3447 and 7337 Digital Linear Tape Library

Service Guide

IBM

3447 and 7337 Digital Linear Tape Library

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IBM

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>
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First Edition (May 1998)

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Contents

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Examples of danger, caution, and attention notices follow.

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A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. The following is a sample danger notice:

DANGER

> **An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.** *(RSFTD201)*

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

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> **The weight of this part or unit is between 32 and 55 kilograms (70.5 and 121.2 pounds). It takes three persons to safely lift this part or unit.** *(RFSTC205)*

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

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3447 and 7337 Digital Linear Tape Library

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- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

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Responsible Party:

International Business Machines Corporation
Old Orchard Road
Armonk, NY 10504
Telephone: 1-919-543-2193

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This Class B digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

Avis de conformité à la réglementation d'Industrie Canada

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

General FRU Strategy

Use the following strategy when replacing a field replaceable unit (FRU):

- If the situation is critical (for example, a single point of failure exists on a high-availability system or the failure represents a severe impact to customer operations), ensure that all FRUs in the FRU group are available locally in case they are needed. Return the unused stock immediately after the problem is corrected.

- If the problem is intermittent and you cannot get the machine to fail, it may be appropriate on the first call to replace the first FRU in the list or the most likely FRU (minus the mechanical assemblies). This action may minimize future calls. Use your judgement, based on problem severity and customer input, to determine the correct action to take.

- If the problem is solid or can be recreated, do not replace multiple FRUs on a trial repair. Also, if a FRU does not correct the problem, re-install the original FRU and return the new FRU to stock. This avoids the introduction of new problems that may increase outage time.

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DLTtape III XT
DLTtape IV

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About This Guide

This guide describes how to service the 3447 and 7337 Digital Linear Tape Library. It contains the following chapters:

Chapter 1, "Reference Information," lists the specifications for the tape library and tape drives, identifies the major components, and provides an overview of the tape library.

Chapter 2, "Maintenance Analysis Procedures," provides procedures for determining the cause of problems that might occur. The emphasis is on determining power-on failures.

Chapter 3, "Service Operations," explains how to perform the procedures for correcting problems. It also includes routine maintenance that service representatives can perform, provides procedures for cleaning the tape drive heads and the tape library cabinet, and gives instructions for running confidence tests and remote diagnostics.

Chapter 4, "Removal and Replacement Procedures," explains how to remove and replace the tape drives, the controller, the power supply and fuse, the tape library cover, the door bezel and upper bezel, the liquid crystal display (LCD) assembly, the bar code reader, and the base tape library.

Chapter 5, "Installing the Rack-Mounted Tape Library," provides procedures for installing the tape library in an instrument rack.

Chapter 6, "Parts Diagram and Parts List," provides illustrations showing the location of field-replaceable parts, and lists the part numbers for ordering the replacement parts.

Appendix A, "Power Cables," provides power cable information for different countries.

Appendix B, "Updating the Tape Library Firmware on the RS/6000," presents the steps required to update the tape library firmware by using the Atape `tapeutil` tool available on RS/6000 computers.

Appendix C, "Accessing the System Error Log (for the RS/6000 Only)," explains how to access the system error log for RS/6000 systems by using the `smit` and `errpt` commands.

Appendix D, "Performing the System Verification (for the RS/6000 Only)," explains how to use the `tapeutil` and `tctl` commands to verify that the RS/6000, SCSI cable connectors, and tape subsystem operate as a complete system.

Appendix E, "Converting Hex Characters to ASCII," gives a table that converts hexadecimal characters (Hex) to ASCII characters. This conversion may be useful during a service call.

Related Publications

- *3447 and 7337 Digital Linear Tape Library Setup and Operator Guide*, GA32-0399, provides information about installing and operating the Digital Linear Tape Library.

- *External Devices Translated Safety Notices*, SA26-7192, provides translations of danger and caution notices.

- *AIX V4 System Management Guide: Operating Systems and Devices*, SC23-2525, provides information about how to manage the AIX operating system.

- *SCSI Tape Drive, Medium Changer, and Library Device Drivers Installation and User's Guide*, GC35-0154, provides information about the AIX device driver for the Digital Linear Tape Library.

Chapter 1. Reference Information

The IBM Digital Linear Tape Library is a robotic tape handling system that provides up to 525 GB of uncompressed or 1050 GB (1.05 TB)[1] of compressed data storage capacity for network computer systems. The total data capacity depends on the type of tape cartridges in the tape library and the number of storage cells reserved for data tape cartridges. The tape library can hold a maximum of 15 tape cartridges; up to 10 cartridges can be held in a removable magazine and up to 5 cartridges in fixed cells located inside the library.

The tape library has two configurations:

- Rack-mounted (for use in industry-standard instrument racks)
- Desktop (for use on horizontal work surfaces)

Figure 1 shows the tape library in these configurations.

MODELS 102, 106 AND 306
(SHOWN EXTENDED)

MODELS 101,105 AND 305

Ibm01a
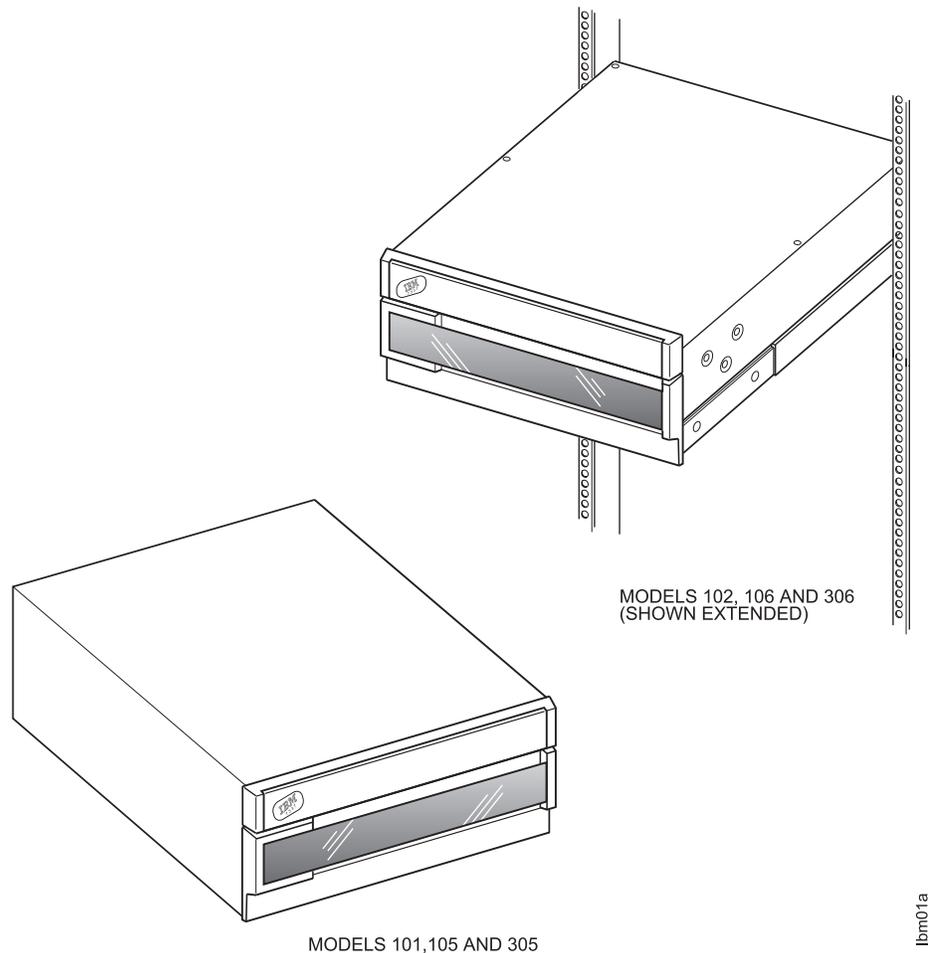
Figure 1. Tape Libraries in Typical Configurations

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[1] 1 GB = one gigabyte or 1 000 000 000 bytes, and 1 TB = one terabyte or 1 000 000 000 000 bytes

1

The tape library connects to computer systems or network servers to provide high-capacity system backups. It is suitable for on-line storage, as well as retrieval and archival of large files (such as image files) and sequential data sets.

The library is available in two machine types: 3447 and 7337. The 3447 Digital Linear Tape Library has two models:

- Model 105 (Desktop Single-ended Interface Library)
- Model 106 (Rack Mount Single-ended Interface Library)

The 7337 Digital Linear Tape Library also has two models:

- Model 305 (Desktop Differential Interface Library)
- Model 306 (Rack Mount Differential Interface Library)

The tape library is designed for unattended operation; however, an operator display panel on the front of the 7337 Tape Library lets you monitor library and drive activities, suspend operations, load and unload tape cartridges, and run confidence tests and diagnostics. These operations can also be initiated through the host computer interface.

The tape library communicates with a host computer through a small computer systems interface-2 (SCSI-2). The library has an RS-232 connector on the back panel. Using this connector, you can attach a terminal or small computer to download firmware or to access diagnostic and statistical information.

Components

The tape library components that a service representative needs to be familiar with are the:

- Front door
- Removable magazine
- Tape drives
- SCSI connections
- RS-232 connection
- Power connection

Figure 2 on page 3 shows the tape library with the front door open and top cover removed so that the removable magazine and tape drives can be seen. This figure also shows the locations of the bar code reader, robotic shuttle, and fixed cells.

FIXED
CELLS
(5)

ROBOTIC
SHUTTLE
ASSEMBLY

TAPE
DRIVE
A

TAPE
DRIVE
B

BAR CODE
READER

TAPE
CARTRIDGES
(10)
IN MAGAZINE
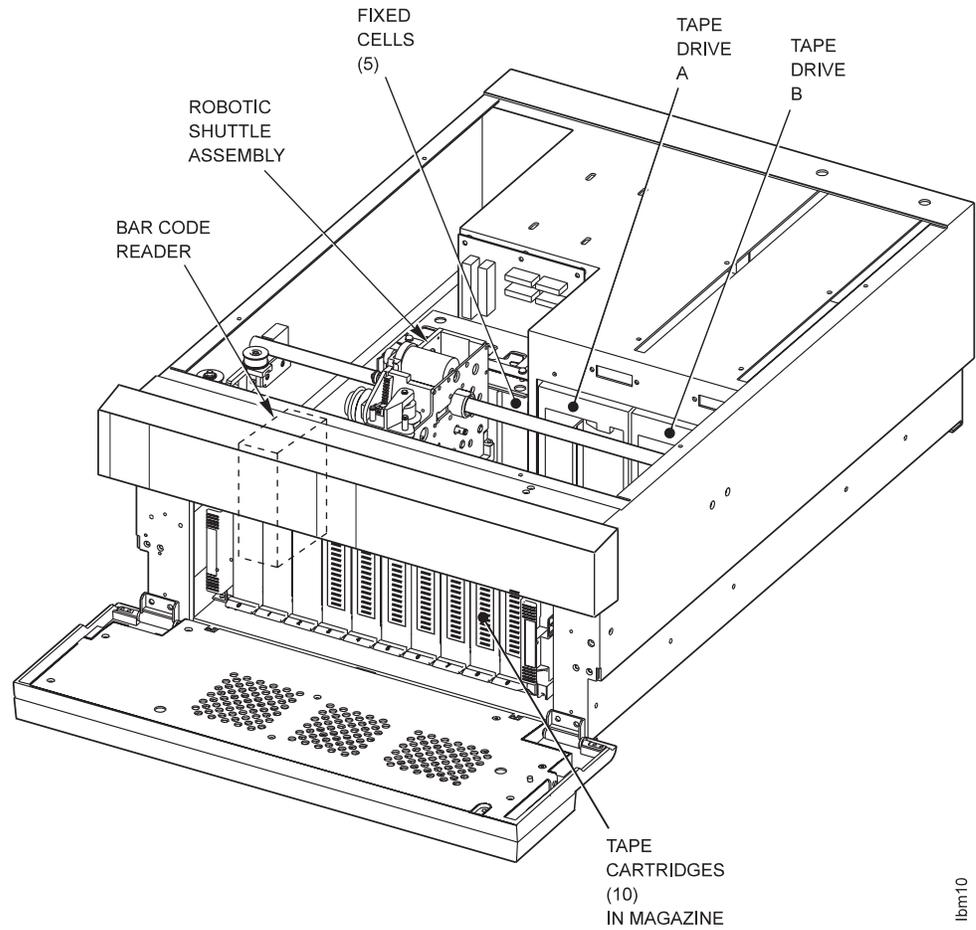
Ibm10

Figure 2. Major Components in the Tape Library

Figure 3 on page 4 shows the back panel of the tape library and the components accessible from the rear of the library.

SCSI ID
SWITCHES

CONTROLLER
SCSI CONNECTORS

LIGHTS
GREEN 24 VOLT
GREEN 5 VOLT
RED CONTROLLER FAULT

TAPE DRIVE B   TAPE DRIVE A   CONTROLLER   POWER SUPPLY

CAUTION
Remove the
power plug
from this unit
prior to service
or removal of
the power
supply, tape
drives or
CPU card.

REPLACEMENT FUSE
T4A, 250V

TAPE DRIVE B
SCSI CONNECTORS

CONTROLLER
RESET
BUTTON

POWER
SWITCH

POWER
CONNECTOR

TAPE DRIVE A
SCSI CONNECTORS

RS-232C
CONNECTOR

4 AMP
250 VOLT FUSE

Ibm04

Figure 3. Back Panel of the Tape Library

Note the SCSI labels on the tape drives and the controller; they indicate whether
the library has a single-ended or differential interface.

The sections that follow describe the components in the tape library.

Front Door

The front door of the tape library provides access for loading and unloading a tape
cartridge magazine, or for reaching the front of the robotics that handle the tape
cartridges. The front door also contains the operator panel that provides operational
information about the tape library. Above the front door, in the upper bezel, are the
control keys and the front door lock. The front door is hinged along the bottom and
is secured by a solenoid and key. When unlocked, you can open the door by
rotating it down. Whenever you open the front door, all robotics movement is
disabled. For information on how to use the front door key, operator panel, and
control keys, see Chapter 3, "Service Operations" on page 49.

Attention: Whenever the front door is opened, the cartridge inventory is
invalidated. For information on how to set up the tape library to automatically run
the tape inventory after the front door has been opened and closed, see "Setup
Procedure" on page 82.

Each time the front door is opened, the tape library reinitializes. If the tape library
was in the middle of a move operation when the front door was open and then
closed, the library restarts from its last known position and finishes the operation.

Removable Magazine

The removable magazine holds tape cartridges used for storing data. The magazine can hold ten tape cartridges. The magazine is keyed to prevent insertion of the cartridges in the wrong orientation. You can add or remove cartridges by opening the front door on the tape library. The magazines are designed so that they can be securely stacked on top of each other when several magazines are stored outside the tape library.

Fixed Cells

The tape library has five fixed cartridge cells located inside the chassis behind the robotic shuttle. The fixed cells can be used for holding cleaning, special purpose, or data tape cartridges. These cells can be loaded manually or by the robotic shuttle under host software control.

Robotic Shuttle

The robotic shuttle moves tape cartridges between the fixed cells, removable magazine, and tape drives. The shuttle is located between the removable magazine and the tape drives. It travels from side to side to position itself in front of the appropriate cartridge. The shuttle then removes the cartridge from its location, transports it to a host- or operator-specified location, and inserts the cartridge into the new location. The shuttle is designed to ensure that a cartridge can never be dropped.

Bar Code Reader

Using the bar code reader, the tape library can identify tape cartridges by bar code labels that you can slide into the face of the cartridge. If a label is missing, the tape can be identified by its recorded data. The tape library bar code reader consists of a light-emitting diode (LED) light bar and a charge-coupled device (CCD) optical sensor located next to the removable magazine. The tape library reads a bar code by moving a tape cartridge from a cell and positioning the cartridge in front of the bar code reader. With the bar code reader, a complete cartridge inventory can be performed in approximately five minutes.

Tape Drives

The tape library contains one or two DLT7000 tape drives. Each tape drive is mounted on a drive load plate that also includes a fan (for cooling the tape drive) and the drive handle-opening mechanism. When the tape library has only one tape drive, the unused drive location is filled by a cover plate. If the tape library was originally installed with only one tape drive, a second tape drive can be added later to increase data transfer capability.

Figure 3 on page 4 shows the location of the DLT7000 tape drives in the tape library back panel.

SCSI Connectors

The tape library uses SCSI-2 protocol to communicate with the host computer. To ensure proper tape library operation, the SCSI connector on the cable from the host to the tape library must meet the following specifications:

- 68 pins
- Fast and wide

- Micro "D" screw mount (2-56 screw)
- Gold-plated connector pins

Figure 3 on page 4 shows the SCSI connectors on tape library controller and tape drives.

SCSI Protocol

Separate protocols exist for the tape library and the tape drive. The sections that follow describe the protocol for each.

Protocol for Tape Library

The tape library uses SCSI-2 protocol to communicate with the host computer. It communicates as a medium changer device, and is available in both differential and single-ended versions. The tape library is a single device target that does not support multiple logical units. Each tape library occupies a maximum of three SCSI target IDs: two for the drives and one for the robotics. The tape library does not support linked commands, tagged command queuing, or the flag bit. Also, the tape library controller does not initiate negotiation of Transfer Parameters. It does, however, participate in (or respond to) negotiations from the host. The tape library defaults to and only supports asynchronous (slow) and narrow transfer parameters.

The software for the tape library robotics is completely self-contained and executes commands received from the host over the SCSI bus. Error recovery is transparent to the host. To support high reliability systems, the tape library can report its internal voltages, drive temperatures, and the controller temperature as log sense information that can be sent to the host computer.

Protocol for Tape Drive

The DLT7000 drive supports wide and narrow asynchronous and synchronous data transfers. The product has differential and single-ended versions. Odd parity is generated during all information transfer phases where the drive writes data to the SCSI bus. Parity is checked during all information transfer phases where data are read from the bus. Parity checking can be disabled. For information about changing parity, contact your support personnel.

The DLT7000 drive supports a block size of from 1 byte to 16 MB (where MB equals one megabyte or 1 000 000 bytes).

Disconnections from the SCSI bus are done at regular intervals during a data transfer. This allows other devices to access the bus.

The DLT7000 drive does not act as an initiator on the SCSI bus. Therefore, the drive does not:

- Generate unsolicited interrupts to the host
- Initiate its own SCSI commands
- Reset the bus

Other SCSI functions that are supported include linked commands and untagged queueing.

SCSI Cable Lengths

The tape library comes with the SCSI cables to connect the tape library controller to the tape drives. The SCSI cable to connect the host to the tape library controller must be supplied by the installer. Figure 4 lists the available SCSI cables and lengths. The following are the maximum combined cable lengths for the host-to-tape library controller SCSI cables:

- Single-ended SCSI cable (19 ft, 8 in. or 6 m)
- Differential SCSI cable (82 ft or 25 m)

Note: These SCSI cable lengths are approximate and do not include the internal cable lengths, which effectively shorten the host-to-tape library cable lengths.

The internal SCSI cable length for the controller is approximately 6 in. (15.3 cm). The length for the internal SCSI cable for each drive is approximately 12 in. (30.5 cm). The length for a cable to connect a tape drive to the controller is approximately 12 in. (30.5 cm). As an example, in a configuration with two tape drives with a daisy-chain connection to the controller, the reduction in length of the host-to-controller cable is approximately 54 in. (137.2 cm).

Figure 4. Table 5. SCSI Cables for RS/6000 and PC		
Feature Code	**Length**	**Part Number**
Cables for RS/6000		
2845	2 ft (0.6 m)	52G4291
2846	8 ft (2.5 m)	52G4233
2878	14 ft (4.5 m)	88G5749
2879	39 ft (12.0 m)	88G5747
2880	59 ft (18.0 m)	88G5746
Cables for PC		
Not applicable	14 ft (4.5 m)	49G6457

Terminators

The SCSI bus is not terminated internally by the drives or tape library electronics. Termination must be installed or present at both ends of the SCSI bus. On the library and tape drive end of the bus, bus termination is supplied by a terminator plug supplied in the ship group. This terminator must be plugged on one of the connectors of the last device on the bus. Termination at the host end is typically supplied by the SCSI adapter card.

The tape library is available as either a single-ended or differential SCSI device. Single-ended and differential SCSI devices require different terminators. The tape drives in the tape library are clearly marked as to the type of device. Make sure that the correct terminator is installed for the type of SCSI device:

- A single-ended terminator has the word **ACTIVE** on the terminator
- A differential terminator has the word **DIFFERENTIAL** on the terminator

Figure 5 on page 8 shows what the single-ended and differential SCSI labels on the tape library look like.

SINGLE ENDED

DIFFERENTIAL

Diffuse

Figure 5. SCSI Labels

Termination Power

Termination power is typically supplied by the SCSI adapter card, in addition to being supplied as the default configuration by the internal drives and the controller. Termination power can be disabled by removing jumper J4 on the controller (see Figure 6). (For information on accessing the controller to remove the jumper, see "Removing and Replacing the Controller" on page 94.) Drive termination power can also be disabled by removing jumpers on the drives.

TERMINATION POWER JUMPER
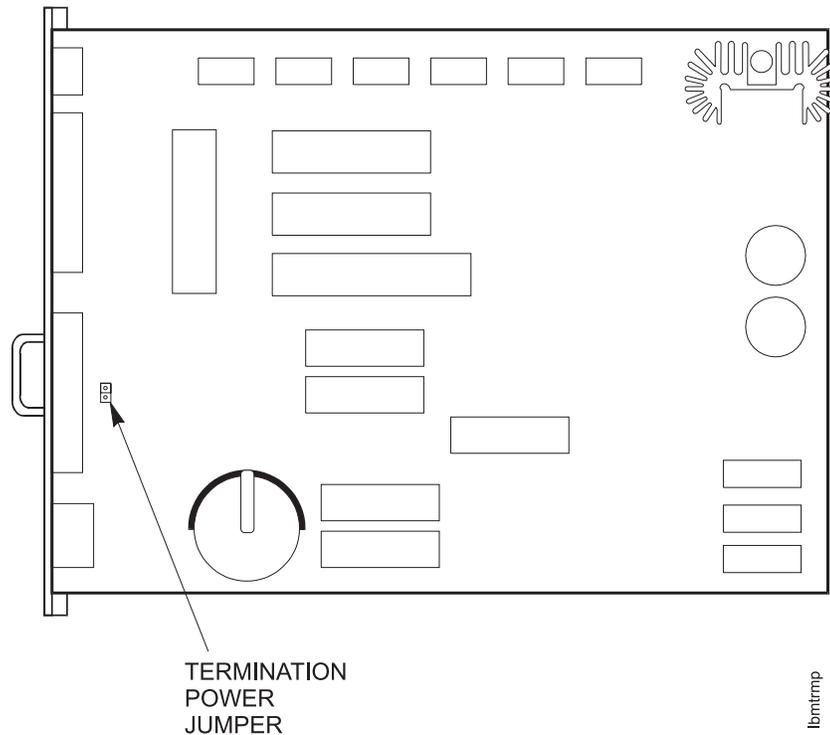
lbmtrmp

Figure 6. Termination Power Jumper on Controller

RS-232 Connector

The RS-232 connection provides a serial interface to the tape library controller. You can connect a host computer or an external terminal to the RS-232 connection to access diagnostic and status information, or to download new tape library firmware.

Figure 3 on page 4 shows the location of the RS-232 connector on the back panel of the tape library.

Power Connector

The tape library connects to a power source through a standard IEC 320 connector. Each tape library is shipped with a power cord for use in the United States. To determine the type of power cord that is appropriate for operation outside the United States, refer to Appendix A, "Power Cables" on page 123.

Figure 3 on page 4 shows the location of the power supply with the power connector and power switch.

Controller Lights

The controller has three lights that indicate the operational state of the tape library (see Figure 3 on page 4). The lights are:

Top   A green light that, when lit, indicates 24 V is available to power the robotic shuttle. If the light is not lit, 24 V is not available because the shuttle could not move and caused a power overload that dropped the 24 V, or because of problem with the power supply. When the tape library controller determines that it has a problem with the robotics, it removes the 24 V. Also, when the front door is open, the 24 V is removed.

Middle   A green light that, when lit, indicates 5 V is present for the controller logic and tape drives.

Bottom   A red light that, when lit, indicates a problem with the controller.

Controller Reset Button

The controller reset button (see Figure 3 on page 4) is used to produce a hard system reset. The effect is the same as powering the tape library off and then on again. When the reset button is pressed, the tape library enters the initialization/setup mode. In the initialization/setup mode, the robotics calibrates the system and prepares to go on-line. This is useful for restarting a library that might have stopped in the middle of an operation, or to start the initialization routine so that you can enter the setup mode.

Simultaneously pressing the MENU, CYCLE, and SELECT control keys for approximately six seconds will also reinitialize the tape library. For more information about the control keys, see "Using the Control Keys" on page 53.

Operational Modes

While the tape library is powered on, it is in one of five operational modes:

- Initialization/setup
- On-line
- Off-line
- Diagnostic Off-line
- Autoloader

Initialization/Setup Mode

The tape library enters the initialization/setup mode when you:

- Turn on the power to the tape library
- Open, then close the front door
- Reset the tape library

In the initialization mode, the robotics calibrate the system and, unless an interrupt occurs, the tape library then goes into the on-line mode. Press any control key during the initialization mode to enter the setup mode.

In the setup mode the installer can change the tape library setup parameters. For information about changing the setup parameters, refer to "Setup Procedure" on page 82.

Attention: If you inadvertently enter the setup mode by pressing any one of the control keys during library initialization, do not press the SELECT control key (right key) at any time, as this action will alter the setup parameter currently shown on the operator panel. To exit the setup mode without affecting any of the setup parameters, recycle the power (press the power switch off and then on) or repeatedly press the MENU control key (left key) until you exit the setup mode.

SCSI communication with the host is not enabled during the initialization/setup mode.

On-Line Mode

After initialization, the tape library automatically enters the on-line mode. Normal host operations (such as tape cartridge mounts and dismounts) are run in the on-line mode. SCSI communication with the host is enabled. The tape library changes from the on-line mode when another mode is selected from the operator panel.

Off-Line Mode

Limited SCSI communication occurs in the off-line mode. The tape library rejects motion commands from the host. To enter the off-line mode, manually select OFFLINE from the operator panel.

Diagnostic Off-Line Mode

Use the diagnostic off-line mode to perform diagnostic tests or exercises on the tape library. In this mode the RS-232 port is active and SCSI communication with the host is not enabled. Enter the diagnostic off-line mode by selecting DIAG OFFLINE from the operator panel. The tape library exits the diagnostic off-line mode when another mode is selected from the operator panel or after remote diagnostics are finished and turned off.

Autoloader Mode

Use the autoloader mode to specify a range of tapes to be autoloaded in a sequential operation (that is, without host media changer commands). Enter the autoloader mode by selecting AUTOLOADER from the setup menu. The tape library exits the autoloader mode when the AUTOLOADER parameter is turned off in the setup menu. For more detailed information, see "Setup Information" on page 81 and Appendix B, "Using Autoloader Mode," in the *3447 and 7337 Digital Linear Tape Library Setup and Operator Guide*.

Note: The preceding description applies to tape library firmware at level 1.50 or higher.

Specifications

The following tables provide the specifications for the tape library:

- Figure 7 lists the specifications for the tape library itself
- Figure 8 on page 13 lists the specifications for the DLT7000 tape drive that is used with the tape library
- Figure 9 on page 14 lists the tape library SCSI commands
- Figure 10 on page 15 lists the DLT7000-supported SCSI commands

Figure 7 (Page 1 of 2). Specifications for the Digital Linear Tape Library			
Physical Dimensions		**Rack-Mount**	**Desktop**
	Height	8.75 in (22.23 cm)	9.25 in (23.50 cm)
	Bezel Height above Rack Mounting Flange	0.75 in (1.91 cm)	- -
	Overall Width	18.88 in (47.96 cm)	18.88 in (47.96 cm)
	Chassis Width	17.50 in (44.45 cm)	- -
	Chassis Width at Mounting Rails	16.625 in (42.23 cm)	- -
	Length	26.50 in (67.31 cm)	26.50 in (67.31 cm)
	Weight (with two drives)	72 lb (32.73 kg)	92 lb (41.82 kg)
	Weight of Tape Drive Module	8.60 lb (3.91 kg)	- -
	Weight of Magazine with 10 Cartridges	6.60 lb (3.00 kg)	- -

Figure 7 (Page 2 of 2). Specifications for the Digital Linear Tape Library		
		Rack-Mount and Desktop
Clearance Requirements	Front (for 3447 Tape Library Model 105 and 7337 Tape Library Models 305 and 306)	8.00 in. (20.32 cm) (for magazine replacement)
	Front (for 3447 Tape Library Model 106)	Sufficient clearance to open the rack door
	Rear	6.00 in. (15.24 cm)
	Sides	0
	Top	0
Operating Environment	Temperature	+50F to +95F (+10C to +35C)
	Humidity	20% to 80% (noncondensing)
	Maximum Wet Bulb	+73.4F (+23C)
	Maximum Temperature Gradient	+11C/hr
	Maximum Humidity Gradient	10%/hr
	Operating Altitude	0 to 8000 ft (0 to 2438.4 m)
Non-operating Environment	Temperature	-40F to +140F (-40C to +60C)
	Humidity	20% to 80% (noncondensing)
	Maximum Wet Bulb	114.8F (+46C)
	Maximum Temperature Gradient	+10C/hr
	Maximum Humidity Gradient	15%/hr
	Non-operating Altitude	30,000 ft maximum (9144 m)
Performance	Typical Power-on to Library On-line	30 s
	Maximum Power-on to Library On-line	80 s
	Typical Cartridge Inventory, Bar Code Disabled	30 s
	Typical Cartridge Inventory Bar Code Enabled	300 s
	Average Cartridge Access	13.5 s
Power Requirements	Voltage	100 to 240 V ac
	Frequency	48 to 64 Hz
	Power Consumption by Library	130 W (typical; maximum with two DLT7000 tape drives)
	Power Consumption by DLT7000 Drive	155 W (peak; maximum with two DLT7000 tape drives)
Power Supplies		One +5/+12/+24V power supply (The power supply provides power to the tape modules and robotics.)
AC Connector and Line Cord	AC Power Connector	Standard IEC 320 connector (The tape library is shipped with a power cord for use in the USA. For operation outside the USA, see Appendix A, "Power Cables" on page 123.)

Figure 8. Specifications for the DLT7000 Tape Drive	
Characteristic	**Value**
Transfer Rate (uncompressed)	5.0 MB/s sustained 20.0 MB/s burst (wide)
Capacity (uncompressed)	35 GB
Transfer Rate (@ 2:1 compression)	10 MB/s
Capacity (@ 2:1 compression)	70 GB
Tape Length	1800 ft (549 m)
Tape Speed	160 ips Read/Write (406.4 cm/s) 175 ips Rewind/Search (444.5 cm/s)
Average Rewind Time	60 s
Maximum Rewind Time	120 s
Average Search Time	60 s
Average Access Time	100 s
Tracks	208; 52 quads
Linear Bit Density	85,937 bpi/track
Interface Configurations	SCSI-2 16-bit fast, wide Single-ended or Differential
Mean Time Between Failures (MTBF)	200,000 hours
Head Life	30,000 tape motion hours
Tape Composition	MP2 (DLTtape IV)

Figure 9. SCSI Commands for the Digital Linear Tape Library	
Command	**Code**
Initialize Element Status	07h
Initialize Element Status with Range	E7h
Inquiry	12h
Log Select	4Ch
Log Sense	4Dh
Mode Select (6)	15h
Mode Sense (6)	1Ah
Move Medium	A5h
Position to Element	2Bh
Prevent/Allow Medium Removal	1Eh
Read Element Status	B8h
Release	17h
Request Sense	03h
Request Volume Element Address	B5h
Reserve	16h
Send Diagnostic	1Dh
Send Volume Tag	B6h
Test Unit Ready	00h
For additional information about SCSI-2 communications, refer to Standard X3T9.2/86-109 Revision 10h of the American National Standard Institute (ANSI).	

Figure 10. DLT7000-Supported SCSI Commands	
Command	**Code**
Erase	19h
Inquiry	12h
Load-Unload	1Bh
Locate	2Bh
Log Select	4Ch
Log Sense	4Dh
Mode Select	15h
Mode Sense	1Ah
Prevent/Allow Medium Removal	1Eh
Read	08h
Read Block Limits	05h
Read Buffer	3Ch
Read Position	34h
Receive Diagnostic Results	1Ch
Release Unit	17h
Request Sense	03h
Reserve Unit	16h
Rewind	01h
Send Diagnostic	1Dh
Space	11h
Test Unit Ready	00h
Verify	13h
Write	0Ah
Write Buffer	3Bh
Write Filemark	10h

Chapter 2. Maintenance Analysis Procedures

This chapter provides procedures to isolate tape library failures and to repair those failures. The emphasis is on determining the cause of failures that occur without an error code shown on the operator panel.

The Maintenance Analysis Procedures (MAPs) in this chapter rely on error codes, sense information, observed status information, and failure information. The diagnostics and exercisers that are required are available using the control keys on the front panel (see "Using the Control Keys" on page 53).

In addition to the MAPs, a Remote Diagnostic Interface can also be used to perform maintenance analysis (see "Remote Diagnostic Interface" on page 65). The Remote Diagnostic Interface is a serial port on the tape library controller card. If you have a PC or a laptop with a communication program and a null modem cable, you can access this supplemental facility. Tape library firmware can be updated and debug trace information can be downloaded to a diskette through the interface.

Begin all problem analysis for the tape library with the Tape Library Start MAP.

Note: This product contains Torx screws. A set of Torx screwdrivers can be obtained by IBM Service Personnel by ordering Chesco 13 Pc Torx Set (IBM part number 62G1347).

Tape Library Start MAP

Leave the tape library power on. If the library power is off, turn the power on. Ensure that all customer applications have completed operation.

Step 1

Note and record the following:

- Are there any obvious power light or error light problems?

  - Are all three fans operating?
  - Is the operator panel lit?
  - Does the operator panel display have poor contrast?
  - Do the control keys function properly?
  - Is the 5 V light on? (The 24 V light may be on or off; see the lights at the rear of the library.)
  - Is the controller fault light (red) on?

- Does the operator panel display any messages or error codes?

- Does the host console display any messages, error codes, or sense data?

- Has the customer made any comments?

Step 2

Open the front door of the tape library and remove the magazine. Go to the "Initial Inspection Checklist," then go to Step 3 .

Step 3

Did you note any power or display problems or is the library controller fault light on?

Yes   Go to "Power Problems and Fault Light MAP" on page 20.

No   Go to Step 4.

Step 4

Did you find and fix an observed library or tape drive problem?

Yes   Go to "Library Exerciser, Diagnostic, and Fix Verify Selections" on page 35, or "DLT7000 Tape Drive Diagnostic and Fix Verify Selections" on page 37.

No   Go to Step 5.

Step 5

Did the operator panel indicate that a drive requires service, or did you observe a possible drive problem (such as blinking lights or a stuck cartridge), or did the host error data or message indicate a tape drive problem?

Yes   Go to "DLT7000 Tape Drive MAP" on page 24.

No   Go to Step 6.

Step 6

Did you observe a possible base library problem during the inspection, or did the bar code reader have difficulty reading external bar code labels on the tape cartridge?

Yes   Go to "Base Library Problem MAP" on page 27.

No   Go to Step 6.

Step 7

Did you have a SCSI or interface problem affecting one or more devices?

Yes   Go to "SCSI or Interface MAP" on page 28.

No   Go to "Problem and Error Code Recreation MAP" on page 30.

Initial Inspection Checklist

Note: If the top cover of the tape library is accessible, remove the top cover to aid in the inspection procedure. Leave the tape library front door open, however, as this action disables the robotic shuttle. The 24 V light on the library controller card at the rear of the tape library will be off if the front door of the tape library is open. Also, if the tape library experiences motion problems, it automatically removes power to the robotic shuttle and the 24 V

light will be off, even with the door closed. For a view of the tape library with the top cover removed, see Figure 11 on page 19.

