HP SureStore Optical Jukebox 80ex

Service Manual

Edition 1

HP Part No. C1115-90030

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Notice

Printing History

New editions of this manual incorporate all material updated since the previous edition. The manual printing date and part number indicate the current edition. The printing date changes when a new edition is printed. (Minor corrections and updates incorporated at reprint do not change this date.)

Part number C1115-90030 Edition 1 March 1998

Typographical Conventions

The following typographical conventions are used in this manual:

Emphasis: Denotes important information.

Keycap: Keys on the library.

`Computer Output`: Information displayed in the display window and screen menu items that you can select.

WARNING **Warnings call attention to a procedure or practice that could result in personal injury if not correctly performed. Do not proceed until you fully understand an meet the required conditions.**

CAUTION Cautions call attention to an operating procedure or practice that could damage the product if not correctly performed. Do not proceed until understanding and meeting these required conditions.

NOTE Notes provide information that can be helpful in understanding the operation of the product.

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1 Product Information

Technical Specifications

Table 1-1 **Technical Specifications**

Characteristics	Description
Drive Characteristics	
Rotational speed (rpm)	• 3000 (5.2 Gb media) • 3600 (650 Mb, 1.3 Gb, 2.6 Gb media)
Average seek, typical (ms)	25.0
Average access time, typical (ms)	35
Write transfer rate - max sustained (Mb/s)	• 2.1 (5.2 Gb media) • 1.7 (2.6 Gb media) • 1.2 (1.3 Gb media)
Burst transfer rate -fast synchronous (Mb/s)	10
Burst transfer rate - synchronous (Mb/s)	5
Burst transfer rate - asynchronous (Mb/s)	3
Raw read/write error rate	Less than 2.0x10-4 errors / total bytes read
Buffer size (Mbytes)	1
Read buffering	Readaheads
Write buffering	Immediate reporting write re-ordering
Interface	Single-ended

Characteristics	Description
Jukebox Physical Characteristics	
Height (cm, inches)	49.2, 19.4
Width (cm, inches)	22.1, 8.7
Depth (cm, inches)	69.5, 27.3
Net weight (kg, lbs))	35.2, 77.5
Packaged weight kg, lbs)	40.8, 90

Environmental Specifications

Table 1-2 **Environmental Specifications**

Characteristics	Robotics	Drive	Media
Temperature (^{o} C)			
Operating	10 to 40	5 to 45	10 to 60
Non-operating w/o disk	- 40 to 70	- 40 to 60	10 to 60
Max. Temperature gradient (^{o} C /hr)	10	10	10
Transportation - <14 consecutive days			-40 to 60
Humidity, non-condensing (%)			
Relative operating	10 to 90	5 to 90	10 to 80
Non-operating w/o disk	5 to 95	5 to 95	10 to 90
Maximum wet bulb (^{o} C)	29	29	29

Characteristics	Robotics	Drive	Media
Shock, non-operating (g/ms)			
End use, handling, half-sine	150 / 3	25 / 11	760 mm drop to 2mm vinyl-covered concrete
Transportation, trapezoidal (g/cm/s)	30 / 523	30 / 742	
Vibration, 5-500 Hz range (g rms)			
Operating, maximum acceleration (g rms)	0.21	0.3	>0.21
Non-operating random (g rms)	2	3	
Non-operating, swept-sine (g, 0-peak)	0.5	0.1	
Altitude (meters, feet)			
Operating	4,572 / 15,000		
Non-operating	15,240 / 50,000		
Acoustic emissions (dB - L noise power emission level)			
Operating (dB - L noise)	61.5		
Idle	47		

Characteristics	Robotics	Drive	Media
Particulates (μg/cm^3)			
	<200		
Electrostatic discharge (kV)			
Airgap (operating)	5 to 15	0 to 10	
Airgap (non-operating survival)	0 to 25	0 to 25	
Direct contact (operating)	0 to 4	0 to 4	
Cooling requirements (CFM)			
		15 (bidirectional through drive)	

