COMPAQ

StorageWorks ESL9000 Series
Tape Library
Maintenance and Service Guide

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Compaq StorageWorks ESL9000 Series Tape Library
Maintenance and Service Guide
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About This Guide

This Maintenance and Service Guide is a troubleshooting guide that can be used for reference when servicing Compaq StorageWorks ESL9000 Series Tape Libraries.

> **WARNING:** To reduce the risk of personal injury from electrical shock and hazardous energy levels, only authorized service technicians should attempt to repair this equipment. Improper repairs could create conditions that are hazardous.

> **IMPORTANT:** The installation of options and servicing of this product shall be performed by individuals who are knowledgeable of the procedures, precautions, and hazards associated with equipment containing hazardous energy circuits.

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.

> **WARNING:** Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.

> **CAUTION:** Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

> **IMPORTANT:** Text set off in this manner presents clarifying information or specific instructions.

> **NOTE:** Text set off in this manner presents commentary, sidelights, or interesting points of information.

Compaq Technician Notes

> **WARNING:** Only authorized technicians trained by Compaq should attempt to repair this equipment. All troubleshooting and repair procedures are detailed to allow only subassembly/module level repair. Because of the complexity of the individual boards and subassemblies, no one should attempt to make repairs at the component level or to make modifications to any printed wiring board. Improper repairs can create a safety hazard. Any indications of component replacement or printed wiring board modifications may void any warranty.

WARNING: To reduce the risk of personal injury from electrical shock and hazardous energy levels, do not exceed the level of repair specified in these procedures. Because of the complexity of the individual boards and subassemblies, do not attempt to make repairs at the component level or to make modifications to any printed wiring board. Improper repairs could create conditions that are hazardous.

WARNING: To reduce the risk of electric shock or damage to the equipment:

■ If the tape library has multiple power supplies, disconnect power from the tape library by unplugging all power cords from the power supplies.

■ Do not disable the power cord grounding plug. The grounding plug is an important safety feature.

■ Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.

CAUTION: To properly ventilate your tape library, you must provide at least 12 inches (30.5 cm) of clearance at the front and back of the tape library.

CAUTION: The tape library is designed to be electrically grounded. To ensure proper operation, plug the AC power cord into a properly grounded AC outlet only.

Where to Go for Additional Help

In addition to this guide, the following information sources are available:

■ User Documentation

■ Service Training Guides

■ Compaq Service Advisories and Bulletins

■ Compaq Download Facility: Call 1-281-518-1418

Telephone Numbers

For the name of your nearest Compaq Authorized Reseller:

■ In the United States, call 1-800-345-1518

■ In Canada, call 1-800-263-5868

For Compaq technical support:

■ In the United States and Canada, call 1-800-386-2172

■ For Compaq technical support phone numbers outside the United States and Canada, visit the Compaq website at http://www.compaq.com .

Illustrated Parts Catalog

Introduction

This chapter provides the spares parts list for the Compaq StorageWorks ESL9000 Series Tape Library. Refer to Table 1-1 for the names of referenced spare parts.

Table 1-1
Spares Parts List – ESL9000 Series Tape Library

Part Number	Description
154841-001	Compaq DLT tape drive assembly (hot-plug)
154842-001	Empty drive canister
154843-001	Power supply (hot plug)
154844-001	Power supply rack assembly
154845-001	AC power distribution assembly
154846-001	Fan module assembly (redundant)
154847-001	Robotics controller PWA with memory module
154848-001	Actuator driver PWA
154849-001	SCSI communication PWA
154850-001	Robotics backplane PWA
154851-001	Control panel
154852-001	Extension axis assembly

continued

Table 1-1
Spares Parts List – ESL9000 Series Tape Library *continued*

Part Number	Description
154853-001	X-axis, or y-axis stepper motor
154854-001	Rotary axis stepper motor
154855-001	X-axis interconnect PWA
154856-001	Y-axis interconnect PWA
154857-001	Rotary axis sensor PWA
154858-001	Motor power converter
154859-001	Drive sideboard PWA (left)
154860-001	Drive sideboard PWA (right)
154861-001	Drive tray PWA (left)
154862-001	Drive tray PWA (right)
154863-001	Horizontal belt, 1in. x 345 in. x 3/8 in. pitch (2.54 cm x 8.76 m x 0.95 cm pitch)
154864-001	Vertical belt, 1 in. x 143 in. x 3/8 in. pitch (2.54 cm x 3.63 m x 0.95 cm pitch)
154865-001	Non-redundant fan
154866-001	System status board
154867-001	Loadpack
158908-001	Library supplies
158909-001	Service tool
158910-001	Force gauge
158911-001	Touch gauge
158912-001	Force gauge
158913-001	Combination wrench
158914-001	Torpedo level
158915-001	Override tool
158916-001	Hex key Allen wrench

Chapter **2**

Tape Library Description

Introduction

The Compaq StorageWorks ESL9000 Series automated tape library stores up to 326 Digital Linear Tape (DLT™) cartridges and holds up to 16 DLT tape drives. The tape library accommodates DLTtape™III, III XT, or DLTtapeIV cartridges and DLT tape drives. The tape library is controlled by a host computer via a SCSI differential bus using the SCSI-2 medium changer command set. There is also an RS-232 diagnostic port interface. This chapter describes in detail each of the following components:

- Control electronics

- Motors

- Scanners

- Storage array

- Load port

- Cooling fans

- Control panel

- Tape drives

- Cabinet

- Power cord

- Power supplies

Figure 2-1 shows a front view of the tape library. Figure 2-2 shows a rear view of the tape library.
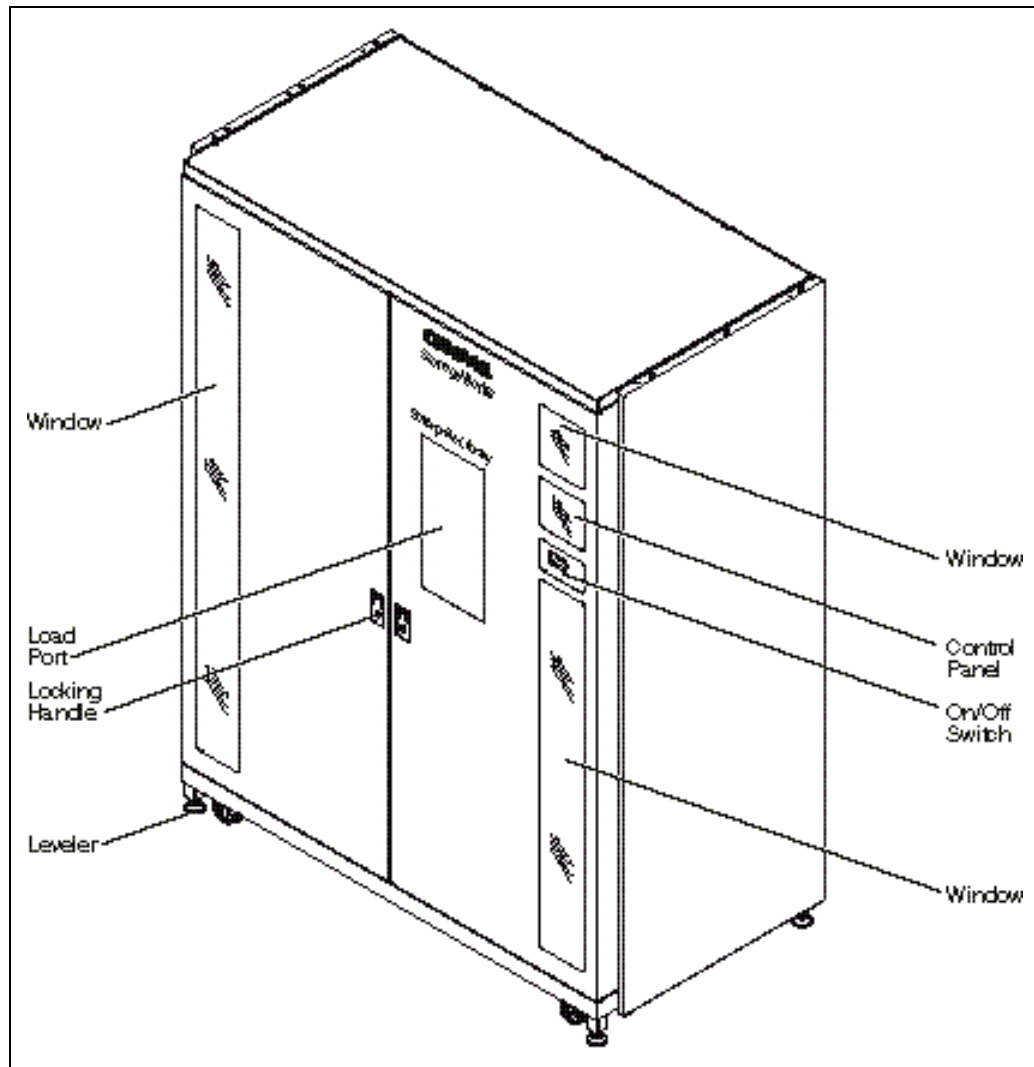
Figure 2-1. Tape library front view
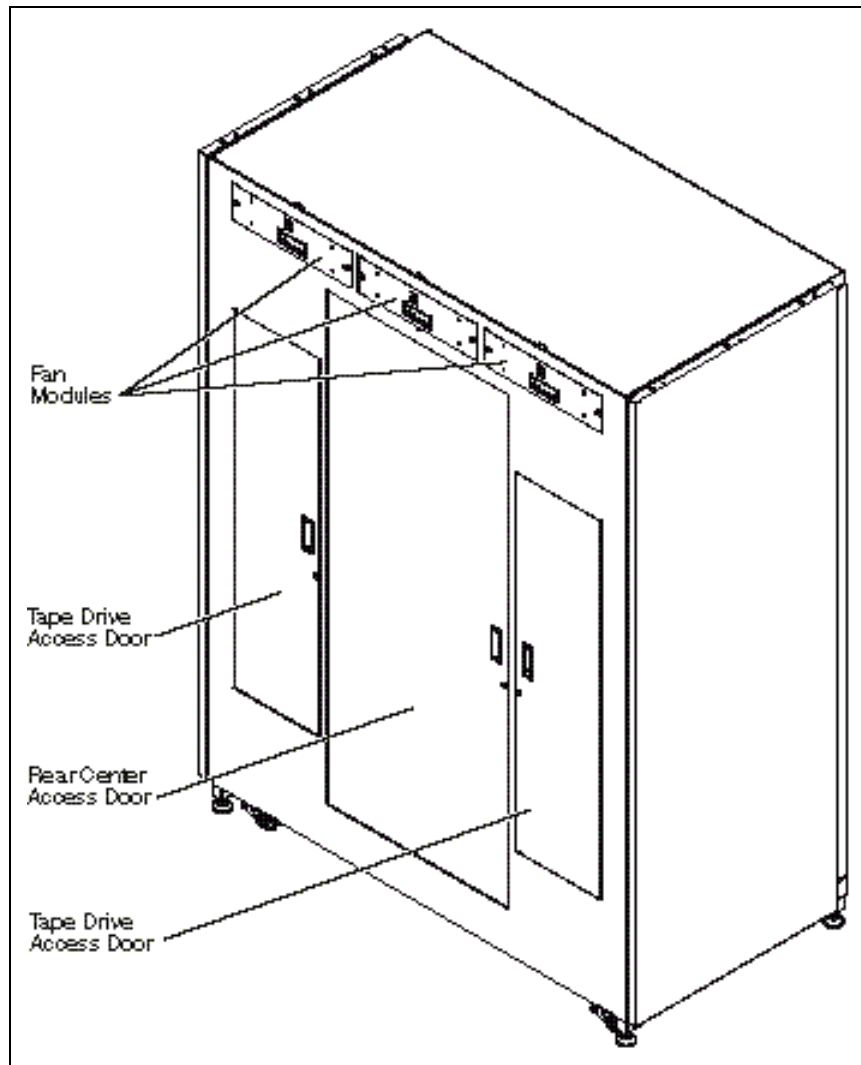
Figure 2-2. Tape library rear view

Cabinet

The tape library cabinet dimensions and weight are:

■ 57 in (144 cm) wide

■ 75 in (191 cm) high

■ 29 in (75 cm) deep

■ 1300 lb (591 kg) with 16 drives and no cartridges

The cabinet houses all components of the tape library. It has five doors for accessing the storage array, tape drives, power supplies, and control electronics. Three exhaust fan modules are located at the top rear of the cabinet. There is a leveling foot at each corner of the cabinet. Figure 2-3 shows the cabinet dimensions.
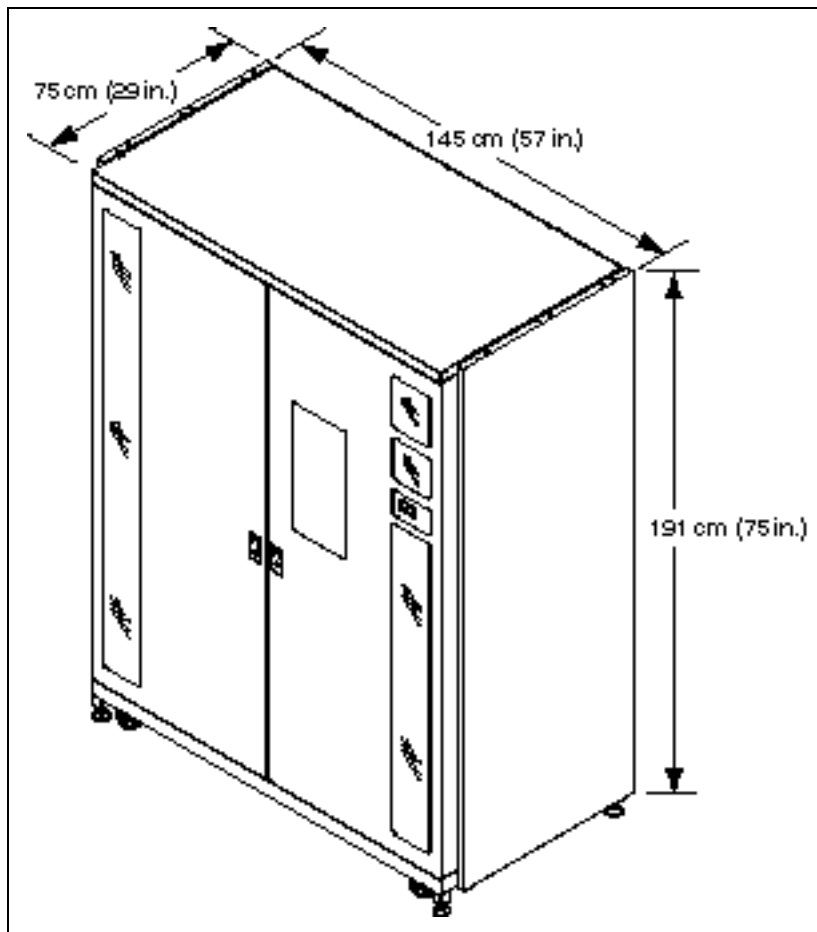
Figure 2-3. Tape library cabinet dimensions

Power Cord

Figure 2-4 shows the power supply cord and wall receptacle. If the tape library is supplied with a redundant AC power distribution unit, it will also have two power supply cords. Disconnect all power supply cords before servicing the tape library in the power supply area.
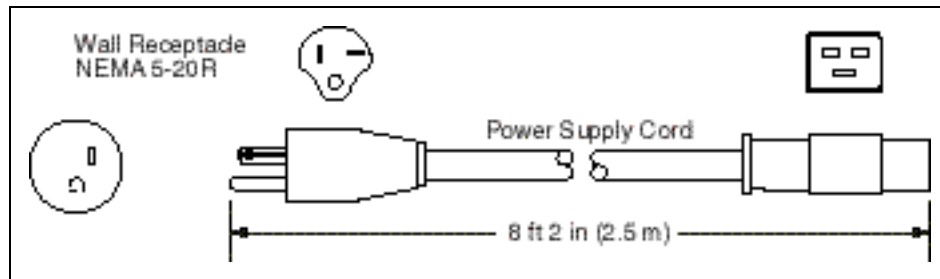
Figure 2-4. Power supply cord and wall receptacle

The wide-ranging power distribution assemblies (Figure 2-7) accept single-phase input power of 90 VAC to 264 VAC at 47 Hz to 63 Hz.

The power inlet connector is an IEC-320 C19 connector (Figure 2-5). For the United States and Canada, a UL/CSA Certified 8ft 2in (2.5 m) power cord is furnished. It uses a 14/3 SJT cord and a 5-20P plug.

Outside North America, replace the power cord with a harmonized 3×1.5 mm^2 power cord that is approved by the country where used.
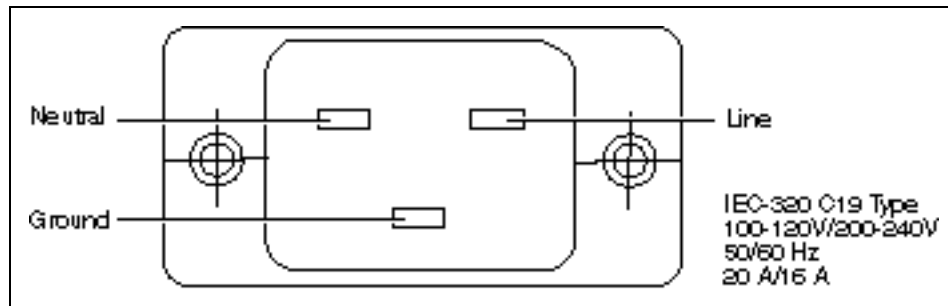
Figure 2-5. Tape library AC power receptacle

CAUTION: The tape library must be connected to a grounded electrical outlet.

Power Supplies

The tape library DC power supplies are located in a swing-out power supply rack near the rear top center of the cabinet. The swing-out rack has eight separate bays for individual hot-plug capable power supplies. Each of the parallel power supplies provides current shared outputs of +5 VDC (50 A) and +12 VDC (15 A). AC input is provided through the power system backplane PWA from one or two identical AC power distribution assemblies, located in the rear lower left corner of the cabinet. One AC distribution assembly can supply AC power to up to five DC power supplies. ESL9000 Series tape libraries are shipped in the 2N power supply configuration (2 AC power distribution assemblies and 8 DC power supplies).

Figure 2-6 shows a single DC power supply. Figure 2-7 shows a single AC power distribution assembly.
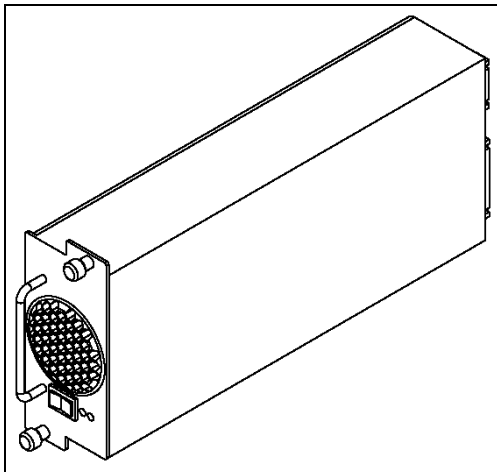
Figure 2-6. DC power supply
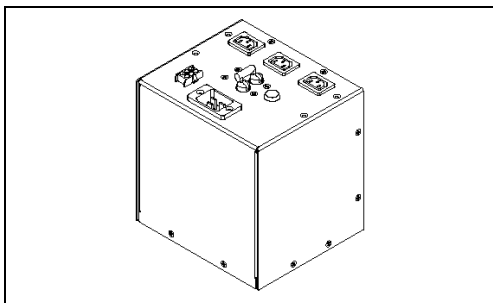
Figure 2-7. AC power distribution assembly

> **CAUTION:** The AC power distribution outlets are for tape library power only. Do not connect external devices or test equipment to these outlets. The electrical rating for the outlets is 10 A in the 100 V to 120 V range and 8 A in the 200 V to 240 V range.

Control Electronics

The tape library control electronics include the following Printed Wiring Assemblies (PWAs) and switches:

■ Robotics backplane

■ Robotics controller

■ Actuator drivers (2 identical PWAs)

■ DC-DC converters (2 identical PWAs)

■ Differential SCSI interface

■ Rear door switches

■ Front door interlock switches

■ Front door low velocity switches

■ x-carriage interconnect

■ x-axis home sensor

■ y-axis interconnect

■ Rotary home/limit sensors

■ Extension axis interconnect

■ Gripper interconnect

■ Cartridge-in-gripper transmitter

■ Cartridge-in-gripper receiver

■ Drive tray PWA

■ Drive sideboard PWA

The following pages describe each component in detail.

Robotics Backplane

The robotics backplane PWA (Figure 2-8) is located at the rear center of the tape library behind the center access door and the electronics bay cover. It provides power and receptacles for the robotics controller, two actuator drivers, two DC-DC converters and some optional electronics boards. It also serves as an interconnect for cables that provide power and signals to all robotics components in the tape library. Some of the major components of the robotics backplane are described below:

■ *F1, 15 amp fuse*—used only when bench testing the PWA

■ *F2, 4 amp fuse*— +12 VDC supply line for system electronics

■ *F3, 1 amp fuse*—used only when bench testing the PWA

■ *J1 - J2*—60-position connectors for lower actuator driver PWA #1

■ *J3 - J4*—60-position connectors for upper actuator driver PWA #0

■ *J5 - J6*—60-position connectors for robotics controller PWA

■ *J8*—92-position connector for optional PCI PWA (additional SCSI or fibre channel interface boards)

■ *J10*—92-position connector for SCSI communications PWA

■ *RT1, RT22, RT39 - RT47*—11 A current-limiting resettable fuses

■ *RT2 - RT4, RT9, RT10, RT17 - RT19*—650 ma current limiting resettable fuses

■ *RT11, RT12*—900 ma current limiting resettable fuses

■ *RT13 - RT16, RT48*—1.1 A current limiting resettable fuses

■ *RT23 - RT27*—3.0 A current limiting resettable fuses

NOTE: Resettable fuses reset within two minutes after the fault is cleared.

■ *S1*—micro miniature push-button reset switch
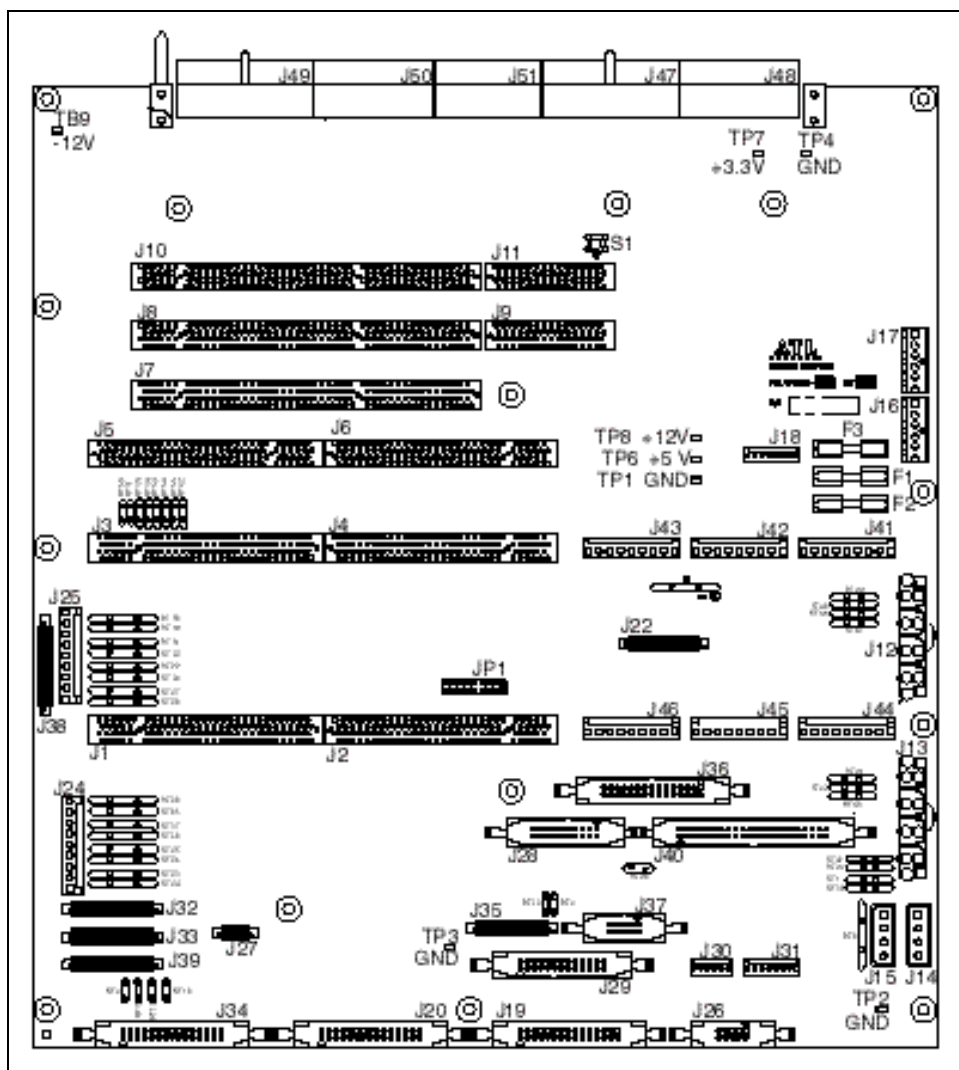
Figure 2-8. Robotics backplane

Robotics Controller

The robotics controller PWA (Figure 2-9) connects to the robotics backplane PWA at J5 and J6. The robotics controller responds to commands from a host computer to control the robotics and movement of cartridges within the tape library. Some components of the robotics controller are listed below:

■ *LED1*—indicates that the microprocessor firmware is running

■ *J1*—10-pin ribbon connector for the background mode debugger port on the 63882 microprocessor

■ *J2*—9-pin D-sub connector serial port used for diagnostics and software updates

■ *J3*—9-pin D-sub connector auxiliary serial port used for development

■ *J6*—72-pin connector for the single-in-line memory module that has on board flash memory and static memory devices

■ *S1*—micro miniature push-button processor reset switch

■ *U1 Motorola 68332 20 MHz microprocessor*—132-pin embedded electronic controller

> ⚠️ **WARNING:** U2 contains a lithium battery.

■ *U2 Dallas 64K Nonvolatile SRAM*—stores configuration, calibration, and SCSI ID information
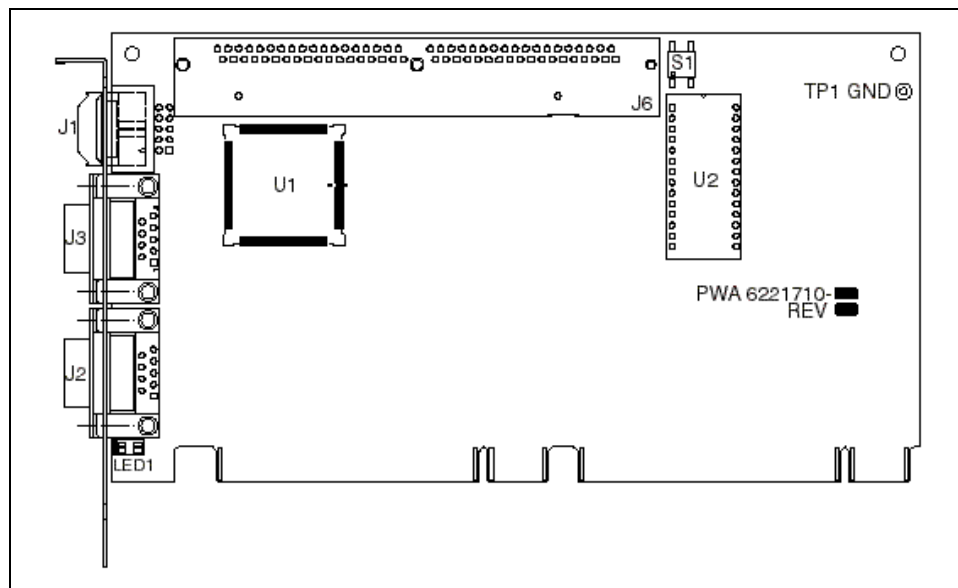
Figure 2-9. Robotics controller

Actuator Driver

There are two identical actuator driver PWAs (Figure 2-10) in the tape library.

■ #AD0 connects to the robotics backplane at J3/J4 and drives the x-axis, rotary axis, extension axis and gripper.

■ #AD1 connects to the robotics backplane at J1/J2 and drives the y-axis and load port.

Some components of the actuator driver PWAs are listed below:

■ *LED1*—indicates motor power fault

■ *LED2*—a bicolor LED indicates that servos are running and robotics are ready

■ *U48 Xilinx*—208-pin FPGA used for servo and limit sensors, tape drive interface, motor drive current loop control, motor drive micro-step interface, position counters, bar code decoding, touch screen interface and decoding
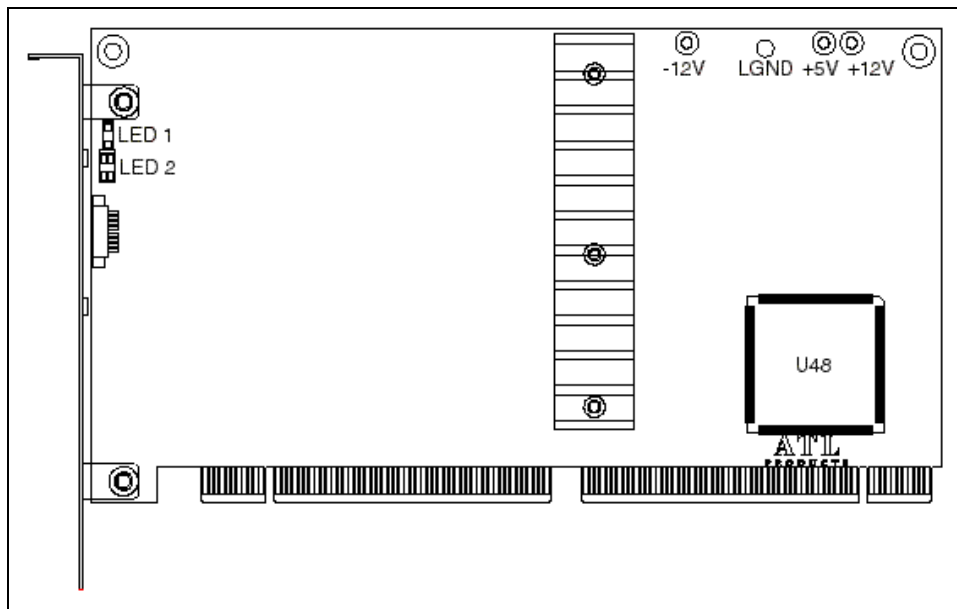
Figure 2-10. Actuator driver

DC-DC Converter

There are two identical DC-DC converter PWAs (Figure 2-11) in the tape library. They are mounted adjacent to the actuator driver PWAs. The function of the DC-DC converter PWAs is to convert +12 VDC to +38 VDC to be used by the motors.

■ #DC0 connects to the robotics backplane at J41, J42, and 43. It drives the x-axis, rotary axis, extension axis, and gripper.

■ #DC1 connects to the robotics backplane at J44, J45, and J46. It drives the y-axis, load port and passthrough.
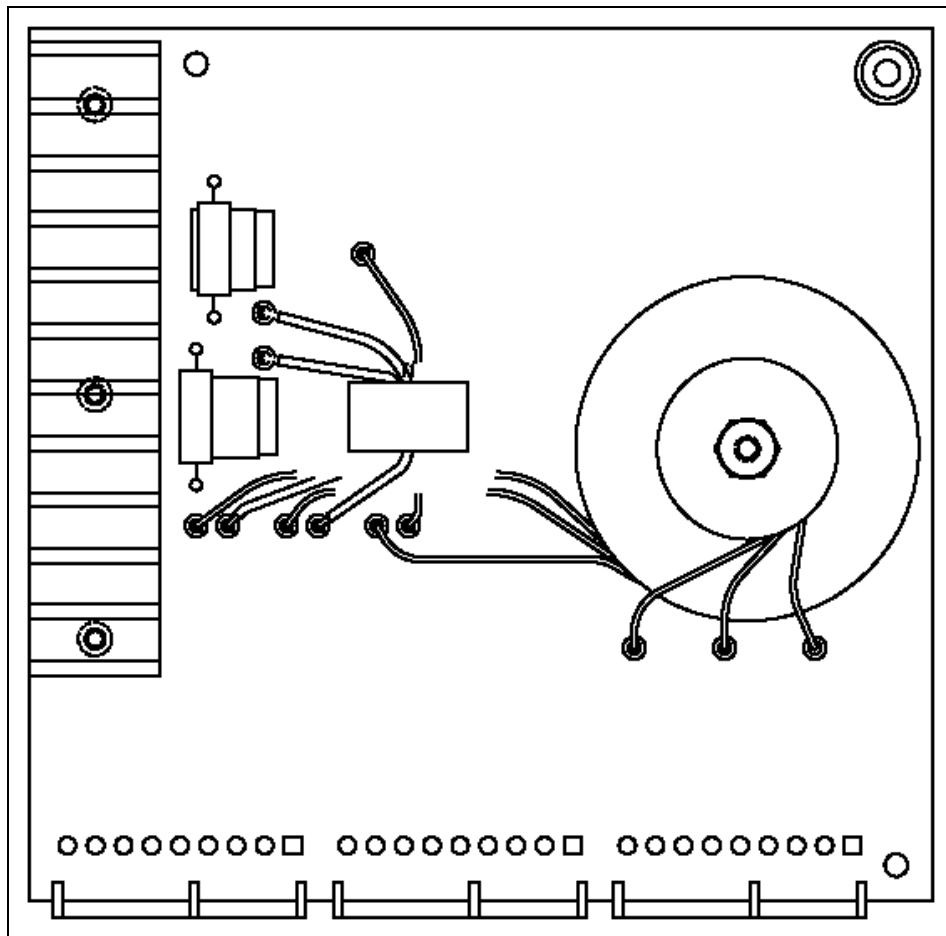
Figure 2-11. DC-DC converter

Differential SCSI Interface

The differential SCSI interface PWA (Figure 2-12) connects to the robotic backplane at J10. It is a PCI 2.1-compliant host bus adapter and supports synchronous fast and wide SCSI technology.

The tape library and its tape drives operate using SCSI synchronous fast and wide (2-byte) communications with data transfer rates up to 20 MB per second. Some common SCSI terms are defined below:

■ *SCSI*—Small Computer System Interface, the standard protocol for high-speed data transfer between computers and peripherals.

■ *Differential*—An electrical signal configuration using a pair of lines for data transfer. Differential SCSI has a higher tolerance for common mode noise than single-ended SCSI. Differential SCSI permits cable lengths of up to 82 ft (25 m) between devices.

■ *Single-Ended*—An electrical signal configuration using a single line for each signal, referenced to a ground path common to the other signal lines. The advantage of single-ended SCSI compared to differential SCSI is that half the number of ICs are required on the SCSI adapter boards. The disadvantage of single-ended SCSI is higher vulnerability to common-mode noise and a 20 ft (6 m) limit on cable length between devices.

■ *Asynchronous transmission*—A timing protocol in which each byte of data is synchronized individually by interlocking the request (REQ) and acknowledgment (ACK) signals.

■ *Synchronous transmission*—A timing protocol that uses a master clock. Sending and receiving devices can operate continuously at the same frequency.

■ *Narrow*—A 1-byte (8-bit) wide plus parity data interface.

■ *Wide*—A 2-byte (16-bit) or 4-byte (32-bit) wide data interface.

■ *Slow*—Data transfer rates up to 5 MB per second.

■ *Fast*—Data transfer rates above 5 MB and below 10 MB per second.

■ *Fast and Wide (2-byte)*—Data transfer rates to 20 MB per second.
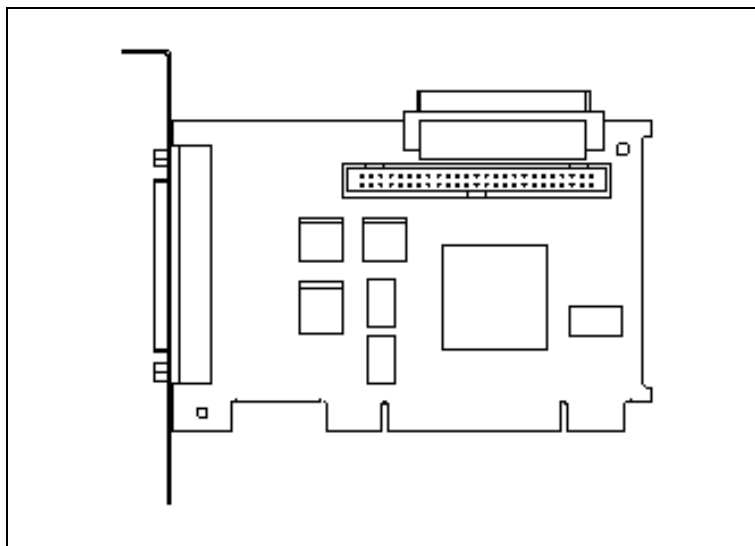
Figure 2-12. Differential SCSI interface

Rear Door Switch

Each rear door has a magnetic switch (Figure 2-13) that notifies the robotics controller when one of the rear doors is opened. The tape library continues to operate with a rear door open, however, the rear doors must be closed for the cooling fans to be effective. Running the tape library with a rear door open for an extended period causes the tape library to overheat, and will eventually cause a maximum temperature exceeded error and shut down the tape library robotics.
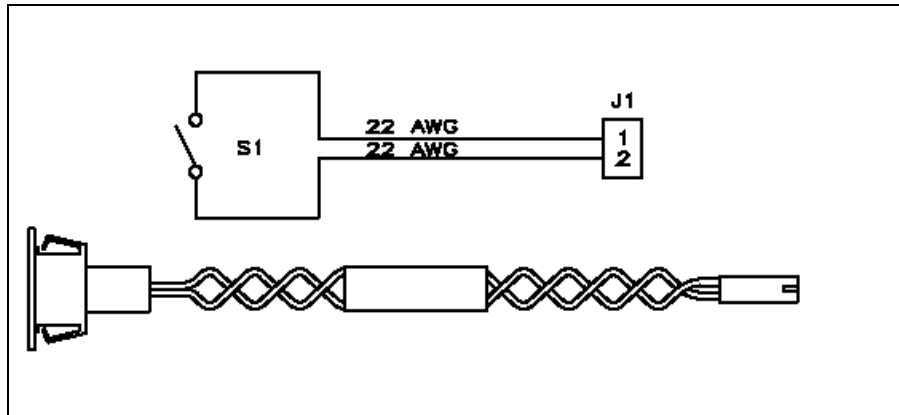
Figure 2-13. Rear door switch

Front Door Interlock Switches

Four front door interlock switches (Figure 2-13) prevent the tape library robotics from operating if either of the front doors is open. Opening either front door immediately shuts down power to all motors in the tape library.