Attention: By removing the top cover and locking the front door you can observe robotic operations. Some of the procedures in the MAPs suggest that you do this. You must be extremely careful not to put your fingers into the moving robotic shuttle or to let loose clothing fall into the interior of the tape library so that it interferes with movement of the robotic shuttle. Never place your fingers or tools into the tape library while a diagnostic test is running or the robotic shuttle is moving.
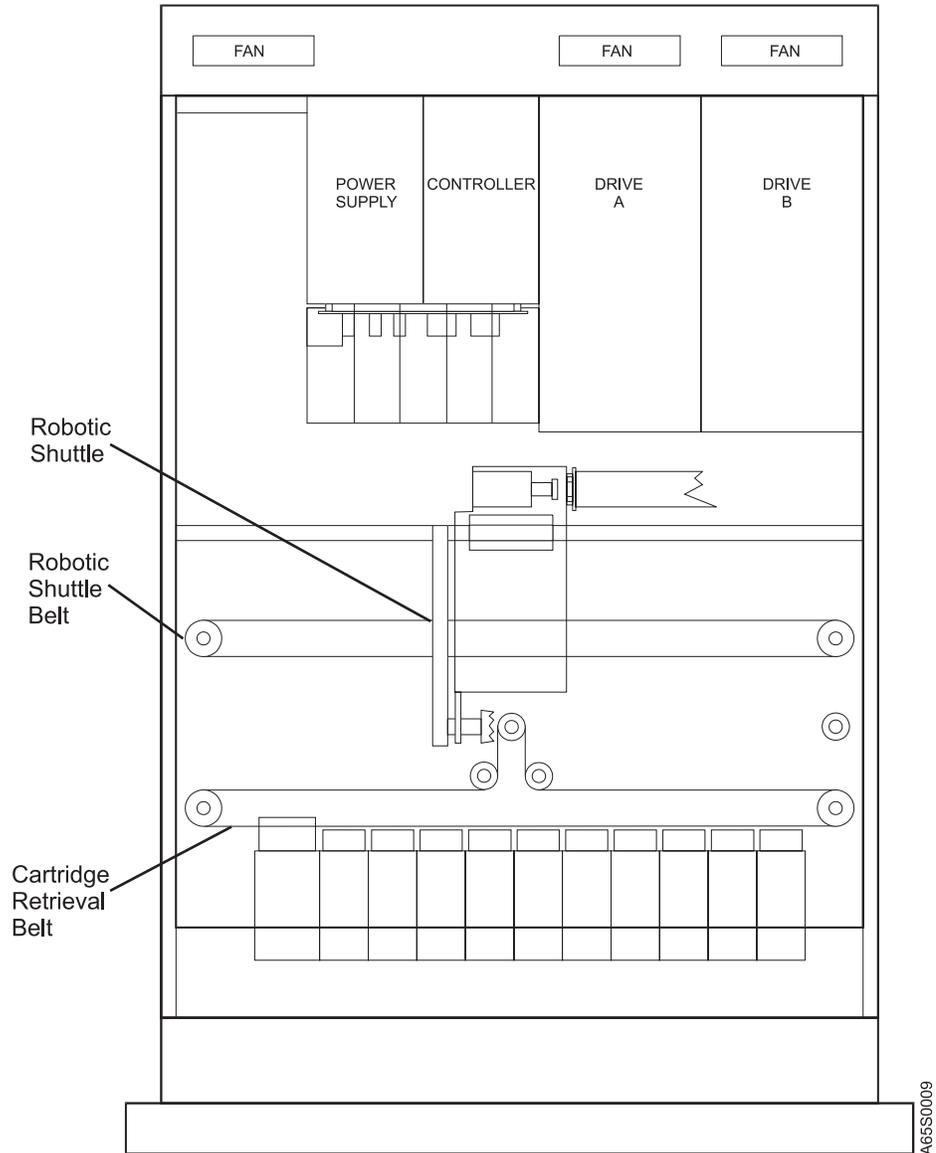
Figure 11. Tape Library with the Top Cover Removed.   The view is from the top. The robotic shuttle belt is visible.

1. Note the location of the shuttle, as it may indicate where the problem is.

2. Inspect for loose or broken parts:

   - Belts
   - Internal cable connectors or wires
   - Tape cartridge
   - Robotic shuttle

3. Gently move the robotic shuttle from side to side, with your fingers pressing on the shuttle chassis:

   - Note any unusual noises or binding
   - Note and correct (if possible) any blockage in the shuttle path
   - Note and correct any protruding cartridges
   - Note and correct any internal cables that are unplugged
   - Note the integrity of the shuttle ribbon cable

4. Move the shuttle to the extreme left (in front of the bar code reader). Observe and note the condition of the tape drives:

   - Are the status lights blinking? (The lights on the top row refer to a servo-related problem; the lights on the bottom row refer to an interface-related problem. To determine the meaning of the steady and blinking status lights, see Figure 15 on page 38.)

     Note: Blinking status lights are often caused by a defective tape cartridge. A defective tape cartridge can cause the drive leader mechanism to detach as it is inserted into the tape drive loader. The detached leader requires a tape drive replacement. If a tape cartridge is found to be defective (see "Tape Cartridge Inspection Procedure" on page 85), **never** reuse this tape cartridge in another tape drive. It will require tape drive replacement on each drive in which it is inserted.

   - Are cartridges in or out of drives?

   - Are the door handles on the tape drives completely open or closed? Press gently on the handle in the appropriate direction when inspecting.

5. Check for proper connection of the SCSI cables and terminator at the rear of the library.

6. Note if the library controller fault light (red) is on. The light is located at the rear of the tape library, on the controller card (see Figure 3 on page 4).

When the inspection is complete, return to the procedure that sent you here.

Power Problems and Fault Light MAP

Attention: Turn off the power to the library.

If you came to this MAP only because the 24 V light is off, check for a different symptom and reenter the MAP with that symptom. The tape library controller turns off the 24 V supply (indicated by the 24 V light) when it experiences positioning or cartridge retrieval problems, as well as more severe problems (such as failed shuttle servo motors). For information about how to remove and install the field replaceable units (FRUs), see Chapter 4, "Removal and Replacement Procedures" on page 91.

Attention: Do not attempt to test voltages on the power supply. The power supply must be under load to test for correct voltage. Voltage can be checked only when running the diagnostic interface (see "Remote Diagnostic Interface" on page 65).

Step 1

Did you observe the red fault light on at the rear of the tape library?

Yes   Replace the library controller card (see "Removing and Replacing the Controller" on page 94). After you have replaced the controller card, go to Step 9.

No   Go to Step 2.

Step 2

Is the power supply fan the only thing not running?

Yes   Replace the library power supply (see "Removing and Replacing the Power Supply" on page 95). After you have replaced the power supply, go to Step 9.

No   Go to Step 3.

Step 3

Does the power problem (fan or lights) seem to be isolated to the DLT7000 tape drive (one or both, if two tape drives are installed)?

Yes   If two DLT7000 tape drives are installed and both tape drives exhibit the same problem, skip the following procedure and answer no to the question following the procedure.

                In tape libraries with two DLT7000 tape drives, temporarily switch the tape drive positions; that is, put drive A into the drive B position and drive B into the drive A position. In tape libraries with only one DLT7000 tape drive, move the tape drive to the vacant position.

                Note: For both types of libraries, make sure to return the drive to its original position after this MAP is complete.

                The SCSI cables and terminator do not need to be reconnected at this time.

                Turn on the power to the library.

                Does the problem remain with the DLT7000 tape drive in the new position?

                Turn off the power to the library.

                Yes   Replace the DLT7000 tape drive.

                              Run the "DLT7000 Tape Drive Diagnostic and Fix Verify Selections" on page 37 on the new tape drive.

                              Go to Step 9.

                No   Replace the FRUs in the following order, one at a time:

                              1. Power Supply (see "Removing and Replacing the Power Supply" on page 95)

2. Library Controller Card (see "Removing and Replacing the Controller" on page 94)

3. Base Library

When you no longer have the power problem, turn off the power to the library and go to Step 9.

No   Go to Step 5.

Step 4

Is the operator panel display working, but the contrast not acceptable?

Yes   Perform the procedure for adjusting the contrast (see "Adjusting the Display Contrast" on page 54).

Did the adjustment procedure correct the problem?

        Yes   Go to "End of Call" on page 34.

        No   Go to Step 5.

No   Go to Step 5.

Step 5

Is the operator panel the only tape library component that is not functioning (the library seems to initialize, and the host communications is working)?

Yes   Replace the FRUs in the following order, one at a time:

1. LCD Assembly (see "Removing and Replacing the LCD Assembly" on page 100).

2. Base Library

3. Library Controller (see "Removing and Replacing the Controller" on page 94)

If replacing the first FRU does not correct the problem, repeat this step for the next FRU.

Go to Step 9.

No   Go to Step 6.

Is the operator panel the only tape library component that is not functioning? (The library seems to initialize, and the host communications is working.)

Step 6

Are the control keys the only tape library component not functioning?

Note: The front door key must be in the 9 o'clock or 12 o'clock position to enable the control keys.

Yes   Replace the FRUs in the following order, one at a time:

1. Base Library

2. Library Controller (see "Removing and Replacing the Controller" on page 94)

If replacing the first FRU does not correct the problem, repeat this step for the next FRU.

Go to Step 9.

No   Go to Step 7.

Step 7

If you observed total power outage on the tape library and DLT7000 tape drives, check the following:

- Power switch is set to on
- Power source is connected to library
- Power cord is seated
- Power cord has continuity
- Fuse is in the power supply (at the rear of the tape library)

Did you find and correct one of the previous items?

Yes   Turn on the power to the library.

If you replaced a burned-out fuse, go to Step 8; otherwise, go to Step 9.

No   Replace the power supply (see "Removing and Replacing the Power Supply" on page 95).

Go to Step 9.

Step 8

Did the fuse blow again?

Yes   Remove the DLT7000 tape drives and replace the fuse again.

Turn on the power to the library.

Did the fuse blow again?

        Yes   Replace the FRUs in the following order, one at a time:

                 1. Power Supply (see "Removing and Replacing the Power Supply" on page 95)

                 2. Library Controller Card (see "Removing and Replacing the Controller" on page 94)

                 3. Base Library

               Turn on the power to the library.

               When the fuse no longer blows, go to Step 9.

        No   Determine which DLT7000 tape drive is causing the power supply fuse to blow and replace it. When finished, go to Step 9.

No   Before going to Step 9, make sure that the library's power supply fan is running. If the fan is not running, turn off the power to the library and replace the power supply (see "Removing and Replacing the Power Supply" on page 95).

Step 9

It is recommended that you run a library exerciser for 10 to 15 minutes to ensure problems do not recur. Perform the tape drive load and unload test (see "Tape Drive Load and Unload Test (DRVLDULD)" on page 36).

Does the tape library power up properly, complete library initialization and any exerciser test, and properly remain powered up?

Note: The front door key must be in the 9 o'clock or 12 o'clock position to enable the control keys.

Yes   Go to "End of Call" on page 34.

No   Replace the FRUs in the following order, one at a time.

1. Power Supply (see "Removing and Replacing the Power Supply" on page 95)
2. Library Controller Card (see "Removing and Replacing the Controller" on page 94)
3. Base Library

After replacing each FRU, turn on the power to the library and repeat Step 9 until successful.

DLT7000 Tape Drive MAP

Before using the following MAP, open the front door of the tape library (see "How to Use the Front Door Key" on page 49) and remove the tape cartridge magazine by firmly grasping the left and right edges and pulling it straight out. If accessible, remove the top cover (see "Removing and Replacing the Desktop Tape Library Cover" on page 97). For a description of the status lights mentioned in the MAP, see "Status Lights on the DLT7000 Tape Drive" on page 37.

If...	Then...
The tape cartridge is not in the tape drive, and the Operate Handle light is blinking.	Carefully close the tape drive handle until the Operate Handle light comes on and is steady. Reopen the tape drive handle.
The tape cartridge is in the tape drive and the Operate Handle light is on and steady (other lights may also be on).	Slowly lift the tape drive handle to eject the cartridge.
The tape cartridge is in the drive and: • The Operate Handle light is not on, or it is blinking • The Tape in Use light is blinking steadily for more than four minutes • All four top lights are blinking	Ensure that the drive handle is completely closed. Gently press on the handle to close it. **Attention:** If the problem persists, suspect a defective tape cartridge, which causes the drive leader mechanism to detach as it is inserted into the tape drive loader. The detached leader requires a tape drive replacement. If a tape cartridge is found to be defective (see "Tape Cartridge Inspection Procedure" on page 85), **never** reuse this tape cartridge in another tape drive. It will require tape drive replacement on each drive in which it is inserted. If closing the handle did not fix the problem, proceed to the next step.

If...	Then...
The tape cartridge may or may not be in the drive, and all top and bottom lights are blinking (even after you have ensured that the drive handle is completely closed).	Do one of the following to reset the tape drive: • Press the Unload button on the tape drive bezel • Turn the power to the library off, then on If the drive performs the Power-On Self Test (POST) without errors (no blinking status lights), remove the cartridge from the drive (if it was still in the drive). You may have to press the Unload button again. After the Operate Handle light comes on, lift the handle and **carefully inspect the ejected cartridge**. If there are no obvious defects, proceed to "DLT7000 Tape Drive Diagnostic and Fix Verify Selections" on page 37. If POST failed (the status lights are blinking), turn off the power to the library and replace the tape drive (see "Removing and Replacing a Tape Drive" on page 92). If a tape cartridge is still in a tape drive, remove it (see "Manually Removing a Tape Cartridge" on page 87). After removing the failed tape drive and installing the replacement drive, perform the test in "DLT7000 Tape Drive Diagnostic and Fix Verify Selections" on page 37.
The SERVICE REQD message displays on the operator panel.	See the **Then...** path for the preceding four conditions.
Your system does not recognize the DLT7000 tape drive, or you are experiencing SCSI problems.	Do one or more of the following: • Configure your system to see the SCSI ID. • Change your SCSI ID to a unique ID. Reconfigure your system, then turn the power off and on. • Check your SCSI adapter installation to ensure that the parameters are correct. • Check the pins on the SCSI cables, then reset the cables. Make sure that the cables are properly connected. • Make sure that the termination is correct (see "Terminators" on page 7). The terminator may be missing, there may be too many terminators, or the terminator may be incorrectly or loosely connected. Check for bent pins. • Make sure that the SCSI cable length is correct and is not too long (see "SCSI Cable Lengths" on page 7).

If...	Then...
You received a system message or error sense data indicating a media or hardware problem or failure (sense key 03 or 04). **Note:** Tape drive load and unload problems could possibly be caused by library failure. Use the appropriate library diagnostics to further isolate the failure.	For the additional sense code (ASC) and additional sense code qualifier (ASCQ) information from the sense data, see Figure 61 on page 134. Verify or recreate the tape drive media or read/write problems using the DLT7000 diagnostic (DLT DIAGNOSTIC) from the tape library operator panel (see "DLT DIAGNOSTIC - DLT7000 Read/Write Test" on page 37). Perform this test before removing or replacing the DLT7000 tape drive. • If the DLT DIAGNOSTIC passes, suspect an intermittent tape drive problem or a media problem. Repeat the test as required. • If the DLT DIAGNOSTIC fails, turn off the power to the library and replace the tape drive (see "Removing and Replacing a Tape Drive" on page 92). On the replacement tape drive, perform the test in "DLT7000 Tape Drive Diagnostic and Fix Verify Selections" on page 37. Call the next level of support if you are unable to determine or isolate the problem.
Other tape drive sense key ASC-ASCQ system console error information was received.	See Appendix C, "Accessing the System Error Log (for the RS/6000 Only)" on page 129 to review various error log capabilities and exercisers available for problem isolation. Also see the Figure 61 on page 134 for descriptions of the error. Refer to Appendix C, "Accessing the System Error Log (for the RS/6000 Only)" on page 129 for help in extracting sense key information. Use any host system diagnostic or exerciser capability to help isolate SCSI communication problems from possible software application problems. Perform the tape drive load and unload test (DRVLDULD) from the tape library operator panel. This test performs SCSI communications as well as library and tape drive operations at the device level. Call the next level of support if you are unable to determine or isolate the problem

Base Library Problem MAP

Turn off the power to the library.

Step 1

Did you observe a broken component (such as a belt, shuttle, or cable)?

Yes   Replace the Base Library (see "Removing and Replacing a Base Tape Library" on page 103.

No   Go to Step 2.

Step 2

Did you observe excessive dust or debris in the base tape library unit?

Yes   Use a lint-free cotton cloth to clean the base unit. Do not use any oils or chemicals. Go to Step 5 when finished.

No   Go to Step 4.

Step 3

Do the cartridges bear correct external labels, but the operator panel or host system message indicates `No Label`**?**

Yes   Replace the bar code reader (see "Removing and Replacing the Bar Code Reader" on page 102). Then, go to Step 5.

No   Go to Step 4.

Step 4

Did you observe a component that you can repair (such as a shuttle drive belt) that is loose or out of adjustment?

Yes   If a drive belt appears to be loose, locate the tension arm adjustment screw on the left side of the library chassis near the front as you face the library. Tighten the tension arm adjustment screw. Do not over tighten. These belts are set and adjusted at the factory, and are intended to maintain the adjustment over the product life. Go to Step 5 when finished.

No   Reenter the Start MAP using an error code or new symptom. If you do not have a symptom, go to "Problem and Error Code Recreation MAP" on page 30.

Step 5

Turn on the power to the library.

With the top cover still removed (if accessible), see "Library Exerciser, Diagnostic, and Fix Verify Selections" on page 35 and select a library exerciser that is appropriate. When finished, go to "End of Call" on page 34.

SCSI or Interface MAP

Before you start, ensure that the DLT7000 tape drive SCSI IDs, at the rear of the tape library, are the same IDs that the host program expects. If they are not correct, set the switches to the proper values. Go to "End of Call" on page 34 and rerun the host program.

The SCSI Interface MAP tests and checks the SCSI connections on the tape library and DLT7000 tape drives. The host-to-library SCSI cable is considered to be part of the host system, and is covered in Step 4.

Turn off the power to the system and disconnect the host-to-tape library SCSI cable at the tape library controller. If another library or other devices are connected to the tape library on this SCSI bus, disconnect those devices from the tape library as well. If the tape library being tested does not have a terminator, temporarily install one.

Check the drive-to-drive SCSI cables and the terminator for proper seating or bent pins before proceeding. If you find a problem, correct or replace the part. Continue with this MAP to verify the fix.

Step 1

Is the tape library the only device failing to communicate?

Yes   Verify the tape library SCSI ID (see "Setup Information" on page 81 and "Setup Procedure" on page 82, or refer to the right digit on the top line of the display panel (this digit is the SCSI tape library ID).

Is it the same SCSI ID that the host program expects?

> **Yes**   Run the communication test (COMM TEST) and the tape drive load and unload test (DRVLDULD) from the tape library operator panel. See "Library Exerciser, Diagnostic, and Fix Verify Selections" on page 35. These tests use the SCSI communications. The library becomes the initiator that issues SCSI commands over the bus to the tape drives.
>
> If the tests run without failing, suspect an intermittent problem or host-to-library SCSI cable or SCSI adapter problem.
>
> If one or both tests fail, replace the FRUs in the following order (one at a time), and rerun the tests until they run without failing.
>
> - Library controller card (see "Removing and Replacing the Controller" on page 94)
>
> - Drive-to-drive and drive-to-controller SCSI cables
>
> - Base tape library (see"Removing and Replacing a Base Tape Library" on page 103)
>
> Go to Step 4. If the problem persists, call your next level of support.

	No	Set the SCSI ID to the correct value (see "Setup Procedure" on page 82).
		Go to "End of Call" on page 34. After completion, rerun the host program to verify proper operation.
No		Go to Step 2.

Step 2

Is a tape drive (even if two are installed) the only device failing to communicate?

Yes   Run the communication test (COMM TEST) from the operator panel.

Did the test fail?

> **Yes**   If the tape drive is the last drive on the bus, replace the SCSI cable that connects to that drive. Rerun the communication test to verify. If the problem persists, replace the tape drive. Rerun the communication test to verify the replacement part. Also, run the DLT7000 diagnostic (DLT DIAGNOSTIC) from the tape library operator panel on the replacement part (see "DLT7000 Tape Drive Diagnostic and Fix Verify Selections" on page 37).
>
> Go to "End of Call" on page 34.

> **No**   Run the tape drive load and unload test (DRVLDULD) from the tape library operator panel. See "Library Exerciser, Diagnostic, and Fix Verify Selections" on page 35. These tests use the SCSI communications. The library becomes the initiator that issues SCSI commands over the bus to the tape drives. If the tests run without failing, suspect an intermittent problem or host-to-library SCSI cable or SCSI adapter problem.
>
> Go to Step 4. If the problem persists, call your next level of support.

No   Go to Step 3.

Step 3

You have indicated a general SCSI problem that affects two or more of the devices on the bus. Run the communication test from the tape library operator panel to determine if the library and tape drives are communicating over the SCSI bus with the library acting as the initiator.

Did the SCSI communication test fail?

Yes   Replace the drive-to-drive and drive-to-controller SCSI cables and terminator. Rerun the Communication Test to verify proper operation. If the problem persists, reenter the MAP with a new symptom or call the next level of support.

No   Go to Step 4. The problem does not appear to be with the tape library. Ensure that all SCSI cables and the terminator are connected to their proper locations.

Step 4

To find system test tools that may be available for the specific operating system or independent software vendor platform that you are using, see Appendix C, "Accessing the System Error Log (for the RS/6000 Only)" on page 129. Only a select group is listed. Whether you run system tests, the following FRUs or firmware should be considered as problems:

- Host-to-library SCSI cable
- SCSI adapter card in the host computer
- Tape library or DLT7000 tape drive firmware
- Host device driver or host software

Problem and Error Code Recreation MAP

This MAP attempts to recreate the library failure. The results may or may not be exactly the same as the error information that was recorded earlier. However, by observing the library operation (if possible, pull the library out on slides and remove the top cover), you should be better able to help isolate the problem area. If you cannot recreate the problem, you may have an intermittent problem. The last step in this MAP provides some suggestions. Even if viewing the library from the top is not possible, it is still recommended and useful to attempt re-creation.

Attention: Use only the CE cartridge (and when necessary, scratch cartridges from the customer) when you run exerciser and diagnostic selections from the operator panel. This is especially true if your selection involves loading or moving cartridges to drives.

Step 1

Ensure that the following actions or precautions have been considered:

- Ensure that customer operations for both the tape library and tape drives have been completed.

- Do not use this MAP if you have a known tape drive problem (such as blinking lights or a stuck cartridge).

  Note: The opening and closing of the tape drive handle is a library function and not a tape drive function.

- If you chose the diagnostics from the library front panel, the SCSI cable to the host does not need to be connected. Turn off the power to the system if you unplug the cable. After unplugging the SCSI cable, turn the power back on.

- If the original cell locations for the customer cartridges need to be preserved, record the cell location for each cartridge before removing it. You do not need the magazine for the tests (unless you are testing a put/pick problem to the magazine). You need only the CE cartridge for the confidence test. For the tape drive load and unload test (DRVLDULD) you need the CE cartridge and two scratch cartridges.

Step 2

See "Library Exerciser, Diagnostic, and Fix Verify Selections" on page 35 for test descriptions and precautions. The tape drive load and unload test (DRVLDULD) is the most complete selection available, as it tests all library operations. The following functions and operations are exercised:

- Reading tape cartridge labels using the bar code reader.
- Moving cartridges from cells to tape drives and between cells.
- Loading tape cartridges into tape drives to the load point. (Data are not written to the tape.)
- Sending SCSI unload commands from the tape library over the SCSI bus to the tape drives. The tape library acts as the initiator

All operations are displayed as they occur on the tape library operator panel.

Step 3

Regardless of the test chosen, as the test proceeds, observe any problems or difficulties (such as the following), and then continue with the next step.

- The bar code reader does not read the bar code labels correctly (note shuttle adjustments at the bar code station). If the cartridges do not have labels or the reader has difficulty reading labels, the tape library firmware makes up to seven adjustments or retrys in attempting to read the label.
- The robotic shuttle is not positioned correctly in front of the cells or the drives.
- The drive belts slip or become loose around the pulleys.
- The cartridges do not move appropriately from or into cells.

  Note: Check the proper seating of the magazine. To move cartridges in and out of the magazine cells, the shuttle trip mechanism must be able to reach and depress the tabs on the magazine base (see Figure 12 on page 32).

SHUTTLE ASSEMBLY
TRIP MECHANISM

MAGAZINE TAB

View Rotated 90° for Clarity

SHUTTLE ASSEMBLY

MAGAZINE

A65S0012
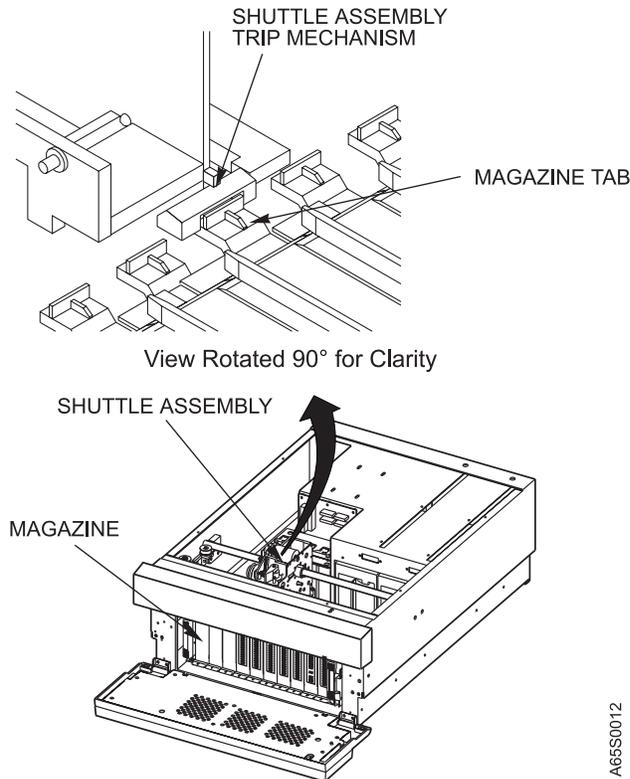
Figure 12. The Shuttle Trip Mechanism Depressing the Tabs on the Magazine Base

- The cartridges moving appropriately from or into the shuttle.

- The cartridges moving appropriately from or into the tape drive.

- The tape drive handle operating correctly (the act of opening and closing should be smooth, with no or minimal over travel or bounce).

Note: Some retry of operations are normal. Note excessive retries (more than three per operation).

Step 4

If you have observed or determined from your analysis that a library mechanism (electrical or mechanical) is likely to be the reason for the failure, and you cannot make an adjustment or cleaning (for example, the shuttle cartridge friction wheels) to correct the problem, replace the base library or tape drive module that contains the failing component. This conclusion could be reached with or without an error code. Two examples are:

- The tape library fails, indicating that it cannot pick a cartridge, even though the cartridge is in the robotic shuttle. Most likely, the failure is a sensor in the robotic shuttle.

- The tape drive handle mechanism has difficulty or cannot open and close. A good isolation technique is to move the tape drive to the other position and determine if the problem follows the tape drive or stays with the position. If the problem follows the tape drive, replace the tape drive; if it stays with the position, replace the tape library controller. If you replace the tape drives, make sure that you change each SCSI ID to the correct ID for the new position.

Step 5

Have you observed or determined a problem other than a problem with the base library?

Yes   If you have decided which FRU needs to be replaced, see Chapter 4, "Removal and Replacement Procedures" on page 91. Run the appropriate tape library or tape drive exerciser and diagnostic selection for the replacement FRU (see "Library Exerciser, Diagnostic, and Fix Verify Selections" on page 35). When complete, go to "End of Call" on page 34.

                    If you noted a problem, but are not sure which FRU to replace, reenter the MAPs with that problem.

No   Go to Step 6.

Step 6

Do you have an error code (original or from a recreation) or Sense Key/ASC/ASCQ code?

Yes   See the tape library error code in Figure 17 on page 43 and replace the FRUs one at a time. If you received more than one error code, try to pick the one closer to your observations. Run the appropriate tape library or tape drive exerciser and diagnostic selection for the replacement FRU (see "Library Exerciser, Diagnostic, and Fix Verify Selections" on page 35).

                    Note: The FRU list does not generally list the base tape library. For most error codes, the base tape library is the last FRU in each list. The order of the FRU list per error code is not necessarily listed by probability of failure.

                    If you only have a Sense Key/ASC/ASCQ library code, see Figure 62 on page 134 to determine what type of error was reported by the library. Remember, only a Sense Key value of 4 indicates a hardware error. When the fix has been verified, go to "End of Call" on page 34.

No   Go to Step 7.

Step 7

You have an intermittent problem. Continue to run the library until an error occurs. Also consider the SCSI cables (controller-to-drive, drive-to-drive, and host-to-controller) and the terminator, if you think the problem might be in the interface area. Check for proper seating and look for bent pins on all SCSI cables and on the terminator.

End of Call

Step 1

Replace all brackets and ensure that all screws are tightened.

Step 2

Replace the top cover of the library, if it was removed.

Step 3

Slide or place the library back in its home location. In a rack-mounted unit, ensure that the library front eyelet bracket is fastened to the rack vertical rail. For more details, see Chapter 5, "Installing the Rack-Mounted Tape Library" on page 105.

Step 4

Ensure that all SCSI cables and the SCSI terminator are connected. Make the widest possible loops in the short drive-to-drive and drive-to-controller cables (see Figure 13). Each device in the tape library (the tape drives and the tape library controller) has two SCSI connectors. Each connector can be used as an in or out connector. This lets you connect the cables so that you can make wide loops between devices, thus reducing cable stress.

Attention: When you attach SCSI cables, make sure that the power is turned off.

Step 5

If they were changed for any reason, make sure that the SCSI IDs for the tape drives are returned to their original values.
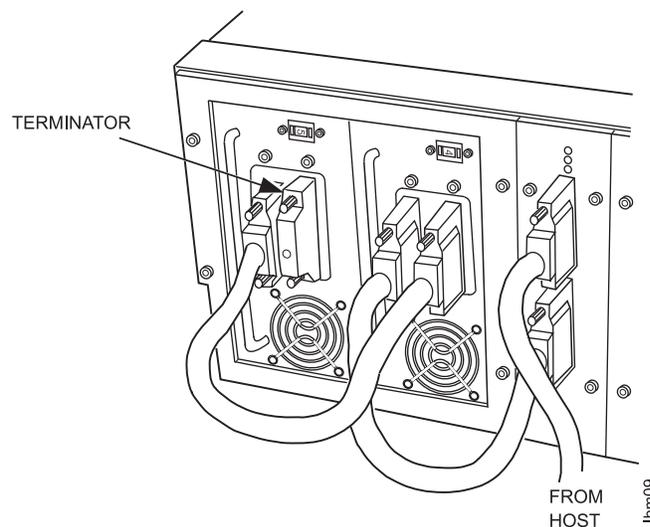
Figure 13. SCSI Cable Attachment on the Tape Library

Step 6

Remove the CE cartridge or any scratch cartridges from the library.

Step 7

If you removed customer cartridges, place them back in the cells from which they were removed. Otherwise, place them randomly in any magazine cell or fixed cell (because the library front door was opened and the power was turned off, the application software must perform a reinventory).

Step 8

Turn on the power to the tape library (if it is not already on), and ensure that initialization successfully finishes.

Step 9

Inform the customer that tape library and DLT7000 tape drives are ready for on-line operation.

Library Exerciser, Diagnostic, and Fix Verify Selections

The following are tape library exercisers and diagnostics that are available in the DIAG OFFLINE mode using the tape library operator panel and control keys. Before using any of these routines, review the following notices and suggestions to help you with your selection and in your assessment of the tape library functions.

Note: For details about how to invoke these routines, see "Menu Operations" on page 55.

- Ensure that all host-to-target (especially host-to-tape drive) operations are finished and that all customer cartridges are returned to their storage cells. The tape library and tape drives must be off-line to host operations. Diagnostic tests, such as the DRVLDULD (tape drive load and unload test) and the COMM TEST (SCSI communications test), use the tape library controller as the SCSI command initiator to the tape drives. If both the host and the tape library controller attempt to initiate SCSI commands, conflicts and bus hangs could result.

- The DRVLDULD test and CONFIDENCE TEST are excellent tests for diagnosing intermittent problems.

- The CONFIDENCE TEST moves cartridges from one storage cell to another in the tape library. The DRVLDULD test moves a tape cartridge from a cell to a tape drive and loads the tape cartridge to the load point. While the tape drives are occupied, the DRVLDULD test moves tape cartridges from one cell to another. Do not use customer cartridges for these tests. Remove the magazine with the customer's tape cartridges and record the location of the cartridges in the fixed cells before removing the cartridges. The CONFIDENCE TEST can be run using only one tape cartridge. The DRVLDULD test requires at least three cartridges: the CE cartridge and two scratch or blank cartridges. Both of these tests can run with or without the magazine in place. Be sure to return the customer's cartridges to their original locations after the tests are completed.

- You can use the MOVE CARTRIDGE test to verify that the library can load an unload a tape drive successfully.

- Be very careful not to select the DLT DIAGNOSTIC test while a customer tape cartridge is in a tape drive. The DLT DIAGNOSTIC test is a read/write test that can will overwrite the data on the customer tape cartridge.

- Some retries of tape library operations are normal and should not be construed as a problem. However, more than three retries per operation are excessive, and might indicate a problem.

Library Power On Self Test and Initialization

After powering up or resetting the tape library, or opening, closing, and locking the front door of the tape library, the library automatically executes POST and the initialization routine, which includes some robotic motion. If POST or initialization fails, the library displays the appropriate library error code and shuts down power (24 V) to the robotic shuttle drive motors. Power shutdown to the robotic shuttle can be noted by the 24 V light turning off. The 24 V light is on the controller at the back of the library (see Figure 3 on page 4).

Confidence Test

The tape library determines which cells contain cartridges (at least one cell must be unoccupied). The test then moves the cartridges from cell to cell randomly until any one of the control keys is pressed or until an error occurs. Tape cartridges are not moved to or from the DLT7000 tape drives. This test can be run with only one cartridge.

Tape Drive Load and Unload Test (DRVLDULD)

This test is similar to the Confidence Test, with the addition of loading and unloading cartridges to the DLT7000 tape drives. The cartridges are only loaded to the load point and then immediately unloaded. No data is written to the tape cartridges and no data is altered on the tape cartridge. SCSI commands are initiated by the tape library controller over the SCSI bus. This test requires a minimum of three cartridges for a tape library with two drives. The following library functions are performed:

- An inventory of each cartridge is taken and read by the tape library bar code reader and maintained throughout the test.

- The cartridges are randomly delivered to the DLT7000 tape drives and loaded to the load point by the drives. The tape library microcode then initiates a tape drive Unload command over the SCSI bus to the tape drives. After the unload is complete, the library retrieves the cartridge from the tape drive and places the cartridge in a vacant cell.

- The test continues until any one of the tape library control keys is pressed, an error occurs, or until 100 cycles have been completed. The tape drives are automatically unloaded if the test is terminated, or after 100 cycles have been completed.

SCSI Communications Test (COMM TEST)

The COMM TEST returns the SCSI IDs of the DLT7000 tape drives to the tape library operator panel.

Move Cartridge Test

This test can be run using any cartridge, or it can be directed to use a particular cartridge, such as the CE cartridge. A cell must be available to manually insert the CE cartridge into, and another cell or DLT7000 tape drive must be available to move it to using the Move Cartridge Test. This test will also move a cartridge from a tape drive where the cartridge is unloaded with the operate handle light lit, or from a loaded tape drive if the cartridge was placed in the tape drive by the move cartridge test. In this situation, the library will first initiate an UNLOAD command to the particular tape drive in order to put the drive in the proper state to operate the tape drive handle. The move cartridge test will NOT issue an UNLOAD command to a tape drive that was loaded from a host command or if it was manually loaded. In this case you must first press the Unload button on the tape drive bezel if you want the move cartridge test to be able to move the cartridge to a cell or another tape drive.