Table 1-3 **Power Requirements**

Line voltage (Vac)	100 - 127, 200-240
Line frequency (Hz)	50 - 60
Power consumption, typical (Watts, BTU)	75, 238.9
Power consumption (Watts, BTU)	100, 341.3
Current (amperes)	8 (120 V) 6 (240 V)

Table 1-4 **Reliability**

Mean swaps between failure (MSBF) - robotics	2,000,000
Mean swaps between failure (MSBF) -drive	750,000
Mean time between failure (MTBF) - robotics (power-on hours	100,000
Mean time between failure (MTBF) - drive (power-on hours)	100,000
Mean time to repair (hours)	2
Preventive maintenance	none required* * for high-usage or zero downtime installations, see the Product Support Plan for special preventative maintenance schedules

Table 1-5 **Product Certifications**

Safety	EN 60950/IEC 950 UL 1950
Electromagnetic emissions	FCC 47 CFR Part 15 Subpart J Class “B” EN 55022/CISPR 22, Level “B”; SABS VCCI Level 2
Laser	CDRH 21 CFR Chapter 1, Subpart J IEC 825

Clearance Requirements

A minimum 70-80 mm (3 in.) is required behind the optical disk library rear panel to allow air to circulate.

Location Requirements

Position the jukebox away from sources of particulate contamination such as frequently-used doors and walkways, stacks of supplies that collect dust, printers, and smoke-filled rooms.

Related Documents

Table 1-6 **Reference Documents**

Document Name	Part Number	Edition
I*nstalling and Administering Optical Jukeboxes, HP9000 Series 700 and 800*	5966-9712	Ed. 1, 2/98
Optical Drive and Library SCSI-2 Command Reference	5966-9711	Ed. 8, 2/98
HP SureStore Optical 80ex User's Guide	C1100-90015	Ed. 1, 2/98

2 Installation

Overview

This chapter tells you how to connect the jukebox to your computer. Follow the unpacking instructions printed on the outside of the shipping carton before you complete the steps given in this chapter.

This chapter gives information on the following topics:

- choosing a proper environment for the jukebox
- identifying parts on the rear panel
- connecting the jukebox to your computer
- connecting power
- moving and shipping the jukebox

What you need for setting up the jukebox:

- power cord (included)
- SCSI terminator (included)
- 50-pin low-density SCSI cable
- single-ended SCSI host adapter with at least one available address
- application software that supports this type of jukebox
- this guide (included)

Choosing a Location

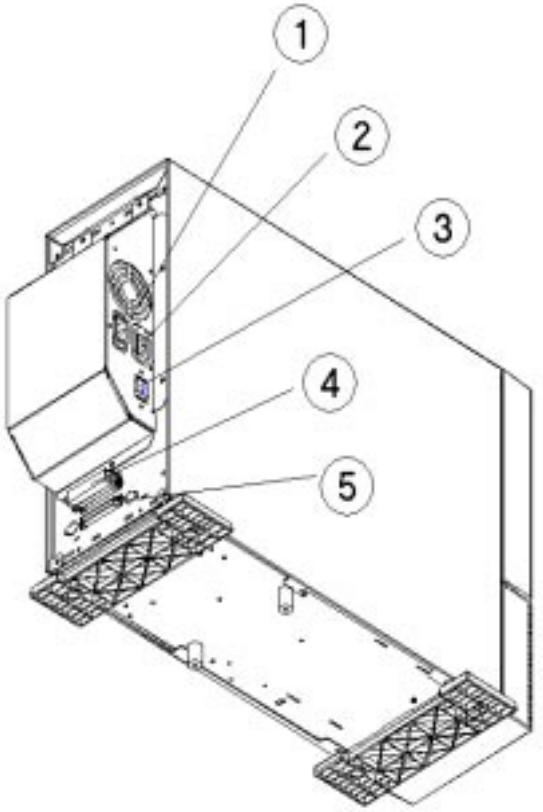
Before setting up your jukebox, choose the proper environment based on the following recommendations:

- temperature range between 65-75º F (18-24º C).
- away from sources of particulate contamination such as printers, scanners, frequently-used doors and walkways, supplies that collect dust, and smoke-filled rooms.
- 2-3 inches in front and back of the jukebox to allow air circulation.
- availability of AC power with voltage ranges of 90-127 V (115 V nominal) or 198-250 V (230 V nominal).