Front Door Low Velocity Switches

There is one switch on each front door that allows the library to operate in a low velocity mode with a front door open (Figure 2-13). Use the front door interlock override tool (PN 6311754) described below to run the library in low velocity mode.

Front Door Interlock Override Tool

Use interlock override tool, PN 6311754 (Figure 2-14), to override the two front door interlock switches and close the low velocity switch. This allows the tape library to run in low velocity mode with a front door open.

> **WARNING:** When the interlock override tool is used, the Class II laser scanner comes on during the cartridge inventory process. Do not stare into the beam.
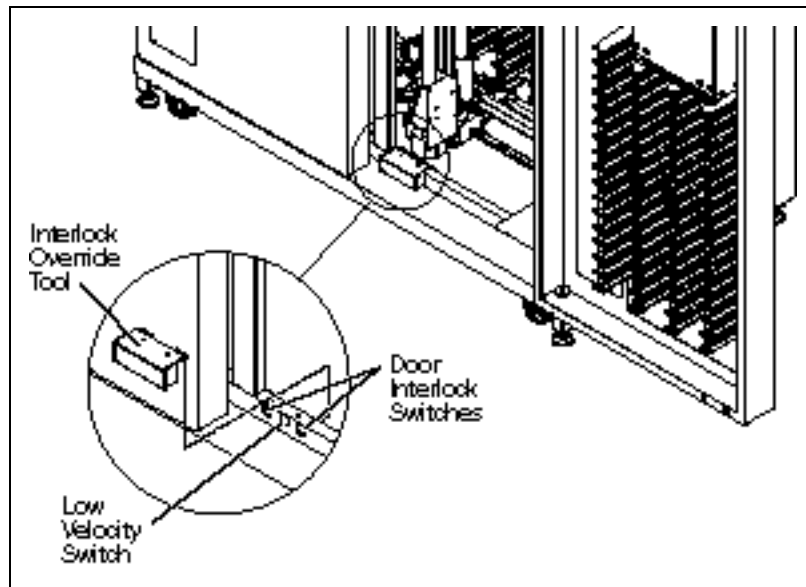
Figure 2-14. Interlock override tool

X-Carriage Interconnect

The x-carriage interconnect PWA (Figure 2-15) is located at the base of the cabinet behind the horizontal rail. It serves as a cable interconnect between the robotics backplane and the following components:

■ x-axis home sensor

■ y-axis stepper motor

■ y-axis stepper motor encoder
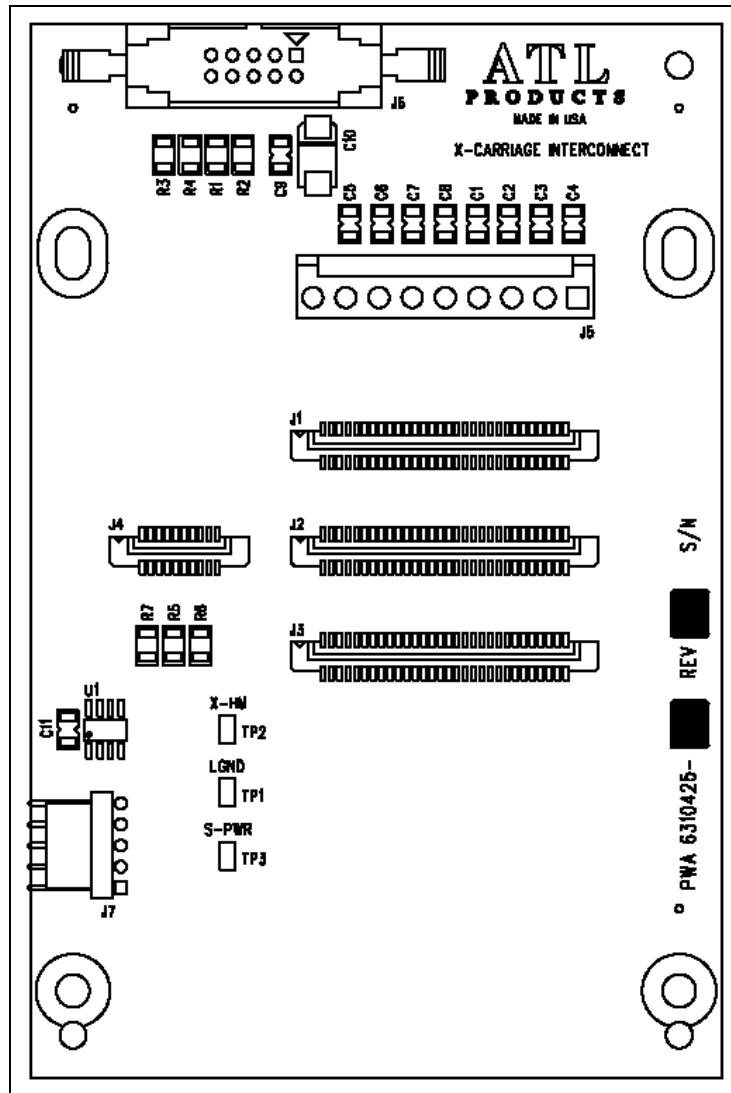
Figure 2-15. X-carriage interconnect

X-Axis Home Sensor

The x-axis optical home sensor (Figure 2-16) extends downward from the base of the horizontal carriage. It is interrupted by the horizontal home flag near the right end of the horizontal rail at the base of the cabinet.
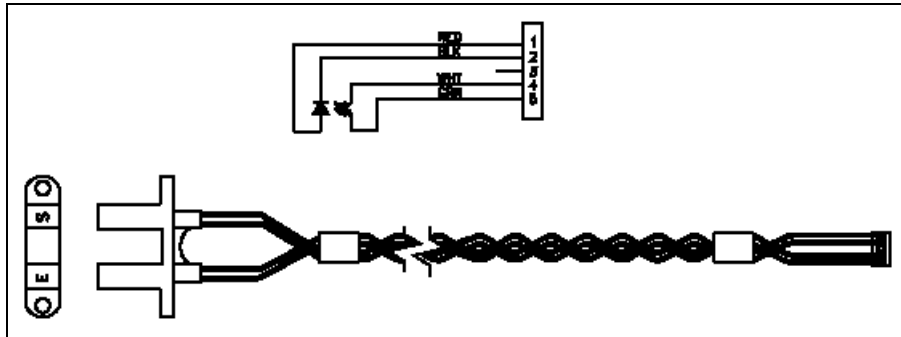
Figure 2-16. X-axis home sensor

Y-Axis Interconnect

The y-axis interconnect PWA (Figure 2-17) is located on the right side of the vertical carriage. It serves as a cable interconnect between the robotics backplane and the electrical components on the vertical carriage, including the:

■ Extension interconnect PWA

■ Rotary stepper motor

■ Rotary home/limit sensor PWA

■ Gripper interconnect PWA

The y-axis optical home sensor is mounted on the rear of the y-axis interconnect.
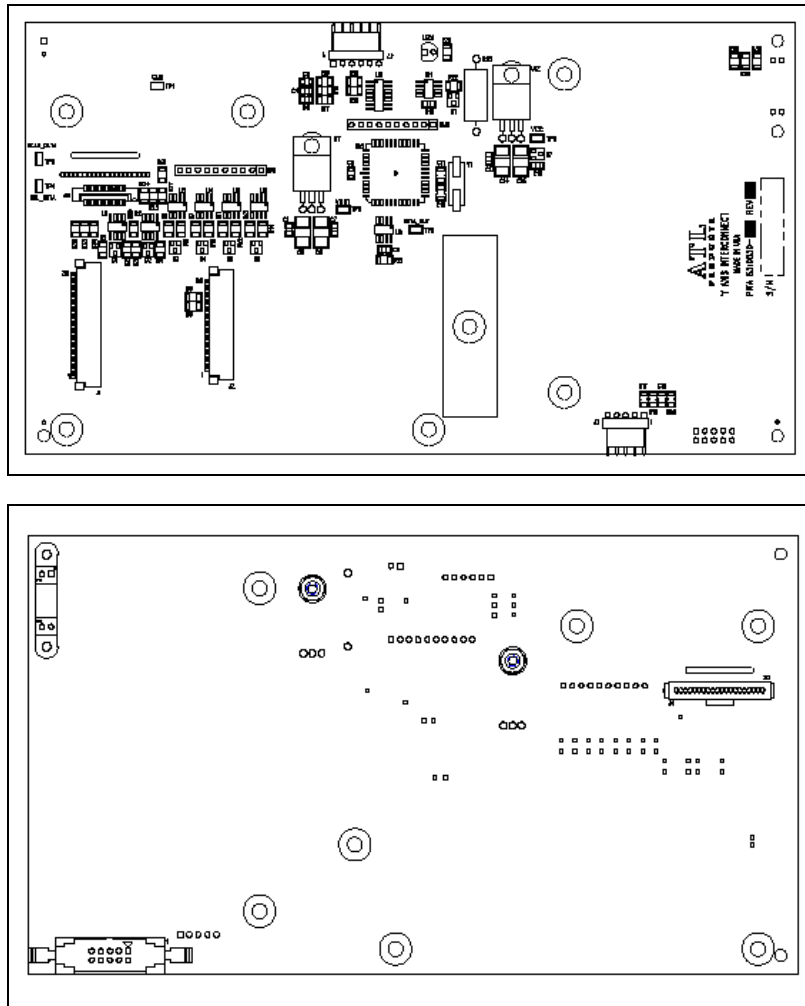
Figure 2-17. Y-axis interconnect (rear view at bottom)

Rotary Axis Sensor PWA

The rotary home/limit sensor PWA (Figure 2-18) is located on the left front side of the vertical carriage, just below the rotary carriage. It contains the rotary home sensor (U1) and the rotary limit sensor (U2).
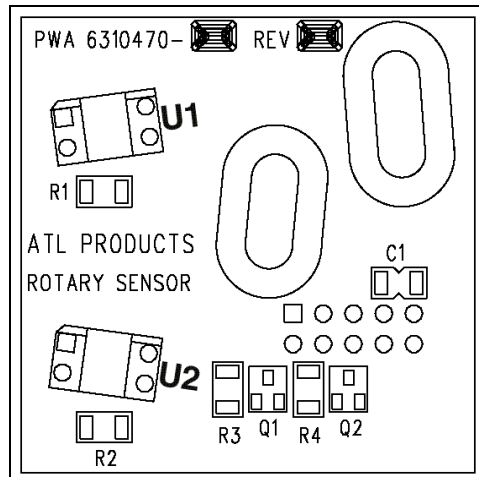
Figure 2-18. Rotary home/limit sensor PWA

Extension Axis Interconnect

The extension axis interconnect PWA (Figure 2-19) mounts on the extension axis underneath the gripper assembly. It serves as a cable interconnect between the y-axis interconnect and the extension axis motor/encoder assembly. The extension axis home sensor (U1) is mounted on the right end of the extension axis interconnect.
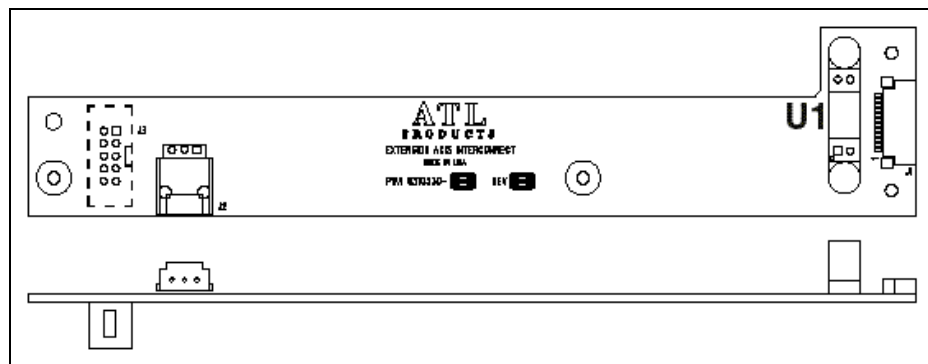
Figure 2-19. Extension axis interconnect

Gripper Interconnect

The gripper interconnect PWA (Figure 2-20) is mounted vertically on the motor shaft end of the gripper assembly. It contains the gripper open sensor (U2) and the gripper closed sensor (U1). It also serves as an interconnect between the laser scanner (bar code reader), the auto-calibration scanner, and the y-axis interconnect PWA.
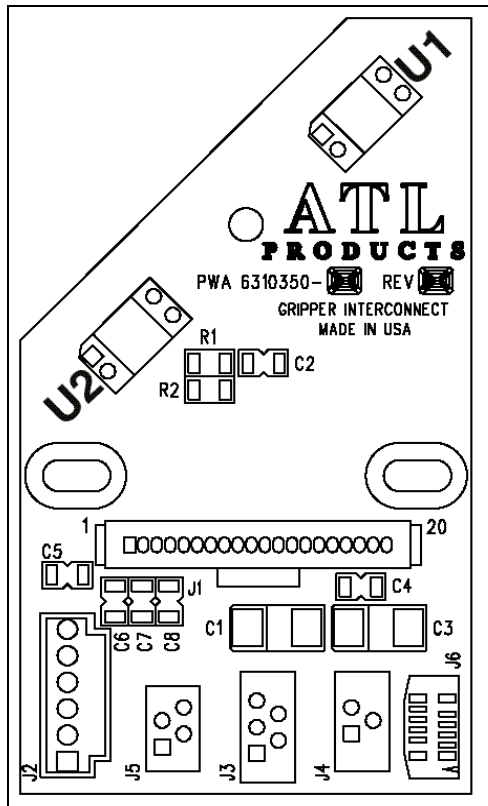
Figure 2-20. Gripper interconnect

CIG Transmitter

The cartridge-in-gripper (CIG) transmitter (Figure 2-21) is a very small PWA mounted in the upper gripper jaw. It contains a 637 nm light-emitting diode (D1) that is transmitted to both CIG detectors mounted in the lower gripper jaw.
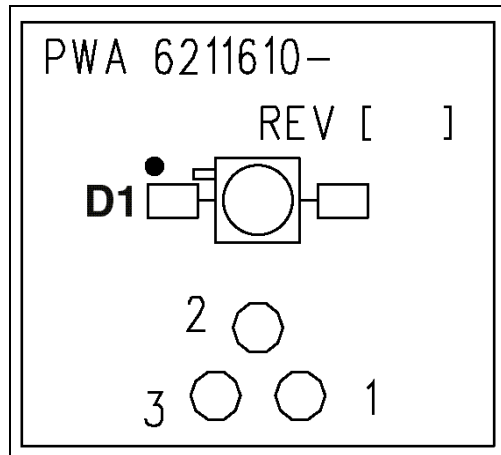
Figure 2-21. CIG transmitter

CIG Receiver

The CIG receiver (Figure 2-22) is a very small PWA located in the lower gripper jaw. It contains the front CIG detector (U1) and the rear CIG detector (U2). If both detector output signals are high (light detected), the gripper has no cartridge. If both detector output signals are low (no light detected), there is a cartridge in the gripper jaws. If the front CIG detector signal is low (no light) and the rear CIG detector signal is high (light detected), there is a partially gripped cartridge in the gripper jaws.
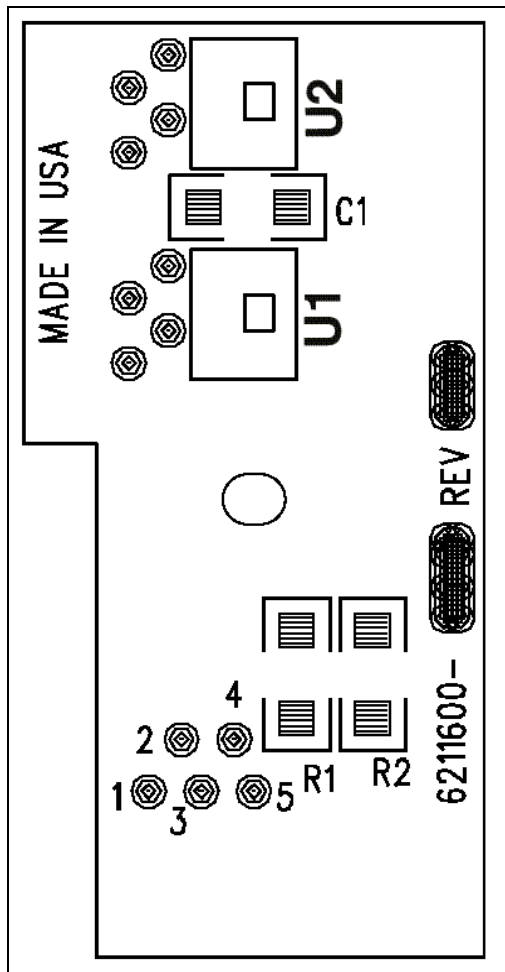
Figure 2-22. CIG receiver

Drive Tray PWA

A column 1 drive tray PWA (Figure 2-23) is located underneath each tape drive bay on the left side of the cabinet (viewed from the rear), and a column 0 drive tray PWA is located underneath each tape drive bay on the right side of the cabinet (viewed from the rear). Each drive tray PWA serves as a cable interconnect between the drive sideboard PWA and the tape drive assembly.
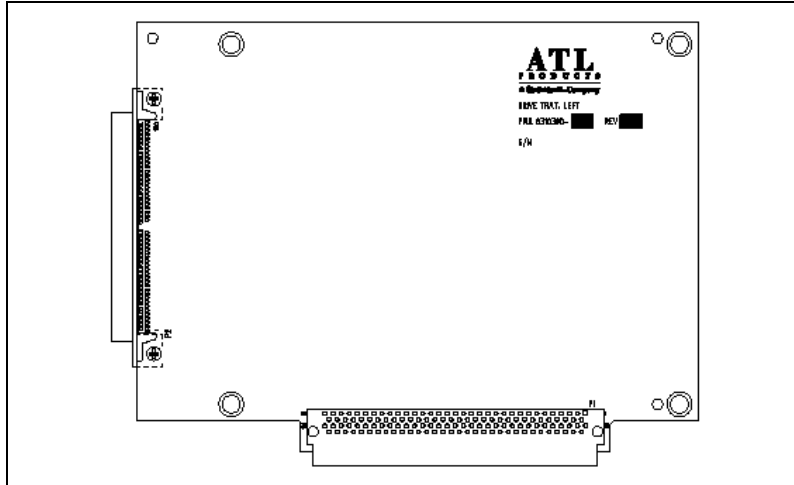
Figure 2-23. Drive tray PWA

Drive Sideboard PWA

A column 1 drive sideboard PWA (Figure 2-24) is located to the left of each tape drive bay on the left side of the cabinet (viewed from the rear), and a column 0 sideboard PWA is located to the right of each tape drive bay on the right side of the cabinet (viewed from the rear). Each drive sideboard PWA serves as a cable interconnect between the drive tray PWA and the power supply backplane, the robotics backplane, and the SCSI distribution ports.
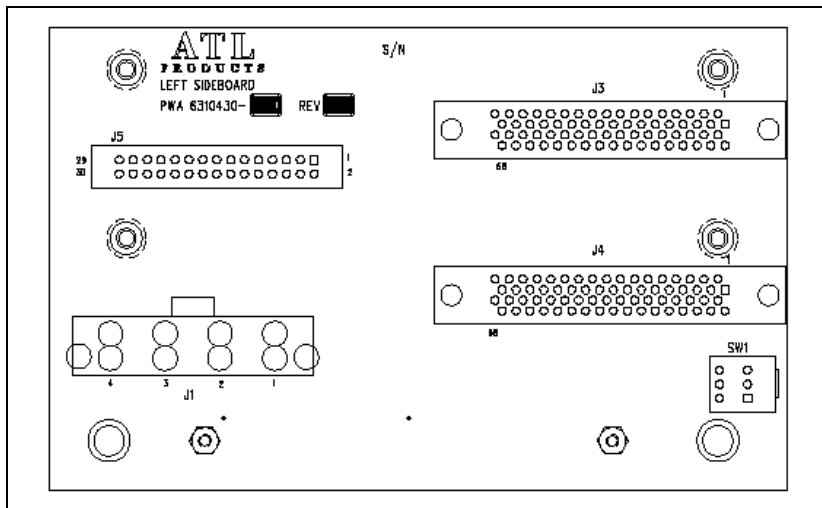
Figure 2-24. Drive sideboard PWA

Motors

The five motors in the tape library are described below.

X-Axis Stepper Motor

The x-axis stepper motor (Figure 2-25) is mounted in the lower left corner at the base of the cabinet. It engages the horizontal belt, driving the horizontal carriage between the left and right end of the cabinet. It is identical to the y-axis stepper motor.

Y-Axis Stepper Motor

The y-axis stepper motor (Figure 2-25) is mounted on the left side of the horizontal carriage at the base of the cabinet. It engages the vertical belt, driving the vertical carriage up and down the vertical rails. It is identical to the x-axis stepper motor.
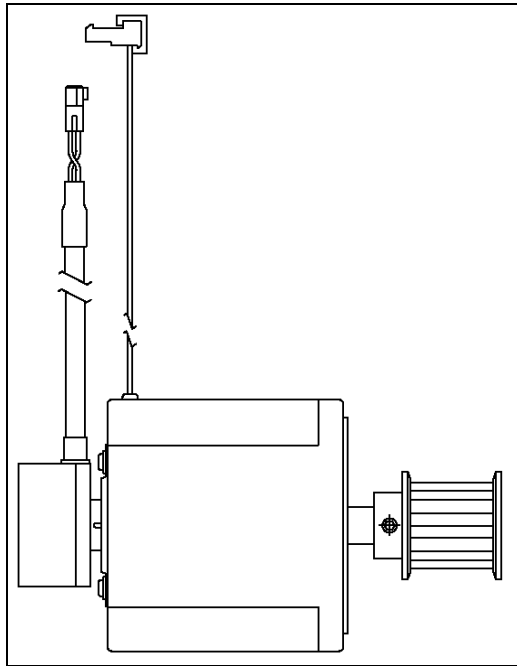
Figure 2-25. X- and y-axis stepper motor assembly

Rotary Stepper Motor

The rotary stepper motor (Figure 2-26) protrudes down from the vertical carriage. It drives the 180° rotation of the extension axis.
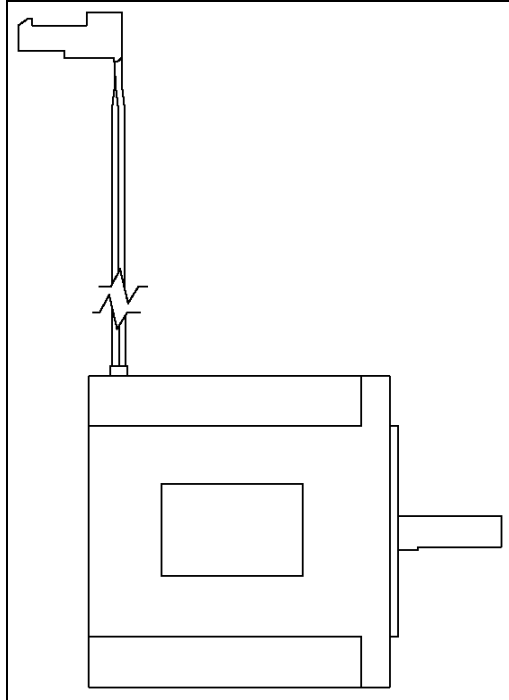
Figure 2-26. Rotary stepper motor

Extension Axis Motor/Encoder Assembly

The extension axis motor/encoder assembly (Figure 2-27) protrudes down from one end of the extension axis. It engages the extension drive belt and drives the gripper assembly forward and backward on the extension rail.
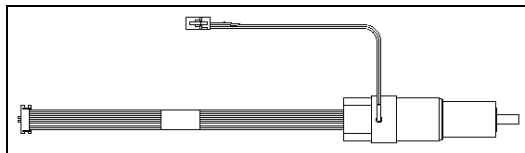
Figure 2-27. Extension axis motor/encoder

Gripper Stepper Motor

The gripper motor (Figure 2-28) is mounted on top of the gripper assembly and opens and closes the gripper jaws.
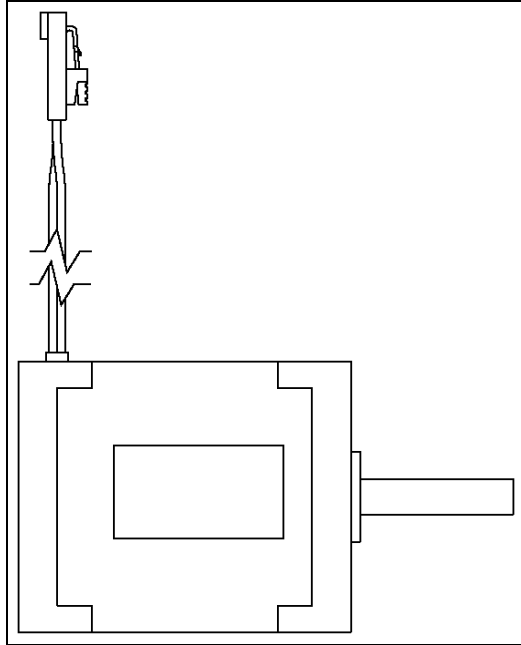
Figure 2-28. Gripper stepper motor

Scanners

The two scanners in the tape library are described below.

Laser Scanner

The laser scanner bar code reader is mounted on the back side of the gripper assembly opposite the gripper jaws. It contains a 670 nm visible laser diode with a bi-directional scan rate of 42 scans per second.

> **WARNING:** This product contains a Class II laser. Laser light - Do not stare into beam. Avoid Exposure - Laser Light is emitted from the bar code scanner.

Auto-Calibration Scanner

The auto-calibration scanner (Figure 2-29) is mounted inside the jaws of the gripper assembly. It contains two 850 nm infrared light-emitting diodes (D4 and D5) and one photo diode (D3). The diodes read placement reflectors on the storage bins and the edges of the tape drive slots to accurately identify the horizontal and vertical location of each storage bin and tape drive. The process of recording the exact location of each bin and drive is known as auto-calibration.

NOTE: This LED scanner is classified as a class 1 laser by IEC 825-1:94/A11:96.
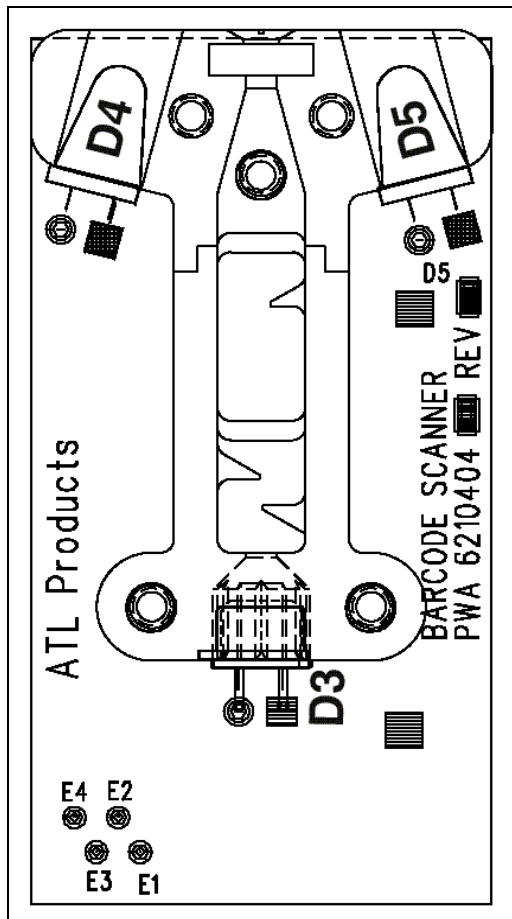
Figure 2-29. Auto-calibration scanner

Storage Array

The storage array holds up to 326 DLT cartridges and includes cartridge bins on the following:

■ rear wall—bins 000 through 169

■ right door—bins 170 through 229

■ left door—bins 230 through 325

Tape drives are arranged in two columns and numbered as shown below:

■ column 0—drives 0 through 7

■ column 1—drives 8 through 15

The cartridge bin and tape drive numbering sequence is shown in Figure 2-30.
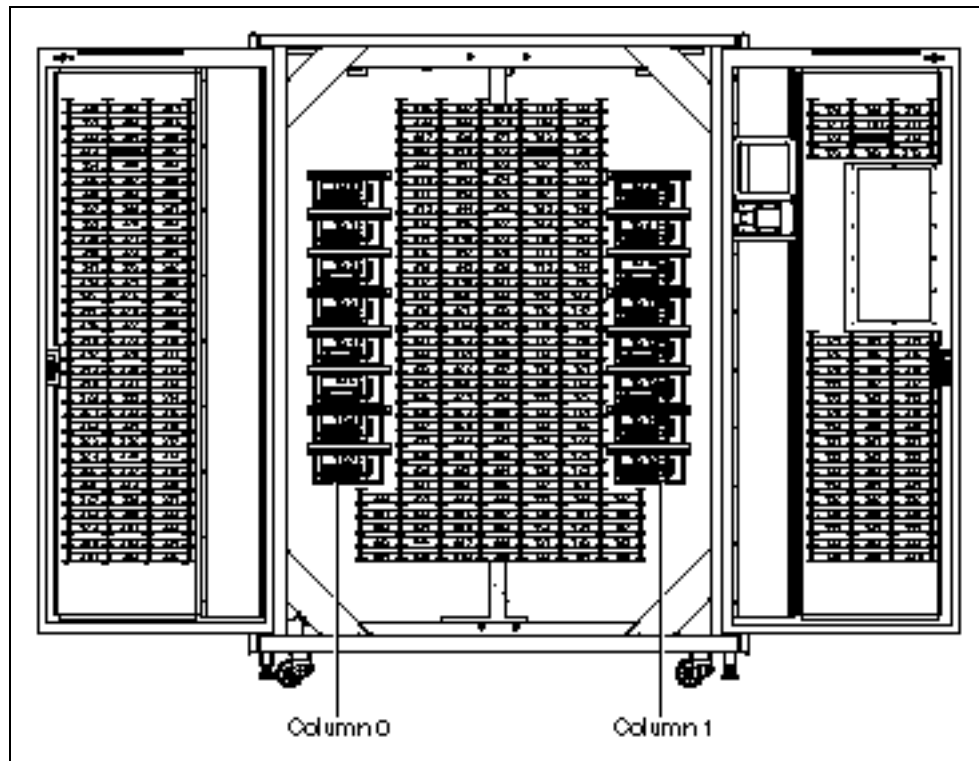
Figure 2-30. Storage array

Load Port

The load port (Figure 2-31) is mounted in the right front door and comprised of two removable 6-cartridge magazines which enable you to swap up to 12 DLT tapes without interrupting tape library operations. While the tape library is operating, you can insert up to 12 tapes in the load port and close the load port door. Once the load port is closed, the tape library robotics inventories the inserted tapes and transfers each to a storage location.
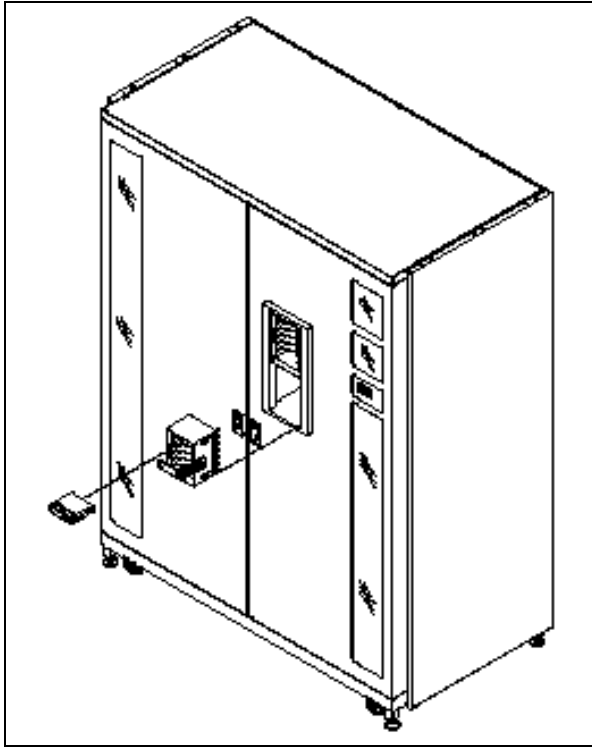
Figure 2-31. Load port

Cooling Fans

There are three identical hot-swap capable fan modules (Figure 2-32) located at the top rear of the tape library cabinet. Each module has one +12 VDC 220 CFM exhaust fan. Each fan module cools one-third of the cabinet. One 3.75 x 12 inch (9.53 x 30.48 cm) fan filter is located at the top of each front door. Air enters through the fan filters, flows to the base of the cabinet, then up the rear of the cabinet, and out the exhaust fans at the top rear of the cabinet.

NOTE: Tape libraries with the redundant fan option have two fans per module.
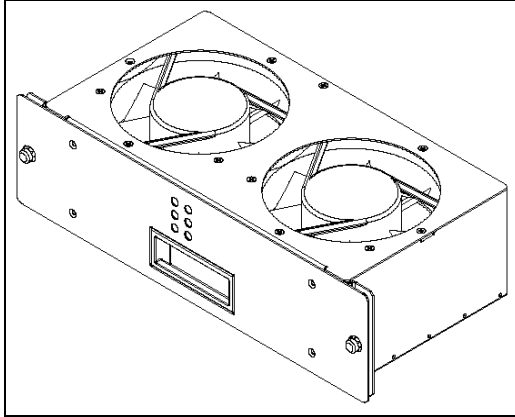
Figure 2-32. 2-fan module

Control Panel

The control panel is the operator interface of the tape library. It includes the:

■ Control panel interface PWA

■ Display panel

■ Touch panel

The display panel is mounted between the control panel interface PWA and the touch panel. Figure 2-33 shows the initial control panel screen.

Figure 2-33. Control panel initial screen

Tape Drives

The tape library holds up to 16 Compaq DLT tape drives (see Figure 2-30). When fewer than 16 tape drives are installed, they must occupy consecutive drive bays beginning with drive bay #0 (top of column 0). You can replace tape drives without turning off the tape library power.

Chapter **3**

Security Levels and Passwords

Introduction

The control panel is the operator interface to the tape library. This chapter describes the following features of the control panel:

■ security level options

■ setting the security level

■ changing the passwords

Security Levels

There are five levels of security for the ESL9000 Series tape library control panel (refer to Table 3-1):

■ *Service (S)—*provides access to all screens and all buttons.

■ *Operator (O)—*provides access to the Overview, Tapes, and Operator screens and the Standby, Load Port, and Stop buttons.

■ *User (U)—*provides access to the Overview and Tapes screens and the Standby, Load Port, and Stop buttons.

■ *Import only (I)—*provides access to the Overview and Tapes screens and Load Port button.

■ *Locked (L)—*provides access to the Overview and Tapes screens only.

The current security level is indicated by the single letters S, O, U, I, or L inside the lock icon on the control panel (Figure 3-1).

Figure 3-1. Control panel security

Table 3-1
Security Levels (listed from highest to lowest)

Security Level	Icon	Password Required	Screen Access				Button Access		
			Overview	Tapes	Operator	Service	Standby	Load Port	Stop
Service	S	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Operator	O	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
User	U	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Import Only	I	Yes	Yes	Yes	No	No	No	Yes	No
Locked	L	No	Yes	Yes	No	No	No	No	No

Setting the Security Level

To change security levels:

1. Press the **Lock** icon.
   The Password screen appears (see Figure 3-2).

2. Press the desired security level button (**Service**, **Operator**, **User**, **Import Only**, or **Locked**).

3. Enter the appropriate password (refer to Table 3-2).

4. Press the **Select** button.

   A screen indicating that the new security level has been set successfully appears.

5. Press the **Ok** button.

   The lock icon displays the new level of security (S, O, U, I, or L).
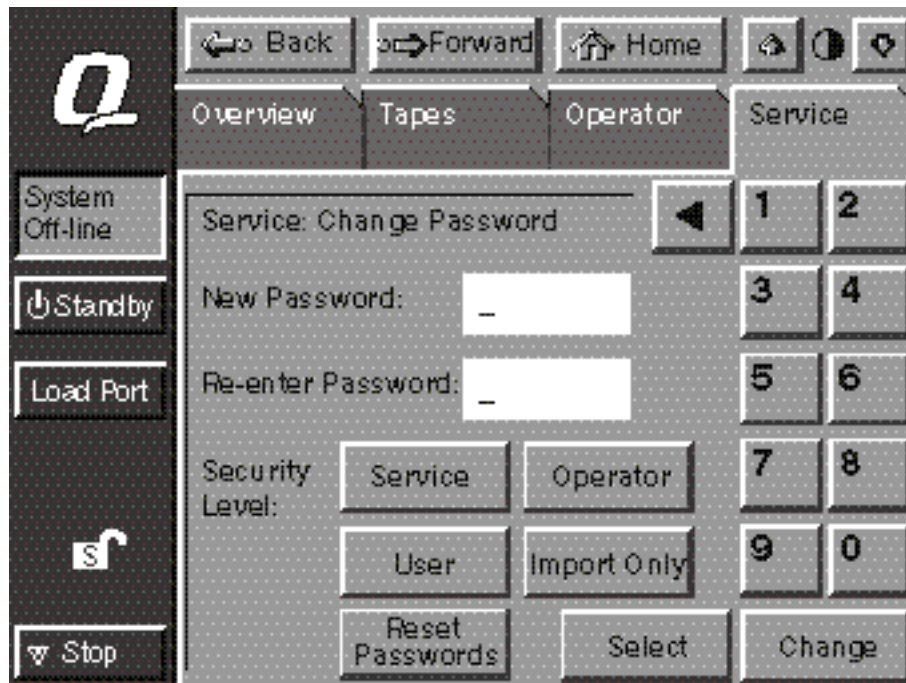
Figure 3-2. Setting the security level

Table 3-2
Factory Default Passwords

Security Level	Factory Default Password
Service	5678
Operator	1234
User	2222
Import only	1111
Locked	No password required

Changing the Passwords

To change a password:

1. Press the Service screen tab (Figure 3-3).

2. Enter the current Service screen password (the default is 5678).

3. Press the **Enter** button.

   The Service screen is shown in Figure 3-4.

4. Press the **Change Password** button.

   The Change Password screen is shown in Figure 3-5.

5. Enter the new password.

6. Press the **Select** button.

7. Re-enter the new password.

8. Press the button (**Service**, **Operator**, **User**, or **Import Only**) that corresponds to the security level to which the new password will apply.

9. Press the **Change** button.

   A screen indicating that a new password has been set successfully appears.