DLT7000 Tape Drive Diagnostic and Fix Verify Selections

The following DLT7000 tape drive read/write test is available in the DIAG OFFLINE mode using the tape library control keys. Before using this selection, all of the target devices on the SCSI bus (tape library and DLT7000 tape drives) must be finished.

Attention: You must be extremely careful to use only the CE cartridge in this test. Using a customer cartridge will overwrite customer data.

DLT DIAGNOSTIC - DLT7000 Read/Write Test

Load the tape drive that is to be tested using this diagnostic with a digital linear tape cartridge. It is recommended that the DLT7000 tape drive be loaded manually to avoid any possibility of loading the wrong tape cartridge. USE ONLY THE CE CARTRIDGE FOR THIS TEST. Any data on the cartridge will be overwritten.

After you select DLT DIAGNOSTIC from the diagnostic selection menu on the operator panel, on the screen that follows select the SCSI ID of the DLT7000 tape drive that you want to perform the read/write test. If a cartridge is present in the tape drive, the library initiates a Send Diagnostic command to the drive. The test runs for approximately five minutes. After completed, success or failure of the test is posted and a query is presented asking whether to unload the tape drive.

Status Lights on the DLT7000 Tape Drive

The condition of a DLT7000 tape drive can be determined by the status lights on the front bezel of the drive. Figure 14 on page 38 shows the lights and controls on the front bezel. (The lights can be seen by looking through the open front door of the tape library.)
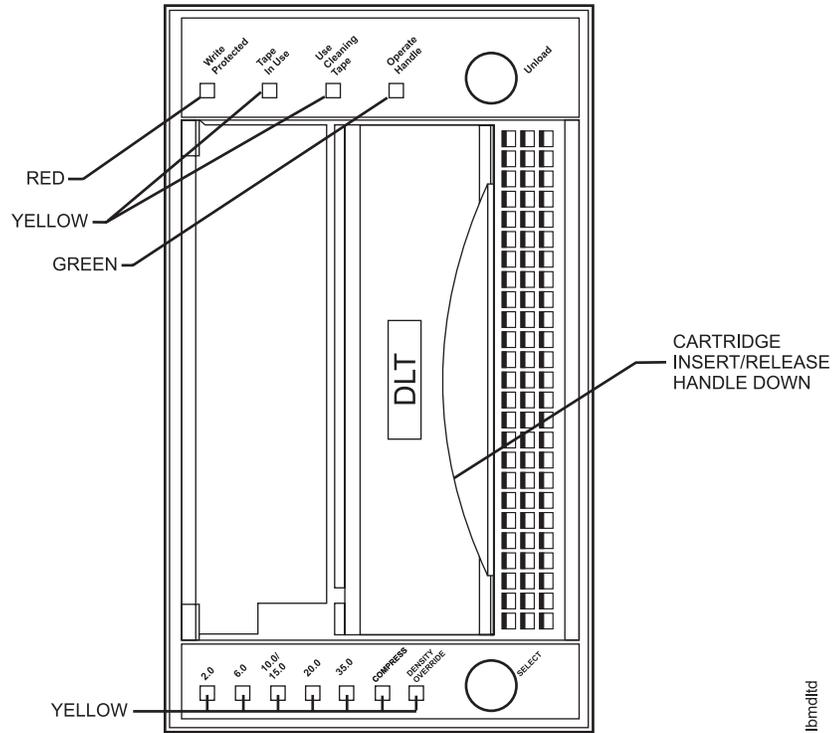
Figure 14. Front Panel of the DLT7000 Tape Drive

The following status lights are located on the front panel of the tape drives in the tape library:

Lights on the Bottom	Lights on the Top
2.6 (density)	Write Protected
6.0 (density)	Tape in Use
10.0/15.0 (density)	Use Cleaning Tape
20.0 (density)	Operate Handle
35.0 (density)	
Compress	
Density Override	

The definition of each light is shown in Figure 15.

Figure 15 (Page 1 of 3). Status Lights on the DLT7000 Tape Drive			
Status Light	**Color**	**State**	**Operating Condition**
Lights on the Bottom			
2.6	Yellow	On	The tape is recorded in 2.6 GB format (42,500 BPI density).
		Blinking	A system command has been issued to change tape density (new density pending).

Figure 15 (Page 2 of 3). Status Lights on the DLT7000 Tape Drive			
Status Light	**Color**	**State**	**Operating Condition**
6.0	Yellow	On	The tape is recorded in 6.0 GB format (42,500 BPI density).
		Blinking	A system command has been issued to change tape density (new density pending).
10.0/15.0	Yellow	On (default)	The tape is recorded in 10.0/15.0 GB format (62,500 BPI density).
		Blinking	A system command has been issued to change tape density (new density pending).
20.0	Yellow	On (default)	The tape is recorded in 20.0 GB format (81,633 BPI density).
		Blinking	A system command has been issued to change tape density (new density pending).
35.0	Yellow	On (default)	The tape is recorded in 35.0 GB format (85,937 BPI density).
		Blinking	A system command has been issued to change tape density (new density pending).
Compress	Yellow	On	The compression mode is enabled (compression can only be done in 10, 15, 20, or 35 GB density).
		Off	The compression mode is disabled.
Density Override	Yellow	On	Density has been manually selected.
		Off (default)	Density is automatically selected by the host system.
All Left Bottom		Blinking	An internal error has occurred. Contact your service representative.
Lights on the Top			
Write Protected	Red	On	The tape is write protected.
		Off	The tape is write enabled.
Tape in Use	Yellow	Blinking	The tape is moving.
		On	The tape is loaded and ready for use.
		Off	No cartridge is loaded.
Use Cleaning Tape	Yellow	On	The tape drive needs cleaning or the tape is defective.
		Remains on after you unload the cleaning tape.	The cleaning tape attempted to clean the tape drive, but the tape had expired.
		Blinking	The data cartridge may be damaged. Back up data to another tape cartridge and discard the old tape cartridge.
		Off	The cleaning is complete or cleaning is unnecessary.

Figure 15 (Page 3 of 3). Status Lights on the DLT7000 Tape Drive			
Status Light	**Color**	**State**	**Operating Condition**
Operate Handle	Green	On	No tape cartridge is loaded. It is safe to operate the cartridge insert/release handle.
		Off	Do not operate the cartridge insert/release handle.
		Blinking	The drive is in an undefined state with the handle open (and no cartridge in the loader). Close the handle and wait for the Operate Handle light to come on steady. Then reopen the handle.
All top lights		Blinking	The tape leader has failed to pull, or the tape drive servos have failed.
Lights on the bottom and top		On	The Power-on Self Test (POST) is starting.
		Blinking	An error has occurred. Contact your service representative.

Select Button

The Select button enables the drive density to be manually adjusted. To ensure compatibility with the host operating system, the drive density should be adjusted only via the host system. For more information, see the *AIX V4 System Management Guide: Operating Systems and Devices*.

Unload Button

Note: The Unload button operates only when the power to the tape library is on.

The Unload button enables a tape cartridge to be removed from the tape library. To remove a cartridge, press the Unload button. After the Unload button is pressed, the tape drive rewinds the tape into the cartridge and sounds a beeper to let you know that the cartridge may be removed (unloading may take approximately one minute). The green Operate Handle light also comes on.

Note: Unloading may take up to two minutes if the cartridge is at the end of tape.

Cartridge Insert and Release Handle

Operate the cartridge insert and release handle to load a cartridge or to eject a cartridge only when the Operate Handle light is on, and after the momentary beep sounds. The handle lifts to the open position and lowers to the closed position.

Beeper

A beeper sound indicates that you can operate the cartridge insert and release handle. When the tape drive beeps, the Operate Handle light should be on. To prevent damage to the tape drive, wait for the sound of the beep before opening the door.

DLT7000 Status Light Action During Power-On Self Test and Operation

When power is applied to the DLT7000 tape drive, it performs POST. POST completes in about 15 seconds and the DLT7000 tape drive responds normally to all commands; however, it might take longer for the media to become ready. After a bus reset, the tape drive responds within a bus selection time-out period.

The sequence of events for POST is:

1. The lights on the top of the DLT7000 tape drive front panel turn on sequentially from left to right. All lights stay on for a few seconds.

2. The lights on the bottom of the DLT7000 tape drive front panel turn on at the same time for about three seconds and then turn off.

3. The Operate Handle, Write Protected, and the Use Cleaning Tape lights turn off. The Tape in Use light blinks while the tape drive initializes.

4. After initialization, the drive is in one of the following conditions:

Condition of the Tape Drive	Condition of the Status Lights on the Drive and Actions Required
No cartridge is present, and the handle is closed.	1. The Tape in Use light turns off. 2. The Operate Handle light turns on. 3. The drive unlatches the handle. 4. The drive beeps momentarily. The handle can be opened and a cartridge inserted.
A cartridge is present and the handle is closed.	The drive loads the cartridge. When the Tape in Use light stops blinking and stays on, the tape's actual density light comes on. For example, if the actual tape density is 20.0 GB, then the light turns on next to the 20.0 label. When the Density Override light blinks, you can select a density. The drive is ready for use. **Note:** The manual Density Override function is not normally used in a library application; typically, the host system controls this function.
A cartridge is present, but the handle is open (not recommended)	The Tape in Use light turns off. The Operate Handle light flashes. When the handle is lowered, the cartridge loads.
The tape drive detects an error condition.	The top or bottom lights blink repeatedly. Try to unload the tape and reinitialize the drive by pressing the Unload button, or turn the power to the library off and then on again. The top or bottom lights stop blinking and the drive tries to reinitialize. The lights turn on steady again and, if the test succeeds, turn off.
The tape drive is powered on with the handle open.	The Operate Handle light flashes. Close the handle and wait for the light to become steady.

Error Codes

If the tape library experiences a problem while running, it reports the SCSI ASC/ASCQ bytes to the host computer and posts an error code on the operator panel (see Figure 16). In addition to an error code, UnSafe or DRIVERS HOT might be shown on the operator panel. UnSafe is shown when the front door is opened. DRIVERS HOT is shown when the motor driver exceeds its maximum operating temperature. Either UnSafe or DRIVERS HOT cause the tape library to immediately turn off all motor power. As a result, error codes reported in conjunction with UnSafe or DRIVERS HOT actually represent secondary errors.
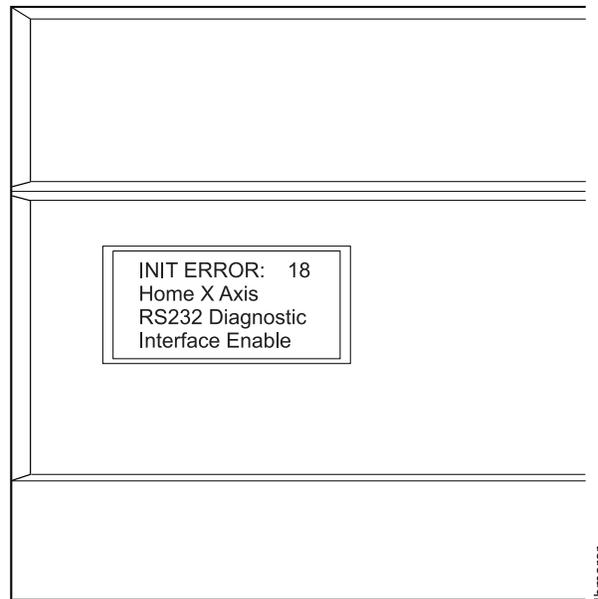
Figure 16. Example of an Error Code

Figure 17 on page 43 lists the error codes, descriptions of the errors, probable cause of the errors, and the module or assembly that you can replace to correct the error (see the Note at the bottom of the table for a list of terms used in the descriptions). The tape library has four major modules or assemblies that you can replace:

- Tape drive modules
- Controller
- Power supply
- Base tape library

The base tape library is one in which the tape drives, controller, and power supply have been removed. Other replaceable components that can contribute failure, but do not necessarily appear as an error code are:

- Drive-to-drive and drive-to-controller SCSI cables
- SCSI terminator
- Bar code reader
- Tape library display
- Tape cartridge magazine

Errors with codes less than 128 are hard errors. Errors greater than 128 are informational.

Attention: For many of the error codes listed in Figure 17 on page 43 (especially those which have a probable cause involving mechanical or shuttle binding), it is important to thoroughly inspect the shuttle path for correctable causes. The inspection procedure is listed in the MAPs. A thorough inspection may also reveal obvious mechanical or electrical problems that can only be repaired by replacing the base tape library, which, if listed in Figure 17, is usually last in the Replaceable Component column. The order of the FRU or replacement component for each error code is not associated with the probability of failure.

Figure 17 (Page 1 of 5). Tape Library Error Codes

Error Code	Error Description (see Note)	Probable Cause	Replaceable Component
1	Servo controller did not come ready in time.	- -	Controller
2	Servo controller command sequence error.	- -	Controller
3	Servo controller did not initialize.	- -	Controller
4	Internal software error.	- -	Controller
5	Difference between desired position and actual position exceeded tolerance. See ASCQ bytes on the host to identify axis. ASCQ=: 0xA1 refers to X-axis 0xB1 refers to rack 0xC1 refers to Z-axis	Mechanical binding of axis	Controller Power supply Base tape library
6	Motion controller position overflowed.	- -	Controller
7	Move in progress timed out.	- -	Controller
8	Servo controller reported BUSY too long.	- -	Controller
9	Z-axis position overflowed during pick or place.	- -	Controller
10	Pick operation timed out.	- -	Controller
11	Homing of rack took too long.	- -	Controller
12	During homing of rack, the difference between the rack actual and desired location exceeded tolerances.	Rack binding Main motor Rack home sensor Rack clutch	Controller Power supply Base tape library
13	Rack position overflowed during rack homing.	- -	Controller Base tape library
14	Home of normal force actuator took too long.	Normal force arm binding Normal force home sensor	Controller Base tape library
15	Gate actuator hung on magazine cell gate.	Gate actuator movement. Remove magazine and check the gate actuator on shuttle for proper movement.	Magazine

Error Code	Error Description (see Note)	Probable Cause	Replaceable Component
			Figure 17 (Page 2 of 5). Tape Library Error Codes
17	Home of X-axis took too long.	- -	Controller
18	During homing of X-axis the difference between the actual and desired location exceeded tolerances.	Shuttle binding on rails Main motor Home Sensor	Controller Power supply Base tape library
19	X-axis position overflowed during homing.	- -	Controller
20	Internal software error.	- -	Controller
21	X-axis controller address overflowed during magazine present detection.	- -	Controller
22	X-axis difference between desired and actual position exceeded tolerance during magazine present detection phase.	Excessive binding in X-axis Main motor	Controller Power supply Base tape library
23	Magazine present detection took too much time.	- -	Controller
24	X-controller address overflowed while moving to element.	- -	Controller
25	Difference between actual and desired position exceeded tolerances during move to element.	Shuttle binding to rails	Controller Power supply Base tape library
26	Move to element taking too much time.	- -	Controller
29	Difference between actual and desired position exceeded tolerances during cartridge latch into drive.	Shuttle binding on rails Drive	Controller Power supply Base tape library
30	Controller address overflowed during cartridge latch into drive.	- -	Controller
31	Cartridge latch took too long.	- -	Controller
35	During cartridge retract, the difference between the actual and desired location exceeded tolerances.	Z-wheels binding Z-motor X-clutch	Controller Power supply Base tape library
36	Z-axis position overflowed during cartridge retract.	- -	Controller
37	Cartridge retract took too long.	- -	Controller
38	Picker lost cartridge and was unable to recover moving cartridge to picker home.	Normal force belt dirty Shuttle alignment Cartridge present sensor	Base Tape Library
39	While centering the cartridge in the shuttle, the difference between the actual and desired location exceeded tolerances.	Normal force binding Main motor	Controller Power supply Base tape library

Figure 17 (Page 3 of 5). Tape Library Error Codes			
Error Code	**Error Description (see Note)**	**Probable Cause**	**Replaceable Component**
40	Position overflowed during cartridge centering.	- -	Controller
41	Cartridge centering took too long.	- -	Controller
42	Drive A handle did not open.	Upper tape drive module	Tape drive A module Controller Power supply
43	Drive A handle did not close.	- -	Tape drive A module Controller Power supply
44	Drive B handle did not open.	- -	Tape drive B module Controller Power supply
45	Drive B drive handle did not close.	- -	Tape drive B module Controller Power supply
47	While placing a cartridge, the difference between the actual and desired location exceeded tolerances.	Shuttle binding Main motor	Controller Power supply Base tape library
48	Position overflowed during cartridge placing.	- -	Controller
49	Placing took too long.	- -	Controller
50	Could not center cartridge in shuttle.	Shuttle binding	Controller Base tape library
51	While homing the rack with a cartridge in the shuttle, the difference between the actual and desired location exceeded tolerances.	Rack binding Main motor Rack clutch	Controller Power supply Base tape library
52	While homing the rack with a cartridge in the shuttle, the difference between the actual and desired location of the rack exceeded tolerances.	Rack binding Main motor	Controller Power supply
129	The tape library was unable to unlatch cartridge from magazine after 20 retries.	- -	Replace Magazine
130	Drive A was not unloaded prior to command to remove cartridge from drive A.	Host software error	- -
131	Drive B was not unloaded prior to command to remove cartridge from drive B.	Host software error	- -
143	The tape library was instructed to remove a cartridge from an empty element.	Host software error	- -

Error Code	Error Description (see Note)	Probable Cause	Replaceable Component
	Figure 17 (Page 4 of 5). Tape Library Error Codes		
144	In remote diagnostic mode, an out of range element was selected as either the source or destination.	Operator	- -
145	The tape library was UnSafe when a motion command was initiated.	- -	If this occurs with the unit in the safe condition check the front panel interlock.
146	The drive interposer dropped during extraction of cartridge. The tape library reinserted the cartridge into the same drive.	Informational	- -
149	The serial EEPROM was unable to be read on power up.	- -	Controller
152	Internal software error.	- -	Controller
153	Internal software error	- -	Controller
154	No cartridges in the tape library while starting confidence tests.	Operator	- -
155	During a place-move recovery following unsafe or power-out recovery, the destination cell (magazine) was removed by user.	- -	Remove the cartridge from the shuttle.
156	Pick was attempted from empty cell.	Host software error Cartridge present sensor	Base Tape Library
157	Internal self test DRVLDULD detected drive inactive too long.	Drive error SCSI connection bad	- -

Error Code	Error Description (see Note)	Probable Cause	Replaceable Component

Figure 17 (Page 5 of 5). Tape Library Error Codes

Note: The following terms are used in the Error Description column of this table.

Gate actuator. A metal arm used to unlatch cartridges from the magazine. Located on the lower right front of the shuttle assembly.

Main motor. As viewed from the front of the library, the drive motor located behind the key switch and on the right of the library.

Normal force arm. A metal rocker arm assembly, with two rollers that move cartridges in and out of the shuttle. As viewed from the front of the library, located on the left side of the shuttle assembly.

Normal force home sensors. Two sensors that detect whether the normal force arm *homes* in the direction of the magazine or the DLT drive. The two interrupter-type sensors are located at the left front and rear sides of the shuttle assembly.

Normal force motor. A small motor that drives the normal force arm. Located on top of the shuttle assembly.

Normal force wheels. Located on each end of the normal force arm, the small wheels that slide cartridges in and out of the shuttle assembly.

Passthru mechanism. A second shuttle mechanism that passes cartridges between the upper and lower units. Not available.

Passthru drive motor. Located on top of the passthru mechanism, in the top unit of the library. Not available.

Rack arm. A black, plastic "tongue" that determines whether a cartridge is present in a drive. The rack slides in and out of the shuttle on the Z axis. As viewed from the front of the library, located on the left of the shuttle assembly.

Rack home position. The position that the rack is in when the rack arm is retracted completely into the shuttle assembly.

Rack home sensor. An optical interrupter-type sensor. Located on the back of the shuttle assembly and directly under the rack arm.

Rack clutch. A mechanism that determines the Z-axis direction of the rack arm. Located at the top rear of the shuttle assembly, and positioned slightly below the normal force motor.

X-axis. The axis of motion that the shuttle assembly moves along. As viewed from the front of the library, this is a left-to-right movement.

X-axis clutch. As viewed from the front of the library, located on the right, behind the main drive motor.

X-axis home position. As viewed from the front of the library, the far left of the library. When the X-axis is homed, the shuttle is behind the bar code reader assembly.

Z-axis. The axis of motion that the tape cartridge moves along. As viewed from the front of the library, this is a front-to-back movement.

Chapter 3. Service Operations

This chapter describes how to perform service and diagnostic procedures. It explains how to power on or off to the tape library, how to use the front door key, operator panel, and control keys, how to run confidence tests, and how to run remote diagnostics. This chapter also tells how to clean the DLT7000 tape drive heads, and how to change the tape library setup.

Turning the Tape Library On and Off

The tape library can be powered on at any time by pressing the power switch on the back panel (see Figure 3 on page 4). The tape library enters the initialization mode, and, unless an interrupt occurs, goes into the on-line mode.

The tape library can be powered off at any time. To avoid problems, make sure the tape library is not performing an operation. If the tape library was performing an operation, it will conclude the operation after reinitializing itself and re-establishing communications with the host computer.

To avoid damage to a tape cartridge, make sure that the tape cartridges are unloaded and removed from the tape drives before turning off the power.

Attention: If you inadvertently enter the setup mode by pressing any of the control keys during library initialization, do not press the SELECT control key (right key), as this action will alter the setup parameter currently shown on the operator panel. To exit the setup mode without affecting any of the setup parameters, recycle power (press the power switch off and then on) or repeatedly press the MENU control key (left key) until you exit the setup mode.

How to Use the Front Door Key

The front door key and lock are located on the front bezel of the tape library. The key and lock are concealed by a panel hinged along the top. The panel is secured by a double acting, push-push latch. It can be opened by pressing the raised area in the middle of the front surface of the panel, which releases the latch. The panel can be secured by closing it and pressing the raised area in the panel until the latch engages.

The front door key has three positions:

- KEY AT 9 O'CLOCK POSITION: Placing the key in this position opens the front door and disables the robotics. The key cannot be removed from the door in this position.

  Note: You may have to press slightly on the right side of the door while turning the key.

- KEY AT 12 O'CLOCK POSITION: Placing the key in this position locks the front door, and enables the robotics and operator panel. The key can be removed from the door in this position.

- KEY AT 3 O'CLOCK POSITION: Placing the key in this position locks out (disables) the operator panel for security purposes (the library continues to function normally). The key can be removed in this position.

Figure 18 shows the three key positions and the labeling on the front door.

KEY NOTCH
INDICATES
CURRENT
POSITION

KEY
INSERTION
ALIGNMENT
SLOTS

FRONT VIEW

Ibm22
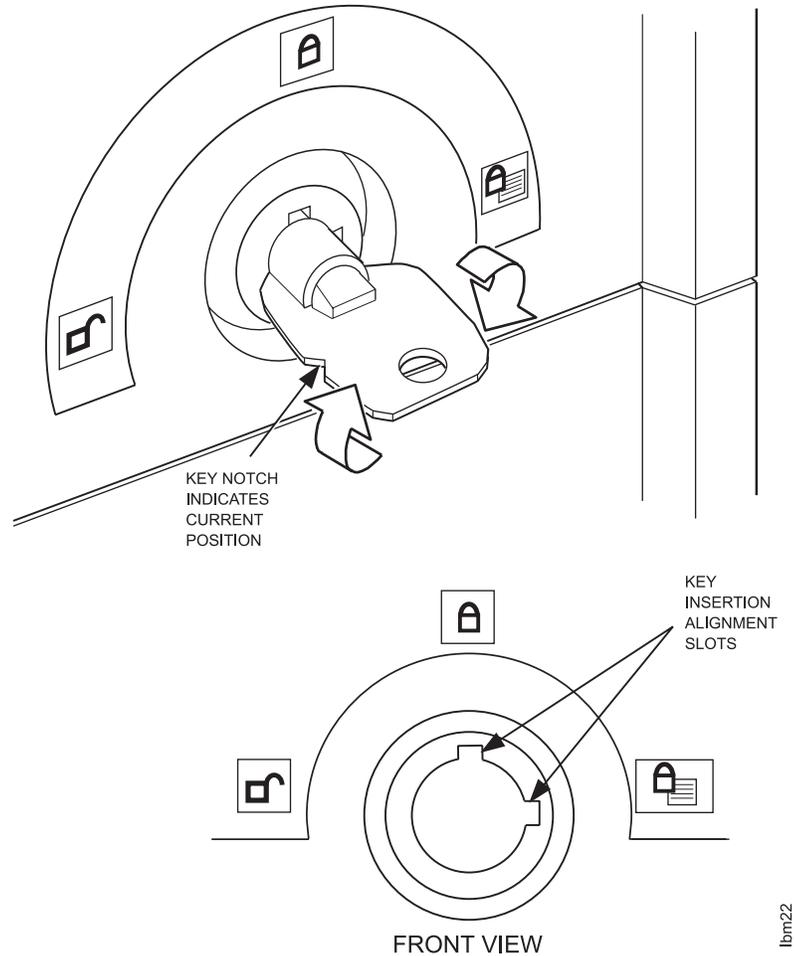
Figure 18. Key Lock

Operator Panel and Control Keys

The operator panel and control keys provide a way for you to:

- Change the tape library operational mode to:

  - Off-line
  - Diagnostic off-line
  - On-line

- Initiate an activity to:

  - Move a cartridge
  - Begin confidence testing
  - Enable the serial interface to perform remote diagnostics

- Change the setup parameters

Figure 19 on page 51 shows the operator panel and control keys on the front door.

The tape library control keys and operator panel can be configured for either a scrolling presentation or menu/cycle presentation.

In the scrolling presentation, you can move an arrow up or down to choose the operation and options.

In the menu/cycle presentation, you can select the desired operational menu, choose an operation option, and initiate the operation.

The tape library default is the scrolling presentation; however, you can change to the menu/cycle presentation when running setup.
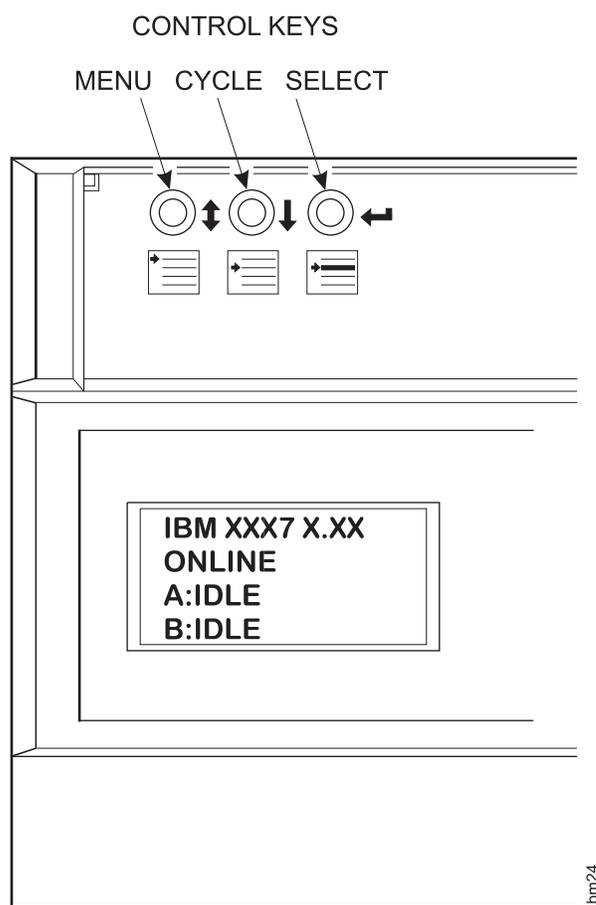
Figure 19. Control Keys and Operator Panel

Operator Panel

The operator panel is a liquid crystal display that provides information about the status and current operating mode of the tape library. In the event of an operational problem, error codes that can be used to determine the cause of the problem are also shown. The operator panel consists of four rows with 16 characters in each row. (The rows are numbered from top to bottom with the top row being row 1 and the bottom row being row 4.) When the tape library is in the on-line mode and running normally, rows 1 and 2 show library status; rows 3 and 4

show tape drive status. When the tape library is in the diagnostic off-line mode, rows 1 and 2 show a menu of options.

Note: The key lock must be in 9 o'clock or 12 o'clock position for the panel to be operative.

When the tape library is in the on-line mode and running normally, information similar to the following is shown.

```
IBM XXX7  X.XX  x
ONLINE
A:  READ C 35.Gb
B:  EMPTY
```

XXX7 represents the machine type of the tape library (either 3447 or 7337); X.XX represents the firmware version running on the tape library; and x represents the SCSI target ID of the tape library.

When the tape library is in the off-line or diagnostic off-line modes, information similar to the following is shown.

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

VNN represents the firmware revision level of the DLT7000 microcode. y1 and y2 represent the SCSI target IDs of the tape drives.

Scrolling Presentation

The scrolling presentation shows the titles for each operation on one menu. (Only four lines of the menu can be shown on the operator panel at any time; however, as you scroll down the menu the lower lines appear on the operator panel.) An arrow on the left side of the menu points to the operations. The arrow can be moved up or down to point at a specific operation: press the CYCLE key to move the arrow down, the MENU key to move the arrow up. To choose a specific operation, move the arrow so that it points to the operation, then press the SELECT key. The operation is performed or additional menus are shown for further selections. The following is how the scrolling presentation appears.

```
->CHANGE MODE
  MOVE CARTRIDGE
  DLT DIAGNOSTIC
  CONFIDENCE TEST
  REMOTE DIAGS
  DRVLDULD
  COMM TEST
  MAINTNANCE MENU
```

Operator Panel Messages

Operator messages are shown on the operator panel. These messages can give status about the library and tape drives, or they can signal an error condition.

Rows 1 and 2 show the tape library status and robotics activity. During initialization, rows 1 and 2 show information such as:

- Definition of the robotic shuttle Y and Z axes

- Audit of the magazines and drives
- Initialization of the drives

This information is part of the normal initialization routine.

When the library is in normal on-line operating mode, rows 1 and 2 show:

```
IBM XXX7  X.XX x
ONLINE
```

Rows 3 and 4 show the tape drive status. Row 3 shows the status for tape drive A. Row 4 shows the status for tape drive B. The two rows provide a running account of drive operations.

During initialization one of the following messages appears briefly (XXXX is the firmware version for the tape drive):

```
A: DLT7000  VNN y1
B: DLT7000  VNN y2
```

or

```
A: DLT7000  VNN y1
B: NOT PRESENT
```

These messages are normal (if, in the second case, the tape library is a single-drive unit). If rows 3 or 4 show the following, call your technical support personnel to get a tape library or DLT7000 software update:

```
A: UNKNOWN TYPE
B: UNKNOWN TYPE
```

If either or both rows 3 and 4 show `Cln Reqd`, clean the head of the appropriate drive (see "Cleaning the Heads" on page 80).

If either or both rows 3 and 4 show `Service Reqd`, have the appropriate drive serviced.

Using the Control Keys

The tape library has three control keys: MENU, CYCLE, and SELECT (see Figure 19 on page 51). Each control key performs a specific function, regardless of whether you are changing modes, initiating an activity, running tests, or setting parameters. Figure 20 lists the key functions for both the scrolling presentation and the menu/cycle presentation.

Figure 20 (Page 1 of 2). Control Key Functions		
Key	**Scrolling Presentation**	**Menu/Cycle Presentation**
MENU	Moves the arrow up.	Changes from the current operational menu to the next menu. The current operational menu is shown on row 1. The operation shown on row 1 is not performed until the SELECT key is pressed.

Figure 20 (Page 2 of 2). Control Key Functions		
Key	**Scrolling Presentation**	**Menu/Cycle Presentation**
CYCLE	Moves the arrow down.	Switches between alternative actions for the operational menus. The current alternative action is shown on row 2. The operation shown on row 2 is not performed until the SELECT key is pressed.
SELECT	Causes the tape library to perform the chosen operation.	Causes the tape library to perform the menu operation and the alternative action.

Attention: Simultaneously pressing the MENU, CYCLE, and SELECT control keys for approximately six seconds will reinitialize the tape library. This is useful for restarting a library that might have stopped in the middle of an operation, or to start the initialization routine so that you can enter the setup mode.

Adjusting the Display Contrast

Use the following procedure to adjust the contrast on the library's display panel:

1. Remove the six Torx T15 screws that secure the top cover to the tape library, then remove the top cover (see "Removing and Replacing the Desktop Tape Library Cover" on page 97).

2. Inside the library chassis, locate the printed circuit board assembly (PCBA) behind the LCD.

3. Locate the potentiometer (marked R1) on the PCBA.

4. While watching the display on the front door of the library, turn R1 in either direction to achieve the best display clarity.

5. Replace the top cover and the six screws.
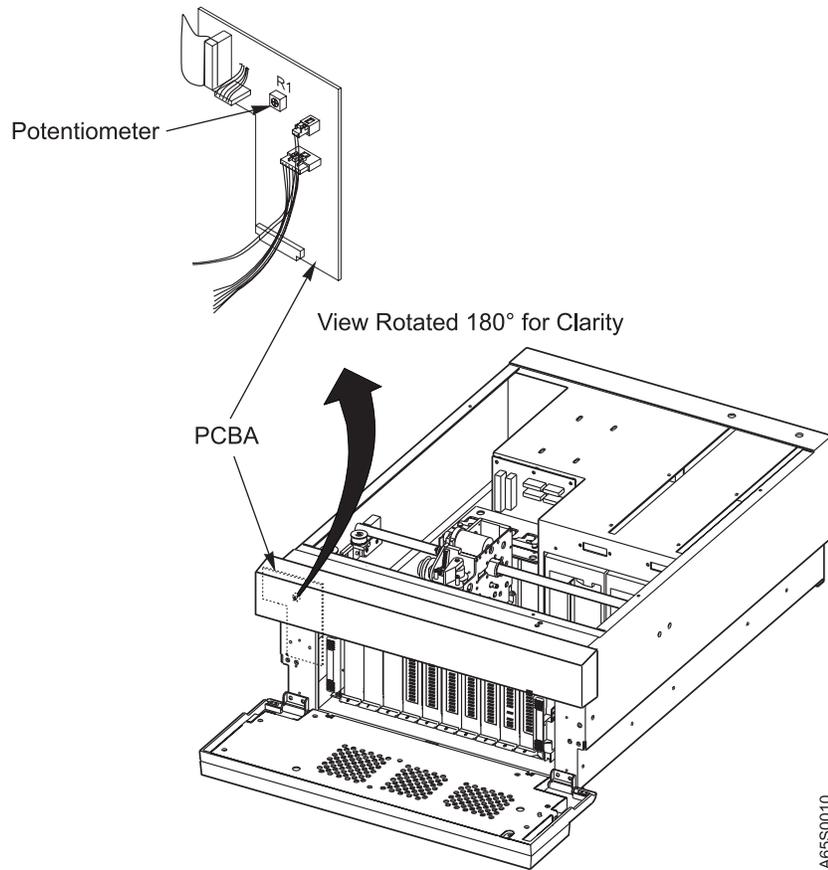
Figure 21. Adjusting the Display Contrast

Menu Operations

The operations that can be performed using the operator panel and control keys are listed in Figure 22.

Certain operations can only be performed from a specific (prerequisite) mode or modes; therefore, before selecting an operation, make sure the tape library is in the proper mode. For example, a move cartridge operation can only be performed with the tape library in the diagnostic off-line mode. To move a cartridge, select the diagnostic off-line operational mode and then select the move cartridge menu operation. If the tape library is not in the correct operational mode, it will show a message on the operator panel prompting for a change to the correct mode.