Identifying Rear Panel Features

Refer to and the text on the next page to identify parts and learn their functions.

Figure 2-1 **Rear Panel Features**



The numbers below correspond to the numbers in Figure 2-1 on the previous page.

1	Power receptacle	Used to connect the power cord to the jukebox.
2	Auxiliary power port	Used for auxiliary power connections. Do not use for connections requiring over 3 amperes of power.
3	Power switch	Switches power on and off to the jukebox.
4, 5	SCSI ports	Two 50-pin low-density connectors (Centronics-type) that allow connection to a SCSI bus and for daisy-chaining to other devices. A terminator must be plugged into one of these connectors when the jukebox is the last physical device on a SCSI bus. A terminator is shown plugged into the “4” connector.

Removing the Mailslot Shipping Bracket and Shipping Screw

The jukebox is shipped with a plastic bracket inserted into the mailslot. In addition to protecting the mailslot during shipment, the bracket also holds a warning decal reminding you to remove the shipping screw on the bottom of the jukebox.

To remove the mailslot bracket and shipping screw, do the following:

1. Grasp both sides of the bracket and at the same time hook your fingers underneath its lower edge (see Figure 2-2).
2. Gently bend the bottom of the bracket out slightly and while jiggling the bracket, pull it out from the mailslot.
3. Lay the jukebox on its side and unscrew the shipping screw. The screw has a knurled top so removing the screw can be done by hand.

NOTE The jukebox will not be harmed by laying it on its side.

Figure 2-2 **The Mailslot Shipping Bracket**

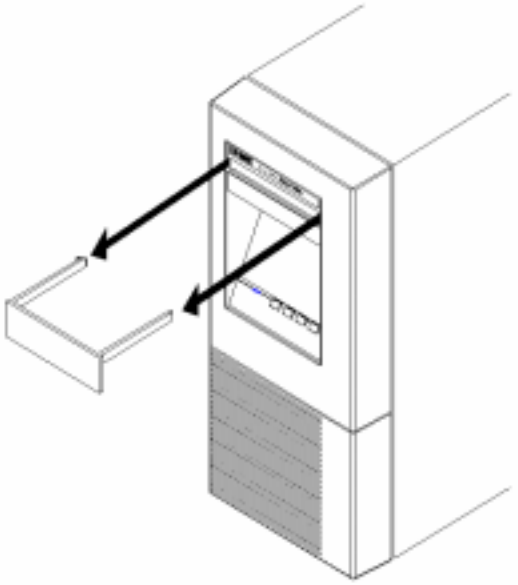
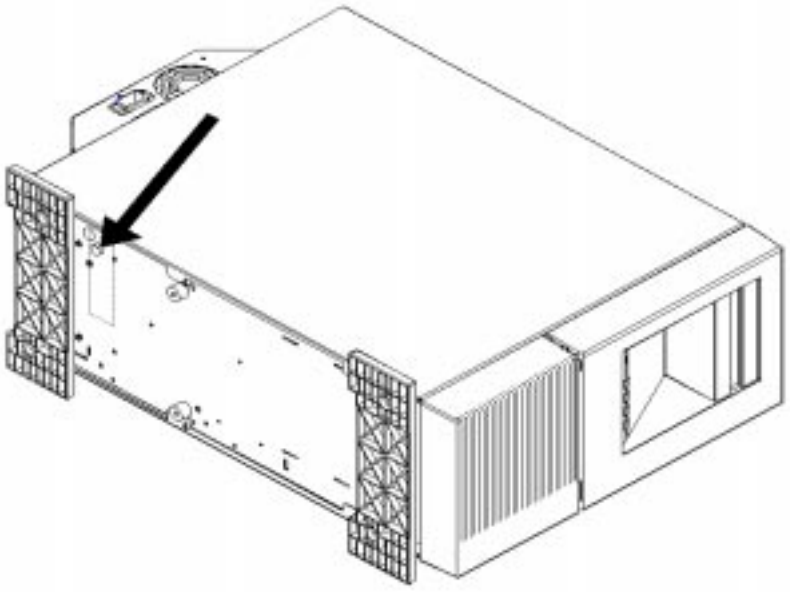