10. Press the **Ok** button.

Figure 3-3. Service password prompt
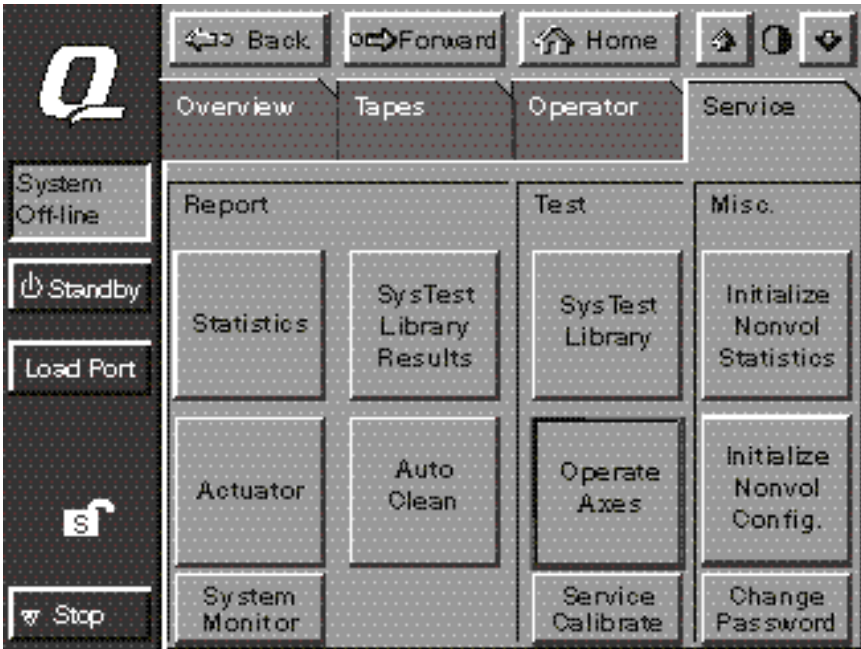
Figure 3-4. Service screen
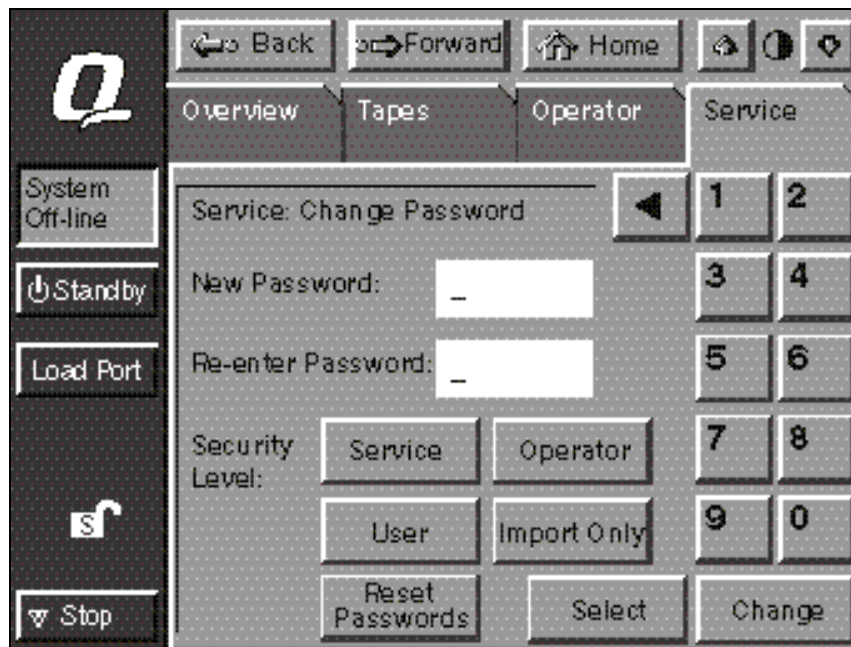
Figure 3-5. Change password screen

To set a new password:

1. Set the security level back to User.

2. Select the screen that has the new password.

3. Enter the new password when prompted by the Password screen.

Chapter **4**

Control Panel Service Screen

Introduction

This chapter describes the following options found in the control panel Service screen:

■ Displaying actuator, auto-clean, statistical, and system test reports

■ Performing axes operations and system tests

■ Initializing nonvolatile statistics and configuration

> **NOTE:** For information about using the Overview, Tapes, or Operator screens, refer to the *Compaq StorageWorks ESL9000 Series Tape Library Reference Guide* (part number 146583-001).

The Service screen (Figure 4-1) is restricted to users with Service security clearance. When you press the Service tab, a dialog box appears requesting a password. Enter the correct password to gain access to the Service screen. The factory default password is 5678. To change the password, refer to Chapter 3, "Security Levels and Passwords."

Figure 4-1. Service screen

Figures 4-2 and 4-3 show an overview of the Service screen.
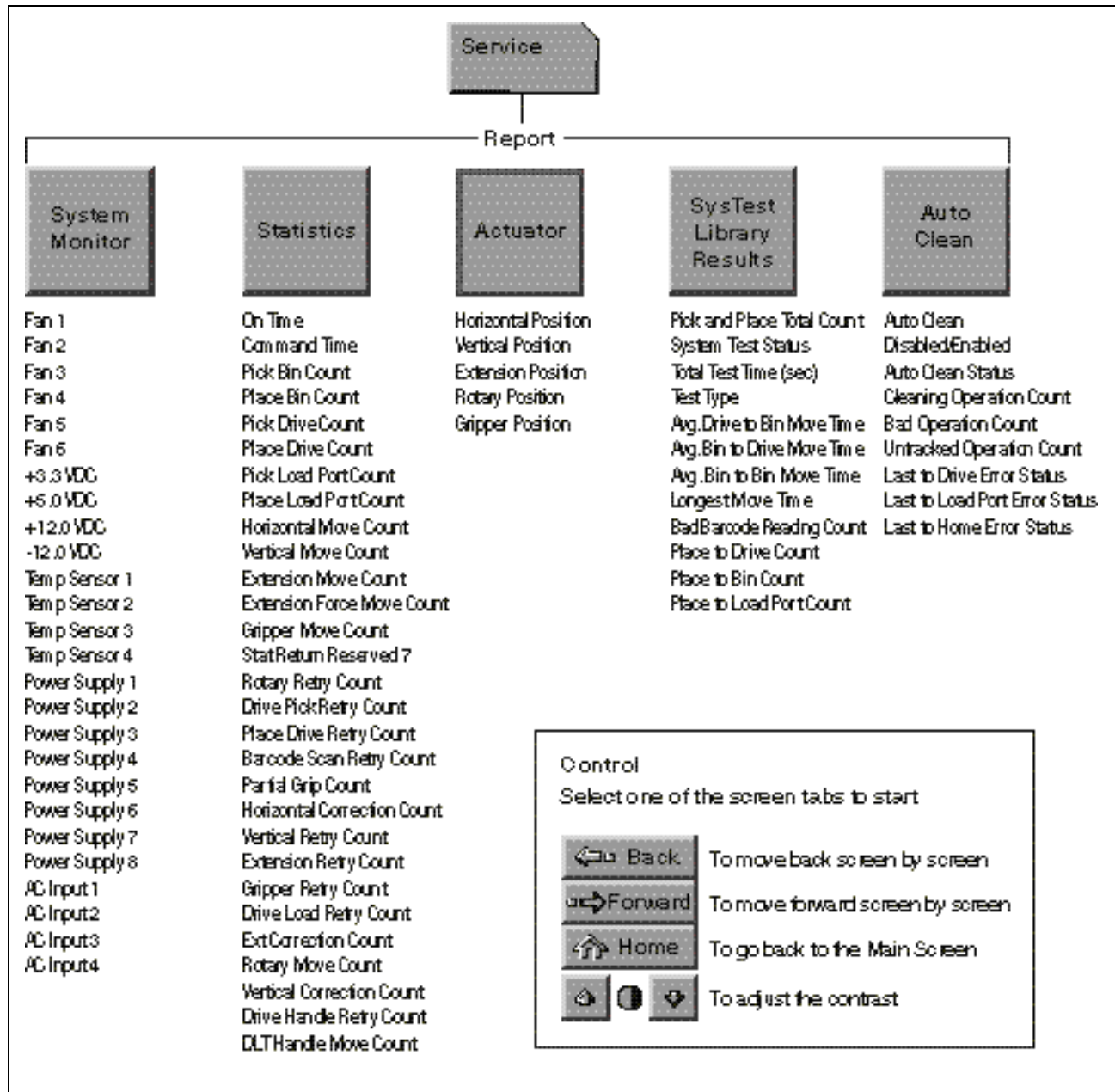
Figure 4-2. Control panel service screen (1 of 2)
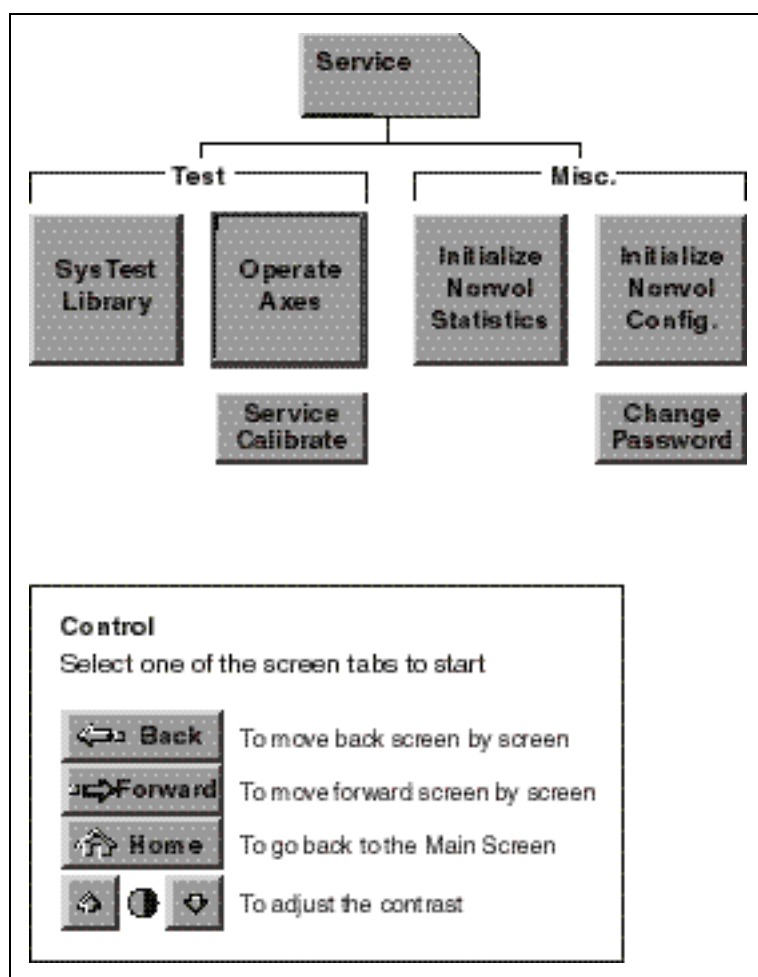
Figure 4-3. Control panel service screen (2 of 2)

Generating Reports

You can generate on-screen reports from the Service screen about:

■ Tape library operation statistics

■ Auto-clean status and tracking information

■ Actuator positions and status

■ System test results

■ Critical tape library component status

To generate any of these reports, press the appropriate button in the Service screen. Within a few seconds the report is displayed on the screen.

Figure 4-4 shows a sample statistics report.
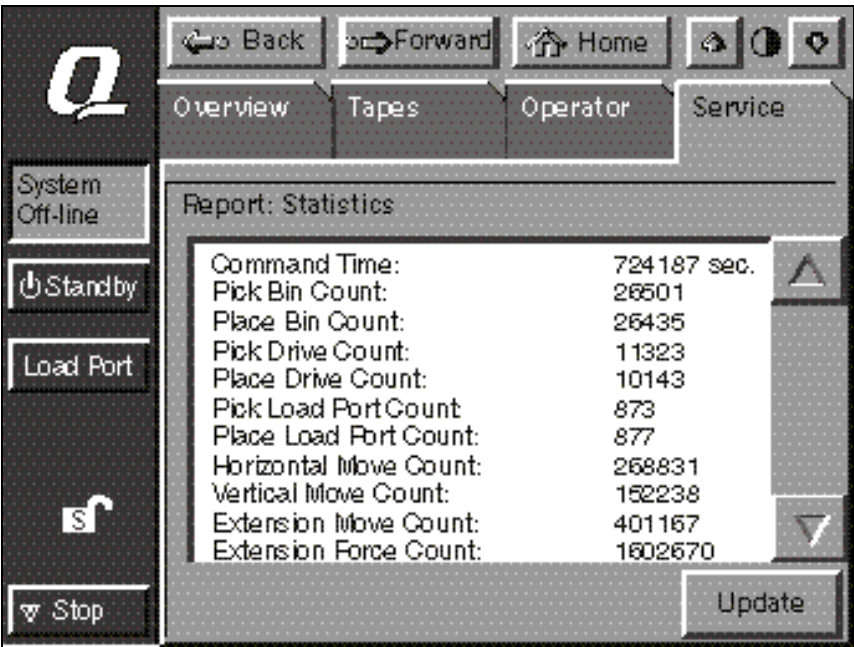
Figure 4-4. Statistics report

Testing the Tape Library

The Service screen provides the following two test options:

■ *SysTest Library*—This option tests the tape library operation by swapping tape cartridges between storage bins or tape drives.

■ *Operate Axes*—This option lets you select self-test, home, position, and exercise options with specific tape library elements. This option is not currently implemented. Instead use the tape library diagnostic software to perform these functions.

SysTest Library

To perform a System Test:

1. On the Service screen, press the **Systest Library** button.

2. Select one of the following system tests:

   ❑ *Swap Bins*—tests storage bins only

   ❑ *Swap Drives*—tests tape drives only

   ❑ *Swap Bins and Swap Drives*—tests both bins and tape drives

3. Select the desired test options:

   ❑ *Random*—swaps cartridges at random

   ❑ *Use Barcode*—reads bar code label as cartridges are swapped

   ❑ *Continuous*—repeats the test continuously until aborted

4. Press the **Execute** button.

   An In Process dialog screen appears.

5. Press the **Abort** button to stop the selected test.

6. Press the **Back** button to return to the main Service screen.

Operate Axes Tests

Use the Operate Axes option to perform the following tests on any of the tape library axes:

■ *Selftest*—check the basic operation of the selected axis

■ *Home*—send the selected axis to its home position

■ *Move to*—move the selected axis to a specified position

■ *Exercise*—operate the selected axis through its full range of motion

To perform a test with a particular axis:

1. On the Service screen, press the **Operate Axes** button.

   The Test: Operate Axes screen appears.

2. Highlight the desired axis in the Axes column.

3. Highlight the desired test in the Operation column.

4. Press the **Select** button.

   NOTE If you selected Move to in step 3, the Move to screen is displayed. Proceed to step 5.

5. Select a destination:

   ❑ Bin

   ❑ Drive

   ❑ Gripper

   ❑ Load Port

   ❑ Position

6. Enter the destination element number or the position (in inches).

   NOTE: The Gripper and Load Port do not require an element number.

7. Press the **Select** button.

   An In Progress dialog screen appears.

8. Press the **Abort** button to stop the selected test.

9. Press the **Back** button to return to the main Service screen.

Service Calibrate

The Service Calibrate button performs a regular calibration of the entire tape library. It is identical to "Calibrate All". Note that this procedure requires that the tape library be emptied of all tapes.

Initializing Nonvolatile Information

The Service screen has two options for initializing nonvolatile memory:

■ *Initialize Nonvolatile Statistics—*purges nonvolatile memory of all statistical information about tape library operation, which is used to generate the statistical report, as described earlier in this chapter.

■ *Initialize Nonvolatile Config—*returns the tape library configuration to the factory default configuration.

To perform nonvolatile memory initialization:

1. On the Service screen, press one of the **Initialize Nonvolatile** memory buttons.

   The verification screen appears.

2. Press the **Ok** button to continue with the initialization process.

3. Press the **Back** button to return to the main Service screen.

Cleaning, Lubrication, and Adjustments

Introduction

This chapter describes the following procedures:

■ Cleaning and Lubrication

■ Belt tension adjustments

> **NOTE:** Maintenance should be performed only by an authorized Compaq service provider.

Cleaning and Lubrication

To optimize tape library performance, the following components can be cleaned and/or lubricated:

■ Fan filters

■ Vertical rails

■ Horizontal rail

■ Horizontal roller bracket

■ Extension axis

■ Gripper cam and roller

■ Tape drives

Use a lint free cloth that is dry or dampened with isopropyl alcohol for cleaning rails, cams, and rollers. For lubrication, use only the lubricating oil with Teflon (in the accessory kit) specified for use with the tape library.

Fan Filters

The tape library has two 3.75 x 12 in (9.53 x 30.48 cm) fan filters. One filter is located at the top of each front door.

1. Open the left and right doors.

2. Slide each fan filter out from the top of each door.

3. Vacuum the dust from each fan filter.

4. Reinstall the fan filters and close the front doors.

Vertical Rails

There are two 1.5 x 65.75 in (3.81 x 167 cm) vertical rails in the tape library. The rotary and extension axes are mounted to the vertical base plate that slides up and down on the two vertical rails.

1. Use a lint free cloth to remove all dirt and grease that has accumulated on both vertical rails.

2. Spread a thin film of lubricant across the entire surface of both vertical rails.

Horizontal Rail

The horizontal rail is 47 in (119.38 cm) long, is mounted across the base of the cabinet, and is part of the robotics horizontal transport mechanism.

1. Use a lint free cloth to remove all dirt and grease that has accumulated on the horizontal rail.

2. Spread a thin film of lubricant across the entire surface of the horizontal rail.

Horizontal Roller Bracket

The horizontal roller bracket is a 0.0625 in thick x 1 in high (0.159 x 2.54 cm) bracket welded to the inside of the top of the cabinet. It spans the width of the cabinet and is a guide for the rollers of the vertical top plate.

Use a lint free cloth to remove all dirt and grease that has accumulated on the horizontal roller bracket.

Rotary Axis Gears

The rotary axis has a 252-tooth gear that is engaged by the rotary axis motor gear to rotate the axis 180 degrees.

1. Use a can of compressed air to clean any dirt that has accumulated on the rotary axis gear, and rotary axis motor gear.

2. Spread a thin film of lubricant on both gears and manually spin the rotary axis.

3. Remove any excess lubricant.

Extension Axis Rail and Follower Guide

The extension axis rail is an 8 in (20.32 cm) case-hardened, carbon steel rail on which the gripper assembly moves from one end of the extension axis to the other. The follower guide is a black molded strip that is parallel to the extension axis rail and serves as a guide for the gripper assembly.

1. Use a lint free cloth to remove all dirt and grease from the extension axis rail and follower guide.

   > **CAUTION:** Do not lubricate the extension axis follower guide.

2. Apply a thin film of lubricant across the entire surface of the extension axis rail.

3. Manually move the gripper assembly forward and backward on the extension axis rail and follower guide.

4. Remove any excess lubricant from the extension axis rail.

5. Use a can of compressed air or a cotton swab dampened with isopropyl alcohol to clean the extension axis home sensor at the end of the extension interconnect PWA.

Gripper Assembly

The gripper assembly is mounted on top of the extension axis assembly, and contains the jaws that close and open to grip and release a DLT cartridge.

1. Use a can of compressed air or a cotton swab dampened with isopropyl alcohol to clean any dust that has accumulated inside the gripper jaws, especially on the CIG sensors.

2. Use a can of compressed air or a cotton swab dampened with isopropyl alcohol to clean the gripper open and gripper closed optical sensors on the gripper interconnect PWA at the end of the gripper motor shaft.

Tape Drives

The tape library has an autoclean feature that can be set from the control panel "Config:Options" screen. When Autoclean is selected, the tape library monitors the status of each tape drive and automatically sends a cleaning cartridge to the drive when cleaning is required.

> **CAUTION:** The auto-clean feature is not compatible with all software applications and may result in an error condition where the library attempts to place a data cartridge into a tape drive that has a cleaning tape present.

Cleaning of the tape drives is an operator function that should only be performed when the "Use Cleaning Tape" LED is illuminated on the tape drive front panel.

> **CAUTION:** Cleaning cartridges are made of abrasive material. Routinely cleaning the tape drive when it is not requested by the drive will prematurely wear out the tape drive head.

If the "Use Cleaning Tape" LED is illuminated, clean the tape drive using the following procedure:

1. Turn on the tape library power.

2. Open the tape drive handle.

3. Insert a cleaning tape into the tape drive.

4. Close the tape drive handle.

   The tape drive loads the cleaning cartridge, begins flashing the "Tape In Use" LED, and uses the cleaning cartridge for approximately five minutes.

5. When the "Tape In Use" LED goes off, and the "Operate Handle" LED lights, open the tape drive handle.

6. Wait two seconds after the cleaning cartridge is ejected, then remove the cartridge from the drive.

Checking and Adjusting Belt Tension

Table 5-1 describes the three timing belts in the tape library that should be checked and adjusted for proper tension.

Table 5-1
Belt Specifications

Belt	Width	Length	Tension Adjustment	Metric Adjustment
Vertical	1.0 in (2.54 cm)	143 in (3.63 m) (cut to fit during installation)	42-46 oz applied at mid-span will deflect the belt 1 in.	2.63-2.88 lbs applied at mid-span will deflect the belt 2.54 cm.
Horizontal	1.0 in (2.54 cm)	345 in (8.67 m) (cut to fit during installation)	42-46 oz applied at mid-span will deflect the belt 1 in.	2.63-2.88 lbs applied at mid-span will deflect the belt 2.54 cm.
Extension axis	3/16 in (0.48 cm)	Endless loop	2.5-3.0 oz applied at mid-span will deflect the belt 0.11 in.	70.87-85.00 gms applied at mid-span will deflect the belt 0.28 cm.

Vertical Belt (154864-001)

Use the following procedures to check and adjust the vertical belt tension:

Tension Measurement

Required Tool:

■ 60-oz (3.75-lb) force gauge (158910-001 or 158912-001)

1. Open the front doors of the tape library.

2. Move the vertical carriage to the base of the cabinet.

3. Using the force gauge at the mid-span of the vertical belt, deflect one side of the belt in until it just touches the opposite side of the belt with the belt cogs interleaved. The force requirement to deflect one side of the belt until it just touches the opposite side of the belt is 42 - 46 oz (2.63 - 2.88 lbs).

4. If tension is outside the above specification, proceed to the tension adjustment.

Tension Adjustment

Required Tools:

■ Phillips screwdriver

■ 5/32-in hex wrench

1. Turn off the tape library power.

2. To gain access to the right-side upper belt clamp screw:

   a. Disconnect all cables on the y-axis interconnect PWA.

   b. Remove the four screws that secure the y-axis interconnect ESD shield in place, and remove the shield (see Figure 5-1).

   c. Remove the Phillips screw near the right edge of the y-axis interconnect that secures it to the vertical carriage.

   d. Remove the Phillips screw that secures the inside y-axis interconnect mounting bracket to the vertical carriage.

   e. Remove the two Phillips screws that secure the outside y-axis interconnect mounting bracket to the vertical carriage.

   f. Remove the y-axis interconnect and its mounting brackets from the vertical carriage.

3. Move the vertical carriage to the base of the cabinet.

4. Loosen the two upper clamp screws (see Figure 5-2).

5. Loosen the belt adjustment screw locknut.

6. To tighten belt tension, turn the adjustment screw clockwise or to loosen belt tension, turn the adjustment screw counterclockwise.

7. Tighten the upper clamp screws.

8. Tighten the belt adjustment screw locknut.

9. Recheck the belt tension.

10. Reinstall the y-axis interconnect PWA.

11. Using the diagnostic software, calibrate the tape library.
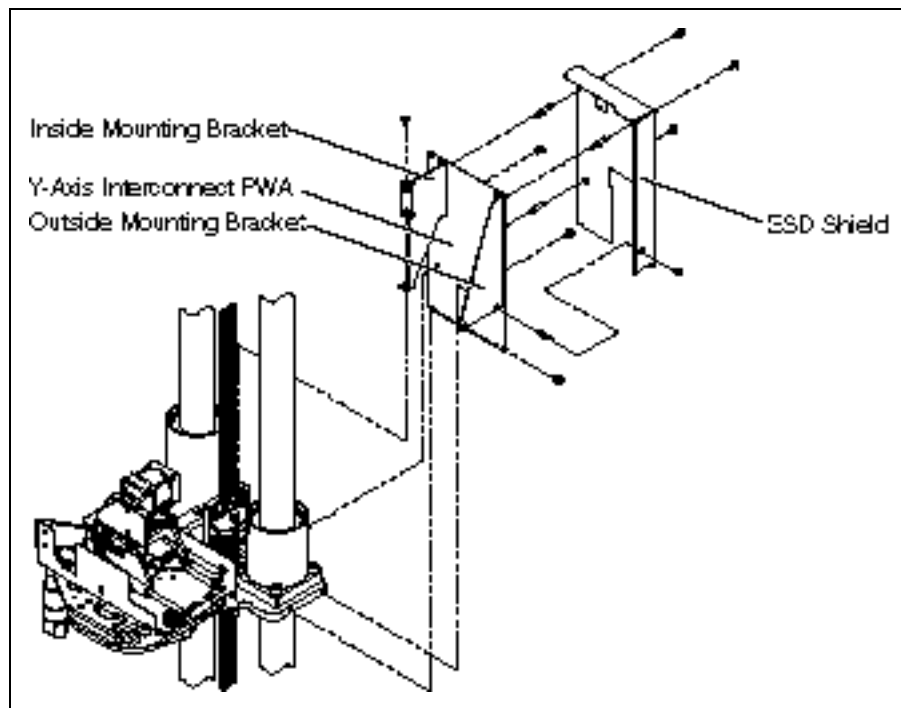
Figure 5-1. Vertical belt clamp access
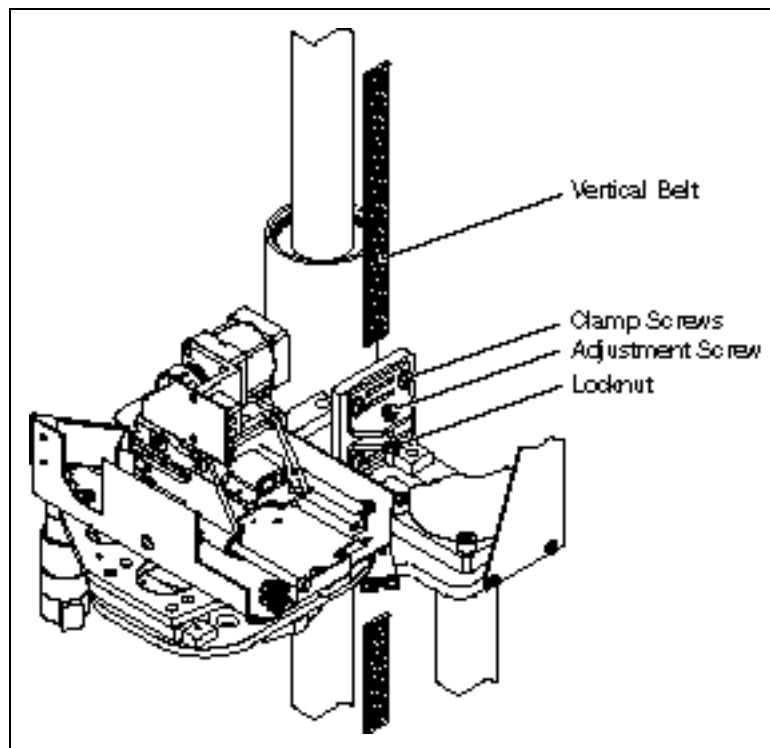
Figure 5-2. Vertical belt clamp adjustment

Horizontal Belt

Use the following procedures to check and adjust the horizontal belt tension:

Tension Measurement

Required Tool:

■ 60-oz (3.75-lb) force gauge (158910-001 or 158912-001)

1. Open the front doors of the tape library.

2. Move the vertical carriage to the base and right edge of the cabinet.

3. Using the force gauge at the mid-span of the horizontal belt, (at the base of the cabinet) deflect the top side of the belt down until it just touches the bottom side of the belt with the belt cogs interleaved. The force requirement to deflect the top side of the belt until it just touches the bottom side of the belt is 42 - 46 oz (2.63 - 2.88 lbs).

4. If tension is outside the above specification, proceed to the tension adjustment.

Tension Adjustment

Required Tools:

■ Phillips screwdriver

■ 5/32-in hex wrench

■ Tie-wrap

1. Turn off the tape library power.

2. Manually raise the vertical carriage to the middle of the cabinet.

3. To hold the vertical carriage, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap (see Figure 5-3).
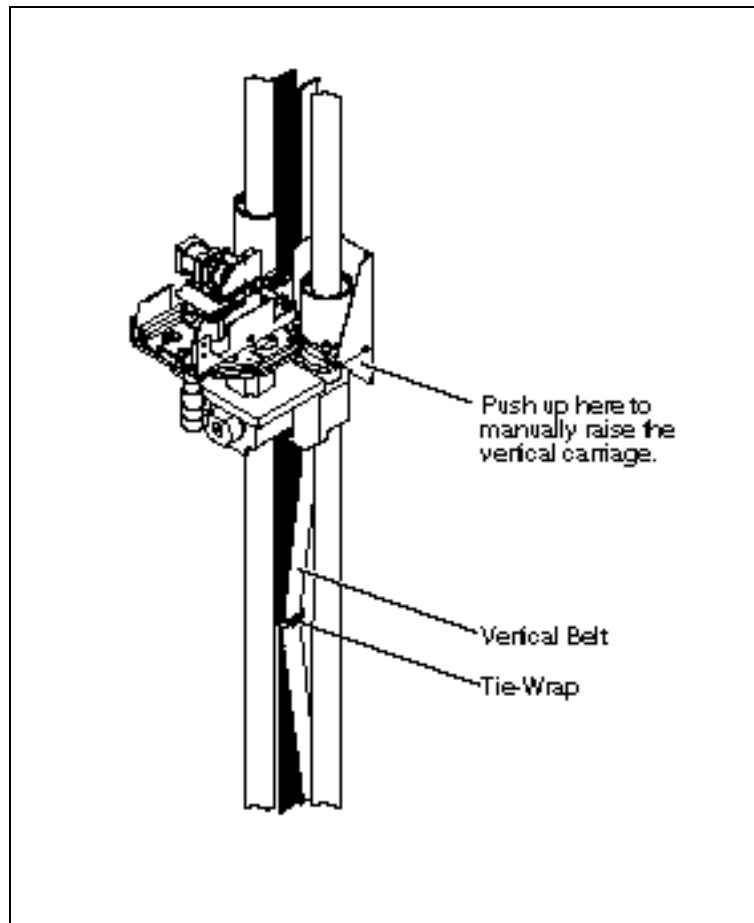
Figure 5-3. Securing the vertical carriage

4. Locate the belt clamps at the rear of the horizontal carriage (see Figure 5-4).

5. Loosen the two right-side belt clamp screws.

6. Loosen the adjustment screw locknut (see Figure 5-4).

7. To tighten belt tension, turn the adjustment screw clockwise or to loosen tension, turn the adjustment screw counterclockwise.

8. Tighten the right-side belt clamp screws.

9. Tighten the adjustment screw locknut.

10. Recheck the belt tension.

11. Using the diagnostic software calibrate the tape library.
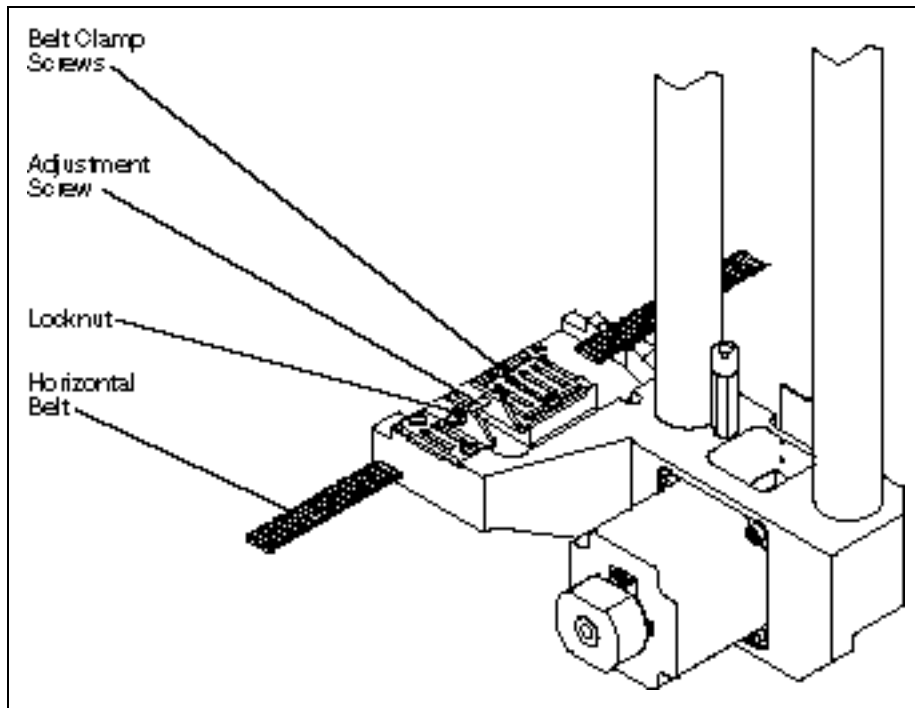
Figure 5-4. Horizontal belt adjustment

Extension Axis Belt

Use the following procedures to check and adjust the extension belt tension.

Tension Measurement

Required Tools:

■ Touch gauge (Compaq part number 158911-001)

■ Force gauge (Compaq part number 158910-001 or 158912-001)

1. Open the front doors of the tape library.

2. Manually raise the vertical carriage to just below eye-level.

3. To hold the vertical carriage, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap (see Figure 5-3).

4. Remove the extension axis ESD cover.

5. Move the gripper assembly all the way forward on the extension axis.

6. Place the extension axis touch gauge inside the extension axis belt, close to the center of the belt span (see Figure 5-5).

7. Using the extension axis force gauge, pull on the outside of the belt until it just contacts the touch gauge.

8. When the belt contacts the touch gauge, note the reading on the force gauge. The gauge should be deflected to approximately the center hole position. If only one hole or all three holes on the force gauge are exposed, adjustment is required.

9. If tension is outside the above specification, proceed to the tension adjustment.
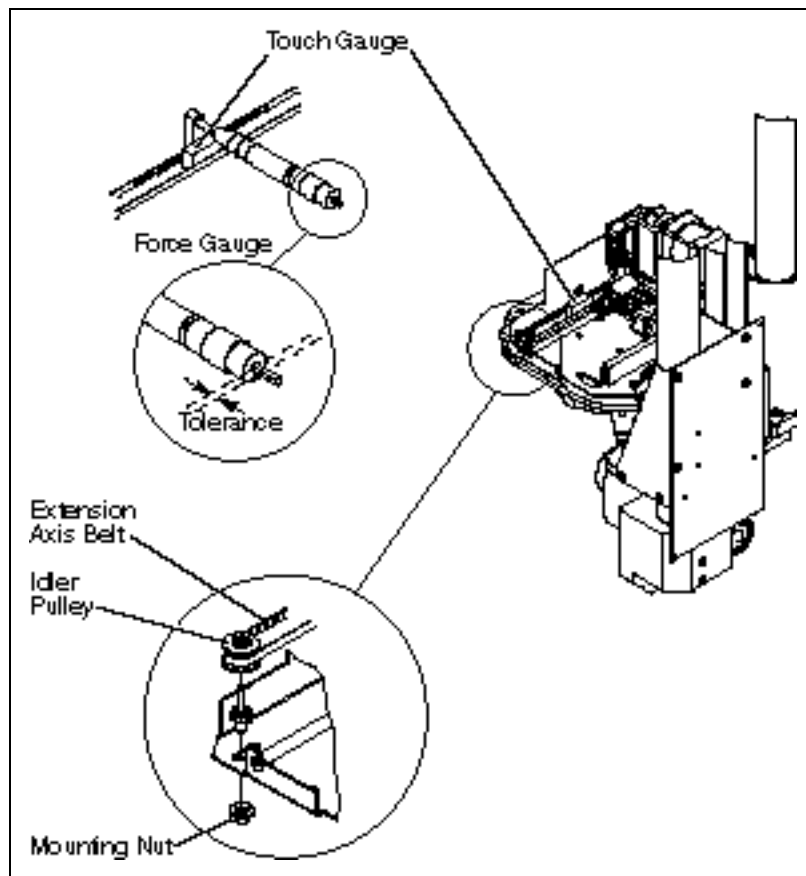
Figure 5-5. Extension axis belt adjustment

Tension Adjustment

Required Tool:

■ 3/8-in hex wrench

1. Loosen the idler pulley mounting nut one revolution.

2. Pull on the idler pulley to apply tension to the belt.

3. Tighten the idler pulley mounting nut.

4. Recheck the belt tension.

Fault Isolation

Introduction

This chapter provides a fault isolation table describing symptoms, corresponding causes, and corrective actions. For some symptoms, there are test questions and answers to help narrow the root cause of the problem.

When the table refers to connector numbers, see the tape library block diagram in Appendix B for connector locations.

This fault isolation table is to be used with the Compaq training and the diagnostic software to effectively troubleshoot problems with the tape library.

**Table 6-1
Fault Isolation**

Symptom	Test Question	Answer	Possible Cause	Corrective Action
Control panel does not light up when touched.	Are fans at rear top running?	No	No power is applied to the tape library.	1. Plug in the tape library.
				2. Turn on the AC distribution circuit breaker(s).
				3. Turn on the front panel power switch.
				4. Verify facility power is present.
			Power switch is defective.	Replace the power switch.
		Yes	Control panel assembly is defective.	Replace the control panel assembly.
			Control panel control cable is defective.	Replace the control panel control cable.
			Robotics backplane is defective.	Replace the robotics backplane.