Figure 22 (Page 1 of 2). Menu Operations		
Menu Operation	**Prerequisite Mode**	**Description**

CHANGE MODE	None	Changes the tape library operational mode. Operational modes are:
		
		    On-line
		    Off-line
		    Diagnostic Off-line

Figure 22 (Page 2 of 2). Menu Operations		
Menu Operation	**Prerequisite Mode**	**Description**
MOVE CARTRIDGE	Diagnostic Off-line	Moves a cartridge from one location to another. Cartridges can be moved from storage cell to tape drive, tape drive to storage cell, storage cell to storage cell, or tape drive to tape drive.
DLT DIAGNOSTIC	Diagnostic Off-line	Issues a SEND DIAG command to the DLT7000 tape drive to perform basic tests. **Service personnel only:** Do not use a good data cartridge. Data will be overwritten and lost forever.
CONFIDENCE TEST	Diagnostic Off-line	Moves cartridges randomly throughout storage locations. This operation does not insert a tape cartridge into a tape drive. The confidence test can be stopped by pressing any control key.
REMOTE DIAGS	Diagnostic Off-line	Enables communication through the RS-232 interface.
DRVLDULD	Diagnostic Off-line	DLT7000 tape drive load and unload test. This test moves a tape cartridge from a cell to a tape drive. The tape drive loads the tape cartridge, reads the data table, and recalibrates the heads. As part of this test, the COMM TEST is run before performing drive loads and unloads. **Service personnel only:** Do not use a good data cartridge. Data can be overwritten and lost forever.
COMM TEST	Diagnostic Off-line	Communications test. This test quickly verifies SCSI communications between the tape library and host.
MAINTNANCE MENU	Diagnostic Off-line	Provides the following service-related information: Machine serial number SCSI configuration SE, single-ended D, differential Re-initialize the tape library Reset the statistics Reset robotic datums Load code tape

Using the Operator Panel to Change Modes

Use the following procedure to change the operational mode.

Note: Make sure the front door key lock is in the 12 o'clock position.

Starting from:

```
IBM XXX7  X.XX x
ONLINE
A:  IDLE
B:  IDLE
```

1. Press the CYCLE key once. The following menu is shown on the operator panel.

   ```
   ->CHANGE MODE
     MOVE CARTRIDGE
     DLT DIAGNOSTIC
     CONFIDENCE TEST
     REMOTE DIAGS
     DRVLDULD
     COMM TEST
     MAINTNANCE MENU
   ```

2. Press the SELECT key once. The following menu is shown on the operator panel.

   ```
   ->ONLINE
     OFFLINE
     DIAG OFFLINE
   ```

3. Press the CYCLE key until the arrow is pointing at the desired operational mode.

4. Press the SELECT key to set the tape library to the new mode.

The tape library is now in the new operational mode. The operator panel shows the starting menu with the new operational mode on row 2.

Using the Operator Panel to Move a Tape Cartridge

You or a service representative can move a tape cartridge from a storage cell to a tape drive or another cell; or from a tape drive to a storage cell or another tape drive. When moving tape cartridges, the cells in the tape cartridge magazine are elements 0-9, the fixed cells are elements 10-14, drive A is element 15, and drive B is element 16.

The following procedures explain how to move a tape cartridge.

Moving a Cartridge from One Cell to Another Cell

This procedure can be used when moving a tape cartridge from either a magazine cell or fixed cell to any other cell.

Starting from:

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

1. Press the CYCLE key twice. The following menu is shown on the operator panel.

   ```
     CHANGE MODE
   ->MOVE CARTRIDGE
     DLT DIAGNOSTIC
     CONFIDENCE TEST
     REMOTE DIAGS
     DRVLDULD
     COMM TEST
     MAINTNANCE MENU
   ```

2. Press the SELECT key once. The following menu is shown on the operator panel.

   ```
   SELECT SOURCE
   ->Storage Cell ?
     Drive ?
   ```

3. Press the SELECT key once. The following menu is shown on the operator panel.

   ```
   SELECT SOURCE
   Cartridge 0 ?
   ```

   Press the CYCLE key to increase the storage cell number from 0 through 14. Press the MENU key to decrease the storage cell number from 14 through 0.

4. Press the SELECT key once. The following menu is shown on the operator panel.

   ```
   SELECT DEST
   ->Storage Cell ?
     Drive ?
   ```

5. Press the SELECT key once. The following menu is shown on the operator panel.

   ```
   SELECT DEST
   Cartridge 0 ?
   ```

   Press the CYCLE key to increase the storage cell number from 0 through 14. Press the MENU key to decrease the storage cell number from 14 through 0.

   To void the pending move operation, press the MENU key when the arrow is pointing at element 0.

   To run the move operation, press the SELECT key. The following menu is shown on the operator panel.

```
                Press select to
                execute move
                From Element xx
                To Element yy
```

6. Press the SELECT key. The following menus are shown on the operator panel as the move operation is performed (xx and yy are the specified element numbers).

```
MOVE
From Element xx

MOVE
To Element yy
```

7. After the move operation is finished, press the MENU key. The DIAG OFFLINE menu is shown on the operator panel, and you can perform additional operations.

Moving a Cartridge from a Cell to a Tape Drive

Starting from:

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

1. Press the CYCLE key twice. The following menu is shown on the operator panel.

```
   CHANGE MODE
->MOVE CARTRIDGE
  DLT DIAGNOSTIC
  CONFIDENCE TEST
  REMOTE DIAGS
  DRVLDULD
  COMM TEST
  MAINTNANCE MENU
```

2. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT SOURCE
->Storage Cell ?
  Drive ?
```

3. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT SOURCE
Cartridge 0 ?
```

Press the CYCLE key to increase the storage cell number from 0 through 14. Press the MENU key to decrease the storage cell number from 14 through 0.

4. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT DEST
->Storage Cell ?
  Drive ?
```

Press the CYCLE key to move the arrow from `Storage Cell` to `Drive`.

5. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT DEST
->Drive A ?
  Drive B ?
```

For tape libraries with two tape drives, use the CYCLE key to switch between drive A and drive B.

To void the pending move operation, press the MENU key when the arrow is pointing at the element 0. To run the move operation, press the SELECT key. The following menu is shown on the operator panel.

```
Press select to
execute move
From Element xx
To Drive y
```

6. Press the SELECT key. The following menus are shown on the operator panel as the move operation is performed (xx is the specified element number and y is the specified drive).

```
MOVE
From Element xx
```

```
MOVE
To Drive y
```

7. After the move operation is finished, press the MENU key. The DIAG OFFLINE menu is shown on the operator panel, and you can perform additional operations.

Moving a Tape Cartridge from a Tape Drive to a Cell

Note: Before moving a tape cartridge from a tape drive to another location, the tape must first be unloaded. The tape can be unloaded by issuing a REWIND/UNLOAD command from the host computer. Also, you can manually unload the tape cartridge by reaching through the front door and pressing the Unload button. (For more information about manually unloading a tape cartridge, see "Manually Removing a Tape Cartridge" on page 87.)

Starting from:

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

1. Press the CYCLE key twice. The following menu is shown on the operator panel.

```
    CHANGE MODE
->MOVE CARTRIDGE
  DLT DIAGNOSTIC
  CONFIDENCE TEST
  REMOTE DIAGS
  DRVLDULD
  COMM TEST
  MAINTNANCE MENU
```

2. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT SOURCE
->Storage Cell ?
  Drive ?
```

3. Press the CYCLE key to move the arrow from `Storage Cell` to `Drive`.

4. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT SOURCE
->Drive A ?
  Drive B ?
```

For tape libraries with two tape drives, use the CYCLE and MENU key to switch between drive A and drive B.

5. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT DEST
->Storage Cell ?
  Drive ?
```

6. Press the SELECT key once. The following menu is shown on the operator panel.

```
SELECT DEST
Cartridge 0 ?
```

Press the CYCLE key to increase the storage cell number from 0 through 14. Press the MENU key to decrease the storage cell number from 14 through 0.

To void the pending move operation, press the MENU key when the arrow is pointing at `Drive A`.

To run the move operation, press the SELECT key. The following menu is shown on the operator panel.

```
Press select to
execute move
From Drive y
To Element xx
```

7. Press the SELECT key. The following menus appear on the operator panel as the move operation is performed.

```
MOVE
From Drive y

MOVE
To Element xx
```

8. After the move operation is finished, press the MENU key. The DIAG OFFLINE menu is shown on the operator panel, and you can perform additional operations.

DLT DIAGNOSTIC Test

The DLT DIAGNOSTIC test issues a SEND DIAG command to the DLT7000 tape drive to perform basic tests. Before running the DLT DIAGNOSTIC test, a scratch tape cartridge must be loaded into a tape drive and at the load point.

Attention: For service personnel only: do not use a customer data cartridge. Data will be overwritten and lost forever.

Starting from:

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

1. Press the CYCLE key three times. The following menu is shown on the operator panel.

```
   CHANGE MODE
   MOVE CARTRIDGE
->DLT DIAGNOSTIC
   CONFIDENCE TEST
```

2. Press the SELECT key once. The following menu is shown on the operator panel (TID means target ID, X is the SCSI ID of the tape drive, and YYYY is the firmware version of the tape drive).

```
DLT DIAGNOSTIC
TEST TID X
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

Press the CYCLE key to increase the SCSI ID number; press the MENU key to decrease the SCSI ID number.

Note:

> If a correct SCSI ID is not selected, the following menu is shown on operator panel; the menu means the drive is not communicating or the ID is not valid.

```
DLT DIAGNOSTIC
NO DRV COMM
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

3. Press the SELECT key once. The DLT DIAGNOSTIC test starts to run and the following menu is shown on the operator panel (X is the time in minutes remaining for the test; the time shown counts down as the test is run).

```
DLT DIAGNOSTIC
Time Left Xm
A:  DLT7000    VNN y1
B:  DLT7000    VNN y2
```

4. When the test is finished, the following menu is shown on the operator panel.

```
DLT DIAGNOSTIC
DLT DIAG PASSED
A:  DLT7000    VNN y1
```

5. Press the MENU key once. The following menu is shown on the operator panel.

```
DLT DIAGNOSTIC
Unload Tape ?
A:  DLT7000    VNN y1
B:  DLT7000    VNN y2
```

6. Press the SELECT key once. The tape is unloaded and the tape library returns to the main diagnostic menu.

   If the DLT7000 tape drive does not pass the DLT DIAGNOSTIC test, the following menu is shown on the operator panel.

```
DLT DIAGNOSTIC
DLT DIAG Failed
A:  DLT7000    VNN y1
B:  DLT7000    VNN y2
```

   Possible causes and corrections for the failure might be:

<u>Cause</u>	<u>Correction</u>
Dirty heads	Perform the procedure for cleaning the heads (see the instructions in Chapter 5, "Using the Operator Panel," of the *3447 and 7337 Digital Linear Tape Library Setup and Operator Guide*).
Bad media	Run the DLT DIAGNOSTIC test again using a different tape cartridge.
Failed DLT7000 Tape Drive	Replace the tape drive.

   Figure 23 lists error messages associated with the DLT DIAGNOSTIC test. The error messages may appear on the operator panel.

Figure 23 (Page 1 of 2). Error Messages from the DLT DIAGNOSTIC Test	
Error Message	**Description**
INIT SETUP ERROR	The controller has a problem so that it cannot set up as an initiator when communicating with the DLT7000 tape drive.
NO DRV COMM	Communications could not be established with the DLT7000 tape drive.
NO TAPE LOADED	A tape was not loaded into the DLT7000 tape drive, or the tape was not at the load point.
ERROR ON DLT DIAG	The controller cannot send the command to perform the DLT DIAGNOSTIC test.

Figure 23 (Page 2 of 2). Error Messages from the DLT DIAGNOSTIC Test	
Error Message	**Description**
DLT DIAG FAILED	The diagnostic status was not 0.

Confidence Test

The confidence test is a random movement test that exercises the robotic shuttle and makes sure that the robotic shuttle can move tape cartridges between the cells. Cartridges are not moved to the drives. Before running this test, make sure at least one cell contains a tape cartridge. Use the following procedure to run the confidence test.

Note: The tape cartridges will be moved and must be reinventoried after running this test. Do not use customer cartridges for this test. Make sure that the front door key lock is in the 12 o'clock position.

Starting from:

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

1. Press the CYCLE key three times. The following menu is shown on the operator panel.

```
   CHANGE MODE
   MOVE CARTRIDGE
   DLT DIAGNOSTIC
->CONFIDENCE TEST
```

2. Press the SELECT key once. The confidence test runs until you press any of the control keys.

DRVLDULD Test

The DRVLDULD test is similar to the confidence test. It makes sure that the robotic shuttle can move tape cartridges between the cells, and can load and unload the drive. Before running the test, make sure that the library contains at least two cartridges (for a single-drive library) and three cartridges (for a dual-drive library). Use the following procedure to run the DRVLDULD test.

Note: The tape cartridges will be moved and must be reinventoried after running this test. Do not use customer cartridges for this test. Make sure that the front door key lock is in the 12 o'clock position.

Starting from the following screen, press the SELECT key twice.

```
  DLT DIAGNOSTIC
  CONFIDENCE TEST
  REMOTE DIAGS
->DRVLDULD
```

The DRVLDULD test runs for 100 cycles, or until you press any of the control keys.

Remote Diagnostic Interface

The remote diagnostic interface provides a way to perform more in-depth testing of the tape library, to load new firmware, and to obtain debug information. This section describes the RS232-C serial interface and the remote diagnostic interface functionality. It also provides information needed to perform certain diagnostic tasks.

Serial Interface

The physical connection for the remote diagnostic interface is provided by an RS232-C serial interface. The remote diagnostic port is accessed through a male DB9 connector. Figure 24 lists the electrical pinout for this connector, which is the pinout for a null modem cable. This interface is in conformance with the RS232-C electrical specification. Parameters for the interface are:

- Serial information transmitted at 19.2 K-baud

- 8 bits, no parity, 1 stop bit

- VT100 terminal emulation

- XON/XOFF protocol, with a one-character maximum delay between receipt of XOFF and transmission halting

- Character framing and translation OFF

Figure 24. Diagnostic Port Pinout		
Pin	**Name**	**Tape Library Connection**
1	DCD	Connected to Pins 4, 6
2	RXD	Data to Tape Library
3	TXD	Data from Tape Library
4	DTR	Connected to Pins 1, 6
5	GND	Logic Ground
6	DSR	Connected to Pins 1, 4
7	RTS	Connected to Pin 8
8	CTS	Connected to Pin 7
9	RI	No Connection

Terminal Emulation Programs

Two common communication programs that can be used for the terminal emulation are:

- HyperACCESS Lite (for an OS/2 operating system)

- PROCOMM (for DOS or Windows operating systems)

Other terminal emulation or communications programs can be used; however, it is necessary to set them up using parameters similar to those described for HyperACCESS Lite or PROCOMM.

The following are procedures for setting up HyperACCESS Lite and PROCOMM.

HyperACCESS Lite

1. Type the executable (normally HALITE) at the prompt in an OS/2 window (or click on the HyperACCESS Lite icon).

2. Click on the PROPERTIES selection on the Action Bar.

3. Click on the Communications selection:

   - At the Settings entry, choose 8-None-1 (data-parity-stop)

   - At the Baud rate entry, choose 19200

   - At Port setup, choose XON/XOFF for both receiving and sending. Do not select hardware handshaking. Choose 750 msec for Break signal duration.

4. Click on ASCII Setting tab and ensure that all selections are blank (off).

5. Click on Terminal Setting tab:

   - Choose VT100 for terminal emulation

   - Use the defaults (Terminal keys) for the Function, Arrow, and Ctrl keys

   - When you are ready to upload new firmware to the library controller card, after selecting the proper symbol from the Diagnostic Selection Menu (see "Remote Diagnostic Menu" on page 68), answer Y to ARE YOU SURE YOU WANT TO CHANGE FIRMWARE? Wait for the READY TO LOAD FIRMWARE message. Click on either the Transfer selection on the Action Bar (then select send) or click on the Send symbol (wings flying away) on the Tool Bar.

   - Choose the Text Protocol; then type in the proper filename (example: a:\xxxxxx.asc) before clicking Send.

   - Depending on the PC attributes, a firmware upload may take from 10 to 30 minutes (or longer). HyperACCESS Lite does not show an hourglass or action symbol other than the blinking cursor to indicated the firmware is being uploaded. If the firmware is being loaded from the floppy or A-drive as indicated by the example, you will notice the floppy busy light going on and off during the transfer. When successfully complete, the PC screen shows a message and the library reboots.

PROCOMM

This procedure describes menus and key strokes for any DOS version of PROCOMM.

1. Type the executable file name (normally PROCOMM) at the prompt in a DOS full-screen session.

2. Press Help (ALT-F10) to display the PROCOMM main menu.

3. Select menu item Line Settings (ALT-P) and choose the following:

   - 19200 baud rate
   - N,8,1 (no parity, 8 data bits, 1 stop bit)
   - COM1 (normally)

4. Select menu item Setup Screen (ALT-S):

   a. Choose Terminal Setup and select the following values:

Terminal Emulation:	VT100
Duplex:	Full
Flow control:	XON/XOFF
CR translation (in/out):	Disable (CR)
BS translation:	NON-DEST
BS key definition:	BS
Line wrap/scroll:	ON
Break length (ms):	0
Inquiry (CTRL-E):	OFF

b. Choose ASCII Transfer Setup and select the following values:

ASCII UPLOAD	
Echo locally:	NO
Expand blank lines:	NO
Page character:	0
Character pacing:	0
Line pacing:	0
CR translation:	NONE
LF translation:	NONE
ASCII DOWNLOAD	
CR translation:	NONE
LF translation:	NONE

c. Choose SAVE SETUP TO DISK to save the settings for the next time.

5. When you are ready to upload new firmware to the library controller card, after selecting the proper symbol from the Diagnostic Selection Menu (see "Remote Diagnostic Menu" on page 68), answer Y to ARE YOU SURE YOU WANT TO CHANGE FIRMWARE?" Then wait for the message READY TO LOAD FIRMWARE. Press ALT-F10 to bring up the main PROCOMM menu.

- Select menu item Send files (PgUp key) to display the Protocol menu.

- Select ASCII protocol.

- Type the filename (for example: a:\xxxxxx.asc).

- Depending on the PC attributes, the firmware upload may take from 10 to 30 minutes (or longer). PROCOMM shows a line counter incrementing while the firmware is being uploaded from the diskette. Also, notice that the diskette busy light goes on and off during the transfer. When successfully complete, the PC screen shows a message and the library reboots.

Enabling the Remote Diagnostic Mode

Before diagnostics can be run:

- Take the tape library off-line by placing it in the DIAGNOSTIC OFFLINE mode.

- Enable the remote interface to allow remote diagnostic commands to be issued.

These tasks are accomplished from the tape library operator panel. Use the following procedure.

Changing to Diagnostic Off-line Mode

Starting from:

```
IBM XXX7  X.XX x
ONLINE
A:  IDLE
B:  IDLE
```

1. Press the CYCLE key once. The following menu is shown on the operator panel.

   ```
   ->CHANGE MODE
     MOVE CARTRIDGE
     DLT DIAGNOSTIC
     CONFIDENCE TEST
   ```

2. Press the SELECT key once. The following menu is shown on the operator panel.

   ```
   ->ONLINE
     OFFLINE
     DIAG OFFLINE
   ```

3. Press the CYCLE key until the arrow is pointing at DIAG OFFLINE.

4. Press the SELECT key to set the tape library to diagnostic off-line mode.

Enabling the Remote Diagnostics Interface

Starting from:

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

1. Press the CYCLE key four times. The following menu is shown on the operator panel.

   ```
     MOVE CARTRIDGE
     DLT DIAGNOSTIC
     CONFIDENCE TEST
   ->REMOTE DIAGS
   ```

2. Press the SELECT key once. The tape library is now ready for remote diagnostics.

Remote Diagnostic Menu

The Remote Diagnostic Menu lists the commands that can be used to perform diagnostic tests, to initialize the library, and to update firmware. To run a command, type the appropriate key from the host keyboard and press Enter or Return. If you type an unrecognized entry, a list of supported commands is displayed. The command level prompt is:

X.XX >

where X.XX is the current firmware level.

Exit the Remote Diagnostics Menu at any time by pressing any tape library control key.

Figure 25 on page 69 lists each command and provides a brief description of the command function.

Command	Description
Command	**Description**
$	This command forces an immediate IPL (reboot) of the tape library by inhibiting the Watchdog Timer update. An IPL can be forced from the front panel by pressing all three control keys simultaneously and holding for about six seconds.
#	This command enables field service personnel to upload new firmware into the tape library. After entering this command, the tape library erases the flash memory bank it uses to store the new firmware. If the tape library is unsuccessful in erasing the flash memory bank, a message is displayed and the machine continues to run with the current firmware. After successfully erasing the flash memory, the tape library prompts you to begin uploading the firmware. At the completion of the upload, you are informed of the upload status. If the tape library is unsuccessful in programming the flash memory bank, a message is displayed and the machine continues to run with the current firmware. After a successful upload, the tape library reboots.
^	This command switches the operating firmware bank on the next IPL. USE THIS COMMAND WITH CAUTION!
+/-	This command allows you to turn power on or off to both the motor driver and the drive handle stepper motor. Drive power is not affected by this command. +/- is typically used to free up the axes for measurement purposes and is used in conjunction with the P command.
%	This command reads and reports the temperature in degrees Fahrenheit (F) of drive A, drive B, and the controller card.
~	This command is used in remote diagnostics only to stop after each pick or place, and to wait for user input before continuing.
*	This command resets all position datum numbers. USE THIS COMMAND WITH CAUTION!
!	This command reads and reports the voltages of the +5V, +12V and +12V power supplies.
&	This command updates library firmware with a DLT code tape.
A	This command moves the shuttle in front of the selected cell, but will not perform a pick or place move.
B	After two additional prompts, this command actuates the normal force arm.
C	This command runs the Confidence Test. The Confidence Test scans the library for cartridges, then randomly moves cartridges between cells. Cartridges are not moved to the drive. Stop this test at any time by pressing any key on the serial terminal or by pressing any tape library operator panel key. **Note:** This command randomly repositions cartridges in the cells unless all cell slots are full.

Figure 25 (Page 1 of 3). Remote Diagnostic Commands

Command	Description
D	Drive load and unload test.
	Attention: To run this test the SCSI addresses must be set at the following; any other addresses will prevent the test from running.
	Drive A = 4 Drive B = 5 Controller = 6
	At the Drive Load and Unload submenu, the following commands are available:
	Command Description
	D Drive load and unload test
	E Drive load and unload test, exclude drive B
	L Drive load and unload test, exclude cells 9 and 14
	Q Query inventory table
	R Request sense
	S SCSI drive communication test
	T Target disconnected status
	U Unload all drives
	W Drive write and read diagnostic test
	X Exit
E	This command continuously picks and places out of one cell only.
F	This command does a bar code scan.
G	This command engages and disengages the cartridge gate solenoid on the shuttle.
H	This command randomly positions the shuttle in front of cells but will not perform a pick or place move.
I	This command initializes the tape library robotics. The tape library performs these four steps: 1. Turns the motor +24 V power supply on. 2. Homes the normal force arm, cartridge seat rack, and the X axis. 3. Checks for magazine present. 4. Detects and initializes the drive that is present. If an error is detected during the execution of this command, the error code and associated SCSI ASC and ASCQ bytes are printed (see "Error Codes" on page 42).
J	This command sets the brake and clutches for an X-axis move, and turns the motor off.
K	This command sets the brake and clutches for an Z-axis move, and turns the motor off.
L	This command sets the brake and clutches for a rack move, and turns the motor off.
M	This command allows the operator to move a cartridge via the serial port. The status for the source and destination locations (full or empty) is not checked.
N	This command checks each cell for a cartridge present. This command does not attempt to read the bar code.
O	This is an internal manufacturing test only.
P	This command continuously prints out the position in counts of the motor rotation. It also prints out the state of the system ports two and three. This command is used typically with power off to check the location of elements and datums.

Figure 25 (Page 2 of 3). Remote Diagnostic Commands

Figure 25 (Page 3 of 3). Remote Diagnostic Commands

Command	Description
Q	This command prints out the internal inventory and statistics table, which provides element information such as OCCUPIED, CARTRIDGE BAR CODE LABEL, PUTS, and POWER ON-TIME.
R	This command toggles the door solenoid on and off.
S	This command enters the Serial EEPROM setup sub-menu.
T	This command outputs 8K ASCII hexadecimal (HEX) bytes that describe the last 4000 events that were logged internally. The trace output is used as a debug tool. For a complete description of that procedure, see "Obtaining Trace Debug Information" on page 71.
U	The tape library prints out on the serial port debug information as the firmware is running. This command allows you to set the amount of debug information printed. There are four levels, 0-3. The default is 0.
V	This command reports the tape library serial number.
W	This command reports what is being communicated to the tape library from each drive.
X/Y	This command moves drive handles up or down. It is used mainly as a test to verify proper drive handle operation.
Z	This command zeroes the retry and put statistics of the internal inventory and statistics table. It does not zero any datum changes.

Obtaining Trace Debug Information

Trace debug information consists of 8K ASCII hex bytes that describe the last 4000 events that were internally logged in a tape library. To obtain trace debug information for later analysis, you must run remote diagnostics with a remote terminal (see "Enabling the Remote Diagnostic Mode" on page 67). After enabling the remote diagnostic mode, perform the following steps.

1. Insert a blank diskette into the diskette drive in your PC or laptop computer.

2. Turn on the text or ASCII capture file option in the communication program (HyperACCESS Lite, PROCOMM, or other).

   Note: For example, on HyperACCESS Lite, the text file capture selection has its own icon on the action bar. When the dialog box appears, type `a:\xxxx.yyy` (for example, `a:\trace1.txt`) and press Enter.

3. Type `T` and press Enter.

4. After the trace is finished, close the capture program.

5. Give the trace information to the next level of support.

Interpreting the Internal Element and Statistics Table

The tape library maintains a 19-element table of the library cartridge inventory and robotics statistics. The table consists of two parts: the inventory page and the statistics page. Each table tracks the library's internal inventory by element address. The following lists the inventory component and its address:

Inventory Component	Element Address
Cartridge magazine	0 through 9
Fixed cells	10 through 14
Drive A	116
Drive B	117
Bar code reader	17
Shuttle	132

I	ADDRS	LABEL	LEPOVDSR	X DATM	X LST	Z DTM	Z LAST	TOLSTP	R	I	SNS	ASC	ASQ
0	0		00101000	26	0	0	0	0	0	FF	0	0	0
1	1	B0003	11111000	0	0	0	0	0	0	FF	0	0	0
2	2		00101000	26	0	0	0	0	0	FF	0	0	0
3	3		11111000	0	0	0	0	0	0	FF	0	0	0
4	4		00101000	0	0	0	0	0	0	FF	0	0	0
5	5		00101000	0	0	0	0	0	0	FF	0	0	0
6	6		00101000	0	0	0	0	0	0	FF	0	0	0
7	7		00101000	0	0	0	0	0	0	FF	0	0	0
8	8		11111000	0	0	0	0	0	0	FF	0	0	0
9	9	B0021	10111000	-26	0	0	0	0	0	FF	4	40	C2
10	10	C0017	10111000	0	0	0	0	0	0	FF	0	0	0
11	11	D0026	10111000	0	0	0	0	0	0	FF	0	0	0
12	12		00101000	0	0	0	0	0	0	FF	0	0	0
13	13		00101000	0	0	0	0	0	0	FF	0	0	0
14	14	B0024	10111000	0	0	0	0	0	0	FF	0	0	0
60	116		00101000	-26	0	0	0	-1402	0	FF	0	0	0
61	117		00101000	-52	0	0	0	-1380	0	FF	0	0	0
66	132		00001000	0	0	0	0		0	FF	0	0	0
I	ADDRS	LABEL	LEPOVDSR	X DATM	X LST	Z DTM	Z LAST	TOLSTP	R	I	SNS	ASC	ASQ

CARTINV

Figure 26. Typical Library Cartridge Inventory Page

Heading	Meaning
I	Decimal internal element address.
ADDRS	Decimal SCSI element address.
LABEL	Right-justified cartridge bar code label, with the checksum character stripped.
LEPOVDSR	Bit-mapped element state field interpreted as:

	L	Label Valid
	E	Label Error
	P	Magazine Present
	O	Element Occupied
	V	Element Occupied Flag Valid
	D	Not Used
	S	Not Used
	R	Not Used

Heading	Meaning
X DATM	X target offset in counts for this element.
X LST	Last X offset target in counts for this element.
Z DATM	Z target offset in counts for this element.
Z LST	Last Z offset target in counts for this element.
TOLSTP	Z count at the back of the drive for this element.
R	SCSI ID of a host reserving this element (0 - 7).
I	Reservation ID:

0 - 0xFE for reserved
0xFF for not reserved

Heading	Meaning
SNS	Last sense code reported to host.
ASC	Last ASC code reported to host.
ASCQ	Last ASCQ code reported to host.

Figure 27 shows a typical statistics page.

```
            I|-CRTY|RTRTY|PTRTY|CTRTY|LTRTY|   PUTS|BCRTRY|
            0     0     2     0     0     0    242      0
            1     0     0     0     0     0    264      0
            2     1     1     2     0     0    215      0
            3     0     0     0     0     0    258      0
            4     0     0     0     0     0    221      0
            5     0     0     3     0     0    237      0
            6     0     0     0     0     0    238      0
            7     0     0     2     0     0    238      0
            8     0     0     0     0     0    243      0
            9     1     0     1     0     0    246      0
           10     0     0     0     0     0    248      0
           11     0     0     0     0     0    226      0
           12     0     0     0     0     0    212      0
           13     0     0     0     0     0    243      0
           14     0     0     0     0     0    232      0
           15     1     0     3     0     1    548      0
           16     1     3     3     0     0    337      0
           17     0     0     0     0     0      0      0
           18     0     0     0     2     0   4452      0
            I|-CRTY|RTRTY|PTRTY|CTRTY|LTRTY|   PUTS|BCRTRY|
           Magazine Offset = 74
           Fixed Cell Offset = 50
           Drive A Offset  = 58
           Drive B Offset  = 92
           Status = 228/33/22603/5.19/12.85/26.20/76F/75F/76F
           ETime =      1:16:53:16.
```

Figure 27. Typical Library Cartridge Statistics Page

Heading	Meaning
I	Internal element address.
CRTY	Number of retries starting cartridge on a pick from this element.
RTRTY	Number of retries after starting cartridge on a pick from this element.
PTRTY	Total number of put retries to this element.
CTRTY	Total number of center retries to this element.
LTRTY	Total number of latch retries to this element (drives only).
PUTS	Total number of puts to this element.
BCRTRY	Total number of bar code retries for this element.
Magazine Offset	Offset from nominal for the magazine.
Fixed Cell Offset	Offset from nominal for the fixed cells.
Drive A Offset	Offset from nominal for Drive A.
Drive B Offset	Offset from nominal for Drive B.
Status	Example status line:228/33/22603/5.19/12.85/26.20/76F/75F/76FTotal power on hours/Total hard pick and put errors/Total puts/ Voltage of +5v supply/Voltage of +12v supply/ Voltage of +24v supply/Drive A temperature/Drive B temperature/Controller temperature
Etime	Total on time in the form of Days: Hours: Minutes: Seconds.

Updating Firmware

Tape Library Firmware

Three methods may be used to update tape library firmware:

- Update using the serial port
- Update using a DLT tape (if the library firmware is at level 1.50 or higher)
- Update using the `tapeutil` tool (for RS/6000 only)

The sections that follow describe the first two methods. For instructions about updating your tape library firmware with the `tapeutil` tool, see Appendix B, "Updating the Tape Library Firmware on the RS/6000" on page 127.

Updating the Tape Library Firmware Using the Serial Port

The following equipment and software are required to update a new version of the tape library firmware using the serial port:

- PC or laptop computer

- Communication program loaded onto the PC or laptop computer (examples of communication software include HyperACCESS Lite, PROCOMM, or other software with the ability to upload text or ASCII data files)

   Note: The communication program that you choose depends on the operating system that is loaded onto the PC or laptop computer. If OS/2 is resident, HyperACCESS Lite is a good choice; if DOS or Windows is resident, PROCOMM is a good choice. Make sure to set the protocol properties to the correct settings (see "Terminal Emulation Programs" on page 65). If you choose an alternate communication program, make sure that the protocol properties are compatible with the properties in "Serial Interface" on page 65. After choosing the settings, you may want to save them so that they will be available when you re-boot.

- Serial port null modem cable, with the cable end configured as a nine-pin male and the other end configured as a nine-pin female

- 3447 Digital Linear Tape Library or 7337 Digital Linear Tape Library with a level of firmware that has the ability to put itself into remote diagnostic mode

- Diskette with an .ASC (text) file that contains the latest tape library firmware (for example, Q2_150.ASC or 150.ASC)

   Note: If several tape libraries are to be updated, it is advisable to copy the .ASC file onto the hard drive of the PC or laptop, and perform the upload from the hard drive. Also, as diskettes may get lost or overwritten, it is best to create a firmware directory to maintain previous levels of firmware.

To update the library firmware using the serial port:

1. Connect the female end of the null modem cable to the PC or laptop, then connect the male end to the serial port at the rear of the tape library.

2. Turn on the power to the PC or laptop.

3. Turn on the power to the tape library.

Attention: The tape library must be in remote diagnostic mode to communicate with the PC or laptop (see "Enabling the Remote Diagnostic Mode" on page 67).

4. Make sure that the tape library is in remote diagnostic mode.

5. Do one of the following:

   - If you have the latest firmware installed on your hard drive, press Enter on the PC or laptop to display the Remote Diagnostic menu, then type # and press Enter.

   - If the latest firmware is on a diskette, insert the diskette into the disk drive of the PC or laptop, then type # and press Enter.

6. At the prompt `ARE YOU SURE YOU WANT TO CHANGE FIRMWARE?`, type `Y` (for yes).

   The tape library erases the alternate flash memory bank. If the upload is unsuccessful, the current flash memory bank will remain active; the procedure does not allow the switching of flash memory banks to occur. After the tape library successfully erases the alternate flash memory bank, it displays a message that indicates it is ready to upload the firmware.

7. Select the option in the communication program that enables a text or ASCII file to be uploaded.

8. Enter the name of the drive, directory, and file to be uploaded. For example:

   `a:\150.asc` (for a diskette drive)

   `c:\firmdirc\150.asc` (for a hard drive)

   The tape library uploads the update file. Depending on the speed of the PC or laptop, the upload normally takes approximately 20 minutes.

   When the upload is complete, an upload status message displays, and the tape library automatically re-boots. The new firmware immediately takes effect.

9. You can repeat this procedure to ensure that both flash memory banks contain the same new level of firmware. However, it may be more valuable to retain the previous level of firmware in the new alternate flash memory bank if you want to return to this level of firmware. The banks do not switch automatically. They must be switched by using the Remote Diagnostic menu.

Updating the Tape Library Firmware Using a DLT Tape Cartridge

If you have Release 1.50 or later of the tape library firmware, your tape library can load firmware updates by reading a DLT firmware tape cartridge. This feature enables you to update your firmware without a host computer.

Notes:

1. The firmware tape that you use for an update must match the IBM family of 3447 or 7337 products (the label on the firmware identifies the family of IBM products for which it is compatible).

2. **Attention:** The main controller contains two flash memories for its firmware. The controller executes code from one flash memory (which contains the original version of the firmware) while it updates the firmware in the other. Should the update process be aborted, the flash memory that contains the udpate firmware will probably be corrupted. The system will not execute code from this flash memory on subsequent re-boots. Execution of the upgraded

firmware will only take place if the upgrade was performed successfully and you did not abort the automatic reboot at the end of the update.

3. Because two flash memory banks are used on the main controller, the original firmware still exists on the library, even after the update completes successfully and the system executes the new firmware. Restoring the original code can be done via the Remote Diagnostics menu (for the appropriate command, see Figure 25 on page 69).

To update the library firmware using a DLT tape cartridge:

1. Place the system in the Diagnostic Off-line mode (see "Using the Operator Panel to Change Modes" on page 57).
2. Load the DLT firmware tape cartridge into drive A. It may be loaded manually or from a storage cell using the Move Cartridge menu). Before continuing, ensure that the code tape is at load point (that is, that the Tape in Use light is on steady).
3. Select MAINTNANCE MENU from the main diagnostic menu (see "Maintenance Menu" on page 79).

Attention: The procedure for updating software uses the internal controller as a SCSI host. Before performing the next step, make sure that no external SCSI hosts are connected to the system.

4. Select the LD CODE TAPE? option. The following message displays on the operator panel.