Figure 2-3 Location of the Shipping Screw



Connecting the SCSI Cable to the Jukebox

The jukebox accepts a single-ended SCSI bus. The connectors are low-density 50-pin (Centronics type).

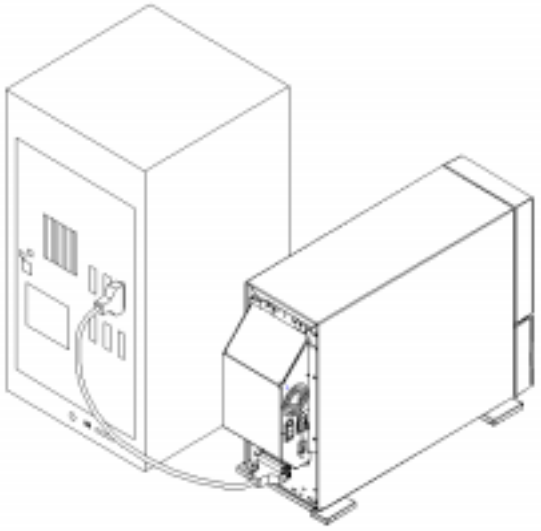
The drives are “fast” SCSI so you have a maximum of 3 meters (9.8 feet) available for the SCSI bus. The jukebox uses 1.5 meters (4.9 feet) of of this bus internally. This leaves 1.5 meters (4.9 feet) for the remainder of the bus.

Your jukebox can be connected to your host computer in two ways:

- as the only SCSI peripheral on a bus
- as one of multiple SCSI peripherals on a bus (not recommended)

Connecting the Jukebox as the Only Peripheral

Figure 2-4 **Connecting the Jukebox as the Only Peripheral**



The default IDs for the jukebox are as follows:

Jukebox = 3

Drive 1 = 4

Drive 2 = 5 (if installed)

1. Ensure that the mailslot shipping bracket and the shipping screw are removed.
2. Ensure that your host computer and your jukebox are OFF.

   The jukebox power switch is OFF when the switch is raised (out).
3. Connect a SCSI cable between one of the SCSI ports on the jukebox with a SCSI port on your host computer (see “4” or “5” on Figure 2-1).
4. Plug a terminator into the unused SCSI port on the jukebox.

   Because this configuration makes the jukebox the last peripheral on the SCSI bus, the bus must be terminated on the jukebox. The jukebox ships with a terminator plugged into one of its SCSI ports for your use.

Connecting the Jukebox with Other SCSI Peripherals

In most circumstances, the recommended configuration for this jukebox is as the only device on a SCSI bus. However, your use of the jukebox may be such that another device could be connected to the bus without a loss of performance.

There are many issues that must be considered when connecting another devices on the same bus with this jukebox such as the following:

- How the jukebox is used; archiving, backup, near-line storage. What performance must be maintained
- How the additional peripheral will be used. How much demand will it place on the bus
- Bus length available.

If you would like a review of SCSI and a discussion of the issues involved with connecting devices on a bus, refer to Appendix B of this guide.

Connecting Power

1. Ensure that the mailslot shipping bracket and the shipping screw are removed (see Figure 2-2 and Figure 2-3).
2. Ensure that your host computer and your jukebox are OFF.