Table 6-1
Fault Isolation *continued*

Symptom	Test Question	Answer	Possible Cause	Corrective Action
Control panel does not light up when touched *(cont.)*.	Is +5 and +12 VDC present at test points on control panel interface PWA?	Yes	Control panel interface PWA or display panel is defective.	Replace the control panel assembly.
		No	Control panel ribbon cable is not seated tightly.	1. Reseat the ribbon cable at control panel connector J2.
				2. Reseat the ribbon cable at robotics backplane connector J23.
			Robotics backplane is defective.	Replace the robotics backplane PWA.
Host indicates logical unit (tape library) is not ready.	Is tape library in standby mode (see control panel indicator)?	Yes	Control panel **Standby** button is set.	Release control panel **Standby** button.
Diagnostics from PC comes up in simulation mode	Is tape library in standby mode (see control panel indicator)?	No	Tape library is not in standby (off-line and ready for diagnostic communication) mode.	Press the control panel **Standby** button, and restart diagnostics.
		Yes	PC to tape library RS-232 diagnostic interface cable is missing or loose.	Connect or reseat the RS-232 interface cable between COM1 of the diagnostic PC and J2 of the tape library robotics controller, and restart diagnostics.
				Note: Diagnostics can be set to communicate through the PC COM port #2.
	Is tape library in standby mode and the RS-232 diagnostic interface cable secure?	Yes	The diagnostic software was started using an improper baud rate for communication with the tape library.	To set the diagnostic PC communication baud rate to 9600 (the default is 2400), use the following command when starting the diagnostics:
				tapelib /b9600 <Enter>
B 47 00 error SCSI Parity Error			Host-to-tape library SCSI cable is too long. Total SCSI cabling, (for differential SCSI) including internal SCSI bus cables may not exceed 82 ft (25 m).	Shorten the overall SCSI bus cable length. (Move the tape library closer to the host and use a shorter host-to- tape library SCSI cable if necessary.)
			Loose SCSI bus cable connection	Check all SCSI bus cable connections. Reseat cables as necessary.

continued

Table 6-1
Fault Isolation *continued*

Symptom	Test Question	Answer	Possible Cause	Corrective Action
_ 80 01 error DLT Drive Requires Cleaning			A DLT tape drive requires cleaning.	Identify which DLT tape drive has the "Use Cleaning Cartridge" indicator lit and clean the drive.
2 08 07 error System Is Stopped			The control panel **Stop** button is selected.	Release the control panel **Stop** button.
6 80 07 error System Stop Button Was Pressed			The control panel **Stop** button is selected.	Release the control panel **Stop** button.
2 80 09 error Logical Unit is Turned Off-line			The control panel **Standby** button is selected.	Release the control panel **Standby** button.
B 80 10 error Load Retry Failed			Robotics was unable to load a tape in a drive because of mis-calibration of the drive.	Using the diagnostic software, calibrate the tape drives.
			DLT tape drive is defective.	Replace the failing DLT tape drive.
B 80 0A error NVRAM Checksum Failure			Nonvolatile RAM contents is corrupted.	Using the diagnostic software, initialize NVRAM, set the tape library configuration, and calibrate the tape library.
B 80 0D error Cartridge is Partially Gripped	Is this a recurring error?	No	A DLT cartridge is not fully seated in the gripper.	Use a move medium command to move the partially gripped cartridge to an empty storage bin.
		Yes	The extension axis is defective.	Replace the extension axis assembly.
B 81 04 error Gripper Open Failure			The gripper did not reach the open position.	Use the diagnostic software to test the gripper. If gripper tests fail, replace the extension axis assembly.
B 81 05 error Gripper Close Failure			The gripper did not reach the closed position.	Use the diagnostic software to test the gripper. If gripper tests fail, replace the extension axis assembly.
4 81 54 error Gripper TPU Register Failure			The robotics controller PWA is defective.	Replace the robotics controller PWA.

continued

Table 6-1
Fault Isolation *continued*

Symptom	Test Question	Answer	Possible Cause	Corrective Action
B 82 04 error Rotary Front Failed			The rotary axis failed to reach the front position.	Use the diagnostic software to test the rotary axis. If rotary axis tests fail:
				1. Replace the rotary axis sensor PWA.
				2. Replace the rotary axis motor.
B 82 05 error Rotary Back Failed			The rotary axis failed to reach the back position.	Use the diagnostic software to test the rotary axis. If rotary axis tests fail:
				1. Replace the rotary axis sensor PWA.
				2. Replace the rotary axis motor.
4 82 08 error Rotary Home Not Found			The rotary axis failed to reach the home position.	Use the diagnostic software to test the rotary axis. If rotary axis tests fail:
				1. Replace the rotary axis sensor PWA.
				2. Replace the rotary axis motor.
4 82 03 error Extension Current Feedback Failure			The extension axis is failing to place a cartridge in a storage bin or tape drive due to mis-calibration.	Calibrate the tape library.
			The extension axis rail is dry or clogged with dirt.	Clean and lubricate the extension axis rail.
4 83 08 error Extension Home Not Found			The extension axis rail is dry or clogged with dirt.	Clean and lubricate the extension axis rail.
			The extension axis belt tension is out of adjustment.	Check the extension axis belt tension.
			The extension axis motor or encoder is defective.	Replace the extension axis assembly.
4 83 20 error Extension Test Failure			The extension axis motor power or encoder cable is not seated tightly.	Reseat the extension axis motor power and encoder cables (J2 and J3 on the extension interconnect PWA).
			The extension axis motor or encoder is defective.	Use the diagnostic software to test the extension axis. If the tests fail, replace the extension axis.
4 83 50 error Extension Sensor Fail			One of the cartridge-in-gripper (CIG) sensors inside the gripper jaws is dirty.	Clean the gripper.

continued

Table 6-1
Fault Isolation *continued*

Symptom	Test Question	Answer	Possible Cause	Corrective Action
B 84 01 error Vertical Timeout			The vertical motor or encoder cable is not seated tightly.	Check the vertical motor and encoder cables (at J5 and J6 of the x-carriage interconnect PWA).
			The vertical rails are dirty or dry.	Clean and lubricate the vertical rails.
			The vertical belt tension is out of adjustment.	Check the vertical belt tension.
			The vertical motor or encoder is defective.	Replace the vertical motor assembly.
4 84 08 error Vertical Home Not Found			The vertical motor or encoder cable is not seated tightly.	Check the vertical motor and encoder cables (at J5 and J6 of the x-carriage interconnect PWA).
			The vertical rails are dirty or dry.	Clean and lubricate the vertical rails.
			The vertical belt tension is out of adjustment.	Check the vertical belt tension.
			The vertical motor or encoder is defective.	Replace the vertical motor assembly.
4 84 20 error Vertical Test Failure			The vertical motor or encoder cable is not seated tightly.	Check the vertical motor and encoder cables (at J5 and J6 of the x-carriage interconnect PWA).
			The vertical rails are dirty or dry.	Clean and lubricate the vertical rails.
			The vertical belt tension is out of adjustment.	Adjust the vertical belt tension.
			The vertical motor or encoder is defective.	Replace the vertical motor assembly.
B 85 01 error Horizontal Timeout			The horizontal motor or encoder cable is not seated tightly.	Check the horizontal motor and encoder cables (at J25 and J26 of the robotics backplane PWA, and at the flying connectors a few inches from the motor).
			The horizontal rail is dirty or dry.	Clean and lubricate the horizontal rail.
			The horizontal belt tension is out of adjustment.	Adjust the horizontal belt tension.
			The horizontal motor or encoder is defective.	Replace the horizontal motor assembly.

continued

Table 6-1
Fault Isolation *continued*

Symptom	Test Question	Answer	Possible Cause	Corrective Action
4 85 20 error Horizontal Test Failure			The horizontal motor or encoder cable is not seated tightly.	Check the horizontal motor and encoder cables (at J25 and J26 of the robotics backplane PWA, and at the flying connectors a few inches from the motor).
			The horizontal rail is dirty or dry.	Clean and lubricate the horizontal rail.
			The horizontal belt tension is out of adjustment.	Adjust the horizontal belt tension.
			The horizontal motor or encoder is defective.	Replace the horizontal motor assembly.
4 85 22 error Horizontal Encoder Failure			The horizontal motor or encoder cable is not seated tightly.	Check the horizontal motor and encoder cables (at J25 and J26 of the robotics backplane PWA, and at the flying connectors a few inches from the motor).
			The horizontal rail is dirty or dry.	Clean and lubricate the horizontal rail.
			The horizontal belt tension is out of adjustment.	Adjust the horizontal belt tension.
			The horizontal motor or encoder is defective.	Replace the horizontal motor assembly.
6 88 00 error Safe Temperature Exceeded			One of the rear access doors is open.	Close all rear access doors.
			One of the hot-swap fan modules is not functioning.	Replace the failing fan module.
4 88 01 error Maximum Temperature Exceeded			One of the rear access doors is open.	Close all rear access doors.
			One of the hot-swap fan modules is not functioning.	Replace the failing fan module.
5 8A 02 error Uncalibrated Position			The tape library calibration values have been corrupted.	Calibrate the tape library.

continued

Table 6-1
Fault Isolation *continued*

Symptom	Test Question	Answer	Possible Cause	Corrective Action
Tape drive has all indicators on face of drive on solid.			Poor connection at power connector J5 of the associated Drive Sideboard PWA.	Reseat the power connector at J5 of the associated Drive Sideboard PWA.
			Defective tape drive.	Replace the tape drive assembly.
Tape drive has all indicators on face of drive flashing.			Tape drive has "swallowed" its take-up reel leader.	Replace the tape drive assembly.
B 8D 01 error DLT Drive Handle Timeout			Tape drive handle stepper motor is not functioning.	Retry the command. If failure recurs replace the tape drive assembly.
4 8D 24 error DLT Handle Hardware			Tape drive handle stepper motor is not functioning.	Retry the command. If failure recurs replace the tape drive assembly.
4 F3 02 error DLT Drive Communication Timeout			The SCSI cabling or termination is not secure.	Tighten all SCSI cabling and termination.
4 8E 03 error Flash Memory Unable to Program			The robotics controller PWA is not seated tightly.	Reseat the robotics controller PWA.
			The robotics controller PWA is defective.	Replace the robotics controller PWA.

FRU Removal and Replacement Procedures

Introduction

This chapter provides the following information for each field-replaceable unit (FRU) of the tape library:

■ FRU name

■ FRU part number

■ Location—describes the physical location of the part within the tape library. Right and left designations refer to the part as viewed from the side of the tape library from which the part is accessed.

■ Characteristics—provides distinguishing details about the part.

■ Function—describes how the part is used in the tape library.

■ Tools Required—lists the tools necessary to remove and replace the part.

■ Removal Procedure—describes the procedure to remove the part. Except where noted, replace the part by reversing the removal procedure.

Turning On and Off the Tape Library

To turn on the tape library:

NOTE: If there is one AC distribution assembly in the tape library, there is only one AC power cord. If there are two AC distribution assemblies in the tape library, there are two AC power cords.

1. Confirm the tape library power cord(s) are connected to facility power.

2. Locate the AC power distribution assembly (or assemblies) in the rear lower left corner of the cabinet (behind the rear left tape drive access door).

3. Turn on CB-1 at the top of the AC power distribution assembly, or assemblies if two are present.

4. Locate the **On**/**Off** switch slide panel on the right front door just below the control panel.

5. Slide the **On**/**Off** switch panel open.

6. Turn on the tape library **On**/**Off** switch (see Figure 7-1).

7. Reverse the above procedure to turn off the tape library.
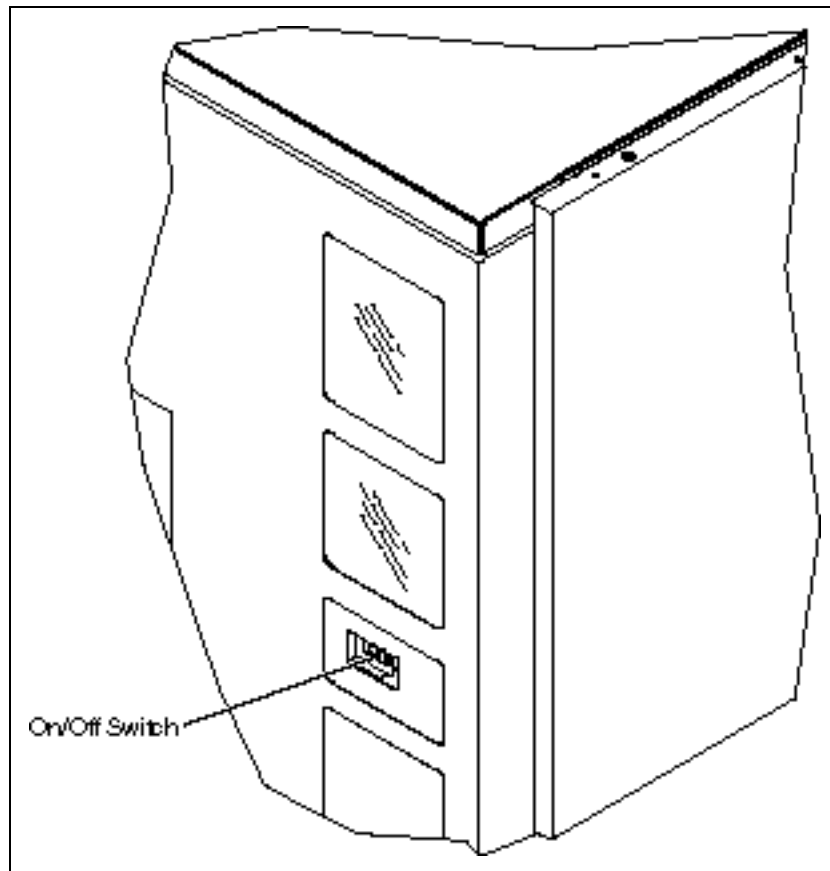
Figure 7-1. Tape library on/off switch

Securing the Vertical Carriage

Some FRU removal procedures include securing the vertical carriage near eye-level. To secure the vertical carriage anywhere above the base of the cabinet, use the following procedure:

1. Turn off the tape library.

2. Open the front doors.

   NOTE: To manually raise the vertical carriage, push up from underneath the vertical carriage baseplate directly behind the rotary sensor cable strain relief and in front of the front vertical rail.

3. Manually raise the vertical carriage to the desired position.

4. To hold the vertical carriage, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap (see Figure 7-2).

Push up here to manually raise the vertical carriage.

Vertical Belt

Tie-Wrap
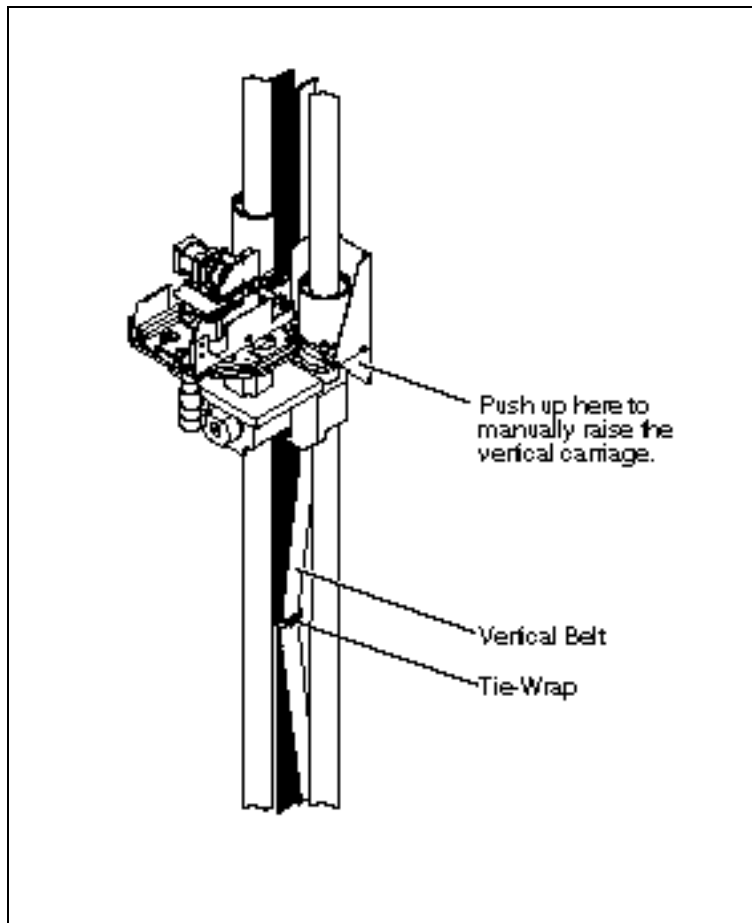
Figure 7-2. Securing the vertical carriage

Compaq DLT Tape Drive

Part Number 154841-001

Location:

- Column 0 from top - drives 0 through 7

- Column 1 from top - drives 8 through 15

- Access for hot-swap through rear access doors

Characteristics:

- hot-swap capable

- 1/2-in cartridge tape drive

- 5.25-in form factor

Function

- Writes data to and reads data from DLT cartridges

Required Tools:

- 5/32-in hex key

- Flat blade screwdriver

Removal Procedure

1. Open the rear tape drive access door (see Figure 7-3).

2. Identify the tape drive to be replaced.

3. Raise the tape drive hot-plug sensor lever.

4. Loosen the two captive screws at the bottom left and bottom right corner of the tape drive module.

5. Pull on the tape drive module handle to remove the module from the tape library.

   NOTE: After installing the replacement drive assembly make sure to lower the hot-plug sensor lever. The tape library will perform Auto Calibration of all drives in the column.
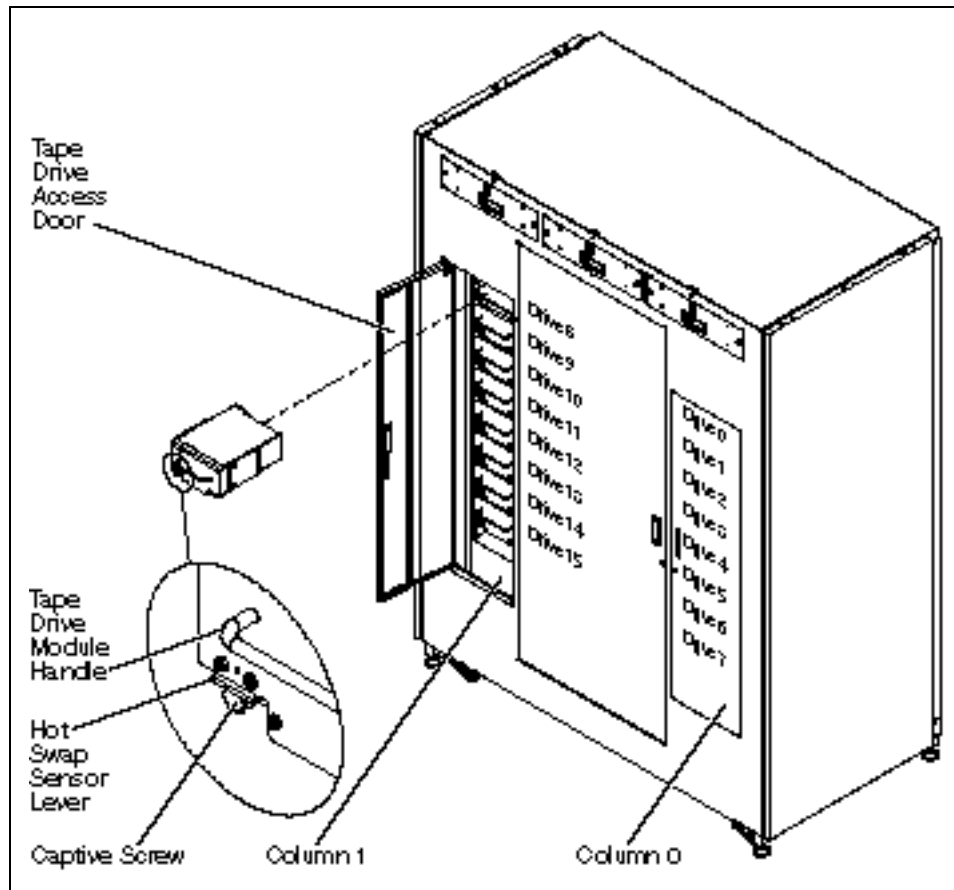
Figure 7-3. Compaq DLT tape drive

Power Supply

Part Number 154843-001

Location

■ There are 8 power supply bays inside a swing-out power supply module at the rear center of the cabinet.

■ Tape libraries are shipped with 8 power supplies installed.

Characteristics

■ Hot-plug capable

■ Input rating: 100-240 VAC / 50-60 Hz / 7A

■ Output rating: +5 VDC – 50 A / +12 VDC – 15 A

■ 400 W total output power

■ 12 x 5 x 2.5 in (30.5 x 12.7 x 6.35 cm) enclosure

Function

■ Provides +5 VDC for electronic PWAs

■ Provides +12 VDC for tape library motors

Required Tools

■ Flat blade screwdriver

Removal Procedure

1. Open and remove the rear center access door (see Figure 7-4).

2. Loosen the two captive screws at the top left and top right of the power supply rack assembly.

3. Slowly swing the top of the power supply rack out of the cabinet until it rests against the rack stops.

4. Determine which power supply is to be replaced, and turn off its power switch.

5. Loosen the two captive screws that secure the power supply in the rack.

6. Pull on the power supply handle to remove the power supply from the rack.

   NOTE: After installing the replacement power supply, make sure to turn its power switch on.
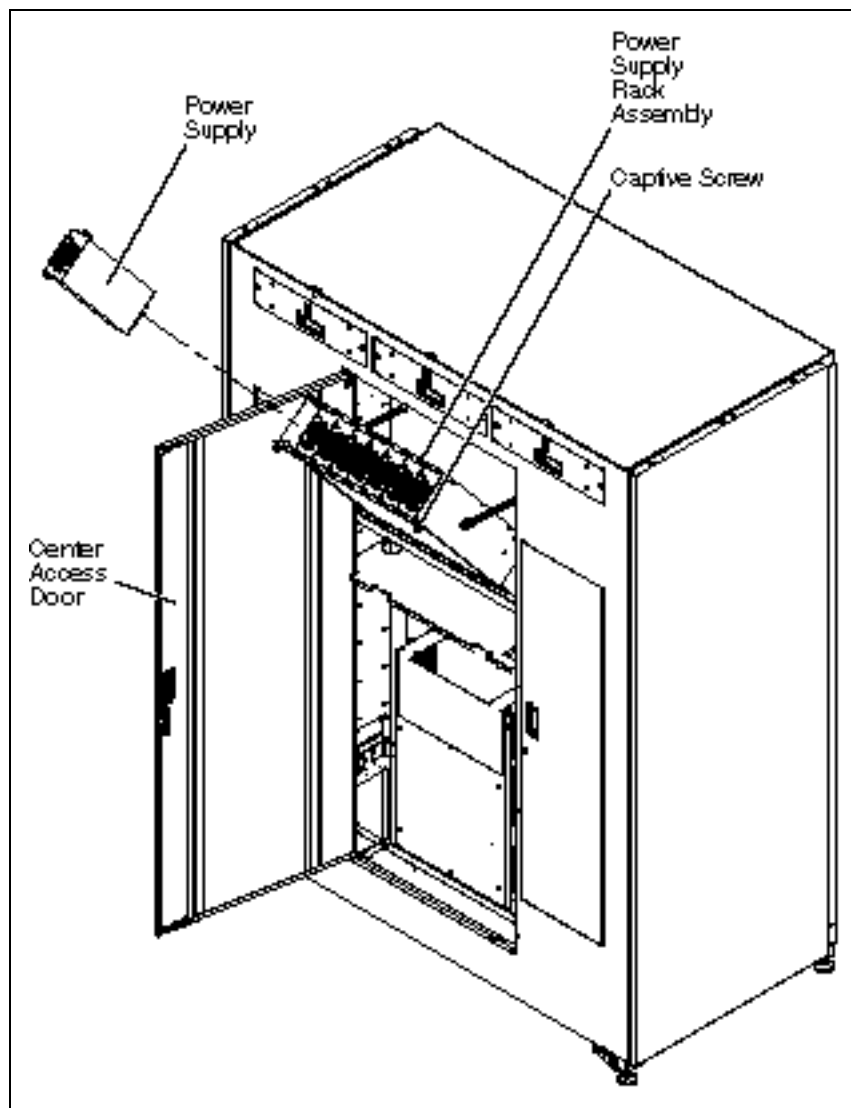
Figure 7-4. Power supply

Power Supply Rack Assembly

Part Number 154844-001

Location

■ Rear center of cabinet

Characteristics

■ Hinged at base, tilts out from top

■ Eight power supply bays

■ 5.5 x 21 x 15.5 in (14 x 53 x 39.37 cm) silver box

Function

■ Holds eight power supplies

■ Provides VAC connection to DC power supplies

■ Connects power supplies to DC voltage output bus

Required Tools

■ 5/32-in Allen wrench

■ Flat blade screwdriver

■ #1 Phillips screwdriver

■ #3 Phillips screwdriver

Removal Procedure

> **WARNING:** This unit might be provided with two AC power distribution units and two power cords. If two AC power distribution units are present, disconnect both power cords before servicing.

1. Turn off the tape library power, and disconnect the AC power cord(s).

2. Open and remove the rear center access door (see Figure 7-5).

3. Loosen the two captive screws at the top left and top right of the power supply rack assembly.

4. Slowly swing the top of the power supply rack out of the cabinet until it rests against the rack slide stops.

5. Remove all power supplies from the rack.

> **CAUTION:** Support the rack when removing the 5/32- in rack slide screws.

6. Using the 5/32-in Allen wrench, remove the two shoulder screws that secure the rack assembly to the rack slides.

7. Slowly tilt the rack assembly all the way forward until it rests against the cabinet frame.

8. Disconnect the AC power cords attached to the bottom of the rack. (Depending on the power supply configuration, there may be three or four AC power cords.)

9. Remove the four small Phillips screws that secure the lower cover on the rack assembly.

10. Open the lower cover at the base and tilt it all the way forward against the rack assembly.

11. Disconnect the 30-pin multi-colored ribbon cable at connector J9 at the left end of the rack assembly.

12. Note the location of the bus cables attached to the DC bus bars.

13. Using a #3 Phillips screwdriver, disconnect all of the DC bus cables.

14. Remove the six Phillips screws that secure the rack assembly hinge to the cabinet frame.

15. Remove the rack assembly from the cabinet.
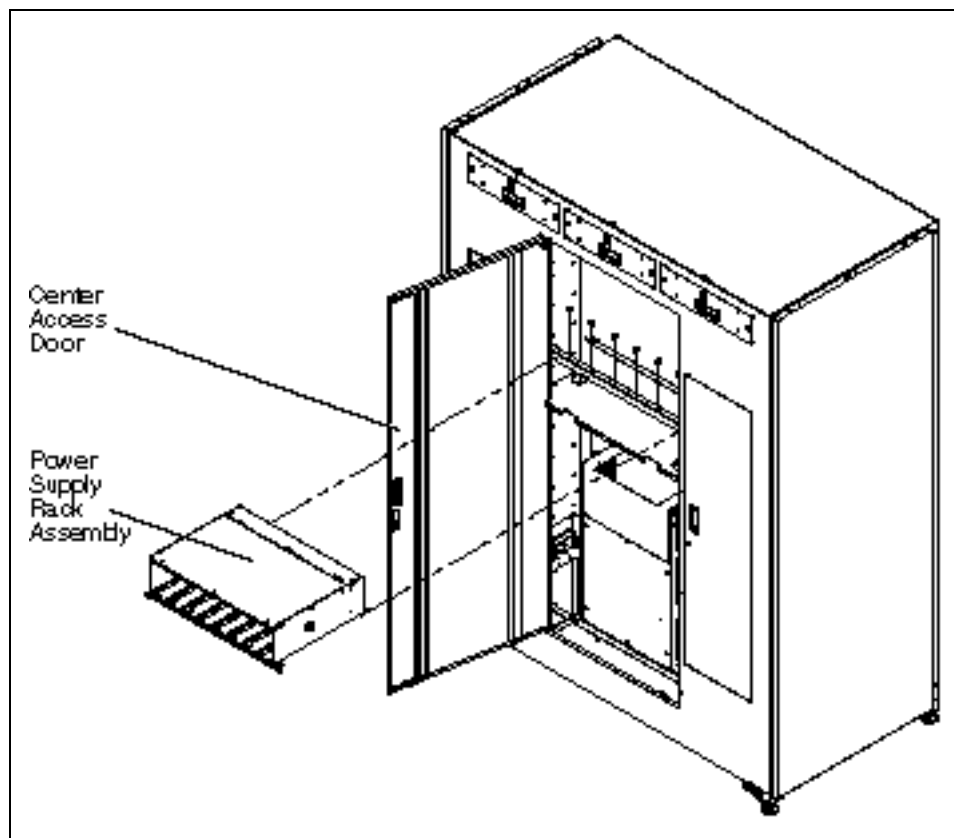
Figure 7-5. Rack assembly

AC Distribution Assembly

Part Number 154845-001

Location

■ Rear lower left corner of cabinet

Characteristics

■ One incoming AC connector

■ Three outgoing AC connectors

■ One 12 VDC bus sensor connector

■ One remote sense connector

■ One 2-position 20 A circuit breaker

■ One amber power-on indicator

■ 7 x 7 x 6 in (17.78 x 17.78 x 15.24 cm) metal box

Function

■ Connects to incoming power and provides VAC to the power supply rack assembly

Required Tools

■ #2 Phillips screwdriver

■ #1 Phillips screwdriver

NOTE: Depending on the tape library configuration, there might be one AC distribution assembly or two AC distribution assemblies mounted side-by-side. The procedure below describes the removal of both assemblies.

Removal Procedure

> **WARNING:** This unit may be provided with two AC power distribution units and two power cords. If two AC power distribution units are present, disconnect both power cords before servicing.

1. Turn off the tape library power and disconnect both AC power cords.

2. Open and remove the rear center access door.

3. Open and remove both rear tape drive access doors.

4. Remove the 19 screws that secure the rear panel to the cabinet frame and remove the rear panel.

5. Locate the two AC distribution assemblies in the lower left corner of the cabinet (see Figure 7-6).

6. Disconnect the main (incoming) AC power cord from each assembly.

7. Disconnect the remote sense cable from each assembly.

8. Disconnect the 12 VDC bus cable from each assembly.

9. Disconnect the (outgoing) AC power cords at J1, J2, and J3 from each assembly.

10. Remove the four Phillips screws that secure the AC distribution assembly mounting plate to the cabinet frame.

11. Remove the eight Phillips screws that secure the mounting plate to the two AC distribution assemblies.

12. Remove the mounting plate from the cabinet.

13. Lift and remove the right-side AC distribution assembly from the cabinet.

14. Slide the left-side AC distribution assembly to the right, then up and out of the cabinet.
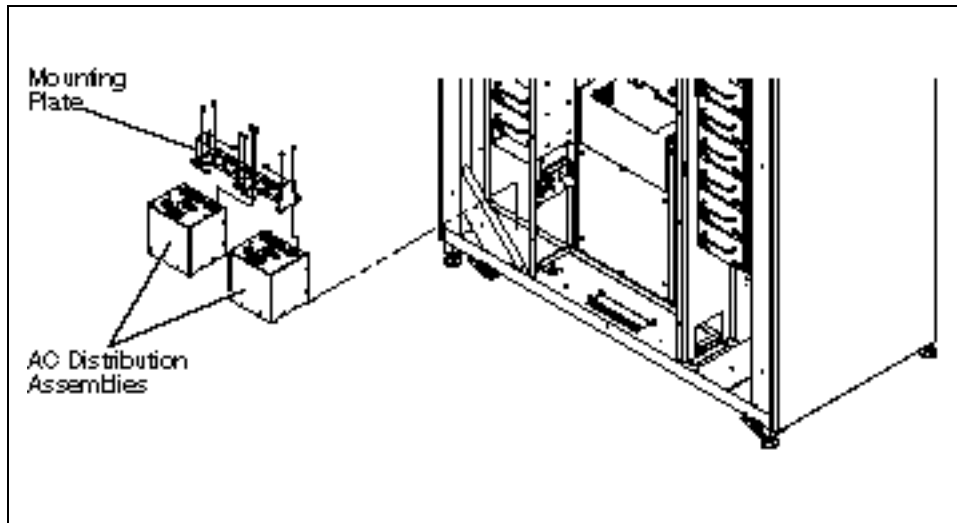
Figure 7-6. AC distribution assembly

Fan Module

Part Number 154846-001 (Redundant)
Part Number 154865-001 (Non-redundant)

Location

■ Across the top rear of the tape library

Characteristics

■ Hot-plug capable

■ Contains one or two 12 VDC 220 CFM exhaust fans

■ 4.06 x 7.31 x 12.94 in (10.31 x 18.57 x 32.87 cm) box

Function

■ Provides cooling for tape drive, electronics, and storage array

Required Tools

■ Flat blade screwdriver

Removal Procedure

1. Loosen the two captive screws at the left and right edge of the fan module (see Figure 7-7).

2. Pull on the handle to remove the fan module from the tape library cabinet.
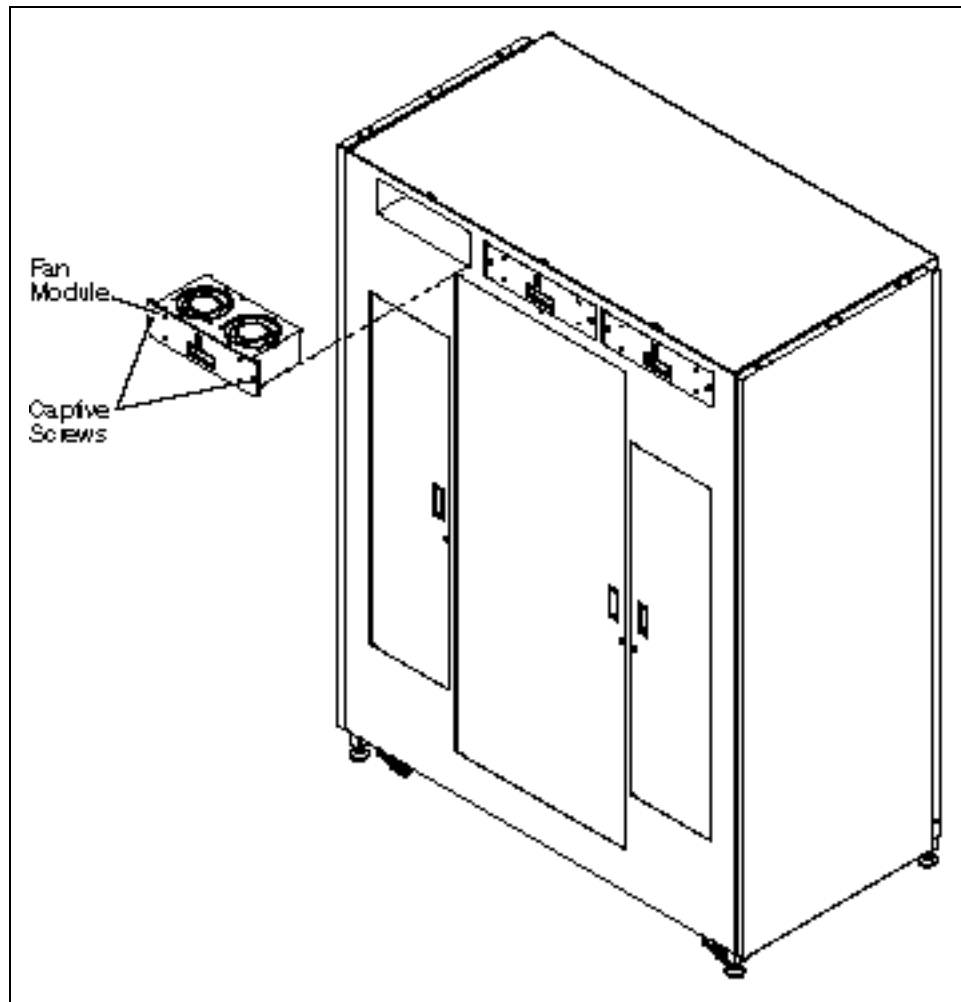
Figure 7-7. Fan module

Robotics Controller PWA

Part Number 154847-001

Location

■ Connects to J5 and J6 of the robotics backplane

Characteristics

■ Contains Motorola 132-pin 68332 20-MHz microprocessor (U1)

■ Contains Dallas 64-KB nonvolatile SRAM (U2) with a lithium battery

■ 4.20 x 7.60 in (10.67 x 19.30 cm) PWA

Function

■ Responds to RS-232 commands from a host computer to control and track movement of cartridges within the tape library

Required Tools

■ 5/32-in Allen wrench

■ #2 Phillips screwdriver

■ #1 Phillips screwdriver

> **WARNING:** The Dallas SRAM U2 on the robotics controller contains a lithium battery.

Removal Procedure

1. Turn off the tape library.

2. Open the rear center access door.

3. Remove the six Phillips screws that secure the cover over the electronics bay, and remove the cover (see Figure 7-8).

4. Locate the robotics controller PWA at J5/J6 of the backplane.

5. If present, disconnect the RS-232 cables at connectors J2 and J3 at the left edge of the robotics controller PWA.

6. Remove the small Phillips screw that secures the robotics controller PWA in the electronics bay.

7. Remove the robotics controller PWA.
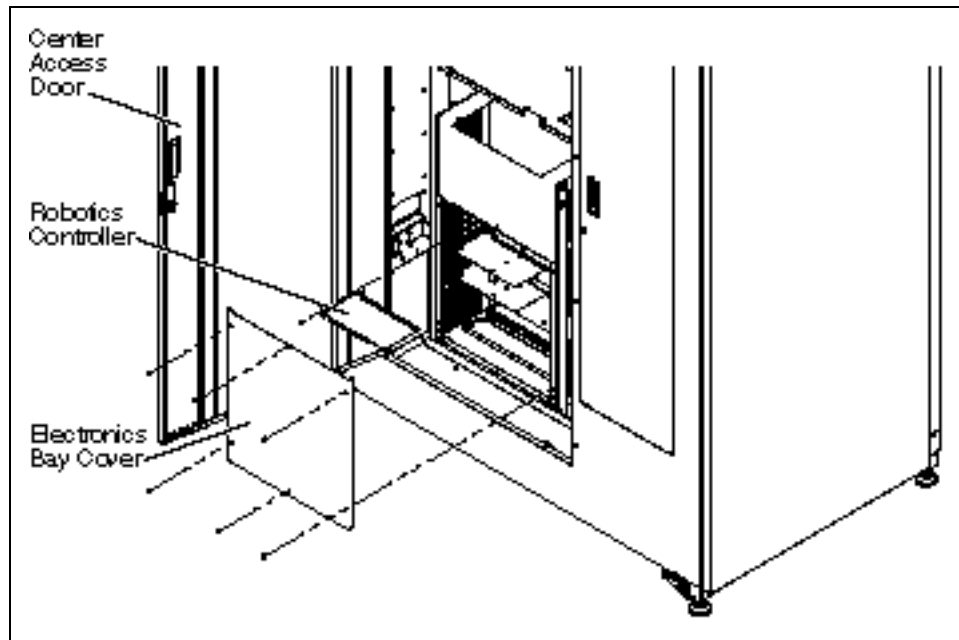
Figure 7-8. Robotics controller PWA

Actuator Driver PWA

Part Number 154848-001

Location

■ Two identical actuator driver PWAs are present:

- ❑ AD0 connects to J3 and J4 of robotics backplane
- ❑ AD1 connects to J1 and J2 of robotics backplane

Characteristics

■ Contains Xilinx 208-pin FPGA (U48)

■ 4.20 x 7.60 in (10.67 x 19.30 cm) PWA

Function

■ AD0 at J3/J4: drives x-axis, rotary, extension, and gripper

■ AD1 at J1/J2: drives y-axis and load port

Required Tools

■ 5/32-in hex key

■ #2 Phillips screwdriver

■ #1 Phillips screwdriver

Removal Procedure

1. Turn off the tape library.

2. Open the rear center access door.

3. Remove the six Phillips screws that secure the cover over the electronics bay, and remove the cover.

4. Remove the robotics controller PWA (see Figure 7-8).

5. Disconnect the flat flex ribbon cable at connector J21 on the robotics backplane (just below the robotics controller connectors, and just above actuator driver AD0 connectors).