```
INITIATING SCSI
HOST OPERATIONS,
OK TO PROCEED?
ABORT or RUN?
```

5. Press the SELECT key. When the first block of data is successfully read from the tape, the following message displays on the operator panel (Q2_150.bin is an example of a firmware file name).

```
Tape Format OK!
File: Q2_150.bin

Press > to load?
```

6. Press the SELECT key. The following message displays on the operator panel.

```
Loading Firmware
File: Q2_150.bin

□ ▪ ▪ ▪ ▪ ▪ ▪ ▪
```

Line 4 indicates the progress of the update process. The update is complete when each of the eight cells displays a white box and the following message displays on the operator panel.

```
Load Completed!
Press > within
30 seconds to
ABORT AutoReboot
```

7. To activate the new firmware, reboot the system by pressing the MENU or CYCLE key or by letting 30 seconds elapse (an automatic re-boot occurs).

DLT7000 Tape Drive Firmware

DLT7000 tape drive firmware can be updated by running a firmware update (FUP) tape in the drive. The following procedure explains how to update the tape drive firmware. Figure 28 shows the DLT7000 tape drive front panel where the controls referenced in the procedure are located.
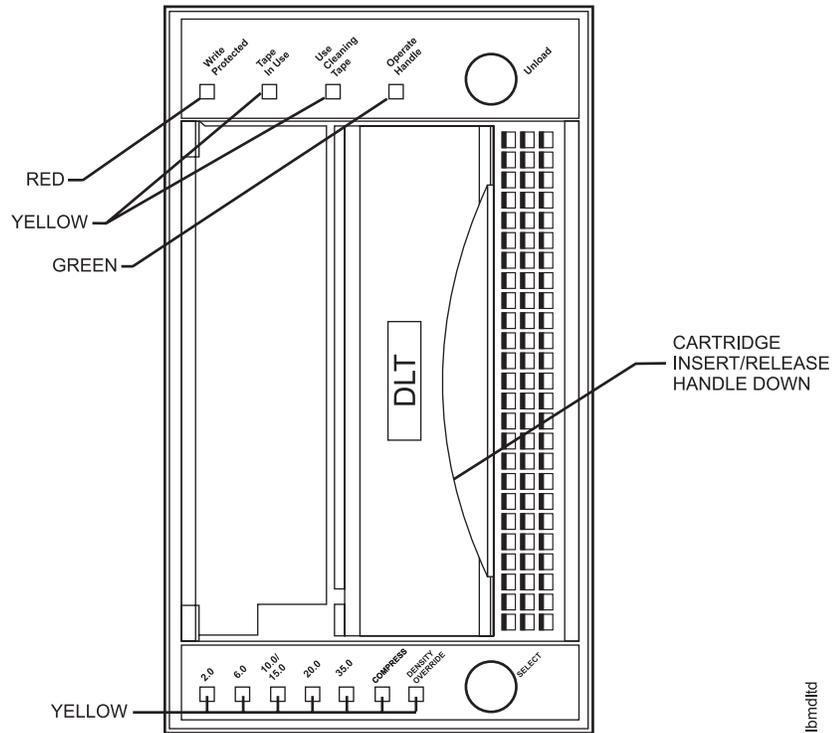

Figure 28. Front Panel of the DLT7000 Tape Drive

Note: Read the following procedures before beginning the firmware update.

1. Remove any cartridge that is in the DLT7000 tape drive and close the handle (down position).

2. Press the Unload button on the drive front panel and hold the button for approximately six seconds until the Write Protected light flashes. The flashing light means that the DLT7000 has recognized a request to update the firmware and is waiting for the sequence to be completed.

   If the Write Protected light does not blink, make sure that the drive is unloaded and the handle is completely in the down position.

3. Immediately after the Write Protected light starts flashing, release the Unload button and press the button again within four seconds. Hold the button for only one second or less.

   The Tape in Use and Write Protected lights flash, indicating that the firmware update mode has been selected.

   If, after a few seconds, the Write Protected light stops blinking, the DLT7000 tape drive has not entered the firmware update mode. Try the previous steps again. If the tape drive and controller are not communicating, you cannot select the firmware update mode.

4. Open the handle (raised position).

5. Load the FUP tape cartridge into the tape drive.

6. Close the handle (down position).

   The DLT7000 tape drive temporarily turns off the Tape in Use and Write Protected lights, automatically reads the FUP tape cartridge, examines the data, and verifies that the data provide a valid DLT7000 firmware image.

   Firmware update mode is automatically cleared at this point.

   Note: Calibration and directory processing cause the tape to move for a few minutes before reading data.

7. If the tape drive firmware is current (that is, if it matches the image on the FUP tape), the tape drive firmware is not updated.

8. If the tape drive firmware is not current, the tape drive firmware is updated, which takes from two to three minutes.

   While the tape drive firmware is being updated, the Write Protected and Tape in Use lights alternately flash.

9. When the tape drive firmware update is finished, the tape drive resets, rewinds the FUP tape to the beginning of tape (BOT), and goes through Power-On Self Test (POST).

10. If the firmware image is valid, the controller flash EEROM is automatically updated with the new firmware image. The Write Protected and Tape in Use lights flash again during the controller firmware update.

11. Wait until the Operate Handle light comes on, then open the handle (raised position) and remove the FUP tape.

Interpreting the Firmware Update Results

Two results can occur after updating the DLT7000 tape drive firmware:

- The firmware update cartridge is unloaded; this means a successful update.

  On the DLT7000 tape drive, the media is placed into the cartridge, the door is unlocked, and the Operate Handle light is turned on. After the tape library is reset or initialized, the new firmware level displays on the operator panel.

- The firmware update cartridge is not unloaded; this means the update was unsuccessful.

  The subsystem should still be usable, but this depends on why the update failed. Reasons for failure could be:

  – Power failure
  – Bad image on the tape
  – Defective flash EEROMs

Figure 29 provides additional information about the results of updating the DLT7000 firmware.

Figure 29. DLT7000 Firmware Update Results	
If ...	**Then...**

The image is valid.	1. The flash EEROM that contains the current firmware is erased.
	
	2. The new image is programmed in. The subsystem completes the update in about two minutes. Then:
	
	    • The tape drive resets itself.
	
	    • POST takes place.
	
	    • The DLT7000 tape drive automatically unloads the tape cartridge containing the firmware image. This signifies a successful firmware update.

The tape is not a valid firmware update tape.	No update is attempted. The Write Protected and Tape in Use lights do not blink. The drive resets and the tape stays loaded to signify that the firmware update was unsuccessful. Replace the FUP tape.
The tape does not contain a valid image.	No update is attempted. The Write Protected and Tape in Use lights do not blink. The drive resets and the tape stays loaded to signify that the firmware update was unsuccessful. Replace the FUP tape.
The tape contains a valid image, but the reprogramming flash memory fails.	The controller is probably unusable and needs to be replaced. The tape drive resets itself and reruns POST, which fails if flash memory does not contain a valid image.

Maintenance Menu

Figure 30 lists the elements that appear in the maintenance menu.

Figure 30. Elements in the Maintenance Menu	
Element	**Definition**
Serial Number	Informational; shows the serial number of the tape library.
SCSI Type	Informational; shows the type of SCSI interface (DIFF for differential and SE for single ended).
Re-initialize?	Reinitializes the library and all axes.
Reset Statistics?	Resets the operational "retry" statistics to zero. The "retry" statistics are listed in the internal inventory/statistics table.
Reset Datums?	Resets the datums to default settings (datums are the reference points for positioning the robotic shuttle).
Load Code Tape?	Puts the library in the proper state to update the tape library firmware with a code update cartridge (see "Updating the Tape Library Firmware Using a DLT Tape Cartridge" on page 75).

The following procedure describes how to use the operator panel to re-initialize the tape library, reset the internal statistics to zero, reset the datums to the default settings, or update the library firmware with a code update cartridge.

Note: Make sure the front door key lock is in the 12 o'clock position, and change the Digital Linear Tape Library to the diagnostic off-line mode.

Starting from:

```
IBM XXX7  X.XX x
DIAG OFFLINE
A:  DLT7000   VNN y1
B:  DLT7000   VNN y2
```

1. Press the CYCLE key eight times. The following menu is shown on the operator panel.

   ```
      CHANGE MODE
      MOVE CARTRIDGE
      DLT DIAGNOSTIC
      CONFIDENCE TEST
      REMOTE DIAGS
      DRVLDULD
      COMM TEST
   ->MAINTNANCE MENU
   ```

2. Press the SELECT key once. The following menu is shown on the operator panel (XXXXX is the serial number of the tape library).

   ```
   ->Serial #: XXXXX
      SE  SCSI:
      RE-INITIALIZE ?
      RESET STATS ?
      RESET DATUMS ?
      LD CODE TAPE ?
   ```

   Press the CYCLE key to move the arrow down to the maintenance task to be performed.

3. Press the SELECT key once. The operation is performed and the tape library returns to the on-line mode.

Cleaning the Heads

The DLT7000 tape drive does not require periodic or scheduled cleaning based on time or usage. When the heads in a tape drive need to be cleaned, the tape library displays a message on the operator panel and also informs the host computer over the SCSI channel. Use a digital linear tape cleaning cartridge to clean the tape heads. Figure 31 lists conditions for when to use the cleaning cartridge.

Note: The cleaning cartridge expires after 20 uses.

Figure 31. When to Use the Cleaning Cartridge		
If...	**It Means...**	**And You Should...**
The Use Cleaning Tape light comes on.	The drive head needs cleaning or the tape is bad.	Use the cleaning cartridge. To use the robotic shuttle to load the cleaning cartridge, see "Using the Operator Panel to Move a Tape Cartridge" on page 57. To manually load the cleaning cartridge, follow the instructions in Chapter 5, "Using the Operator Panel," in the *3447 and 7337 Digital Linear Tape Library Setup and Operator Guide*. When cleaning completes, the Use Cleaning Tape light turns off and the beeper sounds for you to remove the cleaning cartridge.
A specific data cartridge continually causes the Use Cleaning Tape light to blink.	The data cartridge may be damaged.	Back up this data onto another cartridge. Discard the old cartridge, which may be damaged. A damaged cartridge may cause unnecessary use of the cleaning cartridge.
The Use Cleaning Tape light is still on after you clean the drive head.	Your data cartridge may be causing the problem.	Try another data cartridge.
The Use Cleaning Tape light comes on after you load the cleaning cartridge.	Cleaning has not been done and the cartridge is expired.	Replace the cleaning cartridge.

Setup Information

The setup information enables a host computer to identify and communicate with the tape library. Setup information is stored in non-volatile random access memory. In the event of a power outage, the setup information is retained. When shipped, the tape library is set to the defaults shown in Figure 32.

If the defaults are acceptable, the tape library is ready for normal operation immediately after power on. If the setup must be changed (for example, to change the SCSI ID address), see the instructions in "Setup Procedure" on page 82.

When the tape library is powered up or reset, the setup parameters can be redefined. (The tape library can be reset by simultaneously pressing and holding the MENU, CYCLE, and SELECT control keys for approximately six seconds. This resets only the library but not the tape drives.)

Figure 32 (Page 1 of 2). Setup Parameters			
Setup Parameter	**Definition**	**Default Setting**	**Valid Settings**
SCSI ID	Tape library controller SCSI target ID	6	0-7
SCSI PARITY	Parity detection	ON	ON or OFF
INQUIRY=IBM XXX7	Set machine type shown on operator panel	7337	3447 or 7337
3 of 9 CHECK	Bar code check character	ON	ON or OFF

Figure 32 (Page 2 of 2). Setup Parameters			
Setup Parameter	Definition	Default Setting	Valid Settings
AUTO INV-MC	Auto inventory, library running. If this parameter is set to ON, whenever the tape library is operating and the front door is opened and closed, the library will automatically perform an inventory of the tape cartridges.	OFF	ON or OFF
AUTO INV-Pwr	Auto inventory, power on. If set to ON, when the tape library is powered on the library will automatically perform an inventory of the tape cartridges.	OFF	ON or OFF
Scroll Menu	Changes the presentation of information on the operator panel.	ON	ON or OFF
Autoloader	Changes the operating mode of the tape library to perform automatic tape loading.	OFF	ON, OFF, or LOOP

Setup Procedure

The tape library comes preset to meet most customer needs. If, however, you need to change a setup parameter, the following procedure explains how to make changes.

During this procedure the information on row 1 of the operator panel shows the current setup information; row 2 shows the alternative setting. You can make changes to the settings by pressing the MENU, CYCLE, and SELECT control keys:

- Pressing the MENU (left) control key advances the operator panel display to the next menu without changing the settings.

- Pressing the SELECT (right) control key chooses the alternative setting shown on row 2 for the parameter.

- Pressing the CYCLE (middle) control key changes the setting shown on row 2.

To change a setup parameter:

1. Turn the front door key to the 12 o'clock position to enable the robotics and the operator panel.

2. Enter the initialization/setup mode by powering the tape library on or, if it is already on, simultaneously pressing the MENU, CYCLE, SELECT control keys. (After approximately six seconds the tape library starts the initialization routine.) While the tape library is going through its initialization routine, rows 3 and 4 on the operator panel show:

```
PRESS a key to
Queue SETUP
```

Attention: If you inadvertently enter the setup mode by pressing any one of the control keys during library initialization, do not press the SELECT control key (right key) at any time, as this action will alter the setup parameter currently shown on the operator panel. To exit the setup mode without affecting any of the setup parameters, recycle the power (press the power switch off and then on) or repeatedly press the MENU control key (left key) until you exit the setup mode.

3. Press any one of the three control keys to enter the setup mode.

   After the tape library finishes its initialization routine, rows 1 and 2 on the operator panel show:

   ```
   SCSI ID = 6
   Change to  7?
   ```

   (This is a query to change the SCSI ID for the tape library controller.)

   - To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

   - To change the current setting to that shown on row 2 (that is, change SCSI ID 6 to 7) press the SELECT control key.

   - If neither row 1 nor row 2 show the desired setting, change the display on row 2 by pressing the CYCLE key. Press this key repeatedly to cycle through each of the alternatives (in the case of SCSI IDs, 0 through 7). When row 2 shows the correct setting, press the SELECT key.

4. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

   ```
   SCSI PARITY ON
   Change to  OFF?
   ```

   - To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

   - To change the current setting to that shown on row 2 press the SELECT control key. The next parameter and its current setting appear on row 1.

5. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

   ```
   INQUIRY=IBM XXX7
   Change to  YYY7?
   ```

   Where XXX7 is the current machine type and YYY7 is the alternative machine type. (Machine types are either 3447 or 7337.)

   - To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

   - To change the current setting to that shown on row 2 press the SELECT control key. The next parameter and its current setting appear on row 1.

6. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

   ```
   3 of 9 CHECK ON
   Change to  OFF?
   ```

- To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

- To change the current setting to that shown on row 2 press the SELECT control key. The next parameter and its current setting appear on row 1.

7. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

```
AUTO INV-MC OFF
Change to  ON?
```

- To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

- To change the current setting to that shown on row 2 press the SELECT control key. The next parameter and its current setting appear on row 1.

8. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

```
AUTO INV-Pwr OFF
Change to  ON?
```

- To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

- To change the current setting to that shown on row 2 press the SELECT control key. The next parameter and its current setting appear on row 1.

9. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

```
Scroll menu ON
Change to  OFF?
```

- To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

- To change the current setting to that shown on row 2 press the SELECT control key. The next parameter and its current setting appear on row 1.

10. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

```
Autoloader OFF
Change to  ON?
```

or, after pressing the MIDDLE key, rows 1 and 2 on the operator panel show:

```
Autoloader OFF
Change to  LOOP?
```

- To retain the current setting shown on row 1 and move on to the next parameter, press the MENU control key.

- To change the current setting to that shown on row 2 press the SELECT control key.

11. After pressing the MENU or SELECT keys, rows 1 and 2 on the operator panel show:

```
EXIT
Restart Setup ?
```

Note: If you inadvertently press the SELECT key during the setup procedure, you may alter your setup selections. Therefore, before you exit setup, it is recommended that you quickly review and verify the setup parameters that you have selected. To review the parameters, press the SELECT key, then press the MENU (left) key repeatedly until you have examined and verified each parameter. When the operator panel displays the preceding screen, go to step 12.

12. Press the MENU key to exit the setup procedure. The tape library is ready for normal operation.

Tape Drive SCSI Address Setup

The tape drives in the tape library come preset to meet most customer needs. If, however, you need to change a SCSI address, the following explains how to make the change.

The SCSI ID on the tape drives must be changed if you change the tape library controller SCSI ID to one that conflicts with a tape drive. The default SCSI IDs are:

- Drive A = 4
- Drive B = 5
- Library Controller = 6

The SCSI ID on a tape drive can be changed using the push button switch on the drive rear panel (see Figure 3 on page 4). The push button switch is integral with the SCSI ID number display. Press the push button switch to the right or left of the number display to set the tape drive to the desired SCSI ID.

The tape library must be powered off, then on to make the change effective.

Tape Cartridge Inspection Procedure

Before using any tape cartridge, perform the following inspection procedure.

Check the following:

- Exterior casing for visible damage.

- Shake the cartridge; any rattling sound indicates internal damage.

- Open the cartridge door and verify the proper leader position (see "Tape Leader Check" on page 86). Do not touch the tape leader or tape. Body oils that adhere to a tape can cause the heads to degrade.

If damage is apparent, do not use the cartridge.

Tape Leader Check

Check the position of the tape leader in the cartridge by lifting the release lever that opens the tape door. Be sure that the leader is positioned as shown in Figure 33. Make sure the edges of the tape leader tabs are on top of the rails inside the tape cartridge.
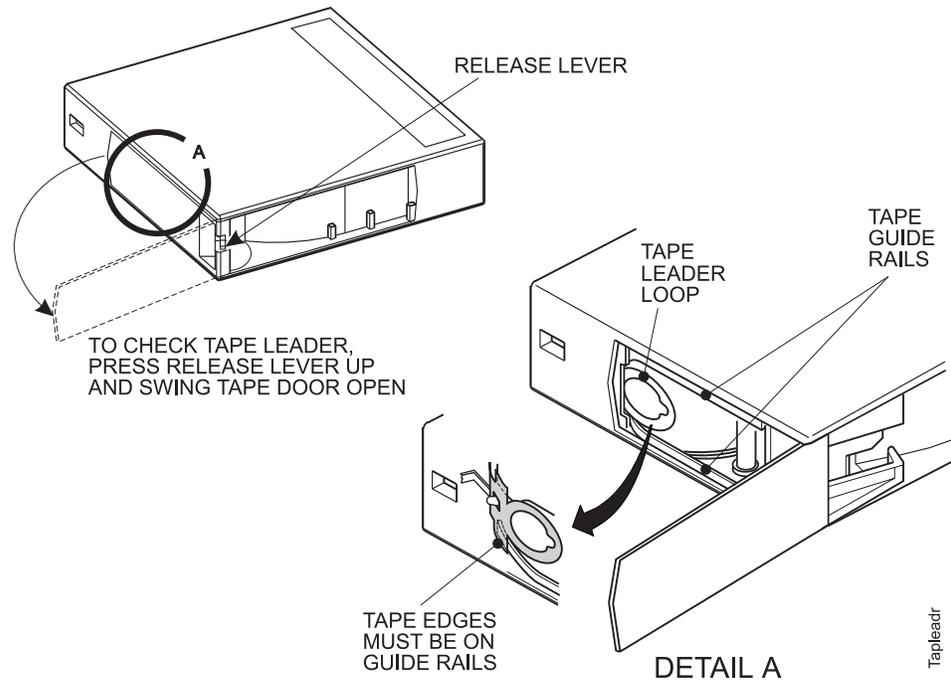

Figure 33. Tape Leader Check

Manually Removing a Tape Cartridge

If a power failure or a drive failure prevents the tape cartridge from ejecting, you can remove the cartridge manually.

Attention: The following procedure may damage the tape cartridge. Before using this procedure, attempt to eject the cartridge by pressing the Unload button (and wait for the green Operate Handle light to come on) or use the appropriate application commands. If you suspect that a defective power supply has prevented the tape from ejecting, leave the cartridge in the drive and replace the power supply (see "Removing and Replacing the Power Supply" on page 95). After removing and replacing the power supply, turn on power to the tape library and attempt to remove the cartridge by pressing the Unload button.

Use the following procedure to manually remove a tape cartridge.

1. Make sure the tape library is not performing an operation. If the tape library is performing an operation, let the tape library complete the operation before shutting off power.

2. Turn off the power to the tape library.

3. Remove the DLT7000 tape drive that contains the tape cartridge (see "Removing and Replacing a Tape Drive" on page 92).

4. Remove the tape drive shroud (see Figure 34 on page 88):

   a. Remove the screw securing the shroud to the load plate.

   b. Depress the shroud tab (the tab is on the opposite side of the screw, behind the printed circuit card).

   c. Lift the shroud straight up.
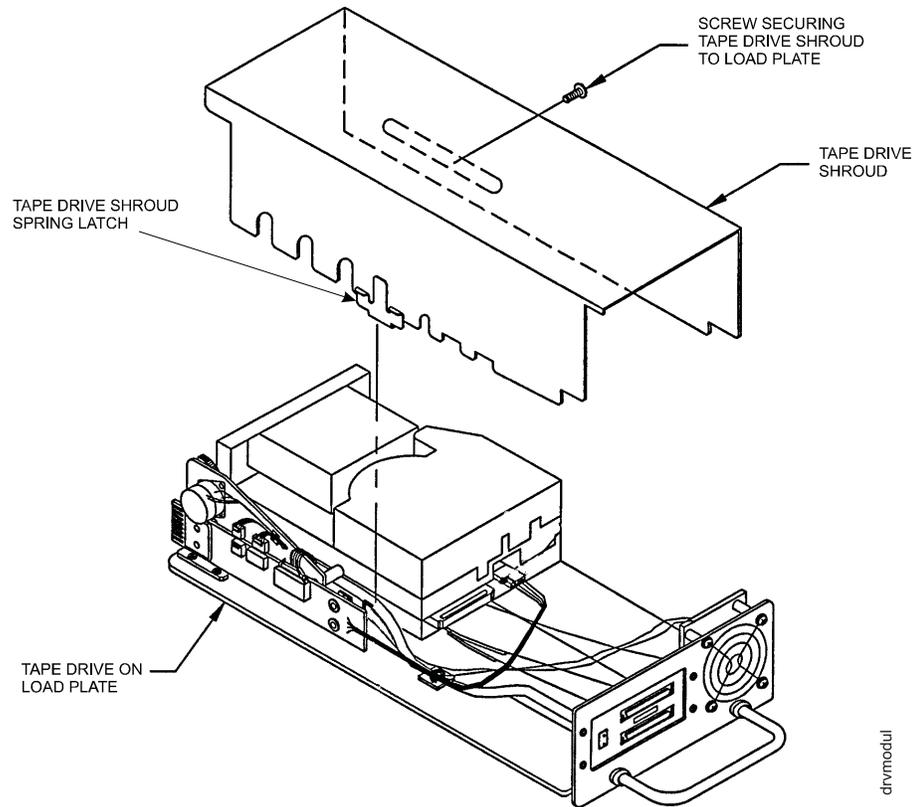
Figure 34. Tape Drive Shroud

5. Check to see if the tape is completely rewound. If so, go to step 10 on page 89. If not, continue with the next step.

6. Ensure that the tape cartridge is fully inserted into the tape drive and that the cartridge insert/release handle is down

7. Place the tape drive load plate on its side so that the printed circuit card is up, the front of the tape drive load plate is toward your right hand, and the rear is toward your left hand.

8. Insert a #1 Phillips head screwdriver into the hole located at the bottom center of the tape drive load plate (see Figure 35 on page 89).
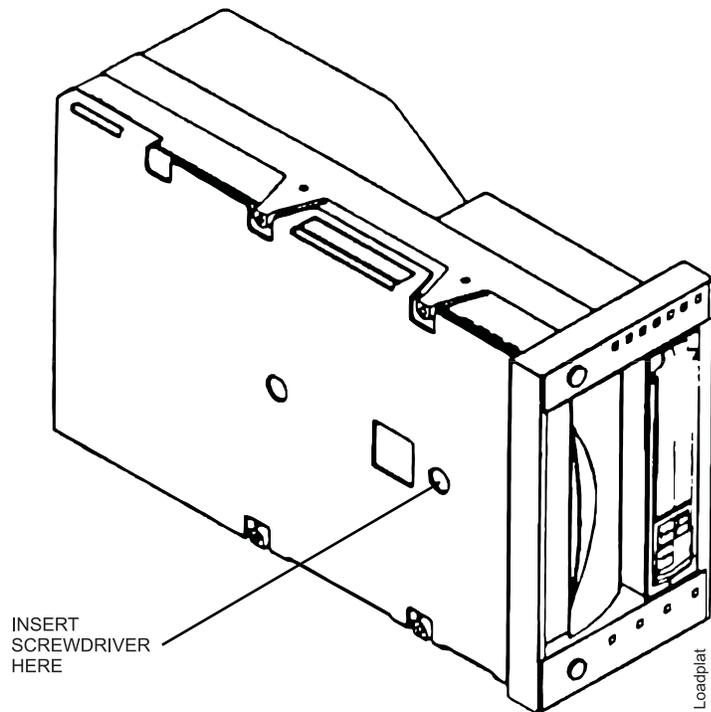
Figure 35. Access Hole in the Tape Drive

9. Rotate the screwdriver counterclockwise until you feel the cartridge leader encounter a hard stop.

   Attention: You may feel some initial resistance as the cartridge leader and drive leader exit the machine reel and enter the tape path. Do not confuse this potential resistance as the hard stop. Failure to fully rewind the cartridge leader into the cartridge before removing the cartridge from the tape drive will render the tape cartridge unusable.

10. Place the tape drive load plate on a flat surface, with the bottom side down and the front facing you.

11. With one hand, press the interposer (behind the face plate) toward the rear of the tape drive and hold it (see Figure 36 on page 90).

INTERPOSER

DETAIL A

Mantape
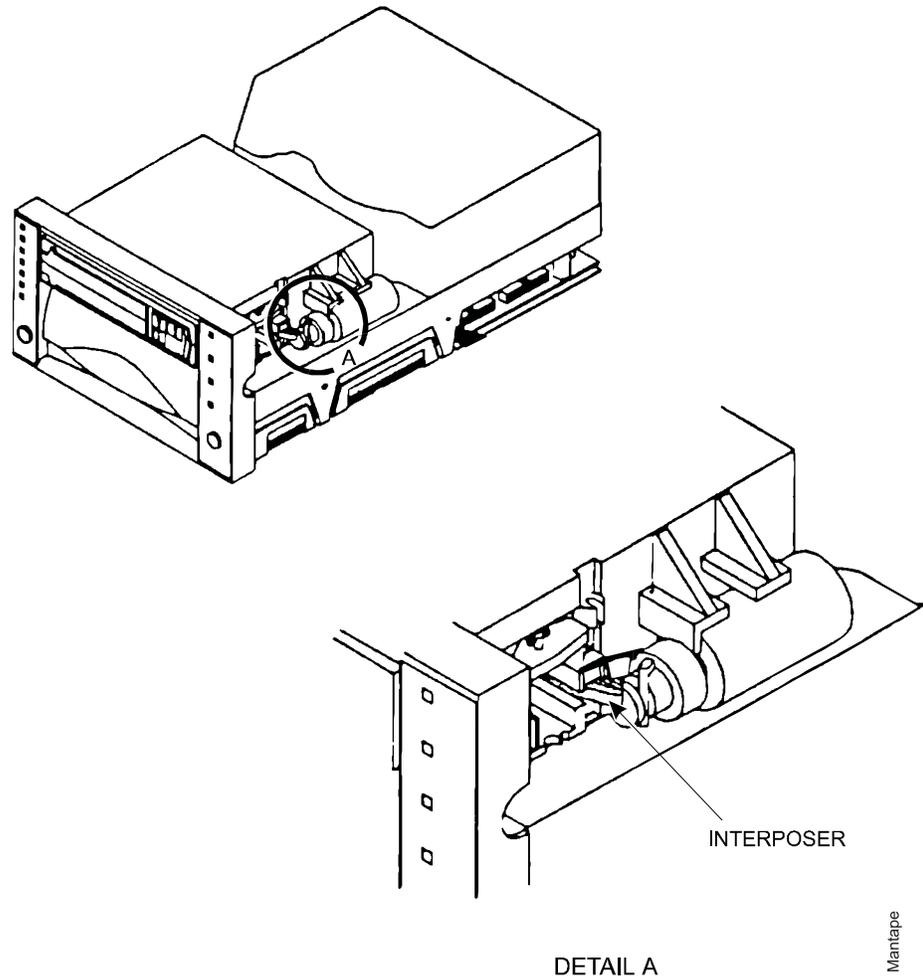
Figure 36. Interposer

12. Lift the cartridge insert/release handle with your free hand to its open position. The tape cartridge ejects approximately 0.75 in. (20 mm).

13. Hold the interposer in the open position. Grasp and remove the tape cartridge.

14. Return the cartridge insert/release handle to the down position.

   Note: If you do not hold the interposer open while lowering the cartridge insert/release handle, the cartridge door may not fully close. Close the cartridge door by holding the interposer open, then raise and lower the cartridge insert/release handle. The cartridge door can also be closed by turning on the power to the tape library (after the drive load plate has been re-installed), then raising and lowering the cartridge insert/release handle after the drive completes POST.

15. Replace the tape drive shroud.

Chapter 4. Removal and Replacement Procedures

This chapter explains how to remove and replace the following field replaceable units (FRUs):

- Tape drives

- Tape library controller

- Power supply and fuse

- Cover for the desktop tape library

- Door bezel and upper bezel

- LCD assembly

- Bar code reader

- Base tape library

DANGER

> **To prevent a possible electrical shock when adding or removing any devices to or from the system, ensure that the power cords for those devices are unplugged before the signal cables are connected or disconnected. If possible, disconnect all power cords from the existing system before you add or remove a device.** *(RSFTD203)*

Note: This product contains Torx screws. A set of Torx screwdrivers can be obtained by IBM Service Personnel by ordering Chesco 13 Pc Torx Set (IBM part number 62G1347).

Removing and Replacing a Tape Drive

This procedure describes how to remove and replace a tape drive module. A tape drive module consists of a tape drive and cooling fan mounted onto a load plate. The load plate supports the tape drive and fan. Figure 37 shows an exploded view of the components for removing or replacing a tape drive module.
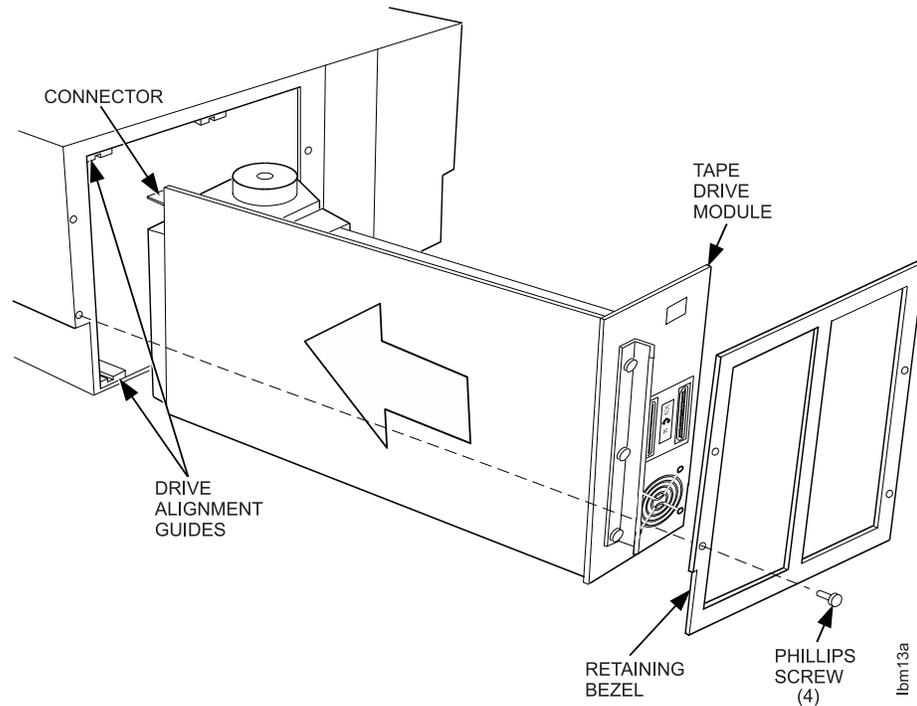

Figure 37. Removing and Replacing a Tape Drive Module

1. Turn off the power to the tape library by setting the power switch to off.

2. Disconnect the SCSI cables from the tape drives.

3. If the tape drive module being removed has a SCSI terminator, remove the terminator.

4. Remove the four screws securing the retaining bezel to the tape library back panel and remove the bezel.

5. Remove the tape drive module by grasping the handle and pulling back until the module is free from the tape library.

6. Replace the tape drive module by aligning the edges of the load plate in the slides and pushing the tape drive into the tape library until the male connector on the tape drive completely engages the female connector in the tape library.

   The connectors are completely engaged when the tape drive module is flush with the tape library back panel.

   Note: Occasionally, the male connector card on the drive load plate might need to be slightly adjusted to properly engage the connector in the tape library.

7. Replace the retaining bezel and reinstall the four screws securing the bezel to the tape library back panel.

8. If the tape drive module being replaced had a SCSI terminator, install the terminator on the new tape drive module.

9. Reconnect the SCSI cables to the drives.

10. If needed, reset the SCSI addresses (see "Tape Drive SCSI Address Setup" on page 85).

11. Turn on the power to the tape library by setting the power switch to on.

Installing a Second Tape Drive

If the tape library was originally configured with only one DLT7000 tape drive, a second DLT7000 drive can be added in the field by performing the following procedure.

1. Turn off the power to the tape library by setting the power switch to off.

2. Disconnect the SCSI cables from the tape drives.

3. Remove the four screws securing the retaining bezel to the tape library back panel and remove the bezel (see Figure 37 on page 92).

4. Remove the cover plate from the empty tape drive module location.

5. Insert the new tape drive module by aligning the edges of the load plate in the slides and pushing the tape drive into the tape library until the male connector on the tape drive completely engages the female connector in the tape library.

   The connectors are completely engaged when the tape drive module is flush with the tape library back panel.

6. Replace the retaining bezel and reinstall the four screws securing the bezel to the tape library back panel.

7. Install the SCSI terminator, as appropriate for tape library configuration.

8. Reconnect the SCSI cables to the drives.

9. If needed, reset the SCSI addresses (see "Tape Drive SCSI Address Setup" on page 85).

10. Turn on the power to the tape library by setting the power switch to on.

    After the power is turned on, the tape library recognizes that two tape drives are installed as it performs its initialization. The tape library will then be able to access either tape as required.

Removing and Replacing the Controller

This procedure describes how to remove and replace the controller. Figure 38 shows an exploded view of the components for removing or replacing the controller.
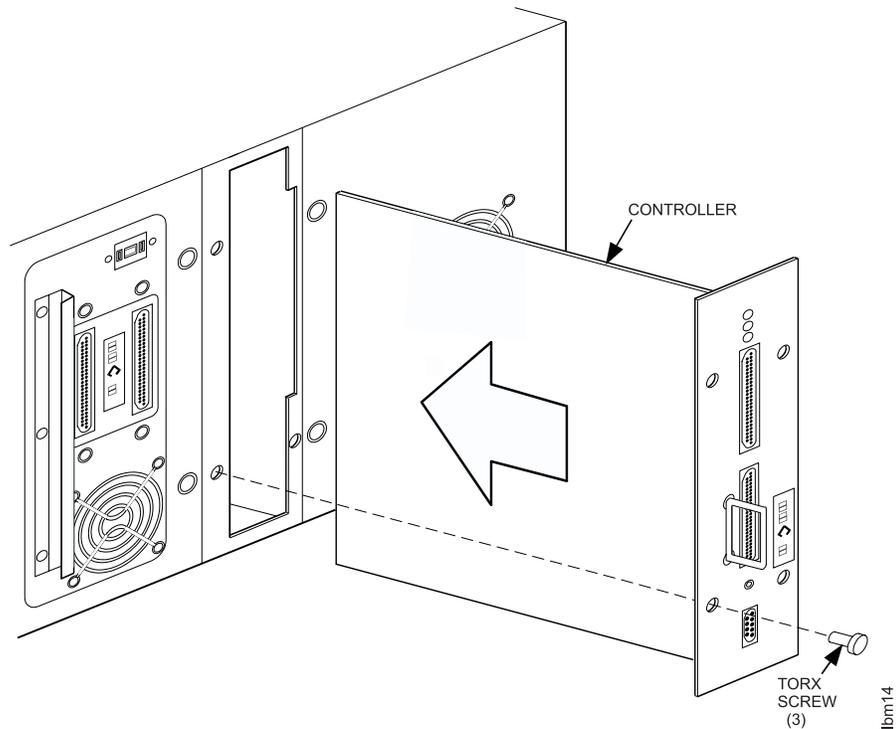

Figure 38. Removing and Replacing the Controller

1. Turn off the power to the tape library by setting the power switch to off.

2. Disconnect the SCSI cables from the controller.

3. Remove the three screws securing the controller to the tape library back panel.

4. Remove the controller by grasping the handle and pulling back until the module is free from the tape library.

5. Replace the controller by aligning the edges of the controller circuit card in the guides and pushing the controller into the tape library until the male connector on the controller completely engages the female connector in the tape library.

   The connectors are completely engaged when the controller is flush with the tape library back panel.

6. Reinstall the three screws securing the controller to the tape library back panel.

7. Reconnect the SCSI cables to the controller.

8. Turn on the power to the tape library by setting the power switch to on.

9. If needed, reset the tape library parameters by performing the "Setup Procedure" on page 82.

Removing and Replacing the Power Supply

This procedure describes how to remove and replace the power supply. Figure 39 shows an exploded view of the components for removing or replacing a power supply.
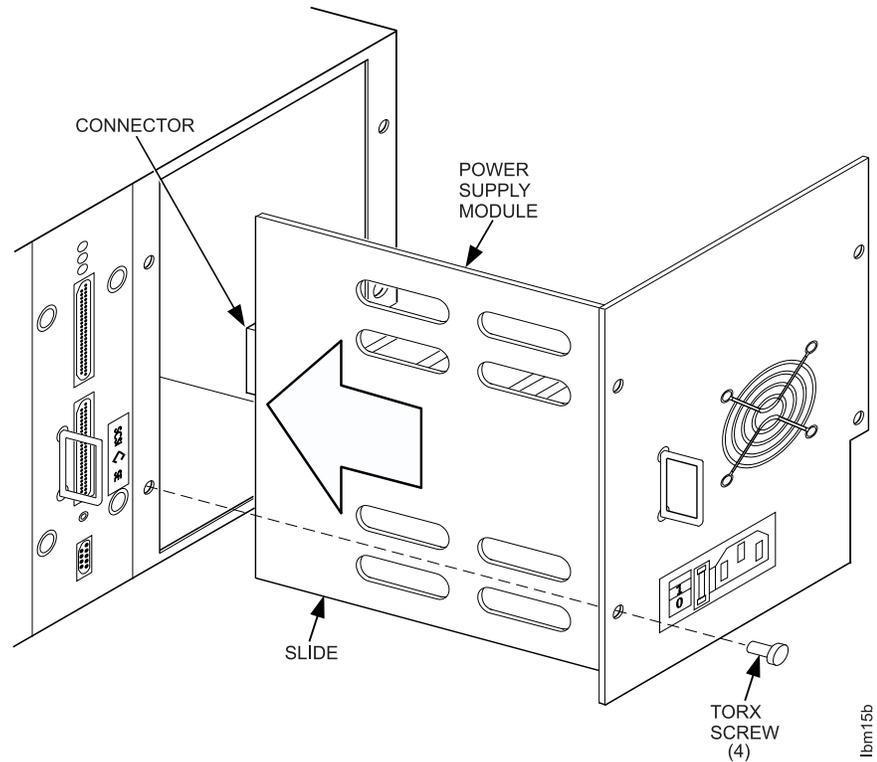

Figure 39. Removing and Replacing the Power Supply

1. Turn off the power to the tape library by setting the power switch to off.

2. Disconnect the power cord from the power supply.

3. Remove the four screws securing the power supply to the tape library back panel.

4. Remove the power supply by grasping the handle and pulling back until the module is free from the tape library.

5. Replace the power supply by aligning the edges of the power supply slide in the guides and pushing the power supply into the tape library until the female connector on the power supply completely engages the male connector in the tape library.

    The connectors are completely engaged when the power supply is flush with the tape library back panel.

6. Reinstall the four screws securing the power supply to the tape library back panel.

7. Reconnect the power cord to the power supply.

8. Turn on the power to the tape library by setting the power switch to on.

Removing and Replacing the Power Supply Fuse

One 5 A, 115 V fuse protects the tape library in the event of excessive current flow. This procedure describes how to replace the fuse in the event it is blown.
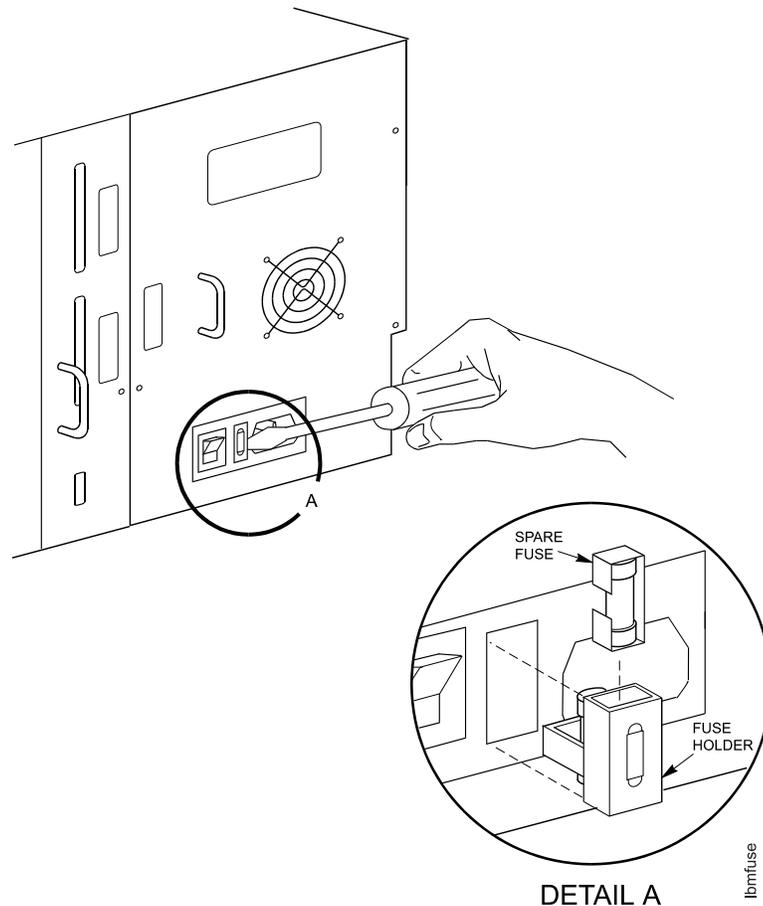Figure 40 shows how to replace the fuse.

Figure 40. Removing and Replacing the Fuse

1. Turn off the power to the tape library by setting the power switch to off.

2. Disconnect the power cord from the power supply.

3. Using a slot screw driver, gently pry the fuse holder straight out from the power supply.

4. Remove the blown fuse from the clips that hold the fuse.

5. A spare fuse is held in a compartment in the fuse holder. Use the tip of the slot screwdriver to slide the compartment open and remove the spare fuse. Slide the compartment back into the holder.

6. Insert the new fuse into the clips.

7. Replace the fuse holder by pressing it straight into the receptacle in the power supply.

8. Reconnect the power cord to the power supply.

9. Turn on the power to the tape library by setting the power switch to on.

If the fuse continues to blow, perform the problem analysis as described in Chapter 2, "Maintenance Analysis Procedures" on page 17.

Removing and Replacing the Desktop Tape Library Cover

This procedure describes how to remove and replace the cover on the desktop tape library. Figure 41 shows an exploded view of the cover and components that attach the cover to the desktop tape library.
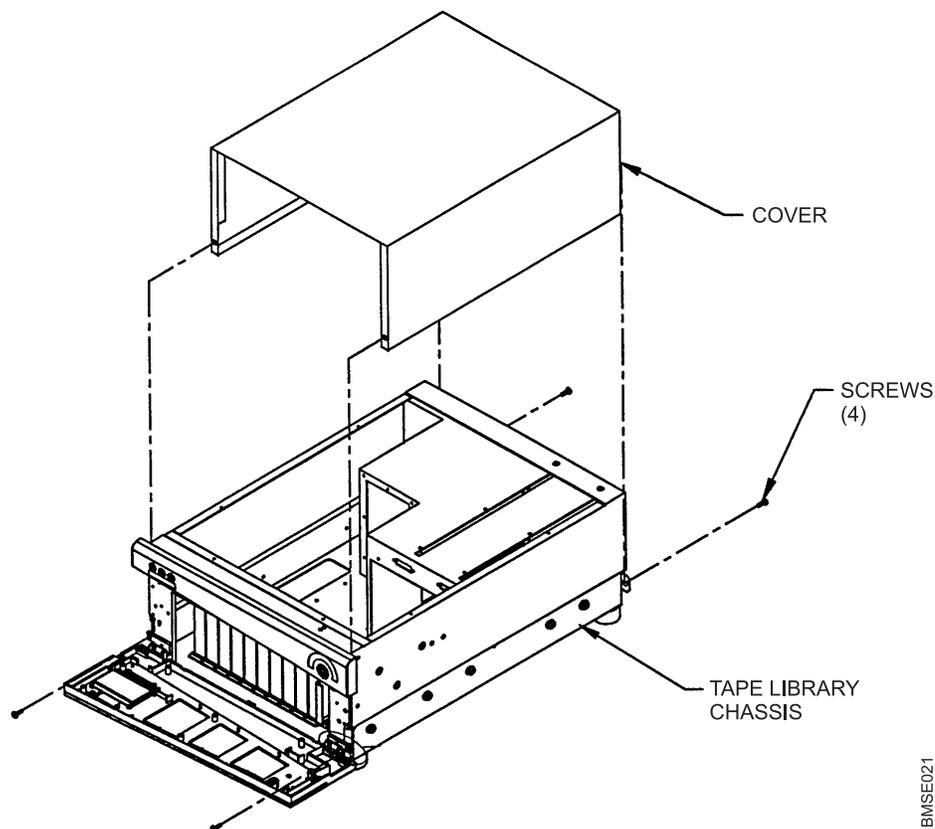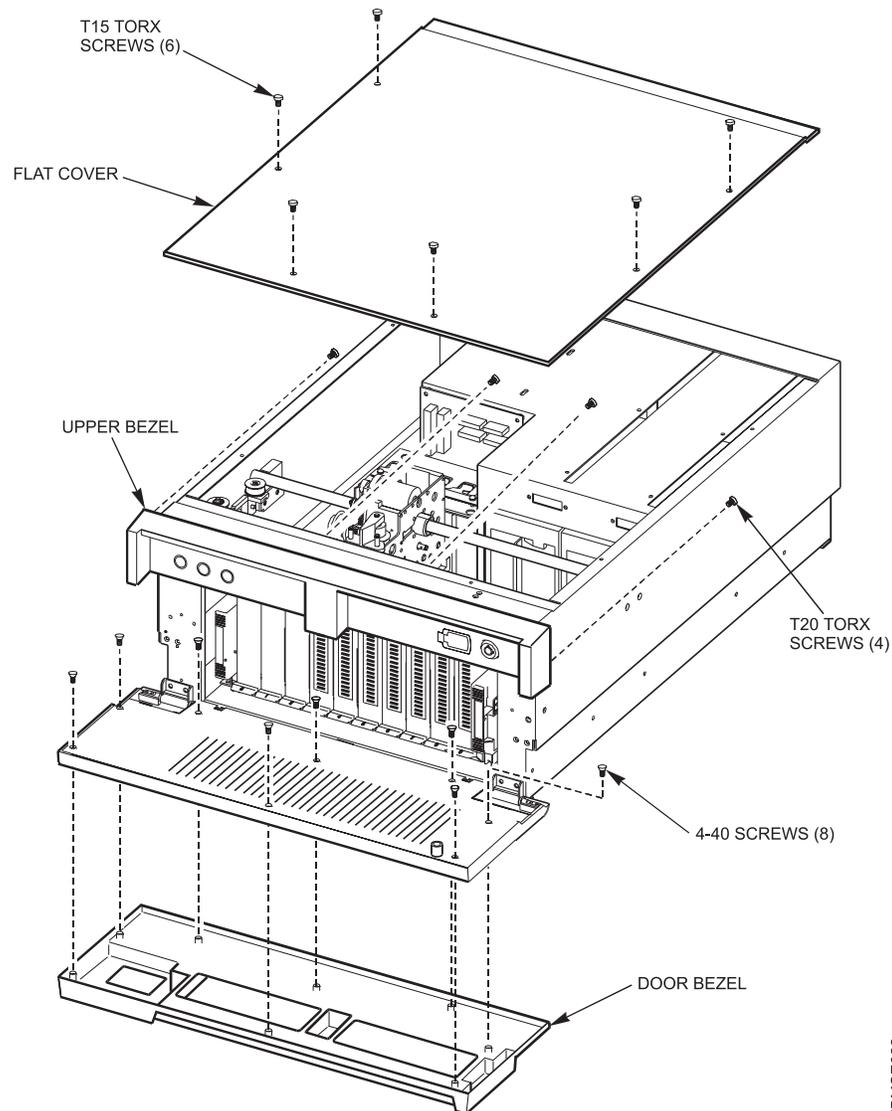

Figure 41. Removing and Replacing the Desktop Tape Library Cover

Four screws secure the cover to the desktop tape library. Two screws can be reached by opening the front door. The remaining two screws can be reached at the back of the tape library.

1. Turn off the power from to tape library by setting the power switch to off.

2. Turn the door key to the 9 o'clock position and open the front door.

3. Remove the two screws that secure the front edges of the cover to the tape library chassis.

4. At the rear of the tape library, remove the two screws that secure the back edges of the cover to the chassis.

5. Slide the cover straight up. You may need to pull the bottom edges of the cover away from the tape library to completely free it from the chassis.

6. Replace the cover by performing the steps in this procedure in reverse order.

Removing and Replacing the Door Bezel and Upper Bezel

This procedure describes how to remove and replace the plastic bezels mounted to the front door and to the chassis above the front door. Figure 42 shows an exploded view of the components for removing and replacing the front door and fixed bezels.

Figure 42. Removing and Replacing the Door Bezel and Upper Bezel

1. Turn off the power to the tape library by setting the power switch to off.

2. Remove the six Torx T15 screws that secure the top cover to the tape library chassis and remove the top cover.

3. Turn the door key to the 9 o'clock position and open the front door. Make sure that nothing is below the door that would keep the door bezel from being removed.

   Eight flat-head screws hold the front door bezel to the door sheet metal panel. The screws are inserted through the sheet metal panel and thread into inserts that are molded into the door bezel.

4. Remove the eight flat-head screws that secure the door bezel to the sheet metal panel. Hold the bezel to keep it from falling away from the sheet metal panel.

5. Remove the four Torx T20 screws that secure the upper bezel to the tape library chassis (see Figure 43).

   Two screws are inserted through mounting ears at the left and right sides of the library chassis. The remaining screws are inserted through the front-center of the library chassis; these screws are partially concealed by a ribbon cable that runs along the front of the library chassis. Carefully move the ribbon cable down to gain access to the screws.

6. Replace the front door and upper bezel by performing the steps in this procedure in reverse order.

Attention: When replacing the upper bezel, make sure that the bezel does not bind the control keys and keep them from making contact or holding them closed.

UPPER BEZEL

MOVE ASIDE
RIBBON CABLES
TO REACH
SCREW HOLES

(ROBOTIC SHUTTLE
ASSEMBLY DETAIL
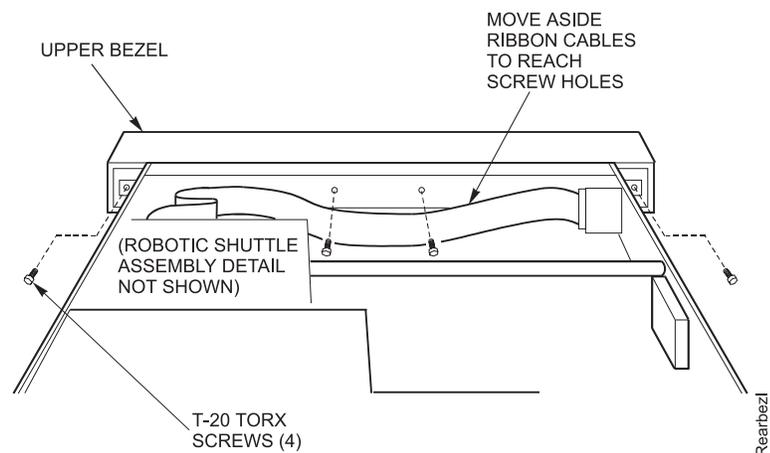NOT SHOWN)

T-20 TORX
SCREWS (4)

Rearbezl

Figure 43. Location of Fixed Bezel Mounting Screws

Figure 43 shows the inside of the chassis and the rear of the upper bezel, as seen when standing at the rear of tape library.

Removing and Replacing the LCD Assembly

This procedure describes how to remove and replace the liquid crystal display (LCD) assembly mounted on the front door. Figure 44 shows an exploded view of the components for removing and replacing the LCD assembly.
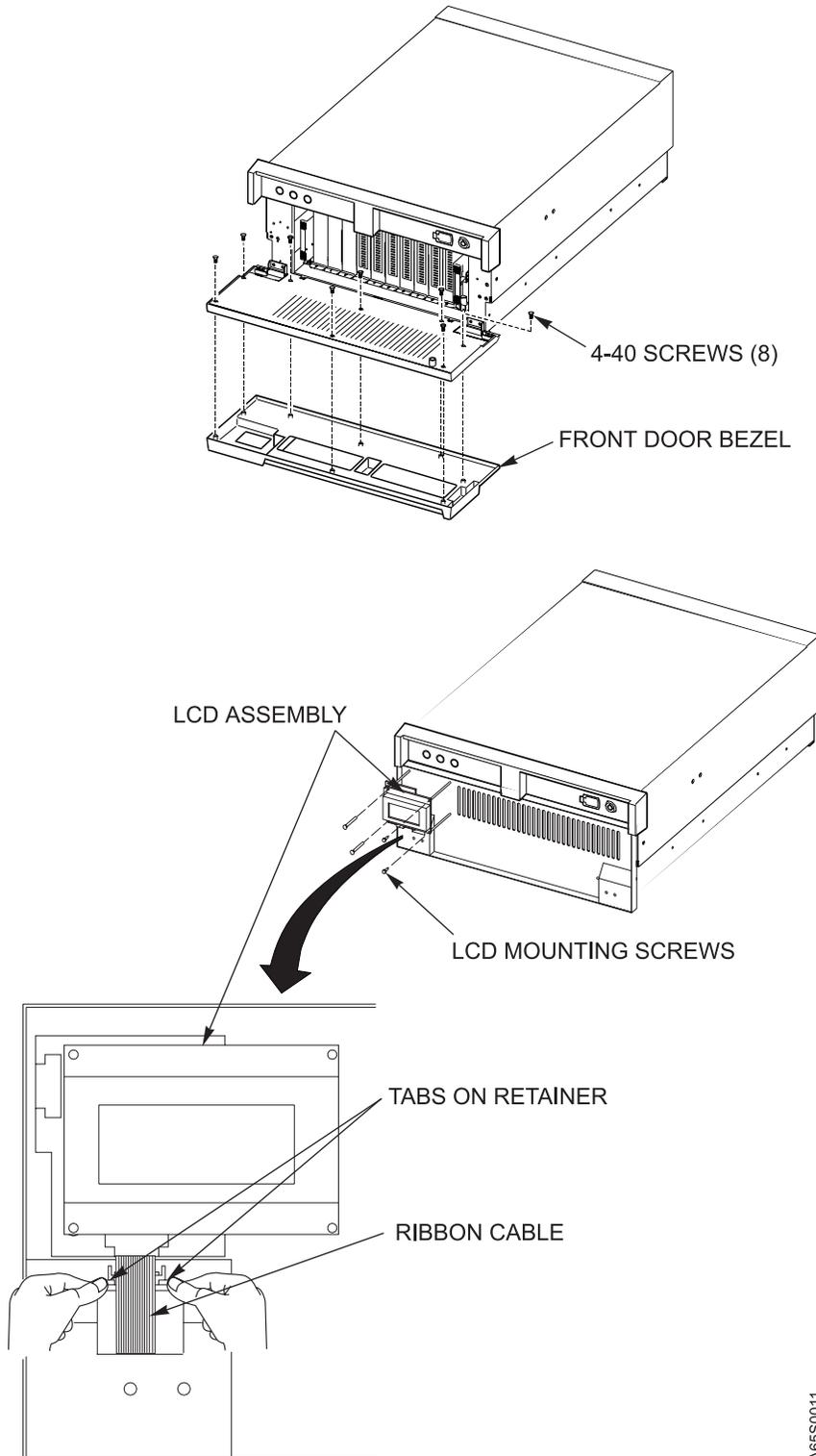

Figure 44. Removing and Replacing the Liquid Crystal Display (LCD) Assembly

1. Turn off the power to the tape library by setting the power switch to off.

2. Unlock and open the front door (see "How to Use the Front Door Key" on page 49).

3. While supporting the front door bezel, remove the eight 4-40 Phillips-head screws that hold the front door bezel to the door frame. Set the screws aside.

4. Remove the front door bezel and set it aside.

5. Close and lock the front door.

6. Locate the LCD assembly on the front door.

Attention: In the following step, note the orientation of the retainer for the ribbon cable; when you replace the connector, it is important to position the retainer correctly (behind the ribbon cable, with the bevel facing toward the cable).

7. Disconnect the ribbon cable from the LCD assembly by applying thumbnail pressure and carefully prying the connector retention tabs in a downward direction.

    a. Remove the ribbon cable connector and set it aside.

    b. Pull the ribbon cable down to remove it from the LCD assembly.

8. Remove the four screws that secure the LCD assembly to the door frame.

    Note: The two screws on the left side of the assembly are longer than the screws on the right side.

9. Remove and replace the LCD assembly.

10. Reverse the preceding steps.

11. Adjust the display contrast (see "Adjusting the Display Contrast" on page 54).

Removing and Replacing the Bar Code Reader

This procedure describes how to remove and replace the bar code reader attached to the left of the magazine housing. Figure 45 shows an exploded view of the components for removing and replacing the bar code reader.
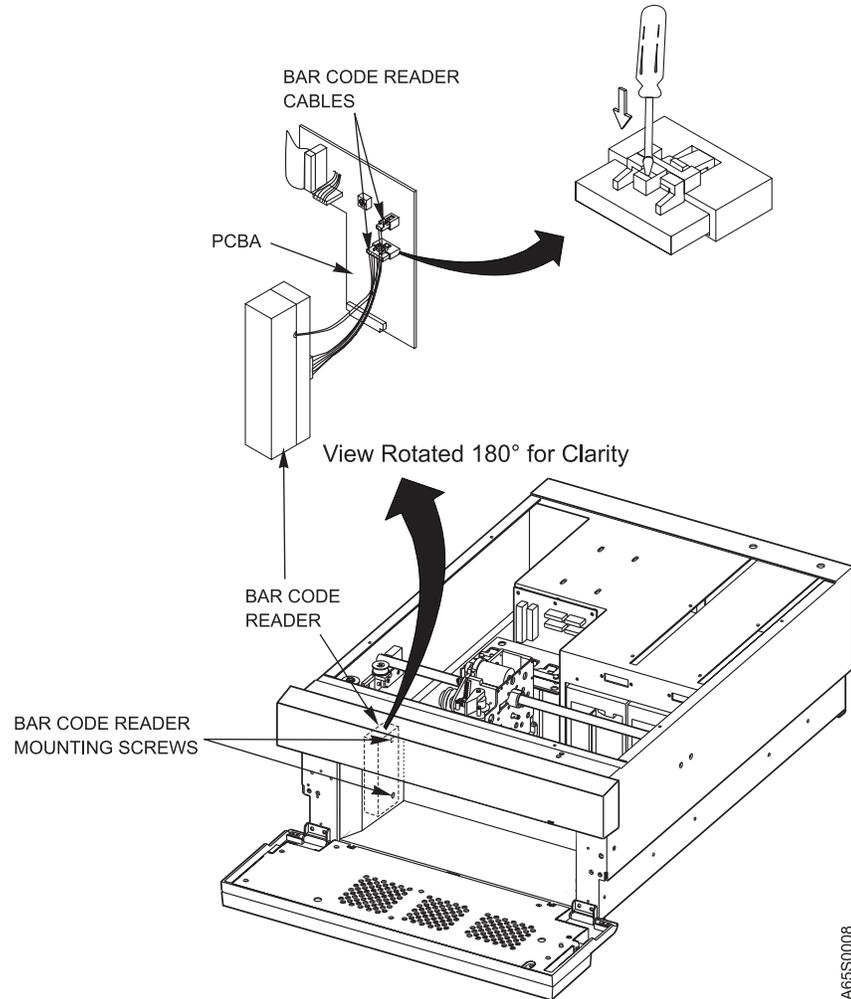

Figure 45. Removing and Replacing the Bar Code Reader

1. Turn off the power to the tape library by setting the power switch to off.

2. Open the front door and remove the magazine (see the instructions for removing a magazine in Chapter 5, "Using the Operator Panel," of the *3447 and 7337 Digital Linear Tape Library Setup and Operator Guide*). Leave the front door open.

3. Remove the top cover (see "Removing and Replacing the Desktop Tape Library Cover" on page 97).

4. Remove the two bar code reader mounting screws that secure the bar code reader to the magazine.

5. Locate the printed circuit board (PCBA) mounted behind the LCD display and on the inside of the library chassis.

6. Locate the two bar code reader cables connected to the PCBA.

7. Using a small screwdriver, depress the retention tab on one of the two bar code reader cable connectors and gently disconnect the cable from the PCBA.

8. Repeat the preceding step for the second cable connected to the PCBA.

9. Remove and replace the bar code reader (with its two cables attached).

10. Reverse the preceding steps.

Removing and Replacing a Base Tape Library

A base tape library is one that does not have tape drives, controller, or a power supply. These components are removed from the tape library being replaced and then replaced in the new tape library. Make sure that you remove the:

- Magazine

- Tape cartridges from fixed cells and robotic shuttle

- Tape drives (see "Removing and Replacing a Tape Drive" on page 92)

- Controller (see "Removing and Replacing the Controller" on page 94)

- Power supply (see "Removing and Replacing the Power Supply" on page 95)

- Power cord (see "Installing Cables and Terminators" on page 115)

- SCSI cables (see "Installing Cables and Terminators" on page 115)

- Terminator (see "Installing Cables and Terminators" on page 115)

- Inner slide rails from the chassis (rack-mounted tape libraries with slides; see Chapter 5, "Installing the Rack-Mounted Tape Library" on page 105)

- Chassis angle brackets (rack-mounted tape libraries with fixed rails)

- Tape library cover and base plate (desktop tape libraries; see "Removing and Replacing the Desktop Tape Library Cover" on page 97)

For information about the magazine and tape cartridges refer to the *3447 and 7337 Digital Linear Tape Library Setup and Operator Guide*.

Chapter 5. Installing the Rack-Mounted Tape Library

This chapter provides step-by-step instructions for installing the tape library in a rack-mounted configuration.

⚠️ **CAUTION:**
The weight of this part or unit is between 32 and 55 kilograms (70.5 and 121.2 pounds). It takes three persons to safely lift this part or unit. *(RFSTC205)*

Rack-Mounted Installation

The rack-mounted tape library is configured for mounting into:

- An EIA-310-D 19-inch instrument rack

- A PCCO instrument rack

The 7337 Tape Library Model 306 (differential, RS/6000 attached) is mounted into an EIA-310-D 19-inch instrument rack. The 3447 Tape Library Model 106 (single-ended, PC attached) is mounted into the PCCO instrument rack.

Tape libraries for mounting into instrument racks do not have covers, and slide rails are attached to the chassis. The installation consists of:

1. Mounting slide rail assemblies onto the instrument rack

2. Sliding the rails on the tape library into rails in the slide assemblies

Figure 46 on page 106 shows the major components for installing a 7337 Tape Library Model 306 into an EIA instrument rack

SLIDE RAIL

SCREW HOLE
OPENINGS

VIEW A

INNER BALL
BEARING SLIDE
(MOVEABLE ALONG INSIDE

SLIDE RAIL
(EXTENDED)

NOTE:
THIS SECTION OF THE
SLIDE RAIL IS ALREADY
MOUNTED TO THE
LIBRARY CHASSIS.

VIEW A

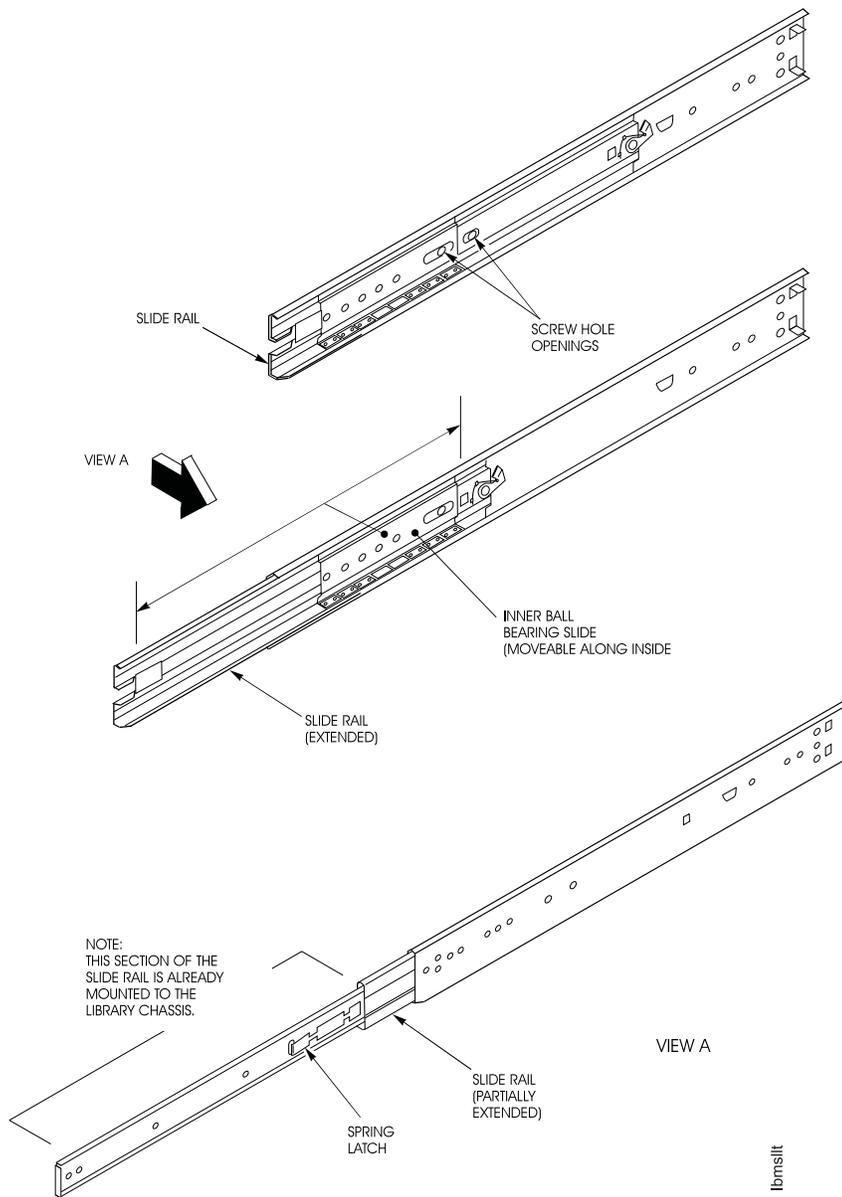SLIDE RAIL
(PARTIALLY
EXTENDED)

SPRING
LATCH

Ibmsllt

*Figure 46. Rack-Mounting Components for the 7337 Tape Library Model 306. The front
and rear brackets must be mounted to the inside of the perforated strip on the rack
enclosure.*

Except for the instrument rack, the components for the 3447 Tape Library Model 106 are similar to the 7337 Tape Library Model 306. Figure 47 provides a detailed view of the slide assembly, showing the features with which the installer needs to be familiar. Note the spring latch shown in view A. The spring latch locks the rails on the chassis to the slide rail assembly.

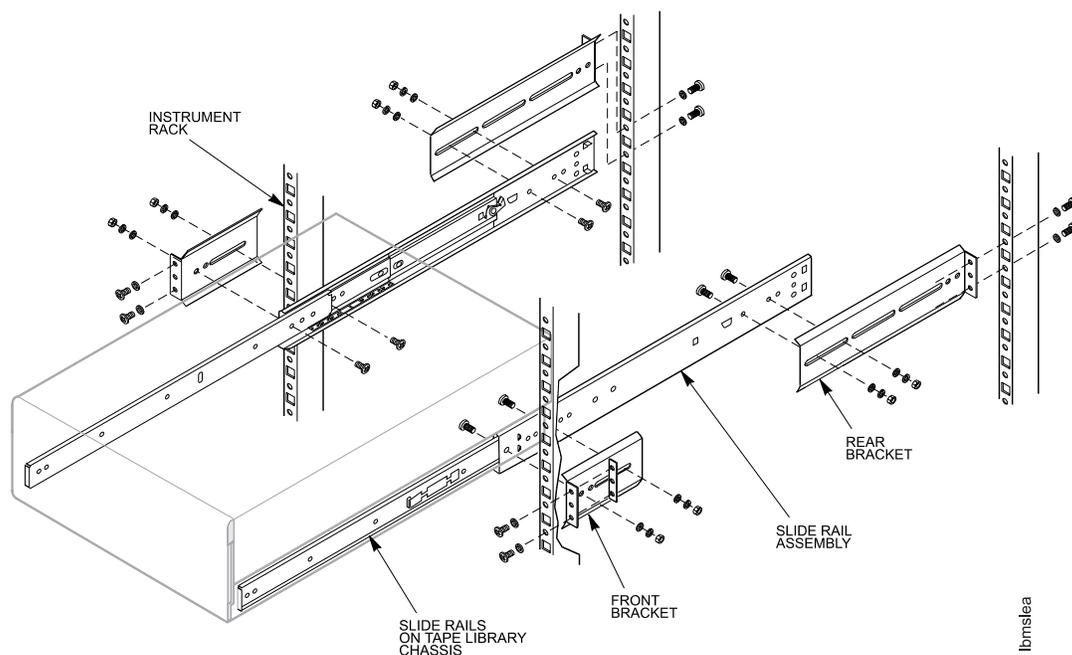**Note:** The slides shown in Figure 47 come with the front and rear mounting brackets attached.

Figure 47. Slide Assembly

For proper tape library operation and to meet regulatory requirements, make sure the following conditions are met.

- The maximum ambient operating temperature, as measured at the front of the tape library, is not to exceed 95F (35C).

- The airflow from the cooling fans must be unrestricted.

- Make sure that mounting the tape library into the instrument rack will not tip the instrument rack over, even when the tape library is fully extended from the rack.

- Make sure that the tape library is connected to the correct power circuit.

- Make sure that the tape library is properly grounded through the power cord while in the instrument rack.

The following sections provide the detailed steps for performing a rack-mounted installation.

Parts for the Rack-Mounted Installation

A rack-mounting kit is included with the tape library that is configured for rack-mounted installation. Figure 48 lists the contents of the rack-mounting kit for the 7337 Tape Library.

Figure 48. Parts List for the Rack-Mounting Kit Shipped with the 7337 Tape Library	
Part	**Quantity**
Slide assembly (includes hardware)	2
Front bracket (short)*	2
Rear bracket (long)*	2
Bar nut	4
10-32 screw	10