   The jukebox power switch is OFF when it is OUT.
3. Plug the socket end of the power cord into the power port on the rear of the jukebox (see "1" on Figure 2-1). Use the power cord supplied with the jukebox.
4. Plug the other end of the power cord into an electrical outlet.
5. Press the power switch (see "3" on Figure 2-1).
6. Initially, `TESTING` appears in the display window on the front of the jukebox. Once the poweron test completes (approximately 1.5 minutes), `READY` displays. (See "Understanding Display Window Messages" in Chapter 3 for additional information about the displayed messages.

NOTE

If `FAIL 1` displays, the poweron test was not successful. Ensure that the shipping screw is removed (see Figure 2-3). If the shipping screw was removed, refer to "Troubleshooting" in Chapter 3.

Moving or Shipping the Jukebox

Moving the Jukebox a Short Distance

1. If removing the disks from the jukebox, follow the jukebox application software instructions for unmounting, ejecting, and labeling disks to ensure that the jukebox can be brought online again easily.

   Ensure that there are no disks in the drives.

   If manually ejecting disks, refer to “Ejecting Disks ” in Chapter 3.

CAUTION Moving the jukebox with a disk in a drive could damage the drive mechanism.

CAUTION Turning off the jukebox in the next step could cause data loss if not done correctly.

Do not turn off power to the jukebox until you are sure the SCSI bus is i*nactive*. Removing power from a SCSI peripheral when the bus is active can result in data loss and/or indeterminate bus states. Check the host system manuals for information about checking the SCSI bus status.

2. Switch jukebox power off.
3. Remove the power cord and the SCSI cable connections.
4. Carefully move the jukebox to its new destination.
5. Set up the jukebox at its new location.
6. Bring the jukebox online according to the customer’s system requirements.

Shipping the Jukebox

1. Follow the jukebox application software instructions for unmounting and ejecting disks.

   Ensure that there are no disks in the drives.

   If manually ejecting disks, refer to “Ejecting Disks” in Chapter 3.

CAUTION

Moving the jukebox with a disk in a drive could damage the drive mechanism.

Failure to remove all disks from the storage slots in the jukebox could result in damage to the jukebox.

2. Follow the jukebox application's instructions for labeling the disks according to what the customer will be doing with the disks (example: archiving, moving them to another jukebox, etc.).

CAUTION

Turning off the jukebox in the next step could cause data loss if not done correctly.

Do not turn off power to the jukebox until you are sure the SCSI bus is *inactive*. Removing power from a SCSI peripheral when the bus is active can result in data loss and/or indeterminate bus states. Check the host system manuals for information about checking the SCSI bus status.

3. Switch jukebox power off.
4. Remove the power cord and the SCSI cable connections.
5. Reinstall the shipping screw on the bottom of the chassis (see Figure 2-3).
6. Repackage the jukebox in the same way it was received.

3 Operation and Configuration

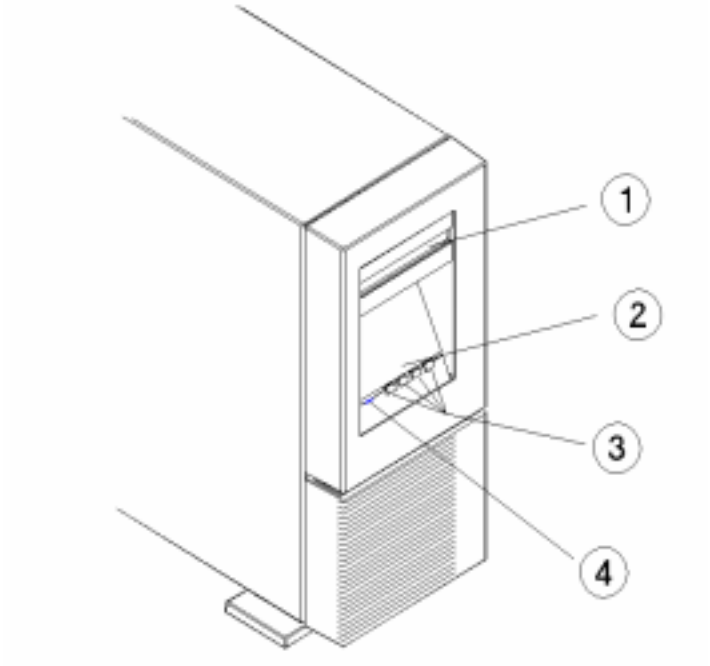
Overview

This chapter gives information in the following topics:

- operating the control panel
- using the selection buttons
- interpreting messages in the display window
- loading optical disks into the jukebox
- ejecting optical disks from the jukebox
- entering the administration menu password
- changing the administration menu password
- setting SCSI IDs or logical unit numbers (LUNs)
- setting configurations
- retrieving log history
- running tests

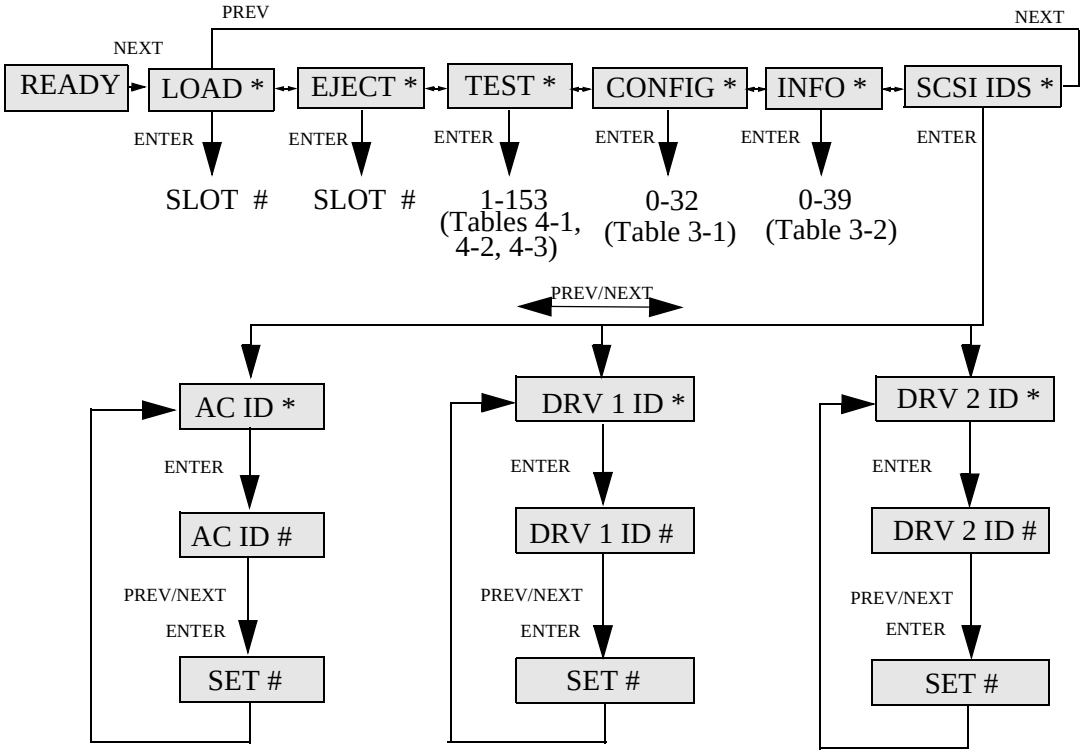
Indentifying Front Panel Features

Figure 3-1 **Features on the Front Panel**



1	Mailslot	Used to load and eject disks.
2	9-Character display	Displays information about the current operation.
3	Selection buttons	Pressed to perform the following operations: **CANCEL** cancels the current operation or choice **PREV** scrolls the displayed choice backward by one **NEXT** scrolls the displayed choice forward by one **ENTER** selects the displayed choice
4	Drive indicator	Lit when the optical drive mechanism is being accessed.