6. Locate the actuator driver PWA at J3/J4 or J1/J2 of the backplane.

7. Remove the small screw that secures the actuator driver PWA in the electronics bay.

8. Remove the actuator driver PWA (see Figure 7-9).

    NOTE: During reinstallation connect the flat flex ribbon cable with the connector pin side facing down.
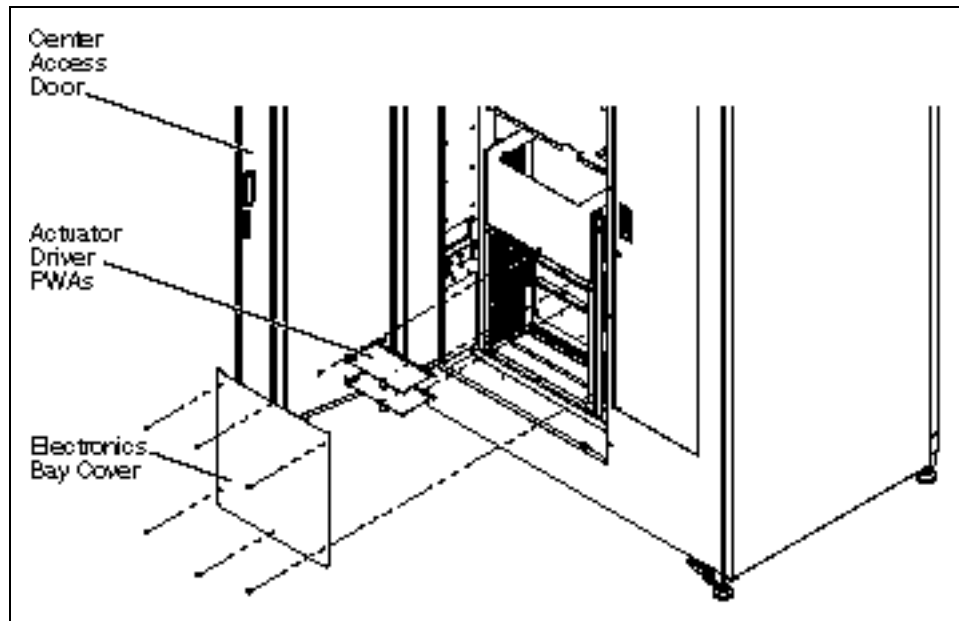
Figure 7-9. Actuator driver PWA

Motor Power Converter

Part Number 154858-001

Location

■ Two identical motor power converters are present:

    ❑ DC0—connects to J41, J42, and J43 of the robotics backplane

    ❑ DC1—connects to J44, J45, and J46 of the robotics backplane

Characteristics

■ Contains three 9-pin connectors

■ 4.83 x 5.00 in (12.27 x 12.70 cm)

Function

■ DC0—drives the horizontal, rotary, extension, and gripper motors

■ DC1—drives the vertical and load port motors

Required Tools

■ 5/32-in hex key

■ #2 Phillips screwdriver

■ #1 Phillips screwdriver

Removal Procedure for DC0

1. Turn off the tape library.

2. Open the rear center access door.

3. Remove the six Phillips screws that secure the cover over the electronics bay, and remove the cover (see Figure 7-10).

4. Locate the motor power converter on the robotics backplane at connectors J41/J42/J43.

5. Disconnect the motor power converter from its respective connectors.

6. Remove the motor power converter from the cabinet.

Removal Procedure for DC1

1. Turn off the tape library.

2. Open the rear center access door.

3. Remove the six Phillips screws that secure the cover over the electronics bay, and remove the cover.

4. Remove motor power converter DC0 (see Figure 7-10).

5. Disconnect the flat flex ribbon cable at connector J22 on the robotics backplane. (J22 is located in between the DC0 and DC1 connectors.)

6. Locate the motor power converter on the robotics backplane at connectors J44/J45/J46.

7. Disconnect the motor power converter from its respective connectors.

8. Remove the motor power converter from the cabinet.

   NOTE: During reinstallation, connect the flat flex ribbon cable with the connector pin side facing down.
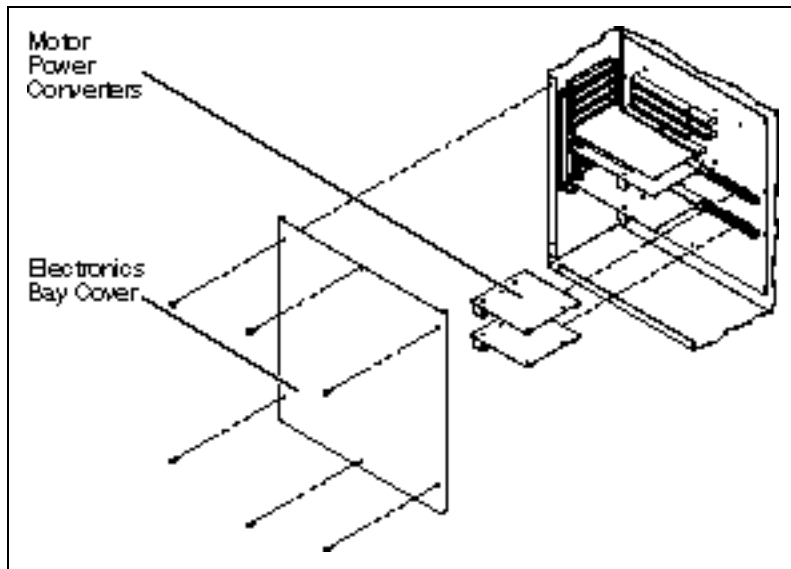
Figure 7-10. Motor power converters

SCSI Communication PWA

Part Number 154849-001

Location

■ Connects to J10 of robotics backplane

Characteristics

■ Differential SCSI bus adapter

■ 3.25 x 5.00 in (8.25 x 12.7 cm) PWA

Function

■ Provides a differential SCSI interface to the host computer

Required Tools

■ #2 Phillips screwdriver

■ #1 Phillips screwdriver

Removal Procedure

1. Turn off the tape library.

2. Open the rear center access door.

3. Remove the six Phillips screws that secure the cover over the electronics bay, and remove the cover (see Figure 7-11).

4. Locate the SCSI Communication PWA at J10 of the backplane.

5. Disconnect the SCSI ribbon cable from connector J3 at the left end of the PWA.

6. Remove the small Phillips screw that secures the SCSI Communication PWA in the electronics bay.

7. Remove the SCSI Communication PWA.
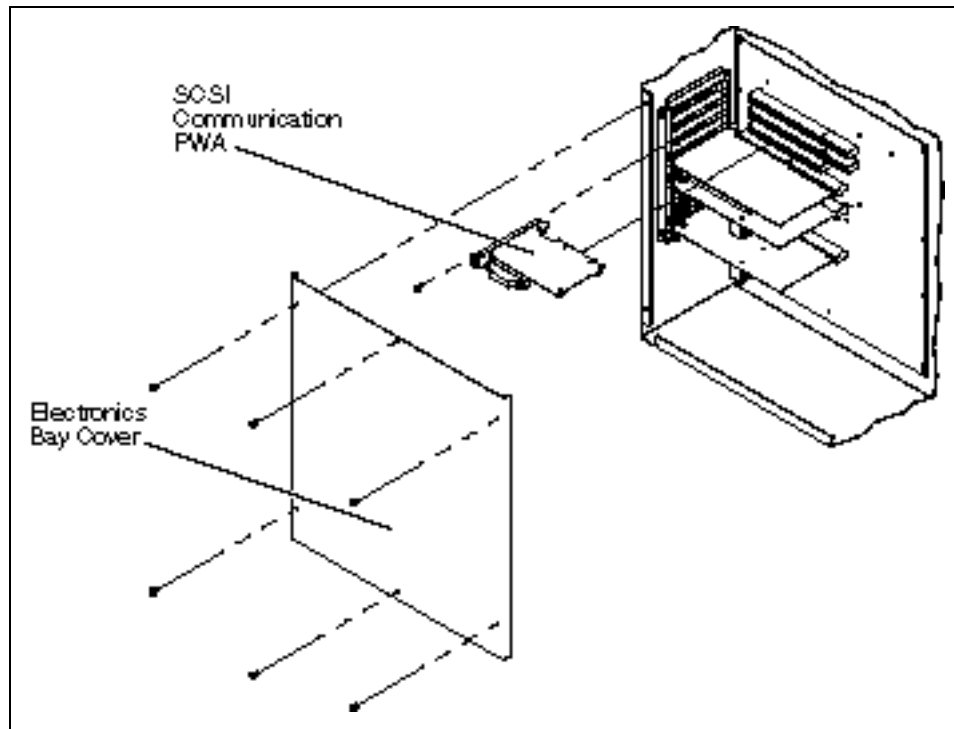
Figure 7-11. SCSI communication PWA

Robotics Backplane PWA

Part Number 154850-001

Location

■ Mounts on rear wall of electronics bay at rear center of cabinet

Characteristics

■ Contains 16 cable connectors

■ Contains 17 board sockets

■ Contains 3 replaceable fuses

■ 13.00 x 13.85 in (33.02 x 35.18 cm) PWA

Function

■ Provides power and sockets for the robotics controller, actuator drivers, DC-DC converters, and SCSI controller boards

■ Serves as an interconnect for cables that provide power and logic signals to all robotics components in the tape library

Required Tools

■ 5/32-in hex key

■ #2 Phillips screwdriver

■ #1 Phillips screwdriver

Removal Procedure

1. Turn off the tape library.

2. Open the rear center access door.

3. Remove the six Phillips screws that secure the cover over the electronics bay, and remove the cover (see Figure 7-12).

4. Remove the SCSI communication PWA.

5. Remove the robotics controller PWA.

6. Remove both actuator driver PWAs.

7. Remove both DC-DC converter PWAs.

8. Make note of all cable locations, then disconnect all cables form their respective connectors.

9. Remove 16 Phillips screws that secure the robotics backplane PWA to the cabinet frame.

10. Remove the robotics backplane PWA from the cabinet.

   NOTE: During reinstallation connect all flat flex ribbon cables with the connector pin side facing down.
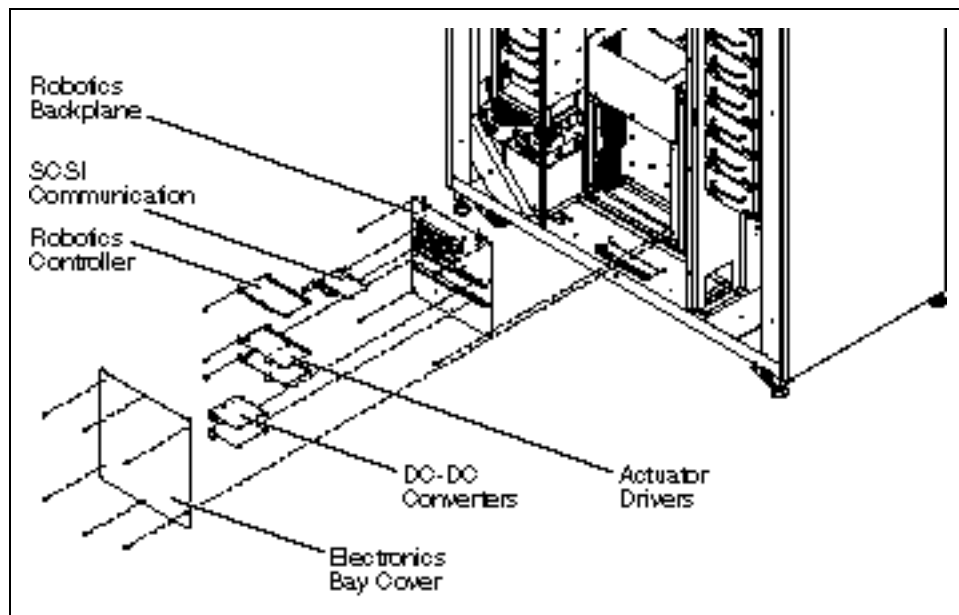
Figure 7-12. Robotics backplane PWA

Control Panel Assembly

Part Number 154851-001

Location

■ Right front door

Characteristics

■ 4.76 x 3.58 in (12.09 x 9.09 cm) display panel

Function

■ Provides user interface for controlling the tape library operation

Required Tools

■ 5/16-in nut driver

Removal Procedure

1. Turn off the tape library.

2. Open the right front door.

3. Using a 5/16-in nut driver, remove the control panel assembly cable clamp (see Figure 7-13).

4. Disconnect the ribbon cable at connector at J2.

5. Using a 5/16-in nut driver, remove the four nuts at the corners of the control panel assembly.

6. Remove the control panel assembly from the cabinet.
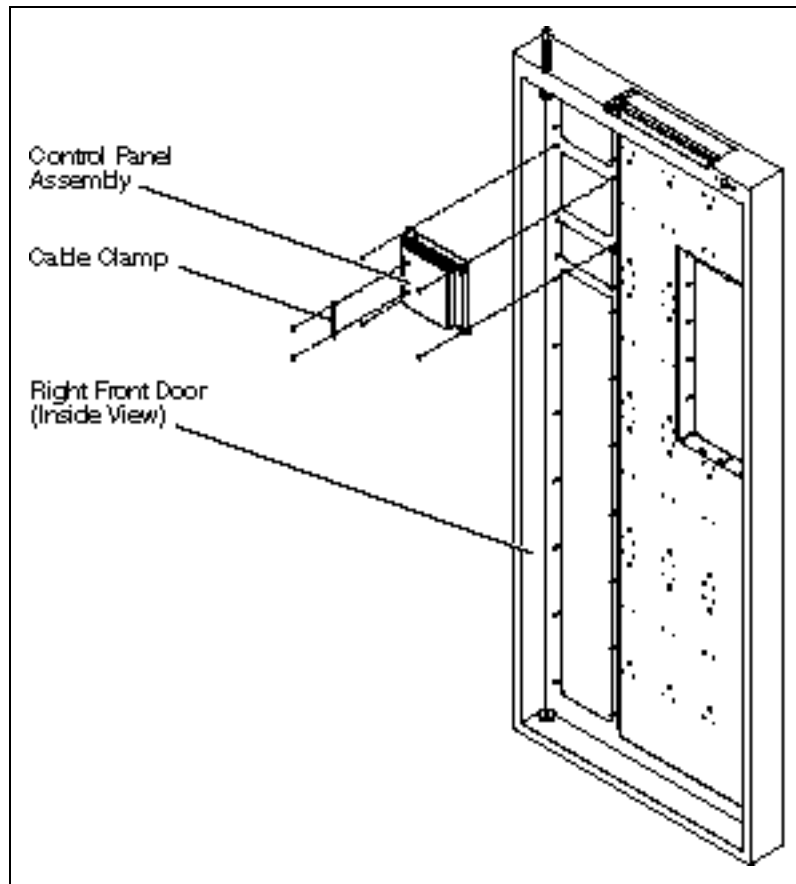
Figure 7-13. Control panel assembly

Extension Axis Assembly

Part Number 154852-001

Location

■ Mounts on top of the rotary axis

Characteristics

■ Contains extension motor which drives gripper forward and backward

■ Contains gripper motor which opens and closes the gripper jaw

Function

■ Grips a single cartridge at a time to move cartridges from one location to another within the tape library

Required Tools

■ Phillips screwdriver

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

3. Raise the vertical carriage to just below eye-level.

4. To hold the vertical carriage, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap.

5. Rotate the extension axis (Figure 7-14) so that the ZIF connector at J1 of the extension axis PWA is facing the front of the cabinet (the gripper jaw will face the rear).

6. Remove the four screws that secure the y-axis interconnect PWA ESD shield in place, and remove the shield.

7. Disconnect the 12-conductor flat white cable from ZIF connector J4 on the y-axis interconnect PWA (located on the front near the top right corner).

8. Disconnect the 20-conductor flat white cable from connector J6 on the y-axis interconnect PWA (located on the back at the top).

9. Remove the cable strain relief that secures the two flat white cables to the vertical carriage frame, and pull the 12-conductor cable through the ¾-inch wide slot in the y-axis interconnect PWA.

10. Rotate the extension axis so the gripper jaws are facing forward. The extension axis drive motor will be at the front (see Figure 7-14).

11. Disconnect the extension axis drive motor encoder cable from J3 of the extension interconnect PWA. (The encoder cable is a 10-conductor cable that goes through a hole in the bottom of the extension axis mounting plate and connects to J3 of the extension axis interconnect PWA.)

12. Remove the four large Phillips mounting screws near the four corners of the extension axis assembly.

13. Remove the extension axis assembly.
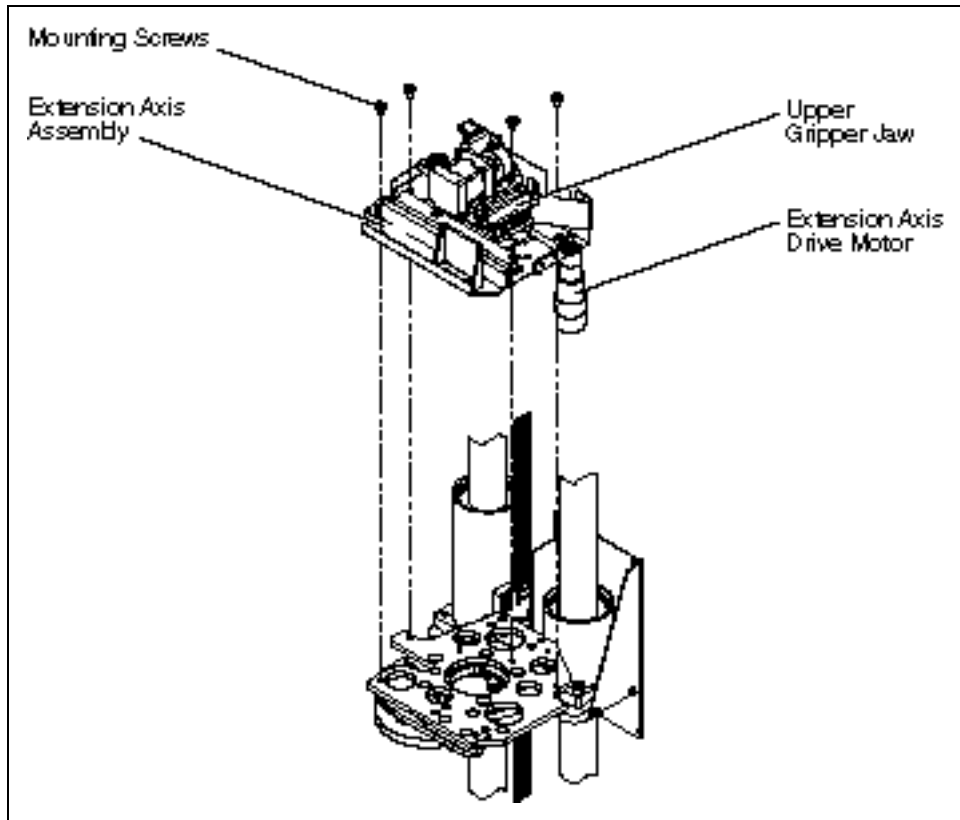
Figure 7-14. Extension axis assembly

X-Axis Stepper Motor

Part Number 154853-001

Location

■ Lower, left corner of the tape library

Characteristics

■ 11 A stepper motor

■ 9-conductor cable harness

■ 3.38 x 3.38 in (8.59 x 8.59 cm) motor

Function

■ Engages the x-axis belt to provide horizontal drive to the vertical carriage

Required Tools

■ 3/16-in Allen wrench

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

3. Loosen the horizontal drive belt.

4. Open the rear right tape drive access door and locate the x-axis stepper motor at the base of the cabinet.

5. Using the 3/16-in Allen wrench, remove the four x-axis motor mounting screws (see Figure 7-15).

6. Disconnect the 9-pin motor cable connector.

7. Disconnect the 10-pin motor encoder cable connector.

8. Remove the x-axis stepper motor from the cabinet.
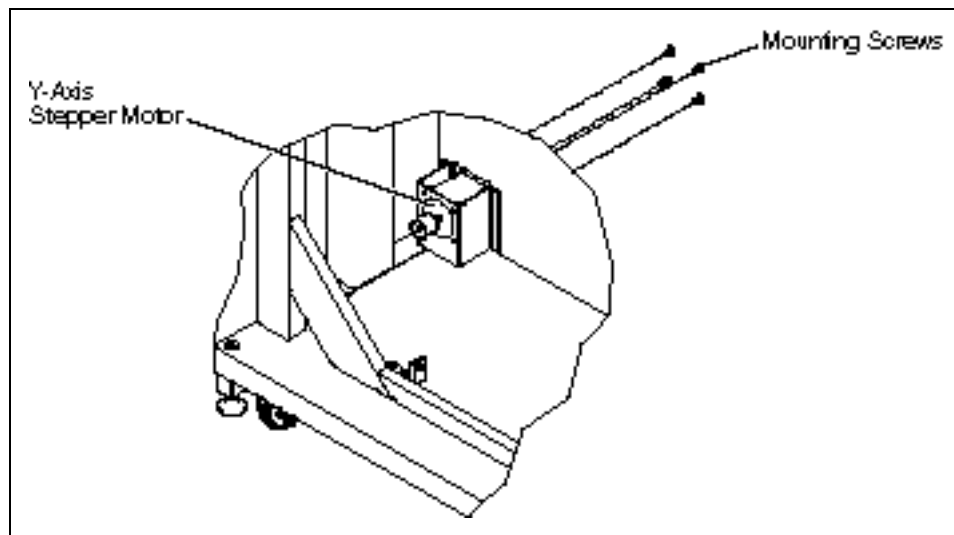
Figure 7-15. X-axis stepper motor

Y-Axis Stepper Motor

Part Number 154853-001

Location

■ Mounts at base of vertical carriage assembly

Characteristics

■ 11 A stepper motor

■ 9-conductor cable harness

■ 3.38 x 3.38 in (8.59 x 8.59 cm) motor

Function

■ Engages the y-axis belt to provide vertical drive to the vertical carriage

Required Tools

■ 3/16-in Allen wrench

■ Small wire cutters

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

3. Loosen the vertical belt.

4. Cut the cable tie that secures the y-axis stepper motor cable to the vertical carriage.

5. Disconnect the y-axis motor cable from J5 of the x-carriage interconnect PWA (see Figure 7-16).

6. Disconnect the y-axis motor encoder cable from J6 of the x-carriage interconnect PWA.

7. Using the 3/16-in Allen wrench, remove the four y-axis motor mounting screws.

8. Remove the y-axis stepper motor from the cabinet.
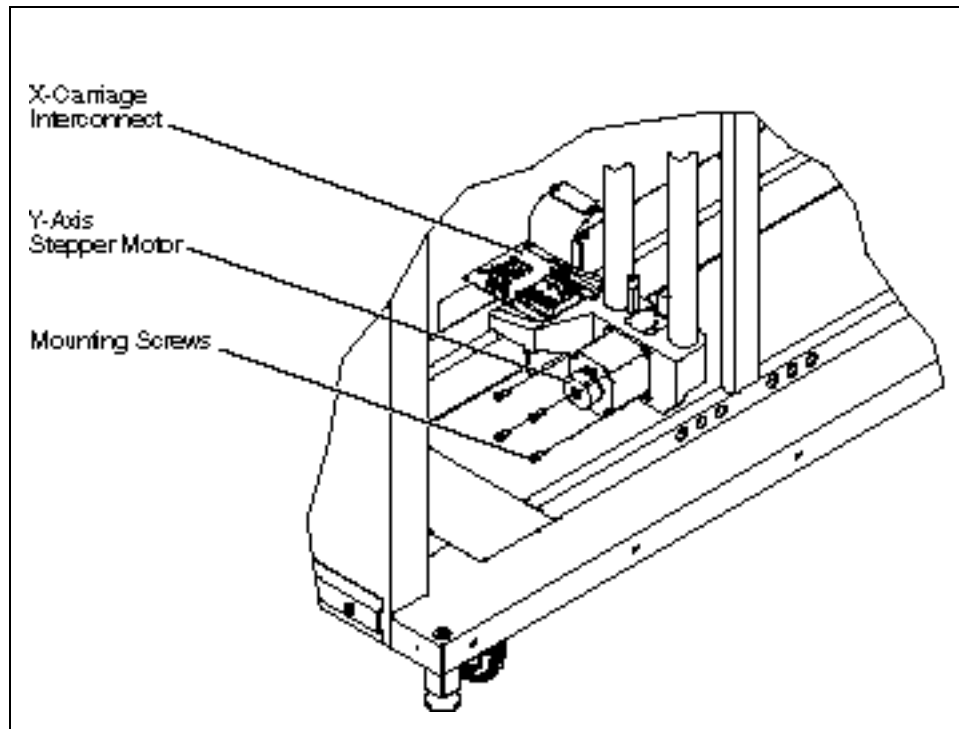
Figure 7-16. Y-axis stepper motor

Rotary Axis Stepper Motor

Part Number 154854-001

Location

■ Mounts to bottom of vertical carriage baseplate

Characteristics

■ 2 phase / 2 A stepper motor

■ 5-conductor cable harness

■ 2.20 x 2.20 in (5.59 x 5.59 cm) motor

Function

■ Drives the rotary axis to spin the extension axis to the front or rear of the cabinet

Required Tools

■ 5/32-in Allen wrench

■ 9/64-in Allen wrench

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

3. Raise the vertical carriage above eye-level.

4. To hold the vertical carriage in position, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap.

5. Disconnect the 4-conductor motor cable from J6 of the y-axis interconnect PWA.

6. Remove the ribbon cable from the strain-relief that is attached to the rotary axis stepper motor.

7. Using the 9/64-in Allen wrench, remove the four socket head mounting screws that secure the rotary axis stepper motor to the baseplate (see Figure 7-17).

8. Remove the rotary axis stepper motor.
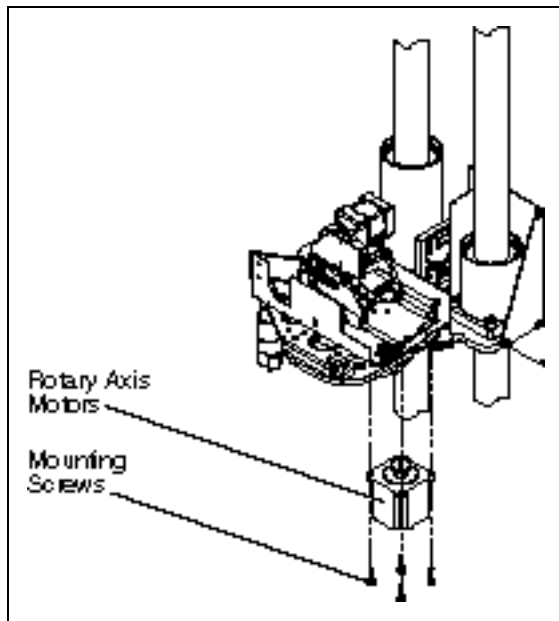
Figure 7-17. Rotary axis stepper motor

X-Axis Interconnect PWA

Part Number 154855-001

Location

■ Mounts to the rear of horizontal carriage, at the base of the cabinet, behind the horizontal rail

Characteristics

■ Contains seven cable connectors

■ 5.00 x 3.25 in (12.7 x 8.25 cm) PWA

Function

■ Serves as a cable interconnect between the robotics backplane and the following:

  ❑ Y-axis stepper motor

  ❑ Y-axis stepper motor encoder

  ❑ X-axis home sensor

Required Tools

■ #1 Phillips screwdriver

■ 1/4-in nut driver

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

3. Raise the vertical carriage to just below eye-level.

4. To hold the vertical carriage, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap.

5. Remove the four Phillips screws at the four corners of the x-axis interconnect PWA (see Figure 7-18).

6. Remove the ESD shield.

7. Disconnect the four umbilical cables from their respective connectors on the x-axis interconnect PWA.

8. Disconnect the 4-conductor cable at J7 of the x-axis interconnect PWA.

9. Remove the three standoffs at the corners of the x-axis interconnect PWA.

10. Remove the umbilical cable strain relief from the x-axis interconnect PWA (leave the umbilical cables clamped to the strain relief).

11. Remove the x-axis interconnect PWA.
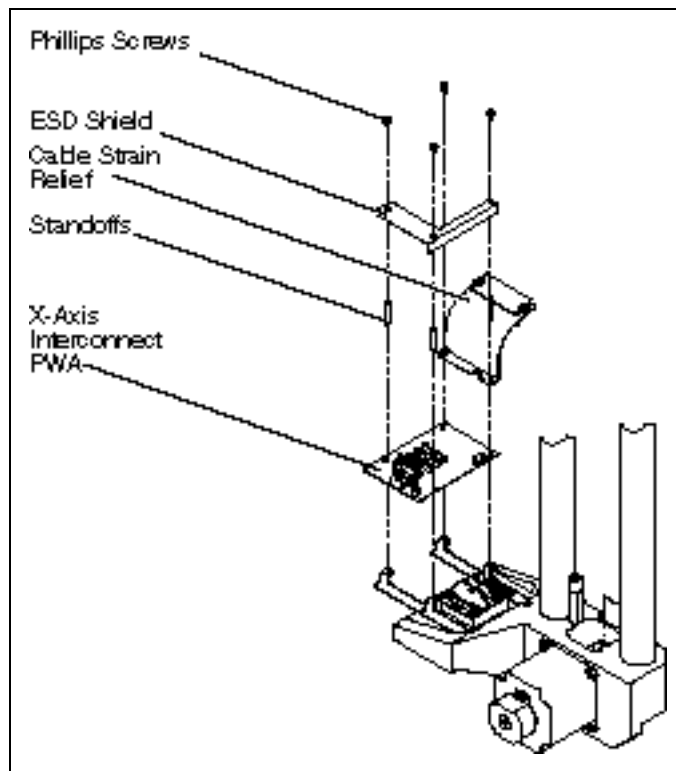
Figure 7-18. X-axis interconnect PWA

Y-Axis Interconnect PWA

Part Number 154856-001

Location

■ Mounts on the right side of the vertical carriage

Characteristics

■ Contains six cable connectors

■ Includes the y-axis home sensor

■ 8.50 x 4.75 in (21.59 x 12.06 cm) PWA

Function

■ Serves as a cable interconnect between the robotics backplane and the following:

  ❑ Extension interconnect PWA

  ❑ Gripper interconnect PWA

  ❑ Rotary stepper motor

  ❑ Rotary home/limit sensor PWA

Required Tools

■ Phillips screwdriver

■ 1/4-inch nut driver

Removal Procedure

1. Turn off the tape library.

2. Open the front door.

3. Raise the vertical carriage to just below eye-level.

4. To hold the vertical carriage in position, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap.

5. Remove the four screws that secure the y-axis interconnect PWA ESD shield in place, and remove the shield (see Figure 7-19).

6. Unhook the vertical cable strain relief.

7. Disconnect the flat ribbon cables at J1 and J2 (front of PWA).

8. Disconnect the 4-conductor cable at J3 (front of PWA).

9. Disconnect the 20-conductor cable at J4 (back of PWA).

10. Disconnect the 12-conductor white ribbon cable at J5 (back of PWA), and gently push it through its mounting slot in the PWA.

11. Disconnect the 10-conductor ribbon cable at J6 (back of PWA).

12. Remove the four 1/4-in standoffs and one Phillips screw that secure the y-axis interconnect PWA to the vertical carriage.

13. Remove the y-axis interconnect PWA.

> ⚠ **CAUTION:** During reinstallation, reconnect cables carefully to prevent damage to the connectors.
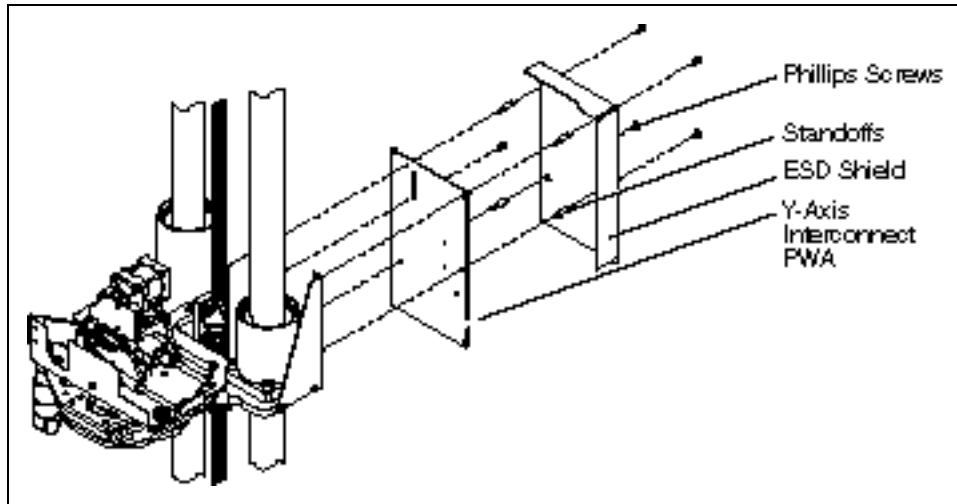
Figure 7-19. Y-axis interconnect PWA

Rotary Axis Sensor PWA

Part Number 154857-001

Location

■ Mounts to front of vertical carriage baseplate

Characteristics

■ Contains rotary home sensor

■ Contains rotary limit sensor

■ 1.5 x 1.5 in (3.81 x 3.81 cm) PWA

Function

■ Reports position of rotary axis

Required Tools

■ #2 Phillips screwdriver

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

3. Raise the vertical carriage to eye-level.

4. To hold the vertical carriage, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap.

5. Disconnect the multi-colored 10-conductor ribbon cable at J1.

6. Remove the two Phillips screws that secure the rotary axis sensor PWA to the vertical carriage (see Figure 7-20).

7. Remove the rotary axis sensor PWA.
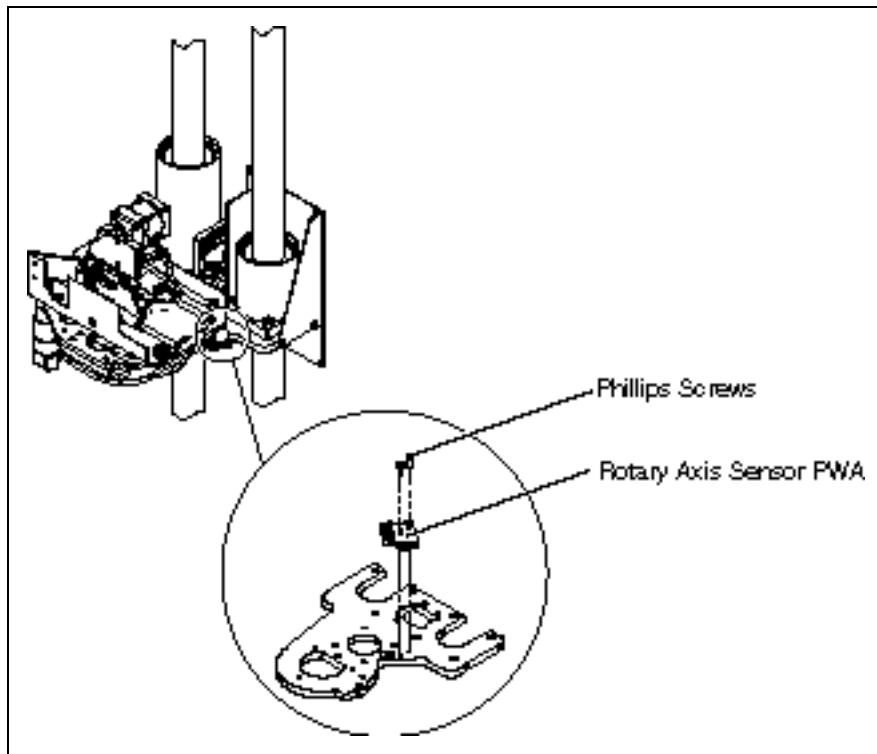
Figure 7-20. Rotary axis sensor PWA

Drive Tray PWA

Part Number 154859-001 (column 1) /154860-001 (column 0)

Location

■ A column 1 drive tray PWA is mounted underneath each tape drive bay on the left side of the cabinet (when viewed from the rear of the cabinet).

■ A column 0 drive tray PWA is mounted underneath each tape drive bay on the right side of the cabinet (when viewed from the rear of the cabinet).

Characteristics

■ Contains two connectors

■ 6.90 x 5.25 in (17.53 x 13.34 cm) PWA

Function

■ Serves as an interconnect between the drive sideboard PWA and the tape drive assembly

Required Tools

■ Flat blade screwdriver

■ #1 Phillips screwdriver

Removal Procedure

1. Turn off the tape library.

2. Remove the associated tape drive assembly.

3. Remove the tape drive assembly in the bay below the associated tape drive.

4. Remove the associated sideboard PWA.

5. Remove four Phillips screws from the floor of the tape drive bay that secure the drive tray PWA to the tape drive bay (see Figure 7-21).

6. Remove the drive tray PWA (with insulator and ESD shield) from the cabinet.
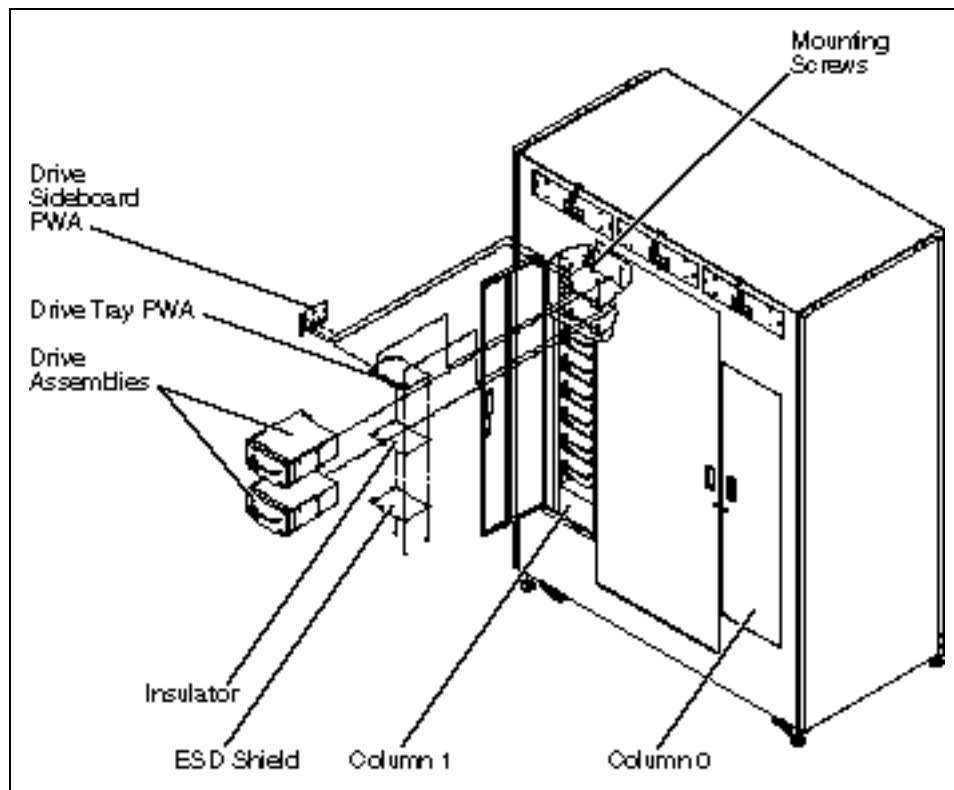
Figure 7-21. Drive tray PWA

Drive Sideboard PWA

Part Number 154861-001 (column 1) /154862-001 (column 0)

Location

■ A column 1 drive sideboard PWA is mounted to the left of each tape drive bay on the left side of the cabinet (viewed from the rear of the cabinet).