*Front and rear brackets come pre-attached to the slide assemblies.	

Figure 49 lists the contents of the rack-mounting kit for the 3447 Tape Library.

Figure 49. Parts List for the Rack-Mounting Kit Shipped with the 3447 Tape Library	
Part	**Quantity**
Slide assembly (includes hardware)	2
Front bracket (short)*	2
Rear bracket (long)*	2
M6 caged nut	10
M6 button head screw	10
*Front and rear brackets come pre-attached to the slide assemblies.	

Positioning the Tape Library in the Rack

The tape library can be mounted immediately above or below other equipment in the instrument rack, as long as adequate clearance is maintained for opening the front door and accessing the back of the tape library. Figure 50 on page 109 shows the vertical dimensions for the tape library and the horizontal dimensions for the spacing between the front brackets (the figure depicts an EIA rack; however, the dimensions are the same for a PCCO rack).
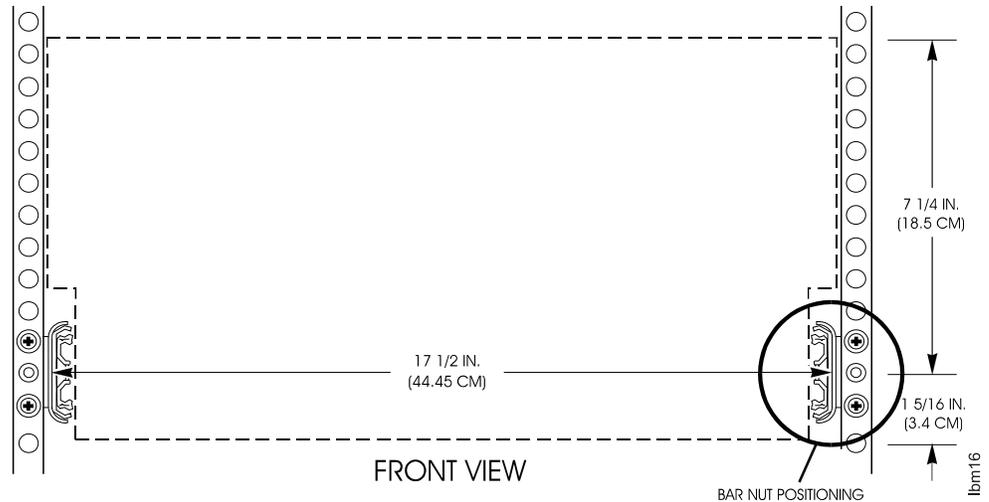
Figure 50. Dimensions for an Instrument Rack. The figure depicts an EIA rack; however, the dimensions are the same for a PCCO rack.

For the 7337 Tape Library Model 306, use one of the bar nuts included in the installation kit to determine the position of the tape library in the rack. The bar nut has three holes drilled and tapped to accept 10-32 screws. The hole pattern in the bar nuts corresponds to the hole pattern in an instrument rack. Figure 51 on page 110 shows the bar nut dimensions on the frame of the instrument rack. Note that the end holes in the bar nut are not equally spaced from the center hole. The bar nut can be installed in the position that best matches the holes in the frame.

Match the holes in one bar nut to the holes in the instrument rack. Measure from the center of the middle hole to determine where the top and bottom of the tape library will be in the rack. From the center of the middle hole to the top of the tape library is approximately 7-1/4 in. (18.5 cm); to the bottom is approximately 1-5/16 in. (3.4 cm).

The PCCO rack, in which the 3447 Tape Library Model 106 is mounted, uses caged nuts that are inserted into square holes in the rack vertical rails. Positioning the 3447 Tape Library Model 106 in the PCCO rack is similar to positioning the 7337 Tape Library Model 306; from the center of the middle hole to the top of the tape library is approximately 7-1/4 in. (18.5 cm); to the bottom is approximately 1-5/16 in. (3.4 cm).
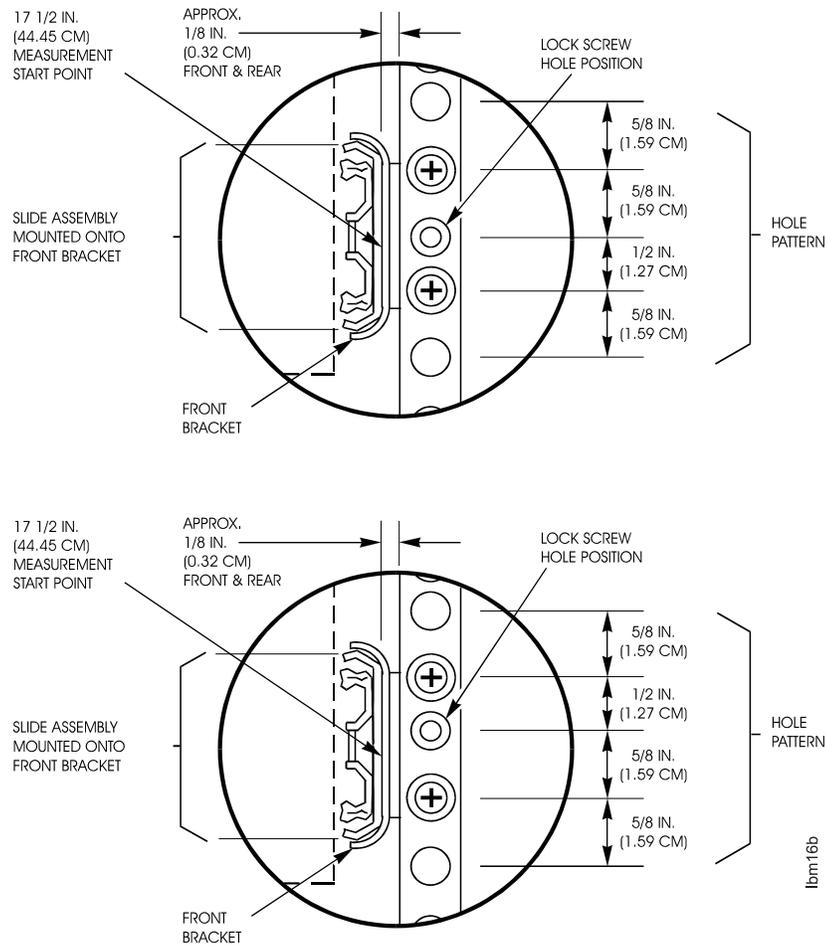
Figure 51. Bar Nut Positioning.   The figure depicts the 7337 Tape Library Model 306, but the positioning is similar for the 3447 Tape Library Model 106.

Installation Procedure for a 7337 Tape Library Model 306

Use the following procedure to install a 7337 Tape Library Model 306 in an EIA instrument rack. Before starting the installation, review the information in Figure 52 on page 111, which shows an exploded view of the slide assembly and front mounting bracket relative to the EIA instrument rack.
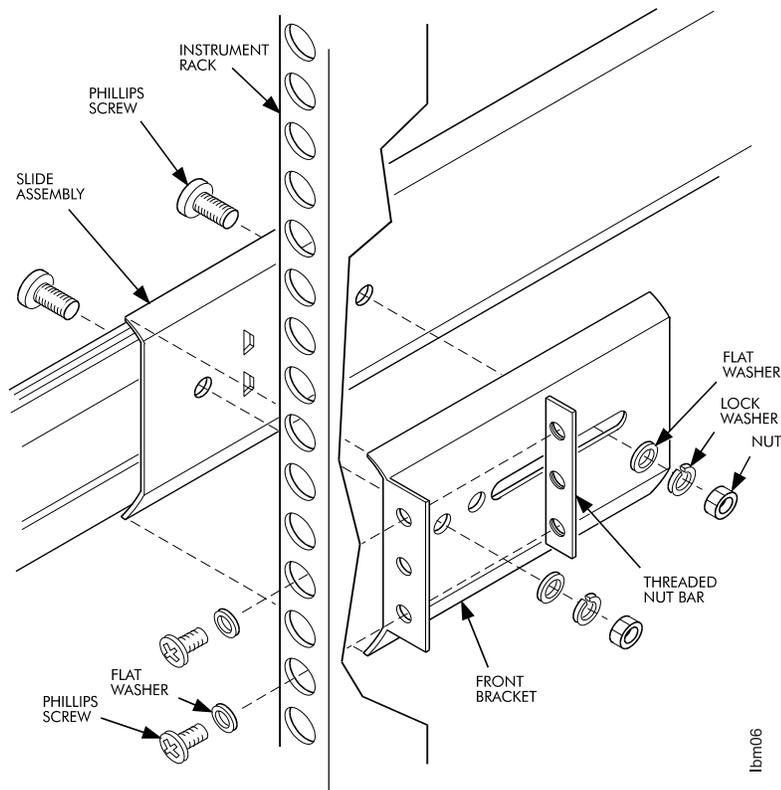
Figure 52. Exploded View of EIA Rack-Mounting Components

⚠

CAUTION:
The weight of this part or unit is between 32 and 55 kilograms (70.5 and 121.2 pounds). It takes three persons to safely lift this part or unit. *(RFSTC205)*

Attaching the Right Slide Assembly

1. Place a slide assembly inside the instrument rack on the right side (when viewed from the front). Adjust the rear (long) bracket so the flanges on the front and rear brackets press against the inside of the instrument rack.

2. Attach the front bracket to the instrument rack by inserting two 10-32 screws through the front of the instrument rack, through the front bracket, and into a threaded bar nut (see Figure 52). Insert screws into only the top and bottom holes of the bracket and tighten them only finger tight (to allow for adjustment).

3. Attach the rear bracket to the instrument rack by inserting three 10-32 screws through the rear of the instrument rack, through the rear bracket, and into a threaded bar nut. (The assembly is similar to that shown in Figure 52.) Tighten the screws only finger tight to allow for adjustment.

4. Adjust the front and rear mounting brackets so they are approximately 1/8-inch (0.32 cm) from the edge of the instrument rack (see Figure 51 on page 110). Tighten the screws firmly.

5. Tighten the screws that attach the slide assembly to the rear mounting bracket.

Attaching the Left Slide Assembly

6. Repeat steps 1, 2, and 3 on page 111 to initially position and attach the left slide assembly to the instrument rack.

7. Measure the distance between the slide assemblies at both the front and rear brackets. The distance must be 17-1/2 in. (44.45 cm) (see Figure 50 on page 109). Adjust as necessary. Do not completely tighten the screws at this time.

Mounting the Tape Library

8. Pull the left and right slide assembly rails out until the rails latch in the fully extended position. Ensure that the inner ball bearing slide is at the front of each slide (see Figure 53).

   Attention: To prevent the rack from rolling, make sure that its castors are blocked or locked before inserting the tape library.

9. Lift the tape library and insert the rails mounted on the tape library chassis into the extended slide assembly rails. Make sure that the tape library is straight relative to the slide assembly and that the tape library rails are in the guides at the front of the slide assembly rails (see Figure 53).

   It may be necessary to first dip the front of the tape library then lift it up to properly join the rails on the tape library with the slide assembly rails.
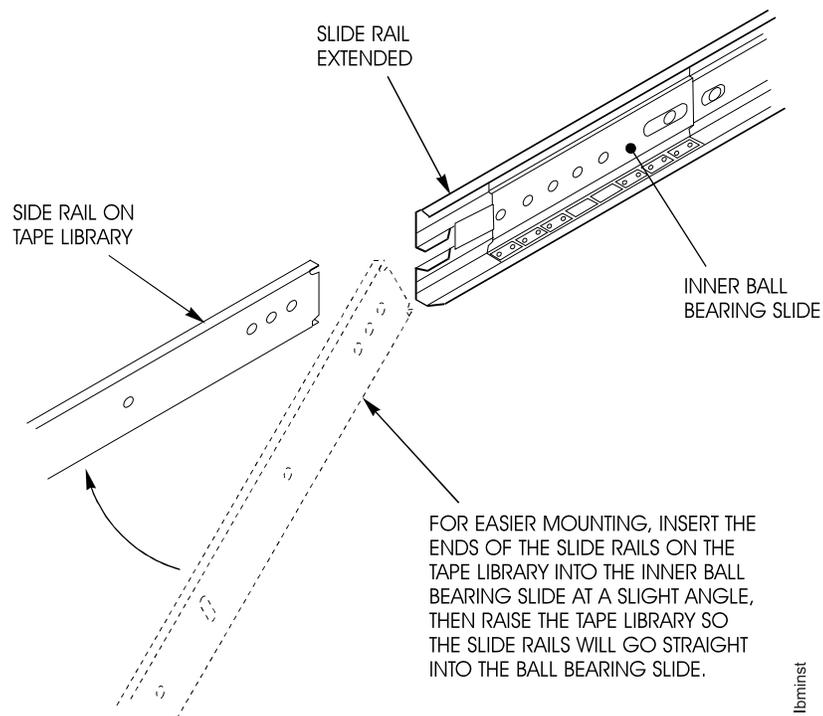

SLIDE RAIL
EXTENDED

SIDE RAIL ON
TAPE LIBRARY

INNER BALL
BEARING SLIDE

FOR EASIER MOUNTING, INSERT THE
ENDS OF THE SLIDE RAILS ON THE
TAPE LIBRARY INTO THE INNER BALL
BEARING SLIDE AT A SLIGHT ANGLE,
THEN RAISE THE TAPE LIBRARY SO
THE SLIDE RAILS WILL GO STRAIGHT
INTO THE BALL BEARING SLIDE.

lbminst

Figure 53. Mounting the Tape Library onto the Slide Assembly

10. Slide the tape library into the instrument rack. Push the spring latch on the side of each rail to slide the tape library completely into the instrument rack (see Figure 53).

11. Move the tape library in and out a few times to ensure that the slide rails are properly aligned and the tape library rolls smoothly on the slide rails.

12. Tighten the 10-32 screws that secure the left slide assembly to the instrument rack.

13. Open the tape library front door and install one 10-32 screw into each retainer tab next to the left and right front door hinge brackets.

14. Close and lock the tape library front door.

Installation Procedure for a 3447 Tape Library Model 106

Use the following procedure to install a 3447 Tape Library Model 106 in an PCCO instrument rack. Before starting the installation, review the information in Figure 54, which shows an exploded view of the slide assembly and front mounting bracket relative to the PCCO instrument rack.
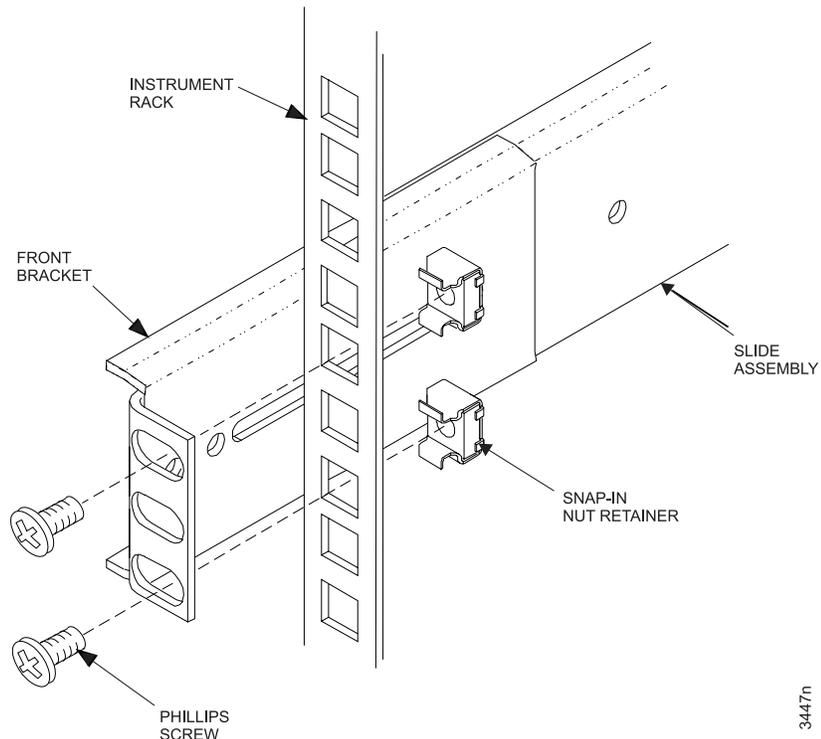

Figure 54. Exploded View of PCCO Rack-Mounting Components. The front and rear brackets must be mounted to the outside of the perforated strip on the rack enclosure.

⚠ **CAUTION:**
The weight of this part or unit is between 32 and 55 kilograms (70.5 and 121.2 pounds). It takes three persons to safely lift this part or unit. *(RFSTC205)*

Attaching the Right Slide Assembly

1. On the PCCO rack, the rear rack flange is adjustable. Move the rack flange to the front of the rack to within 1 in. (2.54 cm) of the end of the available adjustment of the slot.

2. Snap in the caged nuts in the positions shown in Figure 54. This positions the 3447 Tape Library Model 106 in the desired location in the rack.

3. Place a slide assembly inside the instrument rack on the right side (when viewed from the front). Adjust the rear (long) bracket so the flanges on the front and rear brackets press against the outside of the instrument rack.

   It might be necessary to adjust the rear bracket longer by repositioning the screws and nuts into different holes in the slides. This allows the length of the slide and bracket to be longer and fit on the outside of the rack mounting flanges. After the slides have been adjusted to the proper length, tighten the screws.

4. Attach the front bracket to the instrument rack by inserting two M6 screws through the front of the instrument rack, through the front bracket, and into the caged nuts (see Figure 54 on page 113). Insert screws into only the top and bottom holes of the bracket and tighten them only finger tight (to allow for adjustment).

5. Attach the rear bracket to the instrument rack by inserting two M6 screws through the rear of the instrument rack, through the rear bracket, and into the caged nuts. (The assembly is similar to that shown in Figure 54 on page 113.)

   Tighten the screws only finger tight to allow for adjustment.

6. Adjust the front and rear mounting brackets so the maximum width will be between the right and left hand rail assemblies. Tighten screws firmly

7. Tighten the screws that attach the slide assembly to the rear mounting bracket.

Attaching the Left Slide Assembly

8. Repeat steps 1, 2, and 3 to initially position and attach the left slide assembly to the instrument rack.

9. Measure the distance between the slide assemblies at both the front and rear brackets. The distance must be 17-1/2 in. (44.45 cm) (see Figure 50 on page 109). Adjust as necessary.

   Do not completely tighten the screws at this time.

Mounting the Tape Library

10. Pull the left and right slide assembly rails out until the rails lock in the fully extended position. Ensure that the inner ball bearing slide is at the front of each slide (see Figure 53 on page 112).

    Attention: To prevent the rack from rolling, make sure that its castors are blocked or locked before inserting the tape library.

11. Lift the tape library and insert the rails mounted on the tape library chassis into the extended slide assembly rails. Make sure that the tape library is straight relative to the slide assembly and that the tape library rails are in the guides at the front of the slide assembly rails (see Figure 53 on page 112).

    It might be necessary to first dip the front of the tape library then lift it up to properly join the rails on the tape library with the slide assembly rails.

12. Slide the tape library into the instrument rack. Push the spring latch on the side of each rail to slide the tape library completely into the instrument rack (see Figure 53 on page 112).

13. Move the tape library in and out a few times to ensure that the slide rails are properly aligned and the tape library rolls smoothly on the slide rails.

14. Tighten the M6 screws that secure the left slide assembly to the instrument rack.

15. Open the tape library front door and install one M6 screw into each retainer tab next to the left and right front door hinge brackets.

16. Close and lock the tape library front door.

Installing Cables and Terminators

Use the following information to correctly connect the SCSI cables, terminators, and power cord.

DANGER

> **To prevent a possible electrical shock from touching two surfaces with different electrical grounds, use one hand, when possible, to connect or disconnect signal cables.** *(RSFTD004)*

DANGER

> **To prevent a possible electrical shock when adding or removing any devices to or from the system, ensure that the power cords for those devices are unplugged before the signal cables are connected or disconnected. If possible disconnect all power cords from the existing system before you add or remove a device.** *(RSFTD203)*

SCSI Cables

The SCSI cable configuration depends on the requirements and needs of the system to which the tape library is connected. The tape library can be connected to a single host computer that:

- Provides motion commands to the tape library robotic shuttle
- Reads data from a tape cartridge in a tape drive
- Writes data to a tape cartridge in a tape drive

Figure 55 on page 116 shows a typical cable connection to the tape library. There are no in or out SCSI connectors on the tape drives or library controller. When connecting the cables from the controller to a drive and from one drive to another drive, use the farthest possible connector to relieve cable stress. Make the widest possible cable loop (as shown in Figure 55 on page 116).
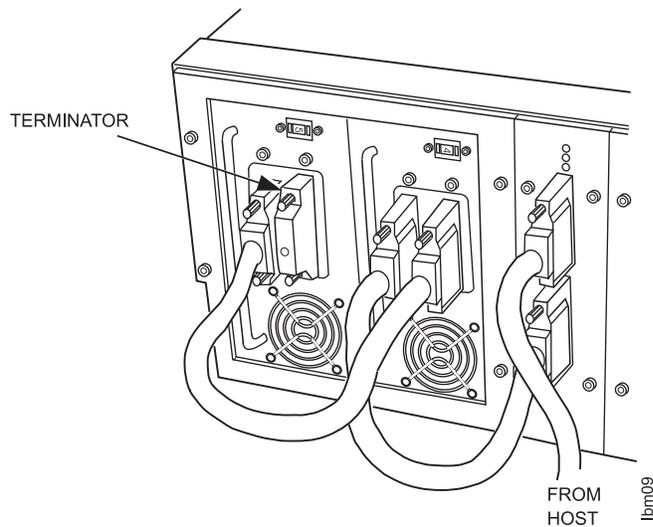
Figure 55. SCSI Cable Attachment on the Tape Library

The SCSI cables that connect the tape library controller to the tape drives are included. In some installations, the installer must supply the SCSI cable that connects the tape library to the host computer. To ensure proper tape library operation, the SCSI connectors supplied by the installer must meet the following specifications.

- 68 pins
- Fast and wide
- Micro "D" screw mount (2-56 screw)
- Gold-plated connector pins

Terminators

The tape library is available as either a single-ended or differential SCSI device. Single-ended and differential SCSI devices require different terminators. The tape drives in the tape library are clearly marked as to the type of device. Make sure that the correct terminator is installed for the type of SCSI device:

- A single-ended terminator has the word ACTIVE on the terminator
- A differential terminator has the word DIFFERENTIAL on the terminator

Figure 56 on page 117 shows what the single-ended and differential SCSI labels attached to the tape library look like.
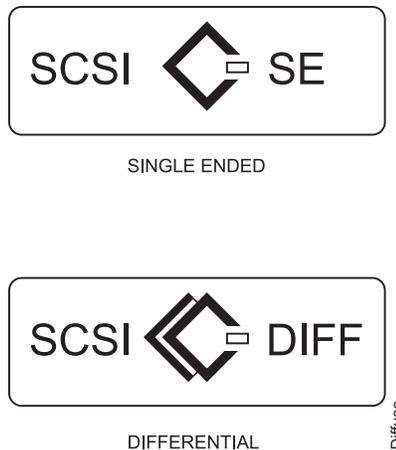
SINGLE ENDED

DIFFERENTIAL

Figure 56. SCSI Labels

Power Cables

The tape library power connector is located on the back panel at the rear of the tape library (see Figure 3 on page 4).

1. Make sure that the tape library is turned off (press the 0 on the ON/OFF switch).

2. Connect the power cable to the power supply in the tape library.

3. Connect the other end of the power cable to a power source.

The tape library can now be powered on and operated. The tape library comes preset with SCSI addresses and operating configurations that meet most users' requirements. If, however, you need to change any settings, refer to "Setup Procedure" on page 82.

Installing the Device Driver (for RS/6000 Users Only)

To ensure that library commands are issued from the host system to the tape library, RS/6000 users must install the Atape device driver. In order to use the Atape device drive to download tape library update firmware over the SCSI bus, Atape must be at level 3.2.0.6, or higher.

Note: Some RS/6000 systems come preloaded with the Atape device driver microcode.

To install the device driver, do the following.

Perform the Default AIX Installation

1. Insert the Tape Device Driver/AIX Enhanced diskette into the diskette drive on the workstation.

   Note: You must have root authority to perform the commands in this section.

2. Using the installp utility, enter the following command from the command line:

   ```
   installp -ac -d /dev/rfd0 Atape.driver
   ```

Note: To reinstall the same version of the Atape driver, use the `installp` command with the `-F` flag to force the installation. The command automatically deconfigures any devices from the device driver and reconfigures them after the new driver is installed.

3. Enter the following command to determine whether the Atape device driver has been committed (accepted):

`lslpp -l Atape.driver`

Note: This command also lists the currently installed version of the Atape driver.

- If the device driver was committed, the host system shows a state of COMMITTED.

- If the device driver was not committed, perform step 1 on page 117 again. If the procedure continues to fail, contact your IBM service representative.

Configure the Tape Library

Configure the tape library by using one of the following options:

- Enter the following command with no parameters:

`cfgmgr`

The command automatically configures all devices known to the Atape driver, including any new tape drive devices.

- Shut down and reset (reboot) the system to automatically configure and make available any new tape or medium changer devices know to the Atape driver, including tape drive devices.

The Atape device driver also includes a test utility (`tapeutil`), which allows you to test the library by issuing commands that move cartridges between cells and drives.

For more information about the Atape device driver, see the *IBM SCSI Tape Drive Medium Changer, and Library Device Drivers Installation and User's Guide.*

Chapter 6. Parts Diagram and Parts List

This chapter provides a parts diagram and parts list required to service the Digital Linear Tape Library.

How To Use This Parts List

AR (As Required) in the *Units* column indicates that the quantity is not the same for all machines.

NP (Non-Procurable) in the *Part Number* column indicates that the part is non-procurable and that the individual parts or the next higher assembly should be ordered.

NR (Not Recommended) in the *Units* column indicates that the part is procurable but not recommended for field replacement, and that the next higher assembly should be ordered.

00 (Not Shown) in the *Asm- Index* column indicates that the part is either not shown or not referenced in the illustration.

R (Restricted) in the *Units* column indicates that the part has a restricted availability.

Indenture The indenture is marked by a series of dots located before the parts description. The indenture indicates the relationship of a part to the next higher assembly. For example:

Indenture	**Relationship of Parts**
(No dot)	MAIN ASSEMBLY
(One dot)	• Detail parts of a main assembly
(One dot)	• Sub assembly of the main assembly
(Two dots)	• • Detail part of a one-dot sub assembly
(Two dots)	• • Sub assembly of a one-dot sub assembly
(Three dots)	• • • Detail part of a two-dot sub assembly

Example of Parts Listing

Asm- Index	Part Number	Units	Description
3-	2512667	1	Cover Asm, Rear, Red
	2513714	1	Cover Asm, Rear, White
			For Next Higher Asm, see Assembly 1-2.
-1	5373637	1	•Seal, Top
-2	5356429	2	•Clip, Retaining
-3	1847630	1	•Finger Stock Asm
-4	1847602	NR	••Channel, Finger Stock
-5	5373639	AR	•Seal, Bottom
-6	5356429	2	•Clip, Retaining
-7	NP	1	•Cover, Rear, Without Paint
-5	0416629	R	•Screw, Panel

Assembly 1: Parts Diagram

1

2A
2B

3A
3B
3C

4

5A

5B

6

7A
7B

8

8

9A
9B

10

11

12
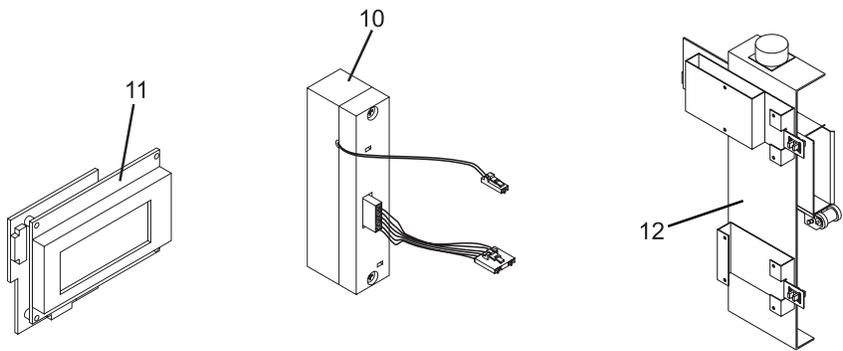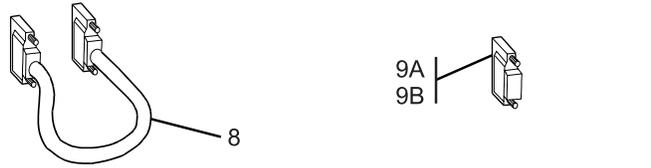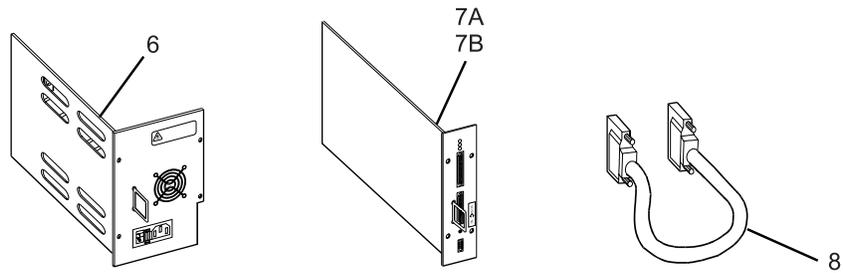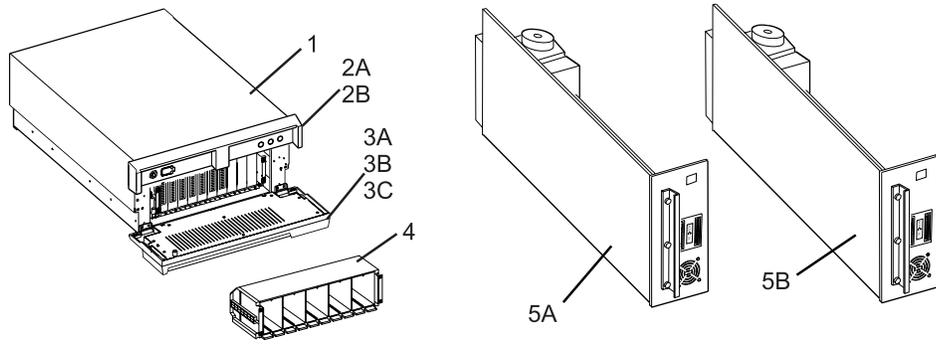
Bhipc

Assembly 1: (continued)

Asm–Index	Part Number	Units	Description
1–1	59H3571	1	Digital linear tape library shell (with black bezels)
–2A	59H4391	1	Upper bezel assembly (black)
–2B	59H4410	1	Upper bezel assembly (white)
–3A	59H4413	1	Front door bezel (white)
–3B	59H4412	1	Front door bezel (black, for rack mount models 106 and 306)
–3C	59H4411	1	Front door bezel (black, for desktop models 105 and 305)
–4	59H3558	1	Media magazine - spare (holds 10 cartridges)
–5A	59H4169	1	Single-ended digital linear tape drive for PC attach
–5B	59H3570	1	Differential digital linear tape drive for RS/6000 attach
–6	59H3560	1	Power module
–7A	59H3561	1	Library controller card - single ended
–7B	59H3582	1	Library controller card - differential
–8	59H3923	1	SCSI cable
–9A	61G8324	1	Differential terminator
–9B	92F2566	1	Single-ended (active) terminator
–10	59H4415	1	Bar code reader
–11	59H4414	1	LCD assembly
–00	59H4390	1	Rack mount hardware kit

Appendix A. Power Cables

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

Power cables used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA). The power cables consist of:

- Electrical cables, type SVT or SJT.

- Attachment plugs complying with National Electrical Manufacturers Association (NEMA) 5-15P, that is:

  "For 115 V operation use a UL Listed Cable Set consisting of a minimum 18 AWG, Type SVT or SJT three conductor cable a maximum of 15 feet in length and a parallel blade, grounding type attachment plug rated at 15 A, 125 V."

  "For 230 V operation in the United States use a UL Listed Cable Set consisting of a minimum 18 AWG, Type SVT or SJT three conductor cable a maximum of 15 feet in length, and a tandem blade, grounding type attachment plug rated at 15 A, 250 V."

- Appliance couplers complying with International Electrotechnical Commission (IEC) Standard 320, Sheet C13.

Power cables used in other countries consist of:

- Electrical cables, type HD21.

- Attachment plugs approved by the appropriate testing organization for the specific countries where they are used.

  "For units set at 230 V (outside of U. S.): Use a Cable Set consisting of a minimum 18 AWG cable and grounding type attachment plug rated 15 A, 250 V. The Cable Set should have the appropriate safety approvals for the country in which the equipment is to be installed and marked 'HAR'."

Figure 57 lists the power cable part number, the country where the power cable can be used, and an index number to be matched with the receptacles shown in Figure 58 on page 125. If your power cable does not match this information, contact your local dealer.

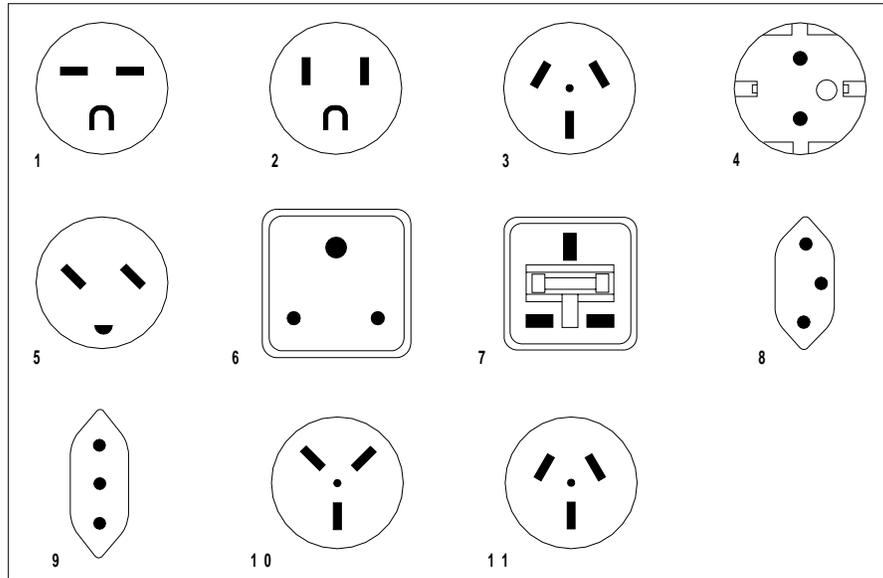| Figure 57. Power Cable Information		
Part Number	**Country**	**Index**
1838574 Japan	Bahamas, Barbados, Bolivia, Brazil, Canada, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Netherlands Antilles, Panama, Peru, Philippines, Taiwan, Thailand, Tobago, Trinidad, U.S.A. (except Chicago), Venezuela	1
6952300 US/Canada	Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea (South), Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Puerto Rico, Saudi Arabia, Suriname, Taiwan, Trinidad, U.S.A. (except Chicago), Venezuela	2
6952301 6 ft Chicago	Chicago, U.S.A.	2
13F9940 Australia	Argentina, Australia, New Zealand, Uruguay	3
13F9979 France	Abu Dhabi, Austria, Belgium, Bulgaria, Botswana, Egypt, Finland, France, Germany, Greece, Iceland, Indonesia, Korea (South), Lebanon, Luxembourg, Macau, Netherlands, Norway, Portugal, Saudi Arabia, Spain, Sudan, Sweden, Turkey, Yugoslavia	4
13F9997 Denmark	Denmark	5
14F0015 South Africa	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka	6
14F0033 United Kingdom	Bahrain, Bermuda, Brunei, Channel Islands, Cyprus, Ghana, Hong Kong, India, Iraq, Ireland, Jordan, Kenya, Kuwait, Malawi, Malaysia, Nigeria, Oman, People's Republic of China, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Arab Emirates (Dubai), United Kingdom, Zambia	7
14F0051 Switzerland	Liechtenstein, Switzerland	8
14F0069 Italy	Chile, Ethiopia, Italy	9
14F0087 Israel	Israel	10
6952291 Colombia	Colombia, Paraguay	11

Figure 58. Types of Receptacles

Appendix B. Updating the Tape Library Firmware on the RS/6000

This appendix presents the steps required to update the tape library firmware using the Atape `tapeutil` tool available on RS/6000 computers. This tool downloads the firmware from a file or diskette across the SCSI bus to the tape library controller. The file must be a binary file (*.bin). The tape library must be in the on-line mode.

Note: The Atape device driver must be at level 3.2.0.6 or higher (see "Installing the Device Driver (for RS/6000 Users Only)" on page 117).

Two methods are described:

- How to uses the Service Aids menu to download the firmware.
- How to use commands to download the firmware.

Tape Drive Service Aids Menu

The following steps download library firmware through the Service Aids menu.

1. At the AIX command line, type `tapeutil` and press Enter. The tapeutil menu appears.

2. Type `4` (Tape Drive Service Aids) and press Enter. This selection also includes service aids for the tape library.

3. Select Microcode Load from the Tape Drive Service Aids menu.

4. Select the device from the Tape Drive Selection menu (for example, `smc0`).

5. Enter the source file name or device on the Prompting for Source File menu. The default source is the /dev/rfd0 diskette drive.

   To load from a file, enter the path and filename (for example, /tmp/q2_150.bin)

The microcode load (or firmware) operation starts and a pop-up window is displayed after the operation is completed.

The media changer performs a power-on reset and reinitializes with the new firmware. On the tape library operator panel, the display shows the new firmware level.

Command Prompt

Use the following commands to download the firmware.

1. Determine the AIX ID of the media changer device by typing the following and pressing Enter.

   ```
   lsdev -Cc tape
   ```

   The ID is smcx, where x equals 0 or higher, and represents the number of the of the attached library).

2. Determine the current level of the firmware by typing the following and pressing Enter.

   ```
   lscfg -vl smc0
   ```

---

3. Change to the directory where the firmware code is located, or include the directory path in the command.

4. Type the following and press Enter (codename.bin is the name of the firmware code file, for example, q2_150.bin.).

