Update, Dump Retrieval and Drive Test Tool” on page 7-17 to secure the dump using ITDT. Contact your next level of support to determine if they can use this dump.
5. If the problem continues to be in the drive, replace the failing drive sled. Refer to “Drive Sled” on page 8-34. When complete, go to “End of Call” on page 7-33.
6. Ensure that the SAS cables or interposers are plugged in and tightened at both ends.
7. Ensure that the drive element address is the same as the element address being used by the host system. From the Operator Panel, select**Reports** → **Library Configuration**.
8. If another SAS drive is available, do the following:
   a. Quiece the library from all activity and swap the drives.
   b. If the problem stays with the suspect drive, replace the drive sled.
   c. If the problem moves to the new drive, replace the SAS cable or interposer.
   d. If the problem still exists after performing the above procedures, suspect a host system hardware or software problem. Refer to the service documentation for the host system.
   e. Go to “End of Call” on page 7-33.
9. If another SAS drive is not available to swap, replace the SAS cable or interposer.
10. If the problem still exists, replace the drive sled. If this does not fix the problem, suspect that the problem is caused by host system hardware or software. Refer to the service documentation for the host system.
11. Go to “End of Call” on page 7-33.

Fixing an Intermittent Error with One Drive on a SAS Connection.

1. Verify that the latest level of firmware is installed on the drive. Update the firmware, if necessary. Required library firmware and drive firmware can be downloaded by visiting http://www.ibm.com/storage/LTO.

2. Check host error logs to determine if a specific cartridge is causing the problem. Replace the cartridge that is listed as being faulty.
3. Check that the SAS cable length does not exceed the 5.5 meters (plus the short length of an interposer if used) allowed. Try a shorter cable (if possible) to see if it makes any difference.
4. If the intermittent failure still occurs, replace the drive sled. See “Drive Sled” on page 8-34.

Appendix E. 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 E-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 E-3 and locate the SCSI sense data.
- For SCSI bus errors (not SCSI adapter errors), refer to "SCSI Bus Error Example 1" on page E-4 and "SCSI Bus Error Example 2" on page E-5 to determine which host adapter, SCSI bus, and device or devices are affected. After you have determined which device or devices are affected, go to "Fixing SCSI Bus Problems" on page D-29 to resolve the problem.
- For Fibre Channel errors (not Fibre Channel adapter errors), determine which host adapter and device are affected, and go to "Fixing Fibre Channel Errors" on page D-32.

- 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 E-1. AIX ERRPT Library Error Log Example

Table E-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 E-2. AIX ERRPT Drive Error Log Example

Table E-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 E-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 E-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 E-5. AIX ERRPT Commands Error Log Example

        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 .
```

Retrieving from a Sun System

The Sun System provides information when an error occurs on a tape drive or library

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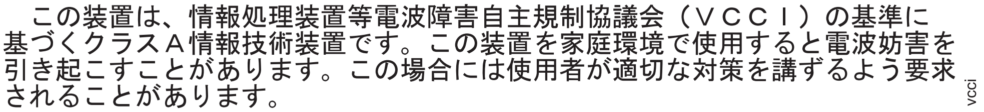

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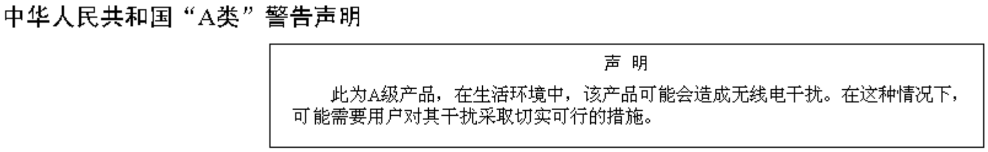

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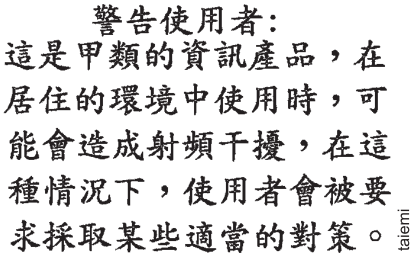

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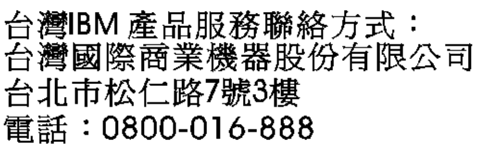

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The warranty for this product is negotiated on a per-customer basis.

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.

ADI. Automation Drive Interface.

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.

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.

DNS. Domain Name System. This allows the library to recognize text-based addresses instead of numeric IP addresses.

download. (1) To transfer programs or data from a computer to a connected device, typically a personal computer. (2) To transfer data from a computer to a connected device, such as a workstation or microcomputer.

DRAM. Dynamic random-access memory.

drive, magnetic tape . A mechanism for moving magnetic tape and controlling its movement.

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.

ITST. Idle-time self-test.

K

kilogram (kg). One thousand grams (approximately 2.2 pounds).

km. kilometer. 1000 Meters, Approximately 5/8 mile.

L

LAN . Local area network. A computer network within a limited area.

LCD. See *liquid crystal display*.

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

LDI. Library Drive Interface.

LED. Light-emitting diode.

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.

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

NVS. Nonvolatile storage. A storage device whose contents are not lost when power is cut off.

O

oersted. The unit of magnetic field strength in the 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 4*π* 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.

retension. The process or function of tightening the tape onto the cartridge, if it is sensed that the tape has a loose wrap on the cartridge.

RID Tag. Repair Identification tag.

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.

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

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

SCSI. Small computer system interface.

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.

SMTP. Simple Mail Transfer Protocol (SMTP) is a standard for e-mail transmissions across the Internet.

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

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.

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IBM System Storage TS3310 Tape Library
Maintenance Information
for IBM Service Personnel
Machine Type 3576

Publication No. GA32-0478-03

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