■ A column 0 drive sideboard PWA is mounted to the right of each tape drive bay on the right side of the cabinet (viewed from the rear of the cabinet).

Characteristics

■ Contains five connectors

■ Contains the drive bay rotary switch

■ 5.30 x 3.29 in (13.46 x 8.36 cm) PWA

Function

■ Serves as an interconnect between the drive tray PWA and the internal cabling

Required Tools

■ Flat blade screwdriver

■ #1 Phillips screwdriver

Removal Procedure

1. Turn off the tape library.

2. Open the rear tape drive access door.

3. Remove the associated tape drive.

4. Disconnect the SCSI cables at connector J3 and J4 near the front of the drive sideboard PWA (see Figure 7-22).

5. Disconnect the 30-conductor multi-colored ribbon cable from J5 near the back of the drive sideboard PWA.

6. Disconnect the 4-conductor power cable from J1 at the back of the drive sideboard PWA.

7. Remove four small Phillips mounting screws from inside the tape drive bay that secure the sideboard PWA in place.

8. Remove the sideboard PWA by disconnecting J2 at its base from the drive tray PWA.
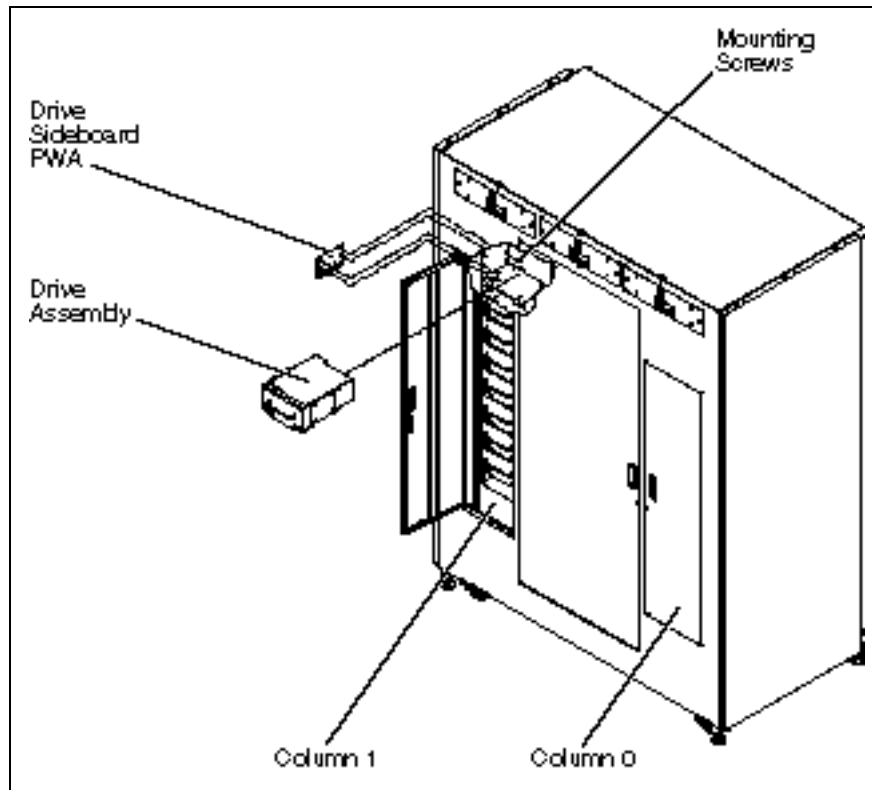
Figure 7-22. Drive sideboard PWA

NOTE: The drive bay rotary switch (Figure 7-23) on the drive sideboard PWA identifies the physical location of the sideboard PWA within the tape library. This switch does not set the drive SCSI IDs. Drive SCSI IDs are set through the control panel. When installing a new drive sideboard PWA, set the drive bay rotary switch as listed in Table 7-1.

Table 7-1
Drive Bay Rotary Switch Settings

Drive Bay	Top	2nd	3rd	4th	5th	6th	7th	Bottom
Column 0	0	1	2	3	4	5	6	7
Column 1	8	9	A	B	C	D	E	F
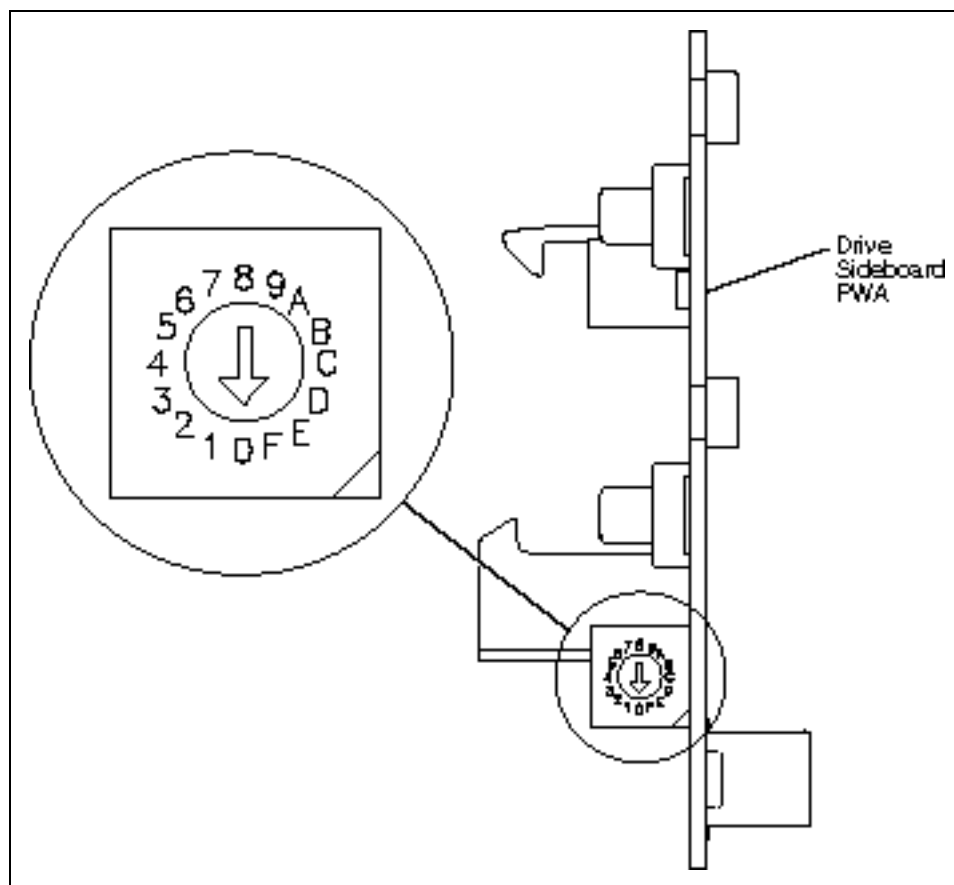
Figure 7-23. Drive bay rotary switch

Vertical Belt

Part Number 154864-001

Location

■ Inside vertical rails from top to bottom of cabinet

Characteristics

■ 1-in wide (2.54 cm)

■ 3/8-in pitch (0.9525 cm)

Function

■ Engaged by the y-axis stepper motor to drive the vertical carriage up and down the vertical rails

Required Tools

■ #2 Phillips screwdriver

■ 11/32-in open end wrench

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

> ⚠ **WARNING:** This product contains a Class II laser. Laser light - DO NOT stare into beam. Avoid Exposure - Laser Light is emitted from the bar code scanner.

3. To gain access to the right-side upper belt clamp screw:

   a. Disconnect all cables on the back of the y-axis interconnect.

   b. Remove the ESD shield mounting screws and the ESD shield.

   c. Remove the Phillips screw near the lower right edge of the y-axis interconnect that secures it to the vertical carriage.

   d. Remove the Phillips screw that secures the inside y-axis interconnect mounting bracket to the vertical carriage.

   e. Remove the two Phillips screws that secure the outside y-axis interconnect mounting bracket to the vertical carriage.

   f. Remove the y-axis interconnect and its mounting brackets from the vertical carriage.

4. Move the vertical carriage to the base of the cabinet.

5. Loosen the two upper belt clamp screws (see Figure 7-24).

6. Loosen the belt adjustment screw locknut.

7. Loosen the belt adjustment screw.

8. Remove the end of the belt from under the upper clamp.

9. Loosen the two lower belt clamp screws.

10. Remove the end of the belt from under the lower belt clamp.

11. Remove the belt from the cabinet.

12. To install the replacement belt:

    a. Place two cogs under the lower belt clamp.

    b. Route the belt across both pulleys.

    c. Cut the belt length so, with no tension applied, there are two cogs under the upper belt clamp.

13. Adjust the belt tension.
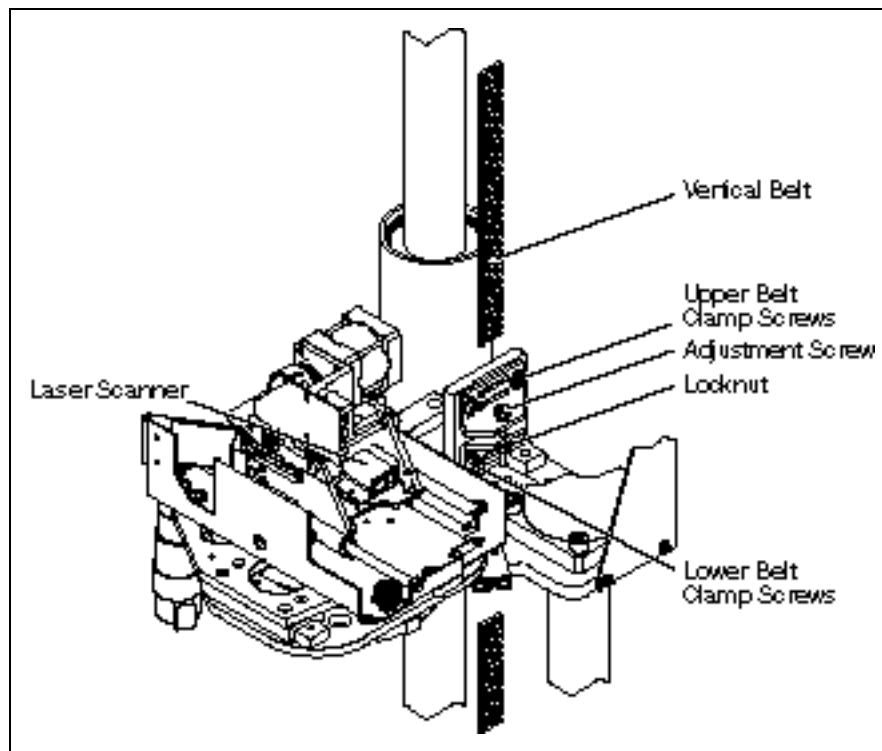
Figure 7-24. Vertical belt

Horizontal Belt

Part Number 154863-001

Location

■ Runs across the bottom of the cabinet, the top of the cabinet and down the right side of the cabinet

Characteristics

■ 1-in wide (2.54 cm)

■ 3/8-in pitch (0.9525 cm)

Function

■ Engaged by the horizontal axis stepper motor to drive the horizontal carriage left and right on the horizontal rail

Required Tools

■ #2 Phillips screwdriver

■ 11/32-in open end wrench

Removal Procedure

1. Turn off the tape library.

2. Open the front doors.

3. Manually raise the vertical carriage to the middle of the cabinet.

4. To hold the vertical carriage, squeeze the two sides of the vertical belt together, with the belt cogs interleaved, and secure them with a tie-wrap.

5. Note the route of the horizontal belt over the horizontal motor pulley and each of the horizontal idler pulleys.

6. Loosen the two right-side belt clamp screws (see Figure 7-25).

7. Loosen the belt adjustment screw locknut.

8. Loosen the belt adjustment screw.

9. Remove the end of the belt from under the right-side clamp.

10. Loosen the two left-side belt clamp screws.

11. Remove the end of the belt from under the left-side belt clamp.

12. Remove the four screws at the top of the horizontal carriage that secure the belt clamp to the horizontal carriage top plate, and remove the belt clamp.

13. Remove the belt from the cabinet.

14. To install the replacement belt:

    a. Place two cogs under the left-side clamp.

    b. Route the belt across the motor pulley and all of the idler pulleys (see Figure 7-26).

    c. Cut the belt length so, with no tension applied, there are two cogs under the right-side belt clamp.

15. Adjust the belt tension.

16. Reinstall the belt clamp on the horizontal carriage top plate.
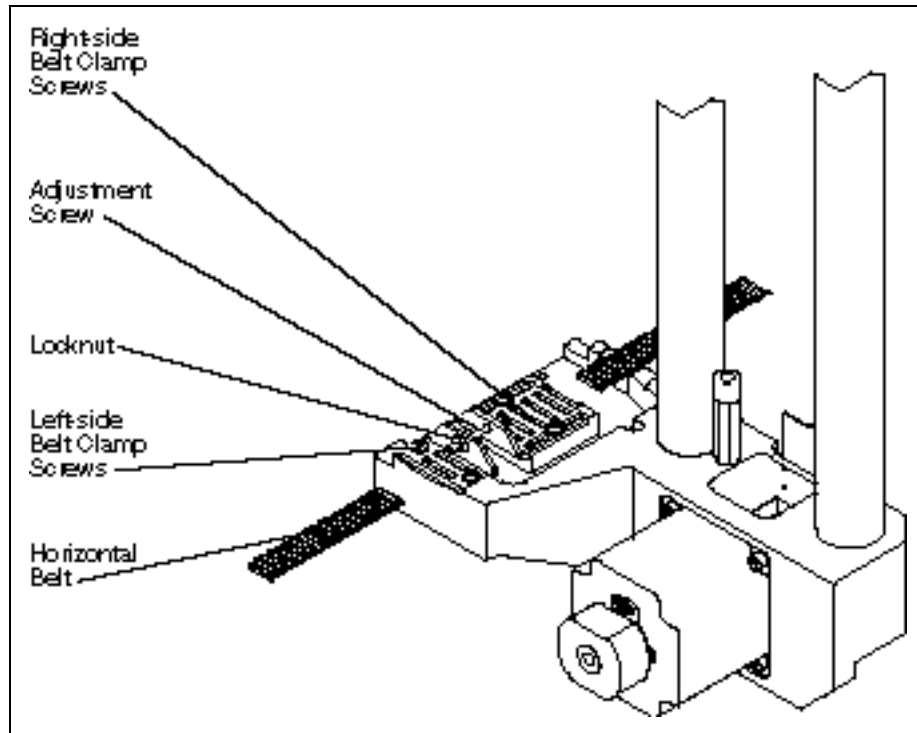
Figure 7-25. Horizontal belt
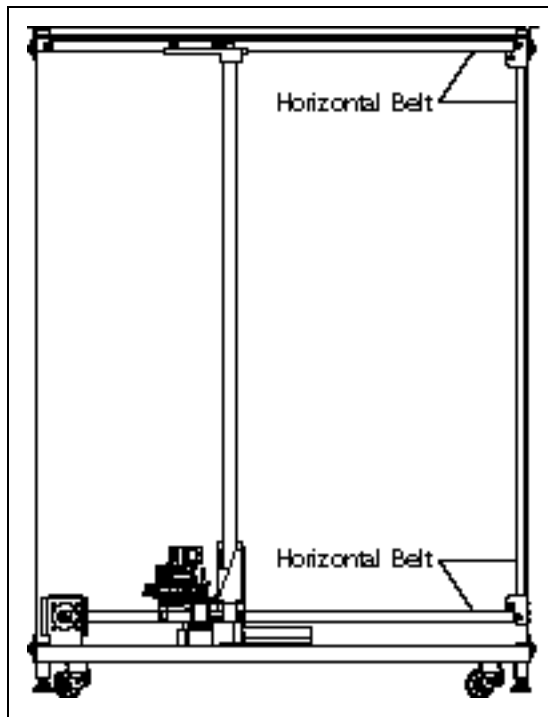
Figure 7-26. Horizontal belt routing

Compaq DLT Tape Drive Assembly

Part Number 154863-001 (Compaq DLT tape drive)
Part Number 154842-001 (Empty drive canister)

Location

- Column 0 from top - drives 0 through 7

- Column 1 from top - drives 8 through 15

- Access for hot-swap through rear access doors

Characteristics

- hot-swap capable

- 1/2-in cartridge tape drive

- 5.25-in form factor

Function

- Writes data to and reads data from DLT cartridges

Required Tools

- 5/32-in hex key

- Flat blade screwdriver

Removal Procedure

1. Turn off the tape library.

2. Follow the procedures for removing a Compaq DLT tape drive. Refer to "Compaq DLT Tape Drive" described earlier in this chapter.

3. Remove the screw that secures the bracket to the right side of the drive canister (see Figure 7-27).

4. Remove the bracket.

5. Remove the four screws that secure the Compaq DLT tape drive to the drive canister.

6. Remove the Compaq DLT tape drive from the drive canister.
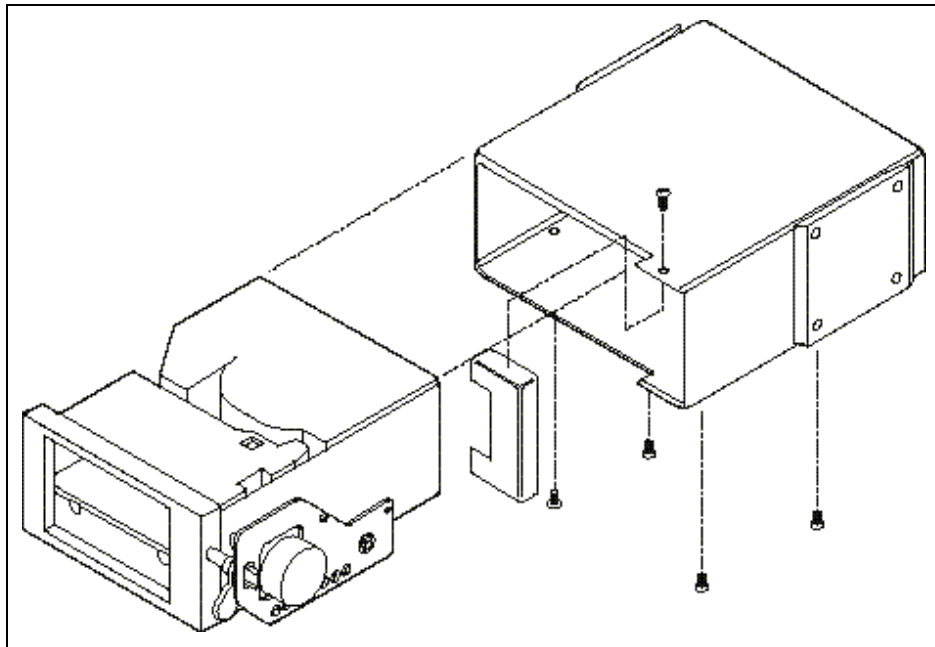
Figure 7-27. Compaq DLT tape drive and drive canister

Diagnostic Software

Introduction

The Compaq ESL9000 Series Tape Library diagnostic software runs on a personal computer (PC) and provides the ability to test individual components and overall operation of the tape library. Topics discussed in this chapter are:

- Installing the diagnostic software on a PC

- Connecting the library to the diagnostic PC

- Starting the diagnostic software

- Understanding the diagnostic software user interface

- Using the diagnostic software

- Exiting the diagnostic software

Installing Diagnostic Software

To install the diagnostic software:

1. Insert the diagnostic diskette into diskette drive "A."

2. At the C:\> prompt, type: A:\INSTALL

3. Press the **Enter** key.

   This starts the installation process.

   NOTE: The install program creates a directory called TAPELIB on the C drive and copies the files listed in Table 8-1 into the new directory.

**Table 8-1
TAPELIB Directory**

File	Description
README.DOC	Contains the latest product information and installation instructions
LIB.DAT	Batch file that invokes the TAPELIB diagnostic program
TAPELIB.EXE	Executable file
TAPELIB.HLP	On-line help file
TAPELIB.MSG	On-line error message data file
TAPELIB.NDX	On-line error message index file
INSTALL.BAT	Installation batch file
PP6.TST	Pre-defined test script

Working with Native MS-DOS

To work in native MS-DOS, you must restart the computer from a bootable diskette.

1. Create a bootable MS-DOS diskette.

   a. Using a computer, go to the MS-DOS prompt (or shell).

   b. Insert a blank diskette into drive A.

   c. Type Format A:/S and press the **Enter** key.

   d. When asked for a label name, press the **Enter** key.

   e. After the formatting is complete, remove the diskette.

2. Boot from native MS-DOS as follows:

   a. Shut down the computer.

   b. Insert the bootable MS-DOS diskette.

   c. Restart the computer. It will come up in native MS-DOS.

3. From native MS-DOS, change to the hard drive and the directory TAPELIB, wherever it is located.

   a. Set the computer's serial port to COM1.

   b. Specify a baud rate of 9600 in the command TAPELIB/B9600.

   NOTE: The tape library diagnostic program must operate from native MS-DOS when using the Flash Download function. For all other functions, use either native MS-DOS or run from a MS-DOS window.

Connecting to the Diagnostic PC

Use the following procedure to connect the tape library to a diagnostic PC.

1. Open the rear center access door on the tape library.

2. Route the RS-232 diagnostic cable through the cable access hole in the bottom of the cabinet and connect it to the 9-pin diagnostic port (J2) on the robotics controller Printed Wiring Assembly (PWA). Note that connector J2 is exposed on the left side of the electronics bay (see Figure 8-1).

3. Connect the other end of the RS-232 cable to the COM port on the diagnostic PC.
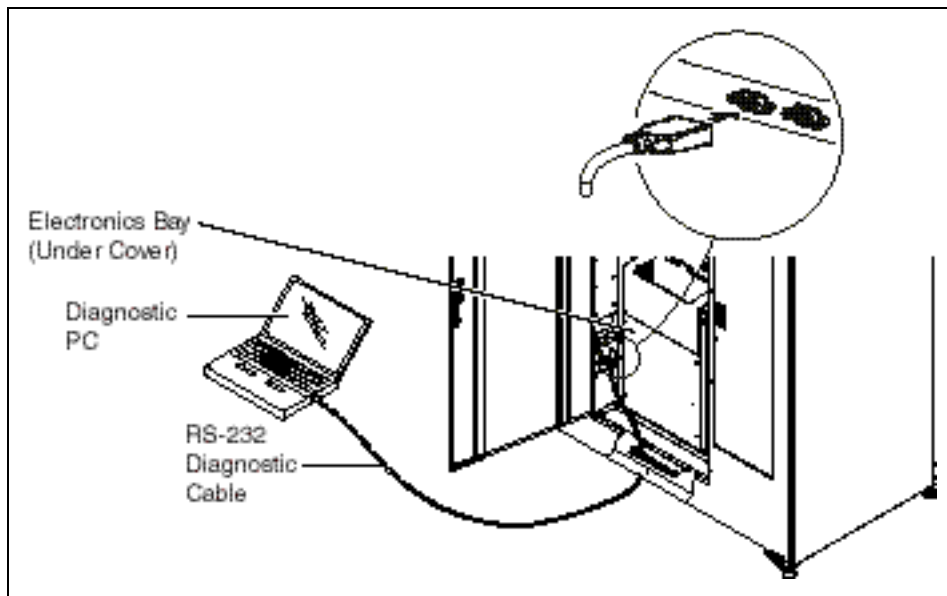
Figure 8-1. Connecting the diagnostic cable

Starting Diagnostic Software

1. Turn on the tape library.

2. Press the **Standby** button on the control panel to switch the tape library to off-line.

3. Set the diagnostic PC in MS-DOS mode.

4. At the DOS prompt type: TAPELIB /b9600 /M /D /CX and then press the **Enter** key,

   where:

   /b = Serial port baud rate. This must be set at 9600 baud rate when interfacing with the tape library. The default is 2400 baud rate.

   /M = Indicates a monochrome display. If this variable is omitted, the software assumes a color monitor is being used.

   /D = Enables the software to capture messages to/from the diagnostic COM port. Messages are logged in the file *CAPTURE.TXT* in the diagnostic software home directory.

   /CX = If specified, uses the COM port (1 or 2) for communication to the host. Supported ports are COM 1 and COM 2. The default is COM1.

5. After several seconds, verify that the main menu appears (see Figure 8-2).

Table 8-2 lists examples of TAPELIB initialization commands.

Table 8-2
Examples of TAPELIB Initialization Commands

Command	Monitor Type	Port Used
TAPELIB /b9600	Color	COM 1
TAPELIB /b9600	Color	COM 1
TAPELIB /b9600 /M	Monochrome	COM 1
TAPELIB /b9600 /M	Monochrome	COM 1
TAPELIB /b9600 /C2	Color	COM 2
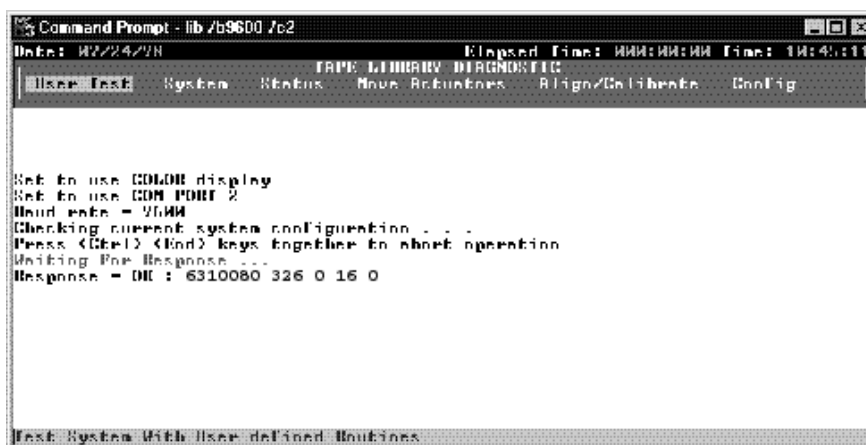
Figure 8-2. Diagnostic software main menu

Modifying the *LIB.BAT* File

If you plan to use *TAPELIB.EXE* with the same configuration options every time, you can modify the *LIB.BAT* file using a text editor. The default *LIB.BAT* file includes the following commands:

```
@ ECHO OFF
C:
CD\TAPELIB
TAPELIB %1%2%3
ECHO ON
```

The variables %1, %2, %3 are configuration options. These variables are described in step 4 of the previous section, "Starting Diagnostic Software". You can modify these options to reflect your specific configuration.

For example, if you plan to use the diagnostic software to control the tape library from a monochrome laptop PC through COM port 2, modify the batch file as shown below:

```
@ ECHO OFF
C:
CD\TAPELIB
TAPELIB /b9600 /M /C2
ECHO ON
```

When you have finished editing the *LIB.BAT* file, save the file under a new file name, for example, *ESL9000.BAT*.

To execute the modified file, type the following at the C: prompt:

```
ESL9000
```

Using Online Help

The online help file, *TAPELIB.HLP*, can be viewed at any time when running the software by pressing the **F1** function key. The help file explains how to use the software and describes special features. (Press the **Enter**+**Shift**+**F1** keys for a more detailed description of the function in question.)

> **NOTE:** You may modify this file to include additional information by using a text editor. However, no line can be longer than 70 characters (a tab is equivalent to four character spaces) and the total file size must be under 5 KB.

Online Error Messages

The diagnostic software automatically displays an error code description each time an error is received from the component being diagnosed. These error descriptions are contained in the error message data file called *TAPELIB.MSG*. An index file, *TAPELIB.NDX*, is included to provide pointers to each error code description.

Using the Diagnostic Software

The diagnostic software options are described in the following sections in the order in which they appear in the Main menu. The listing begins with the User Test menu and ends with the Config menu. Figure 8-3 shows the Main menu screen and Figure 8-4 shows the Diagnostic menu structure. An arrow (>) to the right of an option in a pull-down menu list indicates that a sub-menu exists.

Main Menu

The Main menu screen displays six categories of diagnostic functions (see Figure 8-3).

- User test

- System

- Status

- Move actuators

- Align/calibrate

- Config

Figure 8-3. Main menu

To navigate the Main menu:

1. Use the **Left** and **Right** arrow keys to highlight one of the diagnostic categories.

2. When the category is highlighted, press the **Enter** key to select it. A drop-down menu appears listing the available options (see Figure 8-4).

Main Menu		
System Tests	**Move Actuators**	**Config**
Loop Mode	Self Test All	Configure System
Set Loop Count	Home All	Report System
Exercise Horizontal	Horizontal Axis >	Init Inventory
Exercise Vertical	Vertical Axis >	Init Non-vol RAM
Exercise Extension	Extension Axis >	Recovery >
Exercise Gripper	Gripper >	Auto Drive Unload >
Pick/Place All	Rotary >	Barcode Retries >
Report Calibration	Drive Door >	Auto Inventory >
Bin SysTest	Load Port >	No Barcode >
Bin/Drive SysTest	Unload Tape	Clean Tape >
Random SysTest	Move Cartridges >	Flash Download >
Random Bin SysTest	Barcode Cartriges >	
Random Bin/Drive SysTest		
Abort Command		

User Test	**Status**	**Align/Calibrate**
Loop Mode	Actuator Status	Calibrate >
Set Loop Count	Report Statistics	Library SCSI ID
Track Mode	Reset Statistics	Report Lib. SCSI ID
User Input Command	SysTest Info	Drive SCSI ID
PP6.TST	System Info	Reset Drive
	Display Serial #	Report Drive
	Element Status >	Bin Position >
		Drive Position >
		Load Port Position >

NOTE: An arrow (>) to the right of an option indicates selection of that option will display a sub-menu.

Figure 8-4. Diagnostic software menu options

3. To execute an option, highlight it and press the **Enter** key. Press the **Esc** key to exit any sub-menu or pop-up window.

User Test Menu

The User Test menu (see Figure 8-5) lets you

■ enable or disable Loop Mode.

■ set the number of times a command executes.

■ log Command Status window messages to a designated disk file through Track Mode.

■ display a user-defined test script.

Once you create a user-defined test script, the file name is displayed in the User Test menu window below the User Input Cmd line.
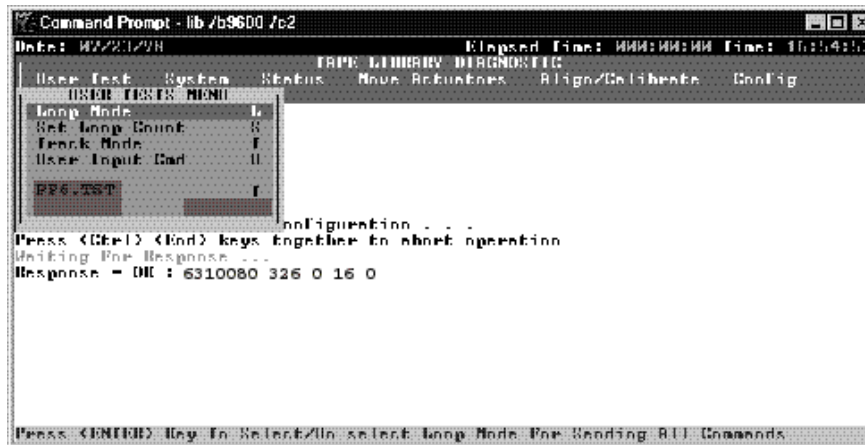
Figure 8-5. User test menu

Loop Mode

Enabling Loop Mode causes the diagnostic software to send commands or sequences of commands continuously. When active, the Loop Mode option (in the drop-down menu) is prefaced with ">>" and Loop Mode flashes on and off in the top-center of the screen.

To terminate commands running in Loop Mode, press the **End** key.

> **NOTE:** When **End** is received, the software waits for the completion of the current command or cycle, then terminates the function and returns to the menu.

To enable Loop Mode:

1. Highlight User Test and press the **Enter** key.

2. Highlight Loop Mode and press the **Enter** key to enable the option. Loop Mode flashes on and off in the top center of the screen.

To disable Loop Mode:

1. With Loop Mode flashing at the top of the screen, highlight User Test and press the **Enter** key.

2. Highlight Loop Mode and press the **Enter** key to disable the option.

   The flashing Loop Mode indicator at the top of the screen disappears.

Set Loop Count

The Set Loop Count option allows you to select the number of times the tape library will perform a command or sequence of commands when Loop Mode is enabled.

For example, if Loop Mode is enabled, the loop count is set to five, and you select the Exercise Gripper command, the tape library will perform the Exercise Gripper command five times and then stop automatically.

To terminate commands running in Set Loop Count, press the **End** key.

> **NOTE:** When **End** is received, the software waits for the completion of the current command or cycle, then terminates the function and returns to the menu.

To set the loop count:

1. Highlight User Test and press the **Enter** key.

2. Highlight Set Loop Count and press the **Enter** key.

   TAPELIB displays a pop-up window prompting you to enter the desired loop count.

3. Use the numeric keys to enter the desired loop count, then press the **Enter** key.

   You can select any value from 2 to 2000000000. The default value is 2000000000.

Track Mode

This option lets you log all messages in the Command Status window to a user-defined disk file.

To enable the Track Mode:

1. Highlight User Test and press the **Enter** key.

2. Highlight Track Mode and press the **Enter** key to enable the option.

   A pop-up window appears.

3. Type in a file name and press the **Enter** key to define the disk file and enable the tracking mode.

> **NOTE:** The file name is limited to eight alphanumeric characters. If you do not enter a file name when requested, the default file name is *TAPELIB*.

4. Verify that Track appears at the top center of the screen.

To disable Track Mode:

1. Highlight User Test and press the **Enter** key.

2. Highlight Track Mode and press the **Enter** key to disable the option.

3. Verify that Track no longer appears on the top center of the screen.

The message sequence is saved on disk in a file named *FILENAME.TRK*, where filename is the file name you specified above. The file is stored in the same directory with the diagnostic software program.

User Input Command

This option lets you enter commands as an ASCII string of characters. It is a development tool not used during normal field service functions. When selected, a password must be entered before the function executes.

To utilize the User Input command:

1. Highlight User Test and press the **Enter** key.

2. Highlight User Input Cmd and press the **Enter** key to enable the option.

   A pop-up window appears.

3. At the Enter Password prompt, type in an authorized password and press the **Enter** key.

4. At the Enter Command line, type in a single line of text representing the function you want performed, for example, SELFTEST ALL.

5. Press the **Enter** key and the command is executed.

This command is equivalent to the menu selection, Move Actuators: Self Test All.

PP6.TST

This test picks cartridges from and places cartridges into the drives and storage bins, exercising all major components of the system. Run PP6.TST as an overall test after servicing the tape library. This test can also be used with the Loop Mode as a demonstration of tape library operation.

To run PP6.TST:

1. Before running this option, verify the following conditions:

   a. There are cartridges in slots 0-5 and 36.

   b. All other storage bins are empty.

   c. All drives are unloaded and ready to accept a cartridge.

   d. The gripper is empty and ready to accept a cartridge.

   e. The tape library has a current inventory of the cartridges.

2. Highlight User Test and press the **Enter** key.

3. Highlight PP6.TST and press the **Enter** key to run the test.

> **NOTE:** The best way to stop the test is to press the **End** key. This stops the test at the end of the loop. The test may then be restarted without moving cartridges. A loop takes approximately 15 minutes to complete.

> **IMPORTANT:** If the test is aborted, then the cartridges must be moved to satisfy the initial conditions described in Step 1 before restarting the test.

User-Defined Tests

This option lets you run diagnostic routines that you create. These routines appear at the bottom of the User Test menu. Create diagnostic routines by capturing one or more commands and saving the commands to a disk file. The routines can be created in normal (standby) mode or in simulation mode.

To capture commands:

1. Press the **Alt**+**C** keys to enter the User Defined Test function.

   A pop-up window appears.

2. Type in a file name and press the **Enter** key.

> **NOTE:** The file name is limited to eight alphanumeric characters. If the file name you select already exists, you may choose to either append to it, or overwrite it.

3. Use the navigation arrows to highlight a test that you want to run, and then press the **Enter** key to execute and capture the command.

4. Repeat step 3 for all additional commands.

5. Press the **Alt**+**E** keys to end the capture mode.

The command sequence is saved on disk in a file named *FILENAME.TST*, where filename is the file name you specified above. All files with the *.TST* extension are automatically added to the User Tests menu and are selectable in the same manner as other options. The file is stored in the same directory with the Diagnostic Software Program.

To run a user-defined test:

1. Highlight User Test and press the **Enter** key.

2. Highlight the test that you want to run and press the **Enter** key to execute it.

System Tests Menu

The System Tests Menu (see Figure 8-6) provides high-level command options that exercise the entire hardware components and test routines that run all tape library actuators.
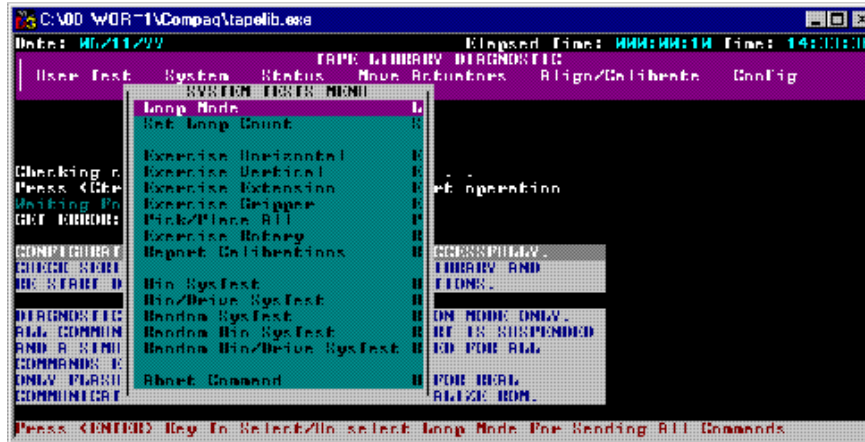
Figure 8-6. System tests menu

Loop Mode Test

See the "Loop Mode" section described earlier in this chapter for a detailed description of this option. The Loop Mode option is also included in this menu for ease of accessibility.