Figure 3-2 **Jukebox Display Menu Tree**



Using Selection Buttons

Use the **CANCEL**, **PREV**, **NEXT**, and **ENTER** buttons to select tasks you want the jukebox to perform. When the buttons are pushed the message in the display window changes. See the next section for a list of messages.

Each time you push the **NEXT** or **PREV** button, a task option appears. (If you see an "*" as part of the message, it indicates there is a menu beneath that option, which you can access by pressing the **ENTER** key. To display additional options press the **NEXT** or **PREV** Key. If you hold the **NEXT** or **PREV** buttons down, the display scrolls faster.)

NOTE

Go back to READY at any time by pressing **CANCEL**. (You may have to press **CANCEL** more than once in some cases.)

Understanding Display Window Messages

The jukebox displays messages according to key presses on the control panel. One level of messages tells you which operation you have selected, another level gives you feedback to which options you are selecting under each operation.

Messages are also displayed that tell about operations that the host computer has initiated.

Messages During Operator Selections

The display window shows the operations selected. A description of each operation is given below. Instructions for using and setting operations are given in the following sections.

`READY` - the jukebox is ready for operation

`LOAD *` - select to load disks through the mailslot

`EJECT *` - select to eject disks through the mailslot

`TEST *` - select to run internal jukebox tests

`CONF *` - select to customize the way the jukebox functions (CONFigurations)

`INFO *` - select to retrieve performance information

`SCSI ID *` - select to set the SCSI IDs for the jukebox controller and the optical drive mechanisms.

NOTE

An "*" indicates there are options that must be set with that operation. The next section explains how to use these operations.

Pressing **CANCEL** one or two times brings the jukebox back to the READY display.

Messages During Host Operations

Some disk operations initiated by the host computer will cause messages to be displayed. The following are examples of these messages.

`LOAD 15` - the host computer selected the disk in slot 15 for insertion into a drive

`MOVING` - the disk transport mechanism is moving a disk

`STORE 1` - the host computer selected slot 1 to store a disk

Using the Front Panel Features

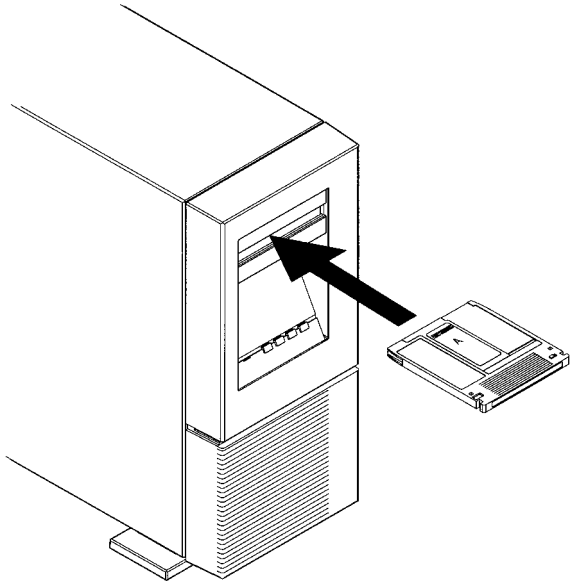
This section gives step-by-step instructions for tasks that are accessed by using the selection buttons on the control panel.

Tasks included in this section are:

- loading a disk cartridge
- ejecting a disk cartridge
- setting a new security code
- customizing the operation of the jukebox
- retrieving information logged by the jukebox
- running an internal test
- changing the jukebox controller SCSI ID
- changing an optical drive SCSI ID

Loading a Disk Cartridge

Figure 3-3 **Loading a Cartridge**



NOTE Some software packages require that disks must be inserted and removed by following the instructions in the software. If the customer is using a software package to manage files in the jukebox, check the software documentation before proceeding with these steps.