```
tapeutil -f/dev/smc0 ucode /path/codename.bin
```

While the firmware is being downloaded the following message displays:

```
DOWNLOADING MICROCODE
```

After the download is finished, the following message displays:

```
UPDATING VPD DATA
```

The media changer does a power-on reset and reinitializes with the new firmware. On the tape library operator panel, the display shows the new firmware level.

Appendix C. Accessing the System Error Log (for the RS/6000 Only)

This appendix explains how to access the system error log for RS/6000 systems. The information in this appendix is valid only for RS/6000 systems.

Error Log Analysis

The AIX Tape and Medium Changer Device Driver for the tape library provides logging to the system error log for a variety of errors. You can view the error log in various formats by using the following AIX commands:

- `smit`
- `errpt`

The sections that follow describe each command, and give examples of the different error log formats.

Running the smit Command

The `smit` command has various ways to format the error log. To use the command:

1. Type `smit` at the AIX command line.

2. Select `problem determination` from the System Management menu.

3. Select `error Log` from the Problem Determination menu.

4. Select `generate error` Report from the Error Log menu.

5. Select `filename`, then select `no` from the Single Select list.

6. From the Generate Error Report menu select the type of reports you want to view, then click on the `Do` icon.

7. To scroll through the log, press the Up or Down keys.

Running the errpt Command

The `errpt` command produces summary reports of AIX and ADSM errors, from which you can gain information to resolve the problem. The reports are based on request sense data defined in a format similar to that shown in Figure 59 on page 131. They enable you to resolve errors that occur in the tape library and in the drive.

To resolve an error, you must locate the following request sense data bytes in the report, identify the hexadecimal (hex) values of the bytes, then refer to the specified table for a description of the error. The bytes that you locate in the summary report are:

- Byte 02 (the Sense Key; to determine the meaning of the Sense Key values, see Figure 62 on page 134)
- Byte 12 (the additional sense code)
- Byte 13 (the additional sense code qualifier)

- Byte 18 (the internal status code; for drive only)

Note: Byte 00 is the Error Code (only error code 70h is supported)

To get a detailed report of errors for a specific resource name (that is, a specific device represented as xxxx below), type the following and press Enter:

`errpt -a -N xxxx`

Note: To allow the screens of the report to scroll, type `|pg` after the command. To direct the report output to a file, type `>filename` after the command. Type `q` to quit the report at any time.

The sections that follow describe how to resolve an error in the tape library and in the drive.

Resolving an Error in the Tape Library

If the DLT Tape Library receives a SCSI Request Sense command, it returns sense information in the format shown in Figure 59.

Byte	Bit 7	6	5	4	3	2	1	0
00	Error Code							
01	0	0	0	0	0	0	0	0
02	0	0	0	RSVD	Sense Key			
03	MSB							
04	Information							
05	Byte							
06	LSB							
07	Additional Sense Information							
08	MSB							
09	Command-Specific							
10	Information							
11	LSB							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15	SKSV							
16	Sense-Key Specific							
17								

A6S50006

Figure 59. Sense Information for the DLT Tape Library

To use the error report to resolve an error in the tape library (and not in the DLT7000 tape drive):

1. Perform one of the following, then go to step 2 on page 132:

   - For systems that use ADSM applications, at the AIX command line type `errpt -a -N lb0 |pg` (where `lb0` equals the device that has the error) and press Enter. A detailed report displays, similar to the one shown in Figure 60 on page 133.

- For system applications that use the Atape device driver, at the AIX command line type `errpt -a -N smc0 |pg` (where `smc0` equals the device that has the error) and press Enter.

2. Press Enter to scroll through the report.

3. Locate the SENSE DATA area of the report:

    - In the byte 02 position, identify the hex value of the sense key. In this example, the value is `05`.

    - In the byte 12 position, identify the hex value of the additional sense code (ASC). In this example, the ASC value is `3B`.

    - In the byte 13 position, identify the hex value of the additional sense code qualifier (ASCQ). In this example, the ASCQ value is `83`.

    - Using the values from the preceding steps, refer to Figure 61 on page 134 and Figure 62 on page 134 for a description of the error.

```
LABEL:     ADSM_DD_LOG2
IDENTIFIER: 5680E405

Date/Time:              Fri May 30 10:17:55
Sequence Number:   11256
Machine Id:             00FFFFFF4C00
Node Id:                speedrace
Class:                  H
Type:                   PERM
Resource Name:      lb0
Resource Class:     library
Resource Type:      ADSM-SCSI-LB
Location:               04-07-00-6,0


Description
STORAGE SUBSYSTEM FAILURE

Probable Causes
ATTACHED SCSI TARGET DEVICE
SCSI ADAPTER

Failure Causes
ATTACHED SCSI TARGET DEVICE
SCSI ADAPTER

Recommended Actions
RUN DIAGNOSTICS AGAINST THE FAILING DEVICE
CHECK PHYSICAL INSTALLATION
CHECK FOR CORRECT MICROCODE FIX
CONTACT APPROPRIATE SERVICE REPRESENTATIVE

Detail Data
COMMAND
0C06 0000 A500 0075 0001 0000 0000

STATUS CODE
0102 0000
SENSE DATA

7000 0500 0000 000A 0000 0000 3B83 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

ERROR CODE
         0

RETURN CODE
         0

REFERENCE CODE
0000 0000 0000 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 60. Sample Excerpt from the AIX Error Report (errpt) for Tape Library Errors. In the Sense Data area of the report, the sense key value is 05. The ASC value is 3B and the ASCQ value is 83.

Figure 61 provides the meaning of the sense key values for the tape library and the DLT7000 tape drive. The sense key is listed in hex form.

Figure 61. Meanings of Sense Key for Tape Library and DLT7000 Tape Drive	
Sense Key (Hex)	**Meaning**
00	No Sense
01	Recovered Error
02	Not Ready
03	Medium Error
04	Hardware Error
05	Illegal Request
06	Unit Attention
07	Data Protected
08	Blank Check
0B	Aborted Command
0D	Volume Overflow
0E	Miscompare

To get a description of the error, determine the hex values of bytes 02 (Sense Key), 12 (ASC), and 13 (ASCQ) from the summary report, then locate those values in Figure 62.

Figure 62 (Page 1 of 3). Sense Key Information for the Tape Library			
Sense Key (Hex)	**ASC (Hex)**	**ASCQ (Hex)**	**Description of Error**
02	04	01	Initialization in progress
02	04	81	Unit off-line
02	04	83	Not ready; front door open
04	08	01	SCSI hardware does not respond
04	15	81	Pick error
04	15	83	Put error
04	15	84	Mechanical problem: Stall while picking from drive
04	3B	82	Cannot close drive door
04	40	82	Flash memory checksum error
04	40	90	Normal force position overflow
04	40	A1	X-axis stuck
04	40	A2	X-axis home failure
04	40	A3	X-axis move time-out
04	40	A4	X-axis controller failure, wrap error
04	40	A7	Motor controller reset failure
04	40	A8	X-axis servo busy bit set

Sense Key (Hex)	ASC (Hex)	ASCQ (Hex)	Description of Error
			Figure 62 (Page 2 of 3). Sense Key Information for the Tape Library
04	40	B1	Rack stuck
04	40	B2	Rack home failure
04	40	B3	Rack move time-out
04	40	B4	Rack controller failure, wrap error
04	40	B6	Rack home with cartridge failure
04	40	B8	Rack servo busy bit set
04	40	C1	Z-axis stuck
04	40	C2	Normal force home failure
04	40	C3	Z-axis move time-out
04	40	C4	Z-axis controller failure wrap error
04	40	C8	Z-axis servo busy bit set
04	40	CA	Read cartridge labels time-out
04	40	E3	Motion control drivers hot
04	44	00	Internal hardware error
04	80	17	Bar code retries exceeded limits
04	84	00	Internal software error
05	1A	00	Parameter list length error
05	20	00	Invalid command operation code
05	21	01	Invalid element address
05	24	00	Invalid field in CDB
05	25	00	Unsupported logical unit
05	26	00	Invalid field in parameter list
05	26	02	Parameter value invalid
05	3B	0D	Medium destination element full
05	3B	0E	Medium source element empty
05	3B	80	User intervention required
05	3B	83	Drive indicates handle is not ready to operate
05	3B	84	Destination drive door is closed
05	3B	85	Destination cannot be cartridge handler
05	3B	86	Source cannot be cartridge handler
05	3B	87	Data cartridge stuck in drive
05	3D	00	Invalid bits in identify message
05	53	02	Medium removal prevented
05	80	03	No source magazine
05	80	04	No destination magazine
05	80	05	No source drive

Sense Key (Hex)	ASC (Hex)	ASCQ (Hex)	Description of Error
05	80	06	No destination drive
06	29	00	Power-on reset or bus device reset occurred
06	2A	01	Mode parameters changed
06	3F	01	Microcode has been changed
0B	3F	80	Flash firmware upgrade error: Unable to erase
0B	3F	81	Write firmware, incomplete code data
0B	3F	84	Flash firmware upgrade error: Unable to program
0B	3F	86	Firmware upgrade error: Flash checksum error

Figure 62 (Page 3 of 3). Sense Key Information for the Tape Library

Resolving an Error in the DTL7000 Tape Drive

If the DLT7000 tape drive receives a SCSI Request Sense command, it returns sense information in the format shown in Figure 63.

Byte	7	6	5	4	3	2	1	0
				Bit				
00	Valid	Error Code						
01	Segment Number							
02	File Mark	EOM	ILI	RSVD	Sense Key			
03	MSB							
04	Information							
05	Byte							
06								LSB
07	Additional Sense Information							
08	MSB							
09	Command-Specific							
10	Information							
11								LSB
12	Additional Sense Code (ASC)							
13	Additional Sense Qualifier (ASCQ)							
14	Subassembly Code							
15	SKSV	C/D	RSVD		BPV	Bit Counter		
16	MSB			Field Pointer				
17								LSB
18	Internal Status Code (VU)							
19	Tape Motion Hours							
20								
21	Power-On Hours							
22								
23								
24								
25	Tape Remaining							
26								
27								
28								
29	Reserved							

A65S0007

Figure 63. DLT7000 Tape Drive Sense Information

To use the error report to resolve an error in the DLT7000 tape drive (and not in the tape library):

1. Perform one of the following, then go to step 2 on page 138:

   - For systems that use ADSM applications, at the AIX command line type `errpt -a -N mt0 |pg` (where `mt0` equals the device that has the error) and press Enter. A detailed report displays, similar to the one shown in Figure 64 on page 139.

- For system applications that use the native AIX device driver, at the AIX command line type `errpt -a -N rmt0 |pg` (where `rmt0` equals the device that has the error) and press Enter.

2. Press Enter to scroll through the report.

3. Locate the SENSE DATA area of the report:

   - In the byte 02 position, identify the hex value of the sense key. In this example, the value is `02`.

   - In the byte 12 position, identify the hex value of the additional sense code (ASC). In this example, the ASC value is `04`.

   - In the byte 13 position, identify the hex value of the additional sense code qualifier (ASCQ). In this example, the ASCQ value is `02`.

   - In the byte 18 position, identify the hex value of the internal status code (ISC). In this example, the ISC value is `82`.

   - Using the values from the preceding steps, refer to Figure 61 on page 134, Figure 65 on page 140, and either Figure 66 on page 143 or Figure 67 on page 145 for a description of the error.

```
LABEL:   ADSM_DD_LOG2
IDENTIFIER:  5680E405

Date/Time:           Fri May 30 10:17:55
Sequence Number:   11215
Machine Id:          00FFFFFF4C00
Node Id:             speedrace
Class:               H
Type:                PERM
Resource Name:      mt0
Resource Class:      tape
Resource Type:       ADSM-SCSI-MT
Location:            04-05-00-4,0


Description
STORAGE SUBSYSTEM FAILURE

Probable Causes
ATTACHED SCSI TARGET DEVICE
SCSI ADAPTER

Failure Causes
ATTACHED SCSI TARGET DEVICE
SCSI ADAPTER

Recommended Actions
RUN DIAGNOSTICS AGAINST THE FAILING DEVICE
CHECK PHYSICAL INSTALLATION
CHECK FOR CORRECT MICROCODE FIX
CONTACT APPROPRIATE SERVICE REPRESENTATIVE

Detail Data
COMMAND
0604 0000 0100 0000 0000 0000 0000 0000

STATUS CODE
0102 0000
SENSE DATA

7000 **02**00 0000 0016 0000 0000 **0402** 0000 0000 **82**00 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

ERROR CODE
            0

RETURN CODE
            0

REFERENCE CODE
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

TADRERS

Figure 64. Sample Excerpt from the AIX Error Report (errpt) for DLT7000 Tape Drive Errors. In the Sense Data area of the report, the sense key value is 02. The ASC value is 04 and the ASCQ value is 02. The ISC value is 82.

To get a description of the error, determine the hex values of bytes 02 (Sense Key), 12 (ASC), 13 (ASCQ), and 18 (ISC) from the summary report, then locate those values in Figure 65 and either Figure 66 on page 143 or Figure 67 on page 145.

Figure 65 (Page 1 of 4). Sense Key Information for the DLT7000 Tape Drive			
Sense Key (Hex)	**ASC (Hex)**	**ASCQ (Hex)**	**Description of Error (see Note)**
00	00	01	Unexpected FM encountered
00	00	02	EOM encountered Unit off-line
00	00	03	BOM encountered
01	0A	00	Error log overflow
01	37	00	Rounded parameter
01	3B	08	Repositioning error
01	44	C1	Internal target failure EEROM copy 1 area bad
01	44	C2	Internal target failure EEROM copy 2 area bad
01	44	C3	Internal target failure EEROM copy 3 area bad
01	47	00	SCSI parity error
01	48	00	IDE message received
01	51	00	Erase failure
01	53	01	Unload tape failure
01	5B	02	Log counter at maximum
01	80	02	Cleaning requested
02	04	00	Unit not ready, cause nonreportable
02	04	01	Unit not ready, calibration in progress
02	04	02	Unit not ready, load command needed
02	04	03	Unit not ready, manual intervention needed
02	3A	00	Medium not present
02	3A	80	Medium not present, cartridge missing
02	5A	01	Operator media removal request
03	04	02	Unit not ready, load command needed
03	0C	00	Write error
03	11	00	Unrecovered read error
03	11	08	Unrecovered read error, incomplete block read
03	14	00	Recorded entity not found

Sense Key (Hex)	ASC (Hex)	ASCQ (Hex)	Description of Error (see Note)
03	15	02	Position error detected by read of medium
03	30	00	Can't read medium
03	3B	00	Sequential positioning error
03	51	00	Erase failure
03	80	00	Calibration error
03	80	01	Cleaning required
03	81	00	Directory read error
04	08	00	LUN communication failure
04	08	01	LUN communication time out failure
04	15	01	Random mechanical positioning error
04	21	01	Invalid element address
04	3B	08	Repositioning error
04	3B	0D	Media destination element full
04	3B	0E	Media source element empty
04	40	80	Diagnostic/POST failure, ROM EDC failure
04	40	81	Diagnostic/POST failure, RAM failure
04	40	82	Diagnostic/POST failure, bad drive status
04	40	83	Diagnostic/POST failure, loader diagnostic failure
04	40	84	Diagnostic/POST failure, POST soft failure
04	44	00	Internal target failure
04	44	80	Unexpected selection interrupt
04	44	83	SCSI chip gross error
04	44	84	Unexplained residue in TC registers
04	44	85	Immediate data transfer time out
04	44	86	Insufficient CDB bytes
04	44	87	Disconnected/SDP sequence failed
04	44	88	Buss DMA transfer time out
04	47	00	SCSI parity error
04)	48	00	IDE message received
04	51	00	Erase failure
04	53	00	Media load/eject failure
04	53	01	Unload tape failure
05	1A	00	Parameter list length error
05	20	00	Illegal firmware

Figure 65 (Page 2 of 4). Sense Key Information for the DLT7000 Tape Drive

Sense Key (Hex)	ASC (Hex)	ASCQ (Hex)	Description of Error (see Note)
05	21	01	Invalid element address
05	24	00	Invalid CDB field
05	24	81	Invalid mode on write buffer
05	24	82	Media in drive
05	24	84	Insufficient resources
05	24	86	Invalid offset
05	24	87	Invalid size
05	24	89	Image data over limit
05	24	8B	Image/personality is bad
05	24	8C	Not immediate command
05	24	8D	Bad drive/server image EDC
05	24	8E	Invalid personality for firmware update
05	24	8F	Bad controller image EDC
05	25	00	Illegal LUN
05	26	00	Parameter list error, invalid field
05	26	01	Parameter list error, parameter not supported
05	26	02	Parameter list error, parameter value invalid
05	39	00	Saving parameters not supported
05	3B	0D	Media destination element full
05	3B	0E	Media source element empty
05	3D	00	Invalid bits in ID message
05	53	02	Media removal prevented
05	82	00	Not allowed if not at BOT
06	28	00	Not ready to ready transition
06	29	00	Reset occurred
06	2A	01	Mode parameters changed
06	2A	02	Log parameters changed
06	3F	01	Firmware has been changed
06	5B	01	Log threshold condition met
07	27	80	Hardware write protected
07	27	82	Data safety write protected
08	00	05	EOD encountered
0B	43	00	Message error
0B	44	82	Command complete sequence failure
0B	45	00	Select/reselect failure

Figure 65 (Page 3 of 4). Sense Key Information for the DLT7000 Tape Drive

Figure 65 (Page 4 of 4). Sense Key Information for the DLT7000 Tape Drive			
Sense Key (Hex)	**ASC (Hex)**	**ASCQ (Hex)**	**Description of Error (see Note)**
0B	47	00	SCSI parity error
0B	48	00	IDE message received
0B	49	00	Invalid message error
0B	4E	00	Overlapped commands attempted
0D			No additional sense firmware
0E			No additional sense firmware

Note: The filemark/EOM/ILI bits may be set, even though ASC/ASCQ = 00 00. The following are ways in which the filemark/EOM/ILI bits can be set:

- FM, EOM, ILI bit may be set with no sense key (0) and ASC/ASQ = 00 00.

- FM, EOM, ILI bit may be set with recovered error (1) and ASC/ASQ = 00 00.

- FM, EOM, ILI bit may be set with medium error (3) and ASC/ASQ = 00 00.

- EOM bit is set at Volume Overflow (Dh) ASC/ASQ = 00 00.

- FM (byte 2, bit 7), EOM (byte 2, bit 6), and ILI (byte 2, bit 5) are fields in request data.

The internal status code (ISC) is unique to the DLT7000 drive and gives a more complete definition of the drive's error condition. The ISC is located at byte 18 of the request sense data.

Depending on the hex value of the ISC code that appears in byte 18 of the `errpt` report (see Figure 64 on page 139), there are two ways of determining a description of the error:

- If the ISC hex value is 7Fh or lower, refer to Figure 66.

- If the ISC hex value is 80h or higher, refer to the bit numbers and descriptions in Figure 67 on page 145.

Figure 66 (Page 1 of 3). Internal Status Codes. Use this table for ISC hex values of 7Fh or lower.	
Hex Value	**Description of Error**
0	No meaning
1	Reed-Solomon error correction code recovery
2	Read or write block retry (soft error)
3	Reposition command aborted
4	Controller has stopped reading
5	No control or data buffers available
6	Target delivered in read ahead
7	Logical EOT encountered, two file marks
8	Command connection dropped
9	Cleared from queue
0A	Missing data block - read only

Hex Value	Description of Error
Figure 66 (Page 2 of 3). Internal Status Codes. Use this table for ISC hex values of 7Fh or lower.	
0B	Gap within object (missing blocks in record)
0C	Record on tape larger than requested
0D	Compare error
0E	Successive blocks missing across objects
0F	Drive state not valid for command
10	Drive error
11	Drive communication time-out error
12	Drive unloaded
13	Unable to write - no CRC
14	Block to append to not found
15	Data synchronization error (read after write not happening)
16	Missing block(s) in current entity
17	Drive hardware write protected
18	Reposition target not found
19	Long gap encountered (blank tape or no data encountered)
1A	End of data or filler block encountered
1B	File mark encountered
1C	EDC error found by GPSP3 - FECC RAM bad
1D	Beginning of medium encountered
1E	EDC error
1F	Hard write error - GPSP3 Underrun
20	Hard write error - Read Sync Time-out
21	Hard write error - Overshoot Append
22	Hard write error - CRC error
23	EDC error found by GPSP3 - FECC RAM OK
24	Time-out on command to medium changer
25	Medium changer UART error (overrun)
26	Medium changer response length error
27	Medium changer detected error
28	Invalid source slot
29	Invalid destination slot
2A	Source slot empty
2B	Destination slot full
2C	Medium changer motion error
2D	Medium changer/drive interface error
2E	Medium changer/slot interface error

Figure 66 (Page 3 of 3). Internal Status Codes. Use this table for ISC hex values of 7Fh or lower.

Hex Value	Description of Error
2F	Medium changer mechanical error
30	Medium changer hardware error
31	Medium changer controller error
32	Unrecognized medium changer subcommand
33	Medium changer fatal error
34	Medium changer is in manual mode
35	68020 detected communication error with servo area
36	68020 detected drive command time-out
37	Calibration failure
38	Bad tape format

Byte 18 has two formats: a byte code and a bit flags format. The bit flags format is used when there is no internal status code to report, and can be distinguished by bit 7 being set. The bit flag numbers are shown in Figure 67, and provide a description of the error. To interpret the bit flags, follow the example below using the ISC value that you extract from the `errpt` report (see Figure 64 on page 139).

As shown in the following example, the error for internal status code 82 that appears in byte 18 of the `errpt` report can be defined as a flag bit 7 on, with the cleaning light off and the status unknown.

```
Example:  Byte 18 = 82h

Bit order        7 6 5 4 | 3 2 1 0

Binary value     1 0 0 0 | 0 0 1 0

Hex value           8         2

                 Bit 7 on:     Flag bit status code
                 Bit 1,2 (01): Unknown status
                 Bit 0 off:    Cleaning light off
```

Figure 67 (Page 1 of 2). Internal Status Codes. Use this table for ISC hex values of 80h or higher.

Number of Bit Flag	Description of Error
0 (least significant bit - LSB)	If set, cleaning light is on; otherwise it is off
1 - 2	Tape directory status: 　　0 Good status 　　1 Unknown status 　　2 Directory partially bad 　　3 Directory bad

Figure 67 (Page 2 of 2). Internal Status Codes. Use this table for ISC hex values of 80h or higher.	
Number of Bit Flag	**Description of Error**
3 - 6	Reserved
7 (most significant bit - MSB)	If set, the internal status byte 18 is in a bit flags format; otherwise it is an internal status code

Appendix D. Performing the System Verification (for the RS/6000 Only)

This appendix explains how to verify that the RS/6000, SCSI cable connectors, and tape subsystem operate as a complete system. The information in this appendix is valid only for RS/6000 systems.

You can verify the system operation by using the following AIX commands:

- `tapeutil`
- `tctl`

The sections that follow describe each command, and give examples of how to use them.

Running the tapeutil Command

Use the `tapeutil` command to exercise (run repetitively) the libraries and devices that attach to the Atape driver. There are two ways to run the command and its subcommands:

- Using the `tapeutil` menu
- Using the `tapeutil` line commands

Using the tapeutil Menu

To use the `tapeutil` menu, type `tapeutil` at the AIX command line. The following screen displays.

```
General Commands:
     1.  Open a Device              5.  Inquiry            9.  Log Sense Page
     2.  Close a Device             6.  Test Unit Ready   10.  Mode Sense Page
     3.  Device Info                7.  Reserve a Device  11.  Release Device
     4.  Tape Drive Service Aids    8.  Reques Sense       Q.  Quit Program

Medium Changer Commands:
    12.  Element Information       16.  Move Medium
    13.  Position To Element       17.  Load/Unload Medium
    14.  Element Inventory         18.  Initialize Element Status
    15.  Prevent Medium Removal    19.  Allow Medium Removal

Tape Commands:
    20.  Query/Set Parameters      30.  Read and Write Tests
    21.  Load Tape                 31.  Unload Tape
    22.  Rewind                    32.  Erase
    23.  Erase Gap                 33.  Write Filemarks
    24.  Forward Space Filemarks   34.  Backward Space Filemarks
    25.  Forward Space Records     35.  Backward Space Records
    26.  Space to End of Data      36.  Query/Set Tape Position
    27.  Log Sense                 37.  Library Sequence Number
    28.  Display Message           38.  Read or Write Files
    29.  Synchronize Buffers       39.  Recover Buffer Data

Enter Selection:
```
TAPEUTIL

To verify that the host system is running appropriately, the system requires that you open a device. To open a device:

1. At the Selection field, type 1 and press Enter.

2. Type the device special file name (for example, `/dev/smc0`) and press Enter.

3. The system responds with the message `Opening Device. . .`

4. Press Enter to continue.

When the screen appears again, make any selection required to verify the operation of the tape library or the tape drive.

Using the tapeutil Line Commands

To use the `tapeutil` line commands, at the AIX command line type the following and press Enter (where x equals the number of the tape library and the subcommand is one of the subcommands from the lists that follow):

```
tapeutil -f/dev/smcx subcommand
```

For example:

- In a library with a resource name of smc0, to perform an inventory type the following and press Enter.

  ```
  tapeutil -f/dev/smc0 inventory
  ```

- In a library with a resource name of smc0, to move a tape cartridge from a cell with an element address of 11 to a drive with an element address of 116 type the following and press Enter. (To determine the appropriate element address, see "Interpreting the Internal Element and Statistics Table" on page 71.)

  ```
  tapeutil -f/dev/smc0 move -s ll -d 116
  ```

The following are subcommands that can be used in a `tapeutil` line command.

Note: For drive subcommands, use the `tctl` command (see "Running the tctl Command" on page 152).

General subcommands:

inquiry	Get inquiry information
vpd	Vital product data
reset	Reset drive
reserve	Reserve drive
reqsense	Request sense data
tur	Test unit ready

Medium changer subcommands:

audit	Audit drive
mount x	Mount cartridge from slot x (where x equals the number of the slot)
unmount x	Unmount cartridge from drive to slot x (where x equals the number of the slot)
inventory	Perform an inventory of the cartridges
allow	Allow operation of the control keys

move -s -d	Move element from source to destination (where s equals the source and d equals the destination)
elementinfo	List all element IDs
prevent	Prevent operation of the control keys
position -d	Move shuttle assembly to destination (where d equals the destination)

tapeutil Error Messages

If the `tapeutil` command has been issued and an error condition is detected, an error message displays. The error sense data has the format shown in Figure 68.

```
          Read/Write test terminated, total bytes written 0
          Operation failed with errno 5: I/O error
          Residual count: 204800

          Error Sense Data, Length 80

          0 1  2 3  4 5  6 7  8 9  10   12   14   A B  C D  E F

          7000 0200 0000 0016 0000 0000 0402 0B00 0000 8200 0000

          0000 0000 0000 0000 0000 0000 0000 0000 0000 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 68. Example of tapeutil Error Sense Data

To use the error message to solve the problem:

1. Locate the AIX errno number (in this example, `errno 5`) and refer to Figure 69 on page 150 for a description of the problem.

   Note: Figure 69 on page 150 shows only the `errno` values that pertain to tape devices. The complete list of `errno` values can be found in the `AIX` `/usr/include/sys/errno.h` header file.

2. Locate the Error Sense Data area of the message:

   - In the byte 02 position, identify the hex value of the sense key. In this example, the value is `02`.

   - In the byte 12 position, identify the hex value of the additional sense code (ASC). In this example, the ASC value is `04`.

   - In the byte 13 position, identify the hex value of the additional sense code qualifier (ASCQ). In this example, the ASCQ value is `02`.

   - Using the values from the preceding steps, refer to Figure 61 on page 134 and Figure 65 on page 140 for a description of the problem.

Figure 69 (Page 1 of 3). Translation of Device Driver Error Code to AIX errno		
AIX errno	**Device Driver Error Code**	**Description**
1	EPERM	• **General:** The process does not have adequate permission to perform the desired function.
5	EIO	• **Open:** An I/O error occurred that indicates a failure to operate the device. • **Write:** The physical end of medium was detected, or it is a general error state indicating a failure to write to device. • **IOCTL:** An I/O error occurred during the operation. • **Close:** An I/O error occurred during the operation.
6	ENXIO	• **General:** The device has not been configured and is not receiving requests. • **Write:** A write operation was attempted after the device had reached end of medium.
9	EBADF	• **General:** A bad file descriptor was passed. • **Write:** A write operation was attempted on a device that was opened for read only.
11	EAGAIN	• **Read:** The device is already opened.
12	ENOMEM	• **General:** Insufficient memory available for some internal memory operation. • **Read:** The number of bytes requested in a read of a variable block record was less than the size of the block. This is referred to as an over-length condition.
14	EFAULT	• **General:** A memory failure occurred due to an invalid pointer or address.
16	EBUSY	• **General:** An excessive busy state was encountered. • Open: The device is reserved by another initiator or an excessive busy state was encountered.
22	EINVAL	• **Open:** The operation requested had invalid parameters or an invalid combination of parameters. • **Write:** The operation requested had invalid parameters or an invalid combination of parameters, or the number of bytes requested in the write was not a multiple of the block size for a fixed block transfer, or the number of bytes requested in the write was greater than the maximum block size allowed by the device for variable block transfers.
28	ENOSPC	• **Write:** A write operation failed because it had reached the early warning mark while running in label processing mode. This return code is only returned once at the moment early warning is reached.

AIX errno	Device Driver Error Code	Description
46	ENOTREADY	• **General:** The device is not ready for operation or a tape is not in the drive. • **Open:** If not opened with the O_NONBLOCK or O_NDELAY, the drive is not ready for operation, or there is no tape in the drive. If the nonblocking flags are used, the drive is not ready for operation.
47	EWRPROTECT	• **Open:** An open operation with the O_RDWR or O_WRONLY flag was attempted on a write-protected tape. • **Write:** A write operation was attempted on a write-protected tape. • **IOCTL:** An operation that would modify the media was attempted on a write-protected tape or a device that was opened for O_RDONLY.
78	ETIMEDOUT	• **General:** A command has timed out.
110	EMEDIA	• **General:** An unrecoverable media error was detected.
3030	00	• **No Message:** This is the default message indicating that the device does not have an error to report.
3430	40	• **Operator Intervention Required:** An operator action is required at the device. For example, a magazine is full and needs to be replaced or emptied. Check the device error log for possible repair action.
3431	41	• **Device Degraded:** The device is performing in a degraded state, but can be used. A FID is displayed with the error message. Check the device error log for possible repair action.
3432	42	• **Device Hardware Failure:** The device can not be used. A FID is displayed with the error message. Check the device error log for possible repair action.
3433	43	• **Service Circuits Failed, Operations not Affected:** This error does not affect the performance of the device. The failure only affects circuits used for nonoperational testing. A FID is displayed with the error message. Check the device error log for possible repair action.
3535	55	• **Clean Device:** Load a cleaning cartridge in the device. The drive returns the cleaning cartridge following the cleaning procedure.
3537	57	• **Device Has Been Cleaned:** The drive has been cleaned by a cleaning cartridge.
3630	60	• **Bad Media, Read Only Permitted:** MIM message.

Figure 69 (Page 2 of 3). Translation of Device Driver Error Code to AIX errno

Figure 69 (Page 3 of 3). Translation of Device Driver Error Code to AIX errno		
AIX errno	**Device Driver Error Code**	**Description**
3631	61	• **Rewrite Media if Possible:** MIM message.
3634	64	• **Bad Media, Cannot Read or Write:** MIM message.
3732	72	• **Replace Cleaner Cartridge:** MIM message.

Running the tctl Command

Use the `tctl` command to verify that system commands can be performed on a device. This is especially useful for those types of devices that are not accessible using the `tapeutil` command (for example, the tape drives in the 7331 Tape Library, 7336 Tape Library, or 7337 Tape Library).

To use the `tctl` command, at the AIX command line type the following and press Enter (where x equals the number of the tape library and the subcommand is one of the subcommands from the list that follows):

`tctl -f/dev/rmtx subcommand`

In a library with a resource name of rmt0, to rewind and unload a tape cartridge, type the following and press Enter.

`tctl -f/dev/rmt0 rewoffl`

The following are subcommands that can be used in a `tctl` line command.

weof	Write end of file
fsf	Forward space file
fsr	Forward space record
rewind	Rewind
rewoffl	Rewind or offload (unload)
eof	Erase end of file
bsf	Backward space file
bsr	Backward space record
offline	Set offline

Appendix E. Converting Hex Characters to ASCII

Figure 70 converts hexadecimal characters (Hex) to ASCII characters. This conversion may be useful during a service call.

Figure 70 (Page 1 of 2). Hex to ASCII Conversion	
Hex Value	**ASCII Value**
00	Null
20	Space
30	0
31	1
32	2
33	3
34	4
35	5
36	6
37	7
38	8
39	9
41	A
42	B
43	C
44	D
45	E
46	F
47	G
48	H
49	I
4A	J
4B	K
4C	L
4D	M
4E	N
4F	O
50	P
51	Q
52	R
53	S
54	T

Figure 70 (Page 2 of 2). Hex to ASCII Conversion	
Hex Value	**ASCII Value**
55	U
56	V
57	W
58	X
59	Y
5A	Z
5F	-
Note: All codes are not shown.	

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

3447 and 7337 Digital Linear Tape Library
Service Guide

Publication No. GA32-0400-00

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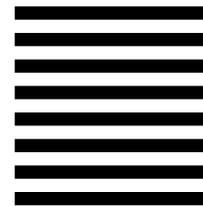
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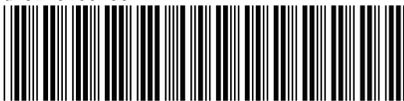GA32-0400-00

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