Set Loop Count

See the "Set Loop Count" section described earlier in this chapter for a detailed description of this option. The Set Loop Count option is also included in this menu for ease of accessibility.

Exercise Horizontal Test

This test homes the horizontal axis and moves it to two additional positions. Use it to verify the proper operation of the horizontal actuator and the horizontal home, limit, and confirmation sensors.

To exercise the horizontal axis:

1. Highlight System and press the **Enter** key.

2. Highlight Exercise Horizontal and press the **Enter** key.

Exercise Vertical Test

This test homes the vertical axis and moves it to two additional positions. Use it to verify the proper operation of the vertical actuator and the vertical home and confirmation sensors.

To exercise the vertical axis:

1. Highlight System and press the **Enter** key.

2. Highlight Exercise Vertical and press the **Enter** key.

Exercise Extension Test

Exercise Extension homes the extension axis and moves it to two additional positions. Use this test to verify the proper operation of the extension actuator and the extension home and limit sensors.

To exercise the extension axis:

1. Highlight System and press the **Enter** key.

2. Highlight Exercise Extension and press the **Enter** key.

Exercise Gripper Test

This option closes and opens the gripper. Use it to verify the proper operation of the gripper actuator and the gripper open and close sensors.

To exercise the gripper:

1. Highlight System and press the **Enter** key.

2. Highlight Exercise Gripper and press the **Enter** key.

Pick/Place All Test

This test picks a cartridge from each of the storage bins and moves it to a new storage bin location, exercising major components of the system in the process. Run Pick/Place All as an overall test after servicing the library or as a demonstration of tape library operation.

When the test routine starts, it picks the cartridge from storage bin 127 and moves it to bin 0. Then, it picks a cartridge from bin 84 and moves it to bin 127. This process continues until all cartridges have been picked and moved to a new bin location. The test then repeats this loop continuously.

> **CAUTION:** Do not run Pick/Place All if you prefer to assign fixed locations for the tape cartridges within the tape library. This test moves cartridges but does not return them to their original locations.

IMPORTANT: Before running the Pick/Place All test, make sure these conditions are met:

1. All bin locations of the FSA contain a cartridge except storage bin 0.

2. The gripper is empty and ready to accept a cartridge.

3. The tape library has a current inventory of the cartridges.

To run Pick/Place All:

1. Use the Pick from Bin option to remove the cartridge at storage bin 0. Refer to Table 8-9 for more information.

2. Remove the tape cartridge from the gripper by either using the Place into Load Port option to place the cartridge into the load port, from which it can be removed, or by using the Place into Drive option to place the cartridge into a tape drive.

3. Highlight System and press the **Enter** key.

4. Highlight Pick/Place All and press the **Enter** key to run the test.

   A pop-up Warning window appears.

5. Enter Y to continue the test or N to return to the previous menu then press the **Enter** key.

   NOTE: To stop the test press the **End** key. This stops the test at the end of the present loop. The test may then be restarted without moving cartridges.

   If the test is aborted, then the cartridges must be moved to satisfy the initial conditions described in step 1 before restarting the test.

Exercise Rotary

This option lets you exercise the rotary axis. Use this test to verify the rotary axis accuracy and proper operation as follows:

1. Highlight System and press the **Enter** key.

2. Highlight Rotary and press the **Enter** key.

Report Calibrations Test

This test reports extension axis and vertical position values for each drive and for bin 0.

Bin SysTest

This test picks tapes from and places to all bins. The test is sequential; it starts with bin 0 and continues in order through all storage bins.

The test finds a bin with a tape cartridge and places it into the next available bin. A test run is complete when the gripper has picked and placed to each bin.

Bin/Drive SysTest

This test picks a tape from each bin and places to a drive and also picks from a drive and places to each bin. The test is sequential; it starts with bin 0 and continues in order through the bins.

The test finds a bin with a tape cartridge and places it into the next available drive. If no drive is available, the tape cartridge is placed into the next available bin. When a drive unloads a tape cartridge, it is picked from the drive and placed into the next available bin. A test run is complete when the gripper has picked and placed to each bin.

Random SysTest

This test randomly picks from and places to both bins and drives.

The test randomly finds a bin with a tape cartridge and places it into the next available drive. If no drive is available, the tape cartridge is randomly placed into an available bin. When a drive unloads a tape cartridge, it is picked from the drive and randomly placed into an available bin. A test run is complete when the gripper has picked and placed to each bin.

Random Bin SysTest

This test randomly finds a bin with a tape cartridge and randomly places it into an available bin. A test run is complete when the gripper has picked and placed to each bin.

Random Bin/Drive SysTest

This test randomly moves tape cartridges between bins and drives. This test differs from the Random SysTest because it does not move tape cartridges between bins.

The test randomly finds a bin with a tape cartridge and places it into the next available drive. If no drive is available, then no moves are performed until an empty drive is available. When a drive unloads a tape cartridge, it is picked from the drive and randomly placed in an available bin. A test run is complete when the gripper has picked each bin and placed its tape cartridge to a drive or another bin.

Abort Command

This option aborts the command that is currently running.

Status Menu

The Status Menu (see Figure 8-7) reports actuator status, statistical information, and system configuration information.

Figure 8-7. Status menu

Actuator Status

This option reports the position of each of the four actuators (horizontal, vertical, extension, and gripper) in the tape library. The Return Status window displays this information. Use this option to test each actuator for proper operation and tracking.

> **CAUTION:** Perform a Self Test All and Home All before selecting Actuator Status. If you do not perform these functions, you may receive erroneous status information.

To display the status of the actuators:

1. Highlight Status and press the **Enter** key.

2. Highlight Actuator Status and press the **Enter** key. The Return Status window shows the position of every actuator in the library, pauses for four seconds, then updates the display with the current changes in the position of each actuator location.

3. Press the **End** key to terminate the report.

Report Statistics

This option displays a screen of statistical information that is stored in nonvolatile RAM on the library robotics controller. The information returned includes:

■ The total power-on hours (POH) for the library.

■ The command time.

■ The numbers of actuations for each of the axes.

■ The numbers of picks and places involving bins and drives.

■ The number and type of retries performed by the library to continue its operation.

To display the library statistics:

1. Highlight Status and press the **Enter** key.

2. Select Report Statistics and press the **Enter** key. The Return Status window displays the statistics.

Reset Statistics

This option resets the statistics table. It is a development tool and is not used for normal field service functions. When selected, a password must be entered before the function is executed.

SysTest Info

This option polls the tape library for the results of the last system test that was run on the tape library. The values are saved in nonvolatile RAM so that a power cycle to the tape library does not reset them.

The return string contains the following items in the following order:

■ Total number of picks and places

■ Last operations status (example: B8302)

■ Total test time in msecs

■ Test type (examples: RANDOM or BIN)

■ Average drive-to-bin move time in msecs

■ Average bin-to-drive move time in msecs

■ Average bin-to-bin move time in msecs

■ Longest move time in msecs

■ Number of bad bar code reads

■ Number of places to drive 0 through 15

■ Number of places to bins

■ Number of places to load port

■ Next-to-last operation (example: Pick B:10)

■ Last operation (example: Place D:1)

System Info

System Info reports the model number, current firmware revision and configuration of the tape library.

To display the system information for the tape library:

 1. Highlight Status and press the **Enter** key.

 2. Select System Info and press the **Enter** key to display the information in a Return Status window.

Display Serial

This option lets you display the serial number of the tape library next to the date on the information line. You must first enter the serial number.

To display the serial number:

 1. Highlight Status and press the **Enter** key.

 2. Select Display Serial# and press the **Enter** key.

   A pop-up windows appears.

 3. Enter the serial number of the library and press the **Enter** key.

Element Status

This option displays status information for the bins, loader, gripper, or drives (refer to Table 8-3).

> **NOTE:** This function is not currently supported.

**Table 8-3
Element Status Sub-Menu Functions**

Option	Description
Bin	Selecting this option reports the status of the selected bin.
Loader	Selecting this option reports the status of the loader.
Gripper	Selecting this option reports the status of the gripper.
Drive	Selecting this option reports the status of the selected drive.

To display the element status:

1. Highlight Element Status and press the **Enter** key.

   A sub-menu appears.

2. Select one of the following options and press the **Enter** key:

   ❑ Bin

   ❑ Loader

   ❑ Gripper

   ❑ Drive

3. Respond to any status-defining queries.

   The status is reported.

Figure 8-8 shows the numbering conventions for the tape library's fixed storage array bins, load port, and tape drives.
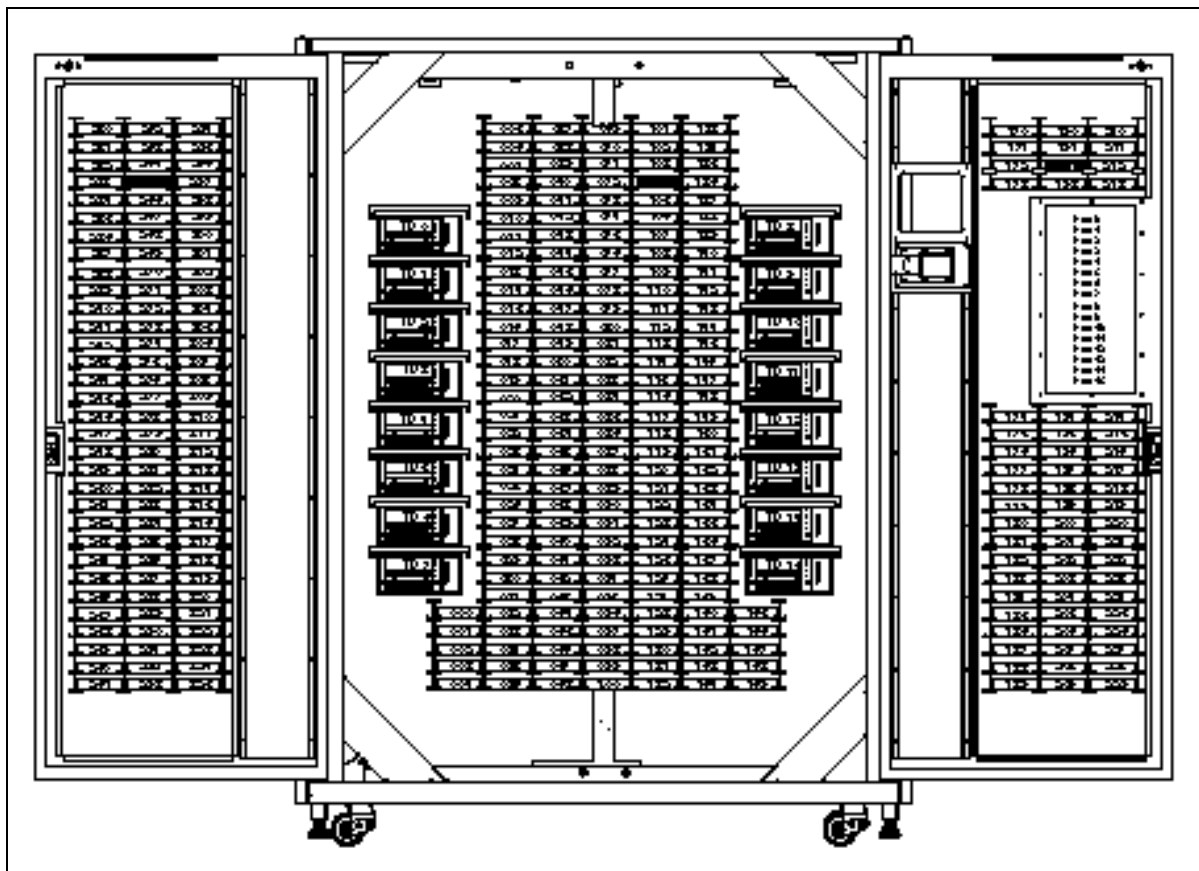
Figure 8-8. Tape library numbering conventions

Move Actuators Menu

The Move Actuators Menu (Figure 8-9) lets you

■ test the tape library actuators and the tape drive insert/release handle.

■ unload cartridges from the tape drives.

■ move individual cartridges within the tape library.

■ read the bar code labels of individual cartridges.

Figure 8-9. Move Actuators menu

Self Test All

This option tests the performance of the motors. Self Test All sends a short electrical pulse to the extension axis, gripper, and drive door motors and then reads the encoder or sensor data associated with each motor.

To self-test the motors in the system:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Self Test All and press the **Enter** key.

Home All

This option returns all actuators to their home positions.

To home all actuators:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Home All and press the **Enter** key.

Horizontal Axis

This option tests individual movements of the horizontal axis.

Table 8-4
Horizontal Axis Sub-Menu Functions

Option	Description
Self Test	Performs a self-test of the horizontal axis.
Home	Returns the horizontal axis to its home position.
Move to Bin	Moves the horizontal axis directly in front of a bin location (0-325) that you specify via a pop-up window.
Move to Drive	Moves the horizontal axis directly in front of the drive (0-15) that you specify via a pop-up window.
Move to Load Port	Moves the horizontal axis directly in front of the load port bin (0-11) that you specify via a pop-up window.
Move to Position	Moves the horizontal axis to a position relative to the home location. Enter a number (in the pop-up window) to specify the position. The position is specified in inches. A positive number moves the axis toward the rear of the tape library. A negative number moves the axis toward the front.

To actuate the horizontal axis:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Horizontal Axis and press the **Enter** key.

3. Highlight the desired test and press the **Enter** key.

4. For a Move to … option, a pop-up windows displays prompting you to enter one of the following based on your selection:

   a. Storage Bin: (0 to 325)

   b. Drive Number: (0 to 15)

   c. Load Port Bin: (0 to 11)

   d. Position: (-2.00 to 36.00)

5. Enter the appropriate information and press the **Enter** key.

Vertical Axis

This option tests individual movements of the vertical axis (refer to Table 8-5).

Table 8-5
Vertical Axis Sub-Menu Functions

Option	Description
Self Test	Performs a self-test of the vertical axis.
Home	Returns the vertical axis to its home position.
Move to Bin	Moves the vertical axis directly in front of a bin location (0-325) that you specify via a pop-up window.
Move to Drive	Moves the vertical axis directly in front of the drive (0-15) that you specify via a pop-up window.
Move to Load Port	Moves the vertical axis directly in front of the load port bin (0-11) that you specify via a pop-up window.
Move to Position	Moves the vertical axis to a position relative to the home location. Enter a number (in the pop-up window) to specify the position. The position is specified in inches. A positive number moves the axis toward the top of the tape library. A negative number moves the axis toward the bottom.

To actuate the vertical axis:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Vertical Axis and press the **Enter** key.

3. Highlight the desired test and press the **Enter** key.

4. For a Move to … option, a pop-up windows displays prompting you to enter one of the following based on your selection:

   a. Drive Number: (0 to 15)

   b. Position: (-1.50 to 52.00)

   c. Bin# For Face: (0 to 23)

   d. Load Port Bin: (0 to 11)

5. Enter the appropriate information and press the **Enter** key.

Extension Axis

This option tests individual movements of the extension axis (refer to Table 8-6).

> ⚠ **CAUTION:** Make sure that the extension axis is returned to the Home position before leaving this menu. If a move command is issued while the extension axis is in an extended position, the extension axis may be damaged.

Table 8-6
Extension Axis Sub-Menu Functions

Option	Description
Self Test	Actuates the extension drive motor and then reads the returned encoder, home sensor, home sensor interrupt, and current feedback information to verify that the motor, encoder, and other sensors are working properly.
Home	Returns the extension axis to its home position.
Move to Drive	Moves the extension axis directly in front of the drive (0-15) that you specify via a pop-up window.
Move to Load Port	Moves the extension axis directly in front of the load port bin (0-11) that you specify via a pop-up window.
Move to Position	Moves the vertical axis to a position relative to the home location. Enter a number (in the pop-up window) to specify the position. The position is specified in inches. A positive number moves the axis toward the storage bins. A negative number moves the axis away from the storage bins.

To actuate the extension axis:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Extension Axis and press the **Enter** key.

3. Highlight the desired test and press the **Enter** key.

4. For a Move to … option, a pop-up windows displays prompting you to enter one of the following based on your selection:

   a. Drive Number: (0 to 15)

   b. Load Port Bin: (0 to 11)

   c. Position: (-0.50 to 5.50)

5. Enter the appropriate information and press the **Enter** key.

Gripper

This option tests individual movements of the gripper assembly (refer to Table 8-7).

Table 8-7
Gripper Sub-Menu Functions

Option	Description
Self Test	Opens and closes the gripper jaw to verify proper functioning of the motor and the gripper sensors.
Home	Moves the gripper to its home (closed) position.
Open	Opens the gripper jaw.
Close	Closes the gripper jaw.

To actuate the gripper:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Gripper and press the **Enter** key.

3. Highlight the desired test and press the **Enter** key.

Drive Door

This option tests the stepper motors that control the Compaq tape drive insert/release handle (refer to Table 8-8).

Table 8-8
Drive Door Sub-Menu Functions

Option	Description
Self Test	Opens and closes the drive door to verify proper functioning of the stepper motor and the sensor operation.
Home	Moves the drive door to its home (closed) position.
Open	Opens the drive door.
Close	Closes the drive door.

To actuate a tape drive door:

1. Highlight Move Actuators and press the **Enter** key.

   A pop-up window appears.

2. Highlight Drive Door and press the **Enter** key.

3. At the Drive Number (0:6): prompt, type the drive number and press the **Enter** key.

4. Highlight the desired test and press the **Enter** key.

   A pop-up window appears.

Rotary

This option tests the tape library's rotary axis (refer to Table 8-9).

Table 8-9
Rotary Sub-Menu Functions

Option	Description
Self Test	Performs a rotary axis self test.
Home	Moves the rotary axis to its home position.
Front	Rotates the axis to face the front.
Back	Rotates the axis to face the back.

To test the rotary axis:

1. Highlight Move Actuators and press the **Enter** key.

   A pop-up window appears.

2. Highlight Rotary and press the **Enter** key.

3. Highlight the desired test and press the **Enter** key.

   A pop-up window appears.

Load Port

This option lets you insert or unload cartridges to/from the load port bins manually (refer to Table 8-10).

Table 8-10
Load Port Sub-Menu Functions

Option	Description
Lock	Locks the load port.
Unlock	Unlocks the load port to open or close it.

To unlock the load port:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Load Port and press the **Enter** key.

3. Highlight Unlock and press the **Enter** key.

Unload Tape

This option performs the same function as the Unload button on the tape drive or the execution of an Unload Drive command from the Operator's screen on the control panel. When the cartridge finishes rewinding to the beginning of the tape, actuating the drive door or picking the cartridge from the drive can eject it.

To unload a cartridge from the drive:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Unload Tape and press the **Enter** key.

   A pop-up window appears.

3. At the Drive Number (0:15): prompt, enter the number of the drive containing the cartridge to be rewound and press the **Enter** key.

   NOTE: When you execute this command, the tape cartridge will rewind completely. Depending on the tape position, it can take up to two minutes before the tape drive Operate Handle indicator lights.

Move Cartridges

This option lets you move (pick or place) cartridges to and from bins (fixed storage bins and load port bins) and tape drives (refer to Table 8-11). This test can also scan a bar code label from a cartridge in a specific location.

Before running this test, the library must have a current inventory of the cartridges. The gripper must also be empty before picking a cartridge from a bin or drive, and must be gripping a cartridge before placing a cartridge into a bin or drive.

Table 8-11
Move Cartridges Sub-Menu Functions

Option	Description
Pick from bin	Picks a cartridge from a storage bin (0-95) that you specify via a pop-up window.
Pick from load port	Picks a cartridge from a load port bin (0-3) that you specify via a pop-up window.
Pick from drive	Picks a cartridge from a tape drive (0-6) that you specify via a pop-up window.
Place into bin	Places a cartridge into a storage bin (0-95) that you specify via a pop-up window.
Place into load port	Places a cartridge into a load port bin (0-3) that you specify via a pop-up window.
Place into drive	Places a cartridge into a tape drive (0-6) that you specify via a pop-up window.

To pick a cartridge:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Move Cartridges and press the **Enter** key.

3. Highlight Pick From Bin, Pick From Load Port, or Pick From Drive and press the **Enter** key.

   NOTE: There must be a cartridge in the source bin or drive you select.

4. For any selection, a pop-up window appears prompting you to enter one of the following, based on your selection in Step 3:

   ❑ Storage Bin: (0 to 325)

   ❑ Load Port Bin: (0 to 11)

   ❑ Drive Number: (0 to 15)

5. Enter the appropriate information and press the **Enter** key.

To place a cartridge:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Move Cartridges and press the **Enter** key.

3. Highlight Place Into Bin, Place Into Load Port, or Place into Drive and press the **Enter** key.

   NOTE: The destination bin or drive you select must be empty.

4. For any selection, a pop-up window appears prompting you to enter one of the following, based on your selection in Step 3:

■ Storage Bin: (0 to 325)

■ Load Port Bin: (0 to 11)

■ Drive Number: (0 to 15)

5. Enter the appropriate information and press the **Enter** key.

Bar Code Cartridges

This option reads the bar code for a designated cartridge. When the option is selected, specify the bin number, drive number, or load port bin for the operation (refer to Table 8-12).

Table 8-12
Bar Code Cartridges Sub-Menu Functions

Option	Description
Bar code – bin	Reads the bar code of a cartridge located in a storage bin (0-325) that you specify via a pop-up window.
Bar code – drive	Reads the bar code of a cartridge located in a tape drive (0-15) that you specify via a pop-up window.
Bar code – load port	Reads the bar code of a cartridge located in a load port bin (0-11) that you specify via a pop-up window.

To read the bar code label of a cartridge:

1. Highlight Move Actuators and press the **Enter** key.

2. Highlight Move Cartridges and press the **Enter** key.

3. Highlight Bar Code – Bin, Bar Code – Drive, Bar Code – Load Port and press Highlight Move Cartridges and press the **Enter** key.

4. For any selection, a pop-up window appears prompting you to enter one of the following, based on your selection in Step 3:

    ❑ Storage Bin: (0 to 325)

    ❑ Load Port Bin: (0 to 11)

    ❑ Drive Number: (0 to 15)

5. Enter the appropriate information and press the **Enter** key.

    The bar code information appears in the Return Status window.

Align/Calibrate Menu

The Align/Calibrate Menu (Figure 8-10) lets you:

■ Calibrate all bin and tape drive locations in the tape library.

■ Selectively calibrate all storage bins, load port bins, or drives.

■ Set and change the SCSI addresses of the tape library and drives.

Figure 8-10. Align/calibrate menu

Calibrate

This option lets you calibrate the entire tape library or selectively calibrate all storage bins, load port bins, or tape drives (refer to Table 8-13).

Table 8-13
Calibrate Menu Functions

Option	Description
All	Calibrate the entire tape library.
Bin	Calibrate all storage bins.
Drive	Calibrate all tape drives.
Load Port	Calibrate all load port bins.
Service	Auto-calibrate all and save the target locations as a baseline for all subsequent calibration procedures.

To calibrate the tape library:

1. Highlight Align/Calibrate and press the **Enter** key.

2. Highlight Calibrate and press the **Enter** key.

3. Highlight the desired option and press the **Enter** key.

Tape Library SCSI ID

This option lets you set the SCSI ID (0-15) of the tape library. To set the SCSI ID of the tape library:

1. Highlight Align/Calibrate and press the **Enter** key.

2. Highlight Library SCSI ID and press the **Enter** key.

   A pop-up window appears.

3. At the SCSI ID: (0-15): prompt, enter the number representing the tape library SCSI ID and press the **Enter** key.

   NOTE: After changing the SCSI address of the tape library, you must reset the SCSI bus either by issuing a SCSI BUS RESET command from the host or by turning the tape library OFF and ON.

Report Lib. SCSI ID

This option displays the SCSI ID (0-15) in the Return Status window.

To display the SCSI ID of the tape library:

1. Highlight Align/Calibrate and press the **Enter** key.

2. Highlight Report Lib. SCSI ID and press the **Enter** key.

   The SCSI ID information displays in the Return Status window.

Drive SCSI ID

This option lets you set the SCSI ID (0-15) of each drive in the tape library.

To set or change the SCSI ID of a drive:

1. Highlight Align/Calibrate and press the **Enter** key.

2. Highlight Drive SCSI ID and press the **Enter** key.

3. At the Drive Number (0-15): prompt, enter the drive SCSI ID and press the **Enter** key.

4. At the SCSI ID (0-15): prompt, enter the drive SCSI and press the **Enter** key.

> **NOTE:** After changing the SCSI ID of a drive, you must reset the SCSI bus by one of the following methods:
>
> ■ Select Reset Drive from the Align/Calibrate menu.
>
> ■ Issue a SCSI BUS RESET command from the host.
>
> ■ Turn the library OFF and ON.
>
> To verify that the SCSI IDs are set as desired, perform the REPORT DRIVE command after the drives have been reset.

Reset Drive

This option resets the drive ID. The drive must be reset after you issue the DRIVE SCSI ID command. This command takes approximately 10 seconds to complete.

To reset a drive's SCSI ID:

1. Highlight Align/Calibrate and press the **Enter** key.

2. Highlight Reset Drive and press the **Enter** key.

3. At the Drive Number (0-15): prompt, enter the drive number and press the **Enter** key.

Report Drive

This option displays the configuration of each drive. The information reported includes:

■ Drive model

■ Drive and controller micro-code revisions

■ Drive SCSI ID

■ Other information about the drive state

■ Drive hardware error

■ Cleaning states

To display the configuration of a drive:

1. Highlight Align/Calibrate and press the **Enter** key.

2. Highlight Report Drive and press the **Enter** key.

3. At the Drive Number: prompt, enter the drive number (0-6) and press the **Enter** key.

   The data for the selected drive appears in the Return Status window.

Bin Position

This option lets you report or change the horizontal, vertical, and extension location values for each storage bin in the tape library.

> **CAUTION:** Changing the calibration values can result in degraded operation of the tape library.

It is not possible to change any of the location values of one storage bin independently of all the other storage bins. Each bin location has the same horizontal and extension value as all other storage bins in a pack. Each bin location has a fixed vertical value relative to all other bin locations in that pack. When any storage bin location is changed, the values for all storage bin locations in that pack will be changed accordingly (refer to Table 8-14).

Table 8-14
Bin Position Sub-Menu Functions

Option	Description
Current Vertical Pos	Current Vertical Pos updates the vertical location value for the specified bin with the current physical location of the vertical axis. When you highlight this option, the diagnostic software displays a WARNING pop-up window. Enter **Y** and press the **Enter** key to clear the warning. When cleared, enter the desired storage bin number and press the **Enter** key.
Input Vertical Pos	Input Vertical Pos updates the vertical calibration value for the specified bin. Enter the desired storage bin number and the desired vertical calibration value.
Report Vertical Pos	Report Vertical Pos displays the current vertical calibration value for a specified bin. Enter the desired bin number, and the current vertical calibration value for that bin is displayed.
Current Extension Pos	Current Extension Pos saves the current physical location of the extension axis as the calibration value for that storage bin.
Input Extension Pos	Input Extension Pos updates the extension calibration value for the specified bin. Enter the desired storage bin number and the extension calibration value.
Report Extension Pos	Report Extension Pos displays the current extension calibration value for a specified bin.

continued

Table 8-14
Bin Position Sub-Menu Functions *continued*

Option	Description
All-Current Hz. Pos	All-Current Hz. Pos updates the horizontal location values for all bins in the same column as the specified bin with the current physical location of the horizontal axis. The horizontal location values for bins in the other two columns are also updated so that the horizontal distance between the bins in adjacent columns is fixed at 4.600 inches.
All-Input Hz. Pos	All-Input Hz. Pos All-Input Hz. Pos updates the horizontal calibration value for all bins in the same column as the specified bin. The horizontal location values in the other two columns are also updated so that the horizontal distance between the columns is fixed at 4.600 inches.
All-Report Hz. Pos	All-Report Hz. Pos displays the current horizontal calibration value for a specified bin. This command performs the same function as Pack-Report Hz. Pos.
Pack-Current Hz. Pos	Pack-Current Hz. Pos updates the horizontal location values for all bins in the same pack as the specified bin with the current physical location of the horizontal axis. The horizontal location values for bins in the other packs remain unchanged.
Pack-Input Hz. Pos	Pack-Input Hz. Pos updates the horizontal calibration value for all bins in the same pack as the specified bin. The horizontal location values for bins in the other packs remain unchanged.
Pack-Report Hz. Pos	Pack-Report Hz. Pos displays the current horizontal calibration value for a specified bin. This command performs the same function as All-Report Hz. Pos.

Drive Position

This option lets you report or change the horizontal, vertical, and extension location values for each drive in the library (refer to Table 8-15).

Table 8-15
Drive Position Sub-Menu Functions

Option	Description
Current Vertical Pos	Current Vertical Pos updates the vertical location value for the specified drive with the current physical location of the vertical axis. When you highlight this option, the diagnostic software displays a WARNING pop-up window. Enter **Y** and press the **Enter** key to clear the warning. When cleared, enter the desired drive number and press the **Enter** key.
Input Vertical Pos	Input Vertical Pos Input Vertical Pos updates the vertical calibration value for the specified drive. Enter the desired drive number and the desired vertical calibration value.
Report Vertical Pos	Report Vertical Pos displays the current vertical calibration value for a specified drive. Enter the desired drive number, and the current vertical calibration value for that drive is displayed.
Current Extension Pos	Current Extension Pos saves the current physical location of the extension axis as the calibration value for that drive.
Input Extension Pos	Input Extension Pos updates the extension calibration value for the specified drive. Enter the desired drive number and the desired extension calibration value.
Report Extension Pos	Report Extension Pos displays the current extension calibration value for a specified drive.
Currrent Horiz. Pos	Current Horiz. Pos updates the horizontal location value for the selected drive with the current physical location of the horizontal axis.
Input Horiz. Pos	Input Horiz. Pos updates the horizontal calibration value for the selected drive with the input value.
Report Horiz. Pos	Report Horiz. Pos displays the current horizontal calibration value for a specified drive.

Load Port Position

This option lets you report or change the horizontal, vertical, and extension location values for the load port bins in the tape library (refer to Table 8-16).

Table 8-16
Load Port Position Sub-Menu Functions

Option	Description
Current Vertical Pos	Current Vertical Pos updates the vertical location value for the specified load port bin with the current physical location of the vertical axis. When you highlight this option, the diagnostic software displays a WARNING pop-up window. Enter **Y** and press the **Enter** key to clear the warning. When cleared, enter the desired load port bin number and press the **Enter** key.
Input Vertical Pos	Input Vertical Pos Input Vertical Pos updates the vertical calibration value for the specified load port bin. Enter the desired load port bin number and the desired vertical calibration value.
Report Vertical Pos	Report Vertical Pos displays the current vertical calibration value for a specified load port bin. Enter the desired load port bin number, and the current vertical calibration value for that load port bin is displayed.
Current Extension Pos	Current Extension Pos saves the current physical location of the extension axis as the calibration value for that load port bin.
Input Extension Pos	Input Extension Pos updates the extension calibration value for the specified load port bin. Enter the desired load port bin number and the desired extension calibration value.
Report Extension Pos	Report Extension Pos displays the current extension calibration value for a specified load port bin.
Currrent Horiz. Pos	Current Horiz. Pos updates the horizontal location value for the selected load port bin with the current physical location of the horizontal axis.
Input Horiz. Pos	Input Horiz. Pos updates the horizontal calibration value for the selected load port bin with the input value.
Report Horiz. Pos	Report Horiz. Pos displays the current horizontal calibration value for a specified load port bin.

Config Menu

The Config Menu (Figure 8-11) lets you

■ set or display the overall tape library configuration.

■ initialize an inventory sequence, NVRAM, or the bar code scanner.

■ enable or disable recovery options or the tape cleaning feature.

■ perform a flash download.

■ enable or disable bar code reading and set number of tries.

■ enable or disable the Autodrive Unload feature.

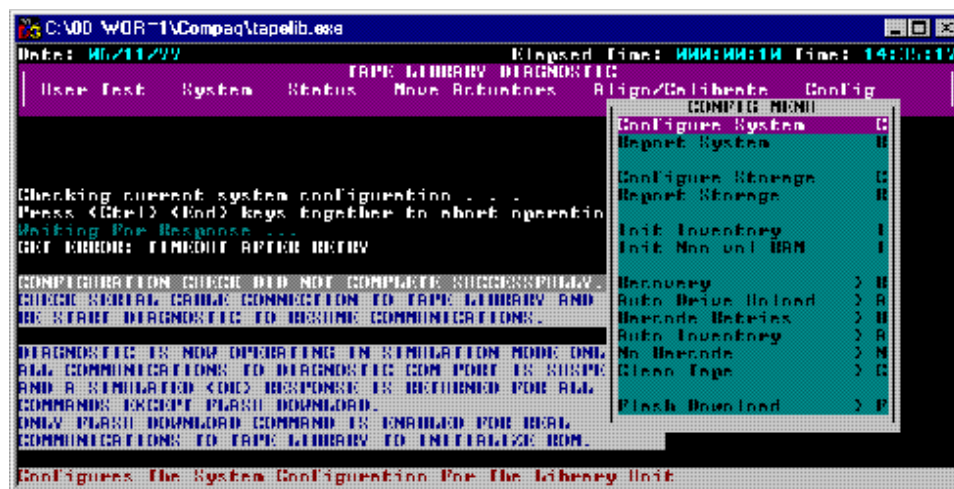■ enable/disable Auto Clean and view current states.

Figure 8-11. Config menu

Configure System

This option lets you select the proper model number of the ESL9000 Series tape library. The default model number for this library is 6310080, which results in an ESL9000 Series tape library product ID.

To configure the tape library:

1. Highlight Config and press the **Enter** key.

2. Highlight Configure System and press the **Enter** key.

   A pop-up window appears.

3. From the list of available model numbers, select 6310xxx and press the **Enter** key.

4. After the model number appears, fill in the xxx with 080.

5. Enter 326 as the number of bins and press the **Enter** key.

6. Enter the number of drives in the tape library and press the **Enter** key.

7. Enter the desired SCSI ID of the tape library and press the **Enter** key.

Report System

This option displays the current tape library configuration, including model number, number of bins, number of drives, and the library SCSI ID in a Return Status window.

To display the current library configuration:

1. Highlight Config and press the **Enter** key.

2. Highlight Report System and press the **Enter** key.

   The information appears in the Return Status window.

Configure Storage

This option lets you eliminate specified sections of the tape library from the inventory process. By eliminating specified sections speeds up the time it takes the tape library to perform an inventory (refer to Table 8-17).

Table 8-17
Configure Storage Details

Selections	Command Options	Default
Back pack	Unavailable/storage	Storage
Left-front door pack	Unavailable/storage	Storage
Right-front door pack	Unavailable/storage	Storage
Load port	Unavailable/import/export	Import/export

Report Storage

This option reports the status of the current selection.

Init Inventory

This option starts a tape cartridge inventory sequence that scans the cartridges in the storage bins, load port bins, and tape drives, and then records the location and identity of all tape cartridges with bar codes. If all bins in the tape library are filled with tape cartridges (no empty bins) and these cartridges all have bar code labels, the entire inventory takes approximately six minutes. Inventories of tape libraries with unlabeled tape cartridges may take longer.

To initialize the inventory of the cartridges in the library:

1. Highlight Config and press the **Enter** key.

2. Highlight Init Inventory and press the **Enter** key.

Init Non-Vol RAM

This option initializes or resets the NVRAM.

To initialize the NVRAM:

1. Highlight Config and press the **Enter** key.

2. Highlight Init Non-Vol RAM and press the **Enter** key.

   A pop-up window appears.

3. At the prompt, enter **Y** and press the **Enter** key.

   NOTE: The tape library must be calibrated after this procedure.

Recovery

This option accesses a sub-menu with the following options:

■ Enable Recovery

■ Disable Recovery

■ Report Recovery

   IMPORTANT: When the tape library is powered on, the enable/disable recovery switch is automatically set to be enabled. This is the default condition for Enable Recovery, and it should remain enabled except when troubleshooting a problem.

Enable Recovery

When recovery is enabled, the tape library attempts to recover from internal anomalies to complete a command sent from the diagnostic PC or host.

To enable recovery:

1. Highlight Config and press the **Enter** key.

2. Highlight Recovery and press the **Enter** key.

3. Highlight Enable Recovery and press the **Enter** key.

Disable Recovery

When recovery is disabled, a command that cannot be successfully completed on the first attempt will immediately generate an error response.

   IMPORTANT: Always leave recovery enabled when returning the tape library to the online state for operator use.

To disable error recovery:

1. Highlight Config and press the **Enter** key.

2. Highlight Recovery and press the **Enter** key.

3. Highlight Disable Recovery and press the **Enter** key.

Report

This option reports the current recovery setting (enabled or disabled).

To report the current recovery setting:

1. Highlight Config and press the **Enter** key.

2. Highlight Recovery and press the **Enter** key.

3. Highlight Report Recovery and press the **Enter** key.

Auto Inventory

When this option is enabled, the tape library performs an inventory automatically when the tape library is powered up. The default setting is enabled.

When you select Auto Inventory, a sub-menu with the following options appears:

■ Enable

■ Disable

■ Report (reports whether Auto Inventory is enabled or disabled)

No Bar Code

When this option is enabled, the tape library does not scan bar codes but instead uses the cartridge-in-gripper sensor to determine the presence of a cartridge in each drive and storage bin.

When this option is disabled, the tape library scans bar codes during the inventory process. The default setting is disabled.

When you select No Bar Code, a sub-menu with the following options appears:

■ Enable

■ Disable

■ Report (reports whether No Bar Code is enabled or disabled)

Bar Code Retries

The diagnostic software supports bar code read retries. The default value is eight retries, but one to eight retries can be selected.

Auto Drive Unload

This option adds an UNLOAD DRIVE command to a MOVE command when the source element is a tape drive. The default setting is enabled.

Clean Tape

This option accesses a sub-menu with the following options:

■ Enable Clean Tape

■ Disable Clean Tape

■ Report Clean Tape

Enable Clean Tape

This activates auto-cleaning.

> **NOTE:** Enabling or disabling auto-cleaning through the diagnostic software is temporary. When the tape library power is cycled, the auto-cleaning mode reverts to the last state selected by the host controller via the MODE SELECT command. Auto-cleaning is disabled by default.

To enable auto-cleaning:

1. Highlight Config and press the **Enter** key.

2. Highlight Clean Tape and press the **Enter** key.

3. Highlight Enable Clean Tape and press the **Enter** key.

4. Verify, through Report Clean Tape, that auto-cleaning has been enabled.

Disable Clean Tape

This deactivates auto-cleaning. To disable auto-cleaning:

1. Highlight Config and press the **Enter** key.

2. Highlight Clean Tape and press the **Enter** key.

3. Highlight Disable Clean Tape and press the **Enter** key.

4. Verify, through Report Clean Tape, that auto-cleaning has been disabled.

Report Clean Tape

This reports auto-cleaning status information (in the Return Status window). Status information includes:

■ Whether auto-cleaning is enabled or disabled.

■ For each drive, whether cleaning is needed or not.

■ Bin location and number of uses for each cleaning cartridge in the tape library.

To display the state of the auto-cleaning feature:

1. Highlight Config and press the **Enter** key.

2. Highlight Clean Tape and press the **Enter** key.

3. Highlight Report Clean Tape and press the **Enter** key.

   The information appears in the Return Status window.

Flash Download

The flash download process is used to load robotics/control panel firmware revisions through the serial port. The firmware downloaded through this method remains in the tape library until new robotics/control panel firmware is downloaded.

> **CAUTION:** Flash downloads should only be performed from native MS-DOS, not from the MS-DOS program running under Windows 95/98 or Windows NT.

NOTE: The firmware hex file must be copied into the same directory as TAPELIB before it can be downloaded to the tape library.

Flash Download

To perform a flash download for the robotics firmware:

1. Press the **Standby** button on the tape library control panel.

2. Connect a RS-232 cable between the diagnostic PC and the DIAGS port at the rear of the tape library.

3. Move to the TAPELIB directory on the diagnostic PC (in native DOS) and type:

   TAPELIB/B9600

4. Highlight Config and press the **Enter** key.

5. Highlight Flash Download and press the **Enter** key.

6. Highlight the file you want to download to the tape library and press the **Enter** key.

7. Enter **Y** and press the **Enter** key at the prompt. The download takes approximately 45 minutes. When complete, Flash Download Complete appears in the Command Status window.

8. After the download has completed successfully, cycle power to the tape library.

> **CAUTION:** When restarting the tape library, leave the power off at least 15 seconds before turning the power back on.

9. Place the tape library in Standby mode and perform the calibration functions described earlier in this chapter.

Flash Download Troubleshooting

If the flash download you performed is not successful:

■ Check that the cable connections between the PC and tape library are securely in place.

■ Verify that the firmware image is in the TAPELIB sub-directory.

■ Be sure you are performing the flash download in native MS-DOS.

■ Retry the flash download in normal (Standby) mode or Simulation mode.

■ Check that the baud rate is 9600.

Initializing the Library

This option lets you initialize the tape library and return it to the factory default settings.

To initialize the tape library:

1. Initialize the nonvolatile RAM (NVRAM).

2. Configure the tape library for the number of existing drives. You can do this either of the following ways:

   a. Use the Configure System option in the diagnostic software. See the "Configure System" section described earlier in this chapter for more information.

   b. Press the **Configure Library** button on the Operator screen of the control panel. When the Configure Library screen appears, press **Configure** to change the current settings. Refer to the *Compaq StorageWorks ESL9000 Series Tape Library Reference Guide* for more information.

3. Restart the tape library

   NOTE: The tape library must be calibrated after this procedure.

Exit the Diagnostic Software

To exit the diagnostic software (see Figure 8-12):

1. Press the **Escape** key until the Exit Diagnostic Program screen appears.

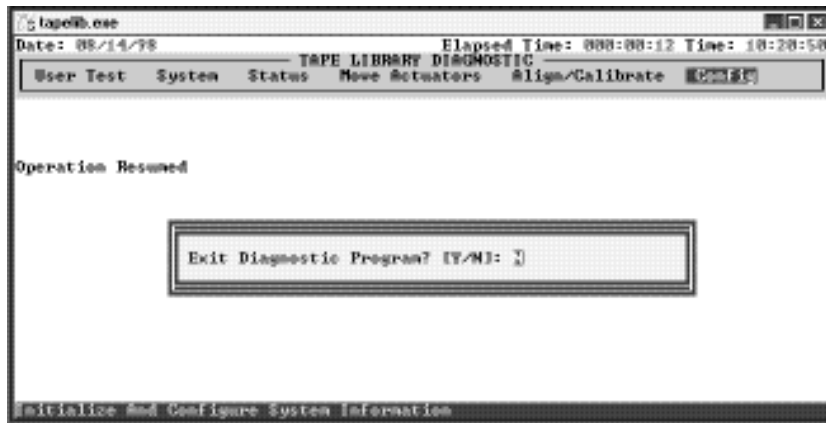2. Select **Y** and then press the **Enter** key.

Figure 8-12. Exit screen

Appendix **A**

Tape Library Specifications

Introduction

This appendix lists the physical, reliability, and environmental specifications for the Compaq ESL9000 Series tape library (refer to Tables A-1 through A-3).

Table A-1
Physical Specifications

Description	Specification

Width:
  Uncrated
  Crated
	57 in (145 cm)
	67 in (170 cm)

Depth:
  Uncrated
  Crated
	29 in (75 cm)
	48 in (122 cm)

Footprint	29 in x 57 in (75 cm x 145 cm)

Height:
  Uncrated
  Crated
	75 in (191 cm)
	80 in (203 cm)

Weight (16 drives, no media):
  Uncrated
  Crated
	1300 lb (589 kg)
	1650 lb (748 kg)

Tape Drives	
Quantity	6 to 16
Type	Compaq DS-TZ89N-AV
Weight	13.5 lb (6.12 kg)

NOTE: To calculate the total weight of a tape library with tape drives and tape cartridges use the following formula:

1,084 lb (492 kg) = weight of unloaded library

+ 13.5 lb (6.12 kg) x number of drives installed = weight of all drives

+ 7.7 oz (218 g) x number of tapes = weight of all tapes

Table A-1
Physical Specifications *continued*

Description	Specification
Cartridges	
Quantity	Up to 326
Type	DLT tape III, IIIXT, or IV
Weight	7.7 oz (218 g)
Host to Library Interface	
	Differential SCSI-3 "P" Fast and Wide, 68-pin Micro D female connector
Software	SCSI-2 medium changer command set
Power Input	
Power connector (2)	IEC 320 C19 female connector
Host to Tape Drive Interface	
	Differential SCSI-3 "P" Fast and Wide, 68-pin Micro D female connector
Software	SCSI-2
Library Diagnostics	
Diagnostics	RS-232C service port for connection to a field service computer

**Table A-2
Reliability Specifications**

Description	Specification
MTBF	250,000 power-on hours
MSBF	1 million load/unload cycles
MTTR	Less than 3 hours

Warranty	3 years:
	  First year on-site
	  Second and third year parts only

**Table A-3
Environmental Specifications**

Description		Specification
Power Environment		
Electrical inputs	Voltage (range)	90 VAC to 264 VAC
	Current (A)	16 A @100/120 VAC 8 A @ 200/240 VAC
	Frequency	47 Hz to 63 Hz
	Power consumption	VAC max 1600 W
	Electrical connection to power	IEC 320 C20 male connector in rear door
Climatic Environmental		
Temperature (operating)	Dry bulb	59°F to 90°F (15°C to 32°C)
	Wet bulb	77°F (25°C) maximum
	Thermal transition	52°F (11°C) per hour
Temperature (shipping and storage)	Dry bulb	-40°F to 151°F (-40°C to 66°C)
	Wet bulb	115°F (46°C) maximum
	Thermal transition	54°F (30°C) per hour

Table A-3
Environmental Specifications *continued*

Description		Specification
Relative humidity	Operating	20% to 80%, non-condensing
	Shipping and storage	5% to 95%, non-condensing
Altitude	Operating	Sea level to 10,000 ft (3,048 m)
	Shipping and storage	Sea level to 12,000 ft (3,657 m)
Heat dissipation	Operating	5500 BTU/hr (1400 Kcal/hr or 1600 W)
Electromagnetic/Electrostatic Susceptibility		
Direct ESD	Contact discharge	@ 2.0, 4.0, 6.0, 8.0 kV to all external metal panels and doors
	Air discharge	@ 2.0, 4.0, 6.0, 8.0 10.0, 12.0, 15.0 kV to the front control panel display
Indirect ESD	Contact discharge	@ 2.0, 4.0, 6.0, 8.0 kV to the VCP
Radiated fields per IEC-801-3	Unmodulated	27 MHz to 500 MHz @ 3 V/m
Fast transients (EFT or Burst) per IEC-801-4	Data cables	@ 0.5 kV
	Power cables	@ 1.0 kV
Acoustical Noise		
Sound power level	Operating	7.8 Bel
	Idle	7.6 Bel
Sound pressure @ loudest bystander position	Operating	63 dB

Gripper Assembly

The gripper assembly includes a Class II laser bar code scanner that reads standard six-character, 3 of 9 bar code labels. The scanner is used to maintain an inventory of the tape cartridges within the tape library. For example, an inventory occurs automatically whenever the tape library is turned on or after the bulk load door has been closed. An inventory can also be initiated manually from the host computer.

Appendix **B**

Block Diagram

Introduction

The tape library block diagram is shown on the following pages. "AX" numbers on the block diagram are also printed on all cable harness labels and used to identify proper cabling connections during assembly and maintenance.
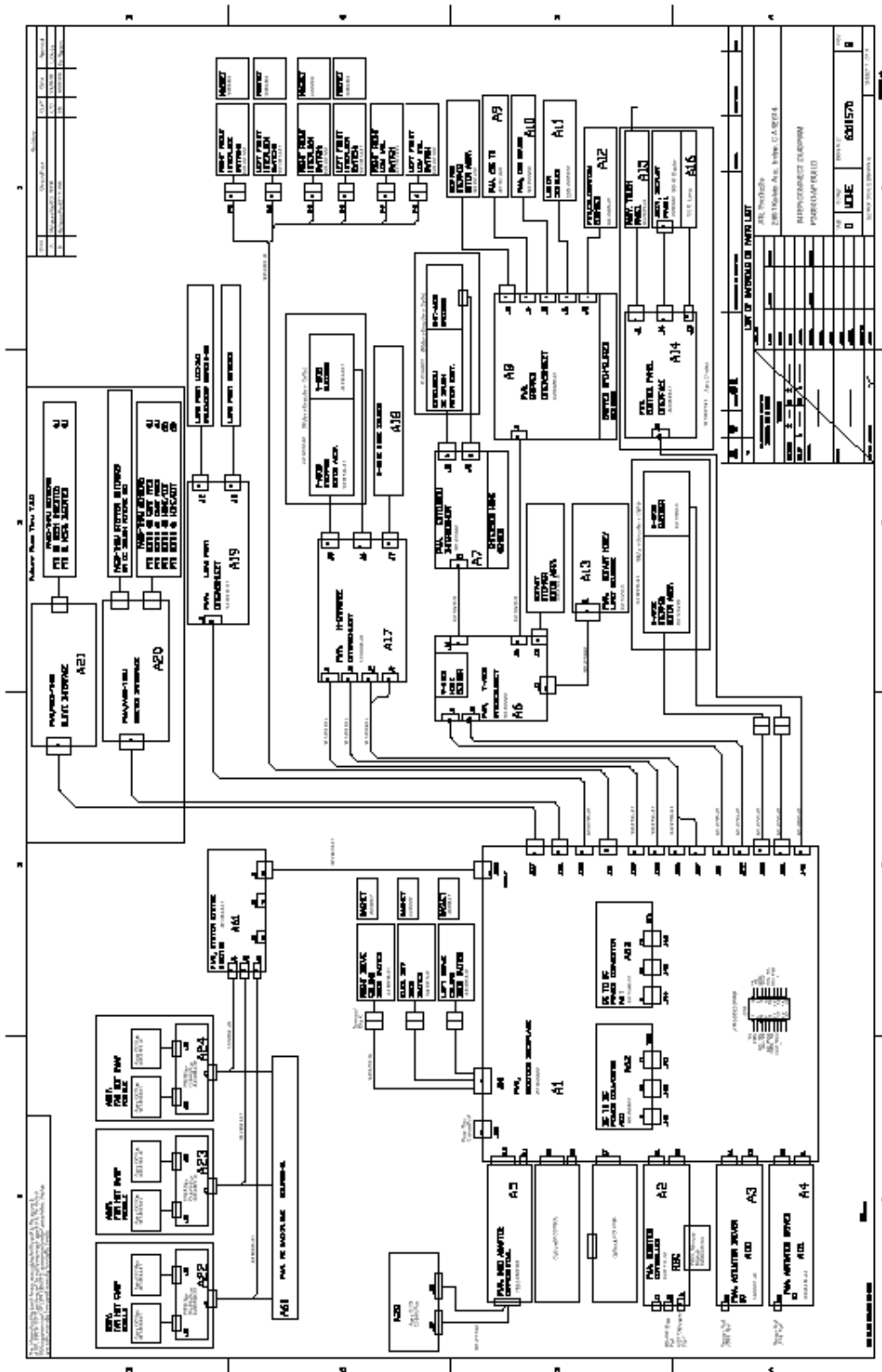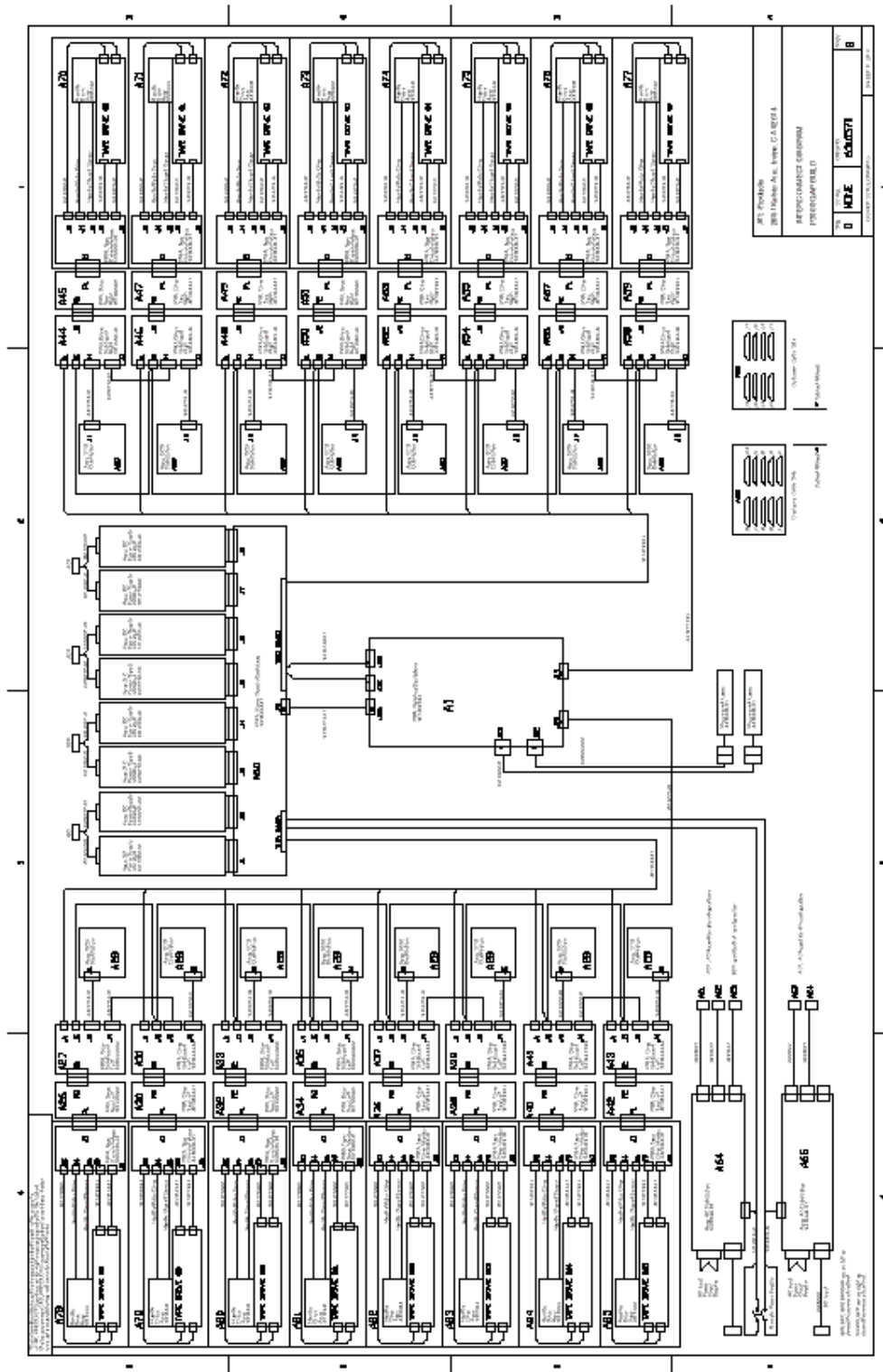
Figure B-1. Block diagram (1 of 2)

Figure B-2. Block diagram (2 of 2)

Appendix **C**

Sense Data Values

Sense Data Values

Table C-1 lists message information that can be sent from the ESL9000 Series tape library to a host computer. The table is sorted by the data in the additional sense code (ASC) column and lists the following information:

■ Sense Key

■ Additional Sense Code (ASC)

■ Additional Sense Code Qualifier (ASCQ)

■ Message name, description and (potential) recovery action

■ Valid interfaces

■ SCSI (host computer)

■ DIAG (diagnostic port/computer)

■ Both = SCSI and DIAG port

The message name and description may contain abbreviations as follows:

■ Logical Unit (LU)

■ Required (REQ'D)

■ Device (DEV)

■ Diagnostics (DIAG)

■ Nonvolatile RAM (NVRAM)

■ Analog-to-Digital (A/D)

**Table C-1
Sense Data Values (Hexadecimal)**

Sense Key	ASC	ASCQ	Message Name/Description	Interface
0	00	00	NO ADDITIONAL SENSE INFORMATION No recovery necessary.	Both
B	00	00	SCSI ABORT Command aborted because host sent SCSI Abort Message.	SCSI
2	04	00	LU IS NOT READY, CAUSE NOT REPORTABLE Check tape library unit power. Retry command.	Both
2	04	01	LOGICAL UNIT IN PROCESS OF BECOMING READY Wait for tape library unit to complete initialization.	Both
2	04	02	LOGICAL UNIT INIT REQUIRED Element status or calibration unknown. Perform "Initialize Element Status" command (SCSI) or "Initialize Inventory" command (DIAG).	Both
2	04	03	LU IS NOT READY, MANUAL INTERVENTION REQ'D Initialization failed. Determine failure type by checking any previous error code returned to host. Correct the cause of the failure and toggle STANDBY button	Both
5	1A	00	PARAMETER LIST LENGTH ERROR Invalid parameter list length field specified by command.	SCSI
5	20	00	INVALID COMMAND OPERATION CODE Verify the host command format.	SCSI
5	21	01	INVALID ELEMENT ADDRESS Check Mode Sense data for correct element addresses.	SCSI
5	24	00	INVALID FIELD IN COMMAND DATA BLOCK Ensure all reserve fields are set to zero.	SCSI

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
5	25	00	LOGICAL UNIT IS NOT SUPPORTED Verify the logical unit field specified in the command contains a legitimate logical unit number. Check cabling to logical unit.	SCSI
5	26	00	INVALID FIELD IN PARAMETER LIST Verify Mode Select page fields. Verify that fields comply with the command format described in this guide.	SCSI
5	26	02	PARAMETER VALUE INVALID Verify Mode Select page fields. Verify that fields comply with the command format described in this guide. This response will also be returned for commands issued to the diagnostic interface of the library if an invalid parameter is sent.	Both
6	28	01	IMPORT OR EXPORT ELEMENT ACCESSED Load port door has been closed.	Both
6	29	00	POWER-ON, RESET OR BUS DEVICE RESET OCCURRED Informational message. If power on occurs, the host user should assume the inventory may have been corrupted, and should ask the library for that information again.	Both
6	2A	01	MODE PARAMETERS CHANGED Mode parameters may have changed due to another host issuing a Mode Select command.	Both
None	30	03	CLEANING CARTRIDGE INSTALLED Indicates that the element contains a cleaning cartridge that is not "used-up." This is returned with the element status data, which has no sense key.	SCSI

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
Or				
5	30	03	A cleaning cartridge cannot be removed from a drive because it is being used in a cleaning operation.	Both
			A cartridge cannot be placed into the drive because the drive is being cleaned.	
			A cartridge cannot be placed into an empty storage element because it is reserved for a cleaning cartridge that is currently in use in a drive cleaning operation.	
5	39	00	SAVING PARAMETERS NOT SUPPORTED	SCSI
			Verify Save Parameter field in the Mode Sense command complies with the command format described in this guide.	
5	3A	00	MEDIUM NOT PRESENT	Both
			The inventory indicated that a cartridge was in this bin but no cartridge was sensed by the gripper when it attempted to pick it. Retry the command. Check for proper seating of the cartridge. It may also indicate that the tape is not ready to be picked from the drive because the tape is not fully unloaded. Retry the command. If the problem persists, check the function of the tape drive handle assembly. Manually unload the tape.	
5	3B	0D	MEDIUM DESTINATION ELEMENT FULL	Both
			Destination element address already contains a cartridge. Issue a Read Element Status command and retry move command. If the problem recurs, issue an Initialize Element Status command followed by a Read Element Status command and retry move command.	
5	3B	0E	MEDIUM SOURCE ELEMENT EMPTY	Both
			Source element address does not contain a cartridge. Issue a Read Element Status command and retry move command. If the problem recurs, issue an Initialize Element Status command followed by a Read Element Status command and retry the move command.	

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sense Key	ASC	ASCQ	Message Name/Description	Interface
B	43	00	SCSI MESSAGE ERROR Detected message error in message processing on the SCSI BUS.	SCSI
B	45	00	SELECT OR RE-SELECT FAILURE P3000 timed out trying to reselect host. Make sure host is running.	SCSI
B	47	00	SCSI PARITY ERROR SCSI Parity Error detected. Check cable connections and cable length.	SCSI
B	48	00	INITIATOR DETECTED ERROR Initiator Detected Error Message was received from the host.	SCSI
5	4E	00	OVERLAPPED COMMANDS ATTEMPTED Due to a second command being sent from the same host before a previous command has completed, the previous command has been aborted. This may also occur when executing off-line commands via the control panel and DIAG port simultaneously.	Both
5	53	02	MEDIUM REMOVAL PREVENTED Prevent Medium Removal command was executed and command was received to export cartridge. Execute Allow Medium Removal command and retry move medium command.	SCSI
6	54	00	SCSI TO HOST SYSTEM INTERFACE FAILURE Possible SCSI bus time-out or premature disconnect. Check cable connections and cable length.	Both
2	5A	01	OPERATOR MEDIUM REMOVAL REQUEST Indicates that the element contains a cleaning cartridge that is "used-up" and the system is unable to export the cleaning cartridge. Manually unload the tape. The load port door is open, so import/export elements can not be accessed.	Both

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sense Key	ASC	ASC Q	Message Name/Description	Interface
2	80	00	DOOR IS OPENED INVENTORY MAY HAVE BEEN CORRUPTED Close door and retry command. If the system is ON-LINE, it executes its initialization procedure.	Both
6	80	00	DOOR WAS OPENED INVENTORY MAY HAVE BEEN CORRUPTED Close door and retry command.	Both
None	80	01	DLT DRIVE REQUIRES CLEANING DLT tape drive indicates that drive needs cleaning. Clean the DLT tape drive. This is returned with element status data, which has no sense key.	SCSI
5	80	01	TRANSFER FULL - COMMAND CAN NOT BE EXECUTED Gripper has cartridge in it. Move cartridge to empty storage element using Move Medium command. Retry command.	Both
B	80	01	TRANSFER FULL - AT END OF PLACE Gripper has cartridge in it at end of a place operation (Move Medium with a target other than the Transfer). Move cartridge to empty storage element using Move Medium command. Retry command.	Both
B	80	06	TRANSFER EMPTY - COMMAND ABORTED Gripper does not contain cartridge at end of pick portion of Move Medium command.	Both
2	80	07	SYSTEM IS STOPPED (BUTTON IS CURRENTLY PUSHED) The STOP button on the control panel was pressed. Press the STOP button.	Both
6	80	07	SYSTEM STOP BUTTON WAS PRESSED (MAY CURRENTLY BE PRESSED) The STOP button on the control panel was pressed. Press the STOP button. Retry command.	Both

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
6	80	08	LOGICAL UNIT TURNED ON-LINE	DIAG
			The library is ready to communicate with the host computer. Press the STANDBY button on the control panel to take the library off-line.	
2	80	09	LOGICAL UNIT IS TURNED OFF-LINE	SCSI
			The library is ready to communicate with the diagnostic PC. Press the STANDBY button on the control panel to place the library on-line.	
6	80	09	LOGICAL UNIT STANDBY BUTTON WAS PRESSED	Both
			Retry command.	
B	80	10	LOAD RETRY FAILED	Both
			P3000 was unable to successfully load the drive, even after retries. Check drive alignment. If the problem continues, drive may need servicing.	
4	80	0A	NVRAM CHECKSUM FAILURE	Both
			Nonvolatile RAM contents are corrupted. Use the diagnostic software to initialize nonvolatile RAM and calibrate system.	
B	80	0B	COMMAND ABORTED BY USER	Both
			Informational message. No action is necessary.	
B	80	0D	CARTRIDGE IS ONLY PARTIALLY GRIPPED (only seen in the front sensor)	Both
			Issue a Move Medium command to move the cartridge from the transfer element to an empty storage element.	
6	80	0E	DATA TRANSFER CHANGED	Both
			A drive has been inserted into the system. Use Read Element Status to determine status of drives.	
4	80	0F	LOW POWER ERROR	Both
			Check power connections.	

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
4	80	11	MOTOR POWER FAILURE	Both
			Indicates motor power turned off for a reason not otherwise reported. Toggle the Stop button to clear.	
5	80	22	ELEMENT CONTENTS UNKNOWN	Both
			The contents of an element address are unknown. Issue a Read Element Status for the element address. If contents are still unknown, issue an Initialize Element Status command.	
4	80	23	BAR CODE DECODER COMMUNICATION FAILURE	Both
			Unable to initialize decoder. Verify that the decoder is powered on. Cycle power and/or check cable connections.	
4	81	00	GRIPPER AXIS INTERNAL FAIL	Both
			Gripper axis code internal failure. Call Technical Support.	
B	81	01	GRIPPER TIMEOUT	Both
			Gripper did not reach desired position. Issue a Rezero Unit command.	
B	81	04	GRIPPER OPEN FAILURE	Both
			Gripper did not reach open position. Issue a Rezero Unit command.	
B	81	05	GRIPPER CLOSE FAILURE	Both
			Gripper did not reach close position. Issue a Rezero Unit command.	
B	81	51	UNABLE TO PICK CARTRIDGE	Both
			Cartridge was sensed in front gripper sensor, but was unable to seat cartridge in the rear gripper sensor. Check that gripper sensors are working and/or that tape was ejected completely.	

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
4	81	54	GRIPPER TPU REGISTER FAILURE	Both
			Replace robotic controller board.	
4	81	55	GRIPPER TPU RAM FAILURE	Both
			Replace robotic controller board.	
4	82	00	ROTARY AXIS INTERNAL FAIL	Both
			Rotary axis code internal failure. Call Technical Support.	
4	82	01	ROTARY TIMEOUT	Both
			The rotary axis did not reach the desired position within the time limit. Retry the command. If the failure recurs, issue a Self-test command.	
B	82	04	ROTARY FRONT FAILED	Both
			The rotary move to the front position failed. Retry the command. If the failure recurs, issue a Self-test command.	
B	82	05	ROTARY BACK FAILURE	Both
			The rotary move to the back position failed. Retry the command. If the failure recurs, issue a Self-test command.	
4	82	08	ROTARY HOME NOT FOUND	Both
			The home flag was not found. Issue Rezero Unit to retry command. If the failure recurs, issue a Self-test command.	
4	82	10	ROTARY INVALID START	Both
			The rotary axis has not been homed yet. Issue a Rezero Unit command.	
5	82	11	ROTARY INVALID COMMAND	Both
			Rotary axis was commanded to a position out of its legal range. This is an internal code failure.	

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sense Key	ASC	ASCQ	Message Name/Description	Interface
4	82	20	ROTARY TEST FAILURE The rotary motor or sensor failed. Check the motor/sensor connections. Make sure that the flags extend into the sensor without contact. Check that the extension axis operates properly, since it must be safely positioned before the rotary axis moves. If the failure recurs, call Technical Support.	Both
4	82	23	ROTARY POSITION OVERFLOW The position step counter overflowed. Issue a Rezero Unit command.	Both
4	83	00	EXTENSION INTERNAL FAILURE Extension axis code internal failure. Call Technical Support.	Both
B	83	01	EXTENSION TIMEOUT Extension axis did not reach desired position. Retry command. If the failure recurs, use the diagnostic software to run extension self-test.	Both
4	83	02	EXTENSION CURRENT FEEDBACK FAILURE The extension axis is obstructed. Determine the cause of the obstruction. Calibrate the system. Lubricate the rail.	Both
4	83	03	EXTENSION MECHANICAL POSITION ERROR The extension axis was unable to move to commanded position. Retry command. If the failure recurs, run extension self-test.	Both
4	83	08	EXTENSION HOME NOT FOUND The extension axis did not reach the home position. Issue Rezero Unit to retry the command. If the failure recurs, then issue the Self-test command.	Both
B	83	10	EXTENSION INVALID ACTUATOR START POSITION Extension axis position is unknown. Issue a Rezero Unit command.	Both

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sense Key	ASC	ASCQ	Message Name/Description	Interface
5	83	11	EXTENSION INVALID COMMAND Extension axis was commanded to a position out of the systems mechanical limits.	Both
4	83	20	EXTENSION TEST FAILURE The value of the extension encoder did not change during the self-test. Check the motor/encoder connector.	Both
4	83	22	EXTENSION ENCODER FAILURE The value of the extension encoder did not change during the self-test. Check the motor/encoder connector.	Both
4	83	40	EXTENSION FORCE NOT REACHED During calibration or pushing into a drive, the extension never reached its intended force. If the failure recurs, run extension self-test.	Both
4	83	41	EXTENSION FORCE OBJECT MISSING During calibration or pushing into a drive, the extension never made contact with any object.	Both
4	83	50	EXTENSION SENSOR FAIL The CIG sensor was occluded unexpectedly during calibration, inventory or pick/place. Retry the command. If the failure recurs, contact Technical Support.	Both
4	84	60	VERTICAL INTERNAL FAILURE Vertical axis code internal failure. Call Technical Support.	Both
B	84	01	VERTICAL TIMEOUT Vertical axis did not reach desired position within the time limits. Retry command. If the failure recurs, run vertical Self-test.	Both

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sense Key	ASC	ASC Q	Message Name/Description	Interface
4	84	03	VERTICAL MECHANICAL POSITION ERROR Vertical axis did not reach desired position. Retry command. If the failure recurs, run vertical Self-test.	Both
4	84	08	VERTICAL HOME NOT FOUND Vertical axis did not reach the home position. Issue Rezero Unit and retry command. If the failure recurs, run vertical Self-test.	Both
B	84	10	VERTICAL INVALID ACTUATOR START POSITION Position of vertical axis is unknown. Issue a Rezero Unit command.	Both
5	84	11	VERTICAL INVALID COMMAND Vertical axis commanded to position out of system mechanical limits. Issue a Rezero Unit command. If the problem persists, calibrate the library.	Both
4	84	20	VERTICAL TEST FAILURE The value of the vertical encoder did not change during the Self-test. Check the motor/encoder connector.	Both
4	84	22	VERTICAL ENCODER FAILURE The value of the vertical encoder did not change during the Self-test. Check the motor/encoder connector.	Both
4	84	23	VERTICAL POSITION OVERFLOW The position step counter overflowed. Issue a Rezero Unit command.	Both
4	84	30	VERTICAL MAPPING FAILURE Scanner was unable to detect vertical target during calibration.	Both
4	85	00	HORIZONTAL INTERNAL FAILURE Horizontal axis code internal failure. Call Technical Support.	Both

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
B	85	01	HORIZONTAL TIMEOUT	Both
			Horizontal axis did not reach desired position within the time limits. Retry command. If the failure recurs, use the diagnostic software to run horizontal Self-test.	
4	85	03	HORIZONTAL MECHANICAL POSITION ERROR	Both
			Horizontal axis did not reach desired position. Retry command. If the failure recurs, use the diagnostic software to run horizontal Self-test.	
4	85	08	HORIZONTAL HOME NOT FOUND	Both
			Horizontal axis did not reach the home position. Issue Rezero Unit and retry command. If the failure recurs, run horizontal Self-test.	
B	85	10	HORIZONTAL INVALID ACTUATOR START POSITION	Both
			Position of horizontal axis is unknown. Issue a Rezero Unit command.	
5	85	11	HORIZONTAL INVALID COMMAND	Both
			Horizontal axis commanded to position out of system mechanical limits. Issue a Rezero Unit command. If the problem persists, calibrate the library.	
4	85	20	HORIZONTAL TEST FAILURE	Both
			The value of the horizontal encoder did not change during the self-test. Check the motor/encoder connector.	
4	85	22	HORIZONTAL ENCODER FAILURE	Both
			The value of the horizontal encoder did not change during the self-test. Check the motor/encoder connector.	
4	85	23	HORIZONTAL POSITION OVERFLOW	Both
			The position step counter overflowed. Issue a Rezero Unit command.	

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
4	85	30	HORIZONTAL MAPPING FAILURE Scanner was unable to detect horizontal target during calibration.	Both
6	88	00	WARNING SAFE TEMPERATURE EXCEEDED This is only a warning that the temperature in the library exceeds the normal operational temperature (90ºF or 32ºC).	Both
4	88	01	MAXIMUM TEMPERATURE EXCEEDED Library turns off and remains off until the temperature returns to an acceptable level (59ºF to 90ºF or 15ºC to 32ºC)	Both
5	8A	02	UNCALIBRATED POSITION System requires calibration.	Both
B	8C	01	LOAD PORT TIMEOUT The load port door was unlocked, but did not leave its current position before time-out (30 seconds). This may be due to the door being stuck, or in the case of a close operation, the operator not moving the door.	Both
4	8C	06	LOAD PORT DOOR OPEN Load port door unlocked but failed to open.	Both
B	8C	09	LOAD PACK DETENT FAILURE The load pack detention spring is unable to hold or release the cartridge. This is detected during a place if the tape does not stay seated in the pack or during a pick if the tape does not eject from the pack.	Both
B	8D	01	DLT DRIVE HANDLE TIMEOUT Drive handle did not reach commanded position within time limits. Retry the command. If the failure recurs, issue a Self-test command.	Both

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
4	8D	24	DLT HANDLE HARDWARE	Both
			Stepper was unable to reach destination (open or close). Retry command. If the failure recurs, run drive handle Self-test.	
4	8E	01	FLASH MEMORY UNABLE TO IDENTIFY	DIAG
			Flash is soldered onto the board. Replace the robotic controller.	
4	8E	02	FLASH MEMORY UNABLE TO ERASE	DIAG
			Flash is soldered onto the board. Replace the robotic controller.	
4	8E	03	FLASH MEMORY UNABLE TO PROGRAM	DIAG
			Flash is soldered onto the board. Replace the robotic controller.	
B	8F	00	LIBRARY UNIT COMMAND TIMED OUT	SCSI
			Verify that communications to library still exists by issuing another command.	
5	F0	01	RESERVATION CONFLICT	Both
			Internal firmware error. Report this occurrence and previous command (if known) to Technical Support.	
5	F1	00	COMMAND UNSPECIFIED	Both
			Internal firmware error. Report this occurrence and previous command (if known) to Technical Support.	
5	F1	01	COMMAND HEAP OVERFLOW	Both
			Internal firmware error. Report this occurrence and previous command (if known) to Technical Support.	
5	F1	02	UNRECOGNIZED COMMAND	Both
			Internal firmware error. Report this occurrence and previous command (if known) to Technical Support.	

continued

Table C-1
Sense Data Values (Hexadecimal) *continued*

Sens e Key	ASC	ASC Q	Message Name/Description	Interface
5	F1	03	COMMAND REGISTER ERROR Internal firmware error. Report this occurrence and previous command (if known) to Technical Support.	Both
5	F3	00	DLT COMMUNICATION INTERNAL FAILURE Internal drive communication port code or hardware failure.	Both
4	F3	02	DLT DRIVE COMMUNICATION TIMEOUT The library is unable to communicate with a drive.	Both
4	F3	01	DLT DRIVE HANDLE NOT OK The tape drive is reporting that the handle cannot open. (This may indicate that a DLT cartridge is present that has not been unloaded.)	Both

Appendix **D**

Glossary

A/D

Analog-to-digital

ACK

Acknowledgment

actuators

Robotics components that move inside the tape library to manipulate cartridges. This includes the gripper, extension axis, rotary axis, horizontal axis, and vertical axis.

ASC

Additional sense code

ASCQ

Additional sense code qualifier

automated tape library

A robotics storage and retrieval system for DLT tape cartridges.

barcode label

The identification label on DLT tape cartridges.

bar code scanner

A device that is mounted on the extension axis that reads the cartridge bar code labels.

calibration

The software measurements and configuration required for successful operation of the tape library.

CFM

Cubic feet per minute

CMOS

Complimentary metal oxide semiconductor

CPLD

Complex programmable logic device

DC

Direct current

DLT

Digital linear tape

extension axis assembly

The extension axis assembly consists of the gripper assembly, the baseplate on which the gripper assembly is mounted, and the motor that drives the gripper forward and back.

extension axis belt

The drive belt connecting the extension motor/gearbox to the gripper assembly.

FCC Class A

Standard established by the U.S. Federal Communications Commission governing electromagnetic emissions.

FPGA

Field-programmable gate array

FRU

Field-replaceable unit

FSE

Field service engineer

Gripper assembly

The assembly that mounts on the extension axis and grips cartridges.

host computer

The computer that issues SCSI commands to control the tape library robotics.

IC

Integrated circuit

LCD

Liquid crystal display

LED

Light-emitting diode

LU

Logical unit

MHz

Megahertz - millions of cycles per second

MSBF

Mean swap before failure

MTBF

Mean time between failures

MTTR

Mean time to repair

NVRAM

Non-volatile random access memory

On-line

Ready for communications with a host computer.

Off-line

Ready for communications through the diagnostic port.

OVP

Over-voltage protection

PCI

Peripheral component interconnect

pick

The act of removing a cartridge from one location in preparation for placing it in another location.

place

The act of placing a cartridge in a location after it has been picked from a previous location.

PROM

Programmable read-only memory

PWA

Printed wiring assembly

PWM

Pulse width modulated

RAM

Random access memory

REQ

Request

RS-232

A serial communications cabling and protocol standard for 9-pin connectors.

SCSI

Small Computer Systems Interface—a communications standard for attaching peripheral equipment to computers.

standby

Ready for communications through the diagnostic port.

SRAM

Static random access memory

tape drive

Mechanism that reads from or writes data to a magnetic tape.

tape library

An automated storage and retrieval peripheral used for storing and handling DLT cartridges.

TTL

Transistor-transistor logic

VDC

Volts of direct current

ZIF

Zero-insertion force

Index