NOTE Label all disks before inserting them into the jukebox

Start with READY *in the display.*

1. Insert a cartridge into the mailslot; shutter end of the cartridge first, Side A facing up (see Figure 3-3). Push the cartridge in firmly but gently until it is fully inserted into the mailslot. SLOT ## displays ("##" is the number of an available storage slot, 1 to 16, in the jukebox).
2. If the displayed storage slot number is the one you want, press **ENTER**. If you want to choose a different storage slot, press **NEXT** until the desired slot number is displayed and then press **ENTER**.

3. After the disk has been loaded into the selected storage slot, READY displays.

Ejecting an Optical Disk From the Jukebox

Start with READY *in the display.*

1. Press **NEXT** until EJECT * displays.
2. Press **ENTER**. SLOT ## displays. ("##" is a slot number from 1-16 where a disk is stored.

   DRIVE # may also display, indicating there is a disk in a drive.)
3. If the number of the slot (or drive) that is displayed is the one you want, press **ENTER**.

   If you want a different numbered slot (or drive), press **NEXT** or **PREV** until that number displays. Then press **ENTER**.

Setting a New Security Code

The security code 0 0 0 is set at the factory. This code is used when accessing and setting jukebox configurations. Consider changing the security code so that only authorized persons can change the configurations.

Start with READY *in the display.*

1. Press **NEXT** until CONF * displays
2. Press **ENTER**. CONF 0 and a flashing 0 displays.
3. Press **NEXT** until CONF 17 displays.

   Starting from when you press **ENTER** in the next step, you are prompted to enter the current security code.
4. Press **ENTER**. CODE 1 and a flashing 0 displays.
5. Press **NEXT** until the first number of the current security code displays.
6. Press **ENTER**. CODE 2 and a flashing 0 displays.
7. Press **NEXT** until the second number of the current security code displays.
8. Press **ENTER**. CODE 3 and a flashing 0 displays.
9. Press **NEXT** until the third number of the current security code displays.
10. Press **ENTER**.

If you entered an incorrect code, `NO CONFIG` displays briefly and then `CONF 17` displays. Repeat steps 4-10 again and enter the correct current code.

After entering the current security code in the previous steps, you are prompted to enter a new three-digit security code.

11. Press **ENTER**. `NEW 1` and a flashing `0` displays.
12. Press **NEXT** until the first number you want in the security code displays
13. Press **ENTER**. `NEW 2` and a flashing `0` displays.
14. Press **NEXT** until the second number you want in the security code displays.
15. Press **ENTER**. `NEW 3` and a flashing `0` displays.
16. Press **NEXT** until the third number you want in the security code displays.
17. Press **ENTER**. `SET 17` displays briefly.
18. Press **CANCEL** to return to `READY`.

CAUTION

The next step is to turn off the jukebox.

Do not turn off power to the jukebox until you are sure the SCSI bus is *inactive*. Removing power from a SCSI peripheral when the bus is active can result in data loss and/or indeterminate bus states. Check the host system manuals for information about checking the SCSI bus status.

19. Turn the jukebox OFF, then ON to save the code to the jukebox flash ROM.

NOTE

Acces to the jukebox can be limited by choosing special security configurations. See Table 3-1 for information about configurations 15, 20 and 31.

Customizing the Operation of the Jukebox

Customize the way the jukebox operates by setting values in its “configurations.” See Table 3-1for a list of these configurations, their default settings, and possible settings.

NOTE

The current security code is required to change configurations 15, 17, 20, and 31.

Some configurations require the current security code. See “Setting a Security Configuration” (after this note) for steps to change configurations 15, 17, 20 and 31.

Changing a Security Configuration

Configurations that affect security of the disks in the jukebox are numbered 15, 17, 20, and 31. Table 3-1 describes these configurations.

Normally, this is not an operation done by service. It is described here for you information.

During the process of setting the security configurations, the operator is prompted for the current security code. If the customer has not reset the default security code, 0-0-0 should work.If the current securit code has been reset, coordinate with the customer.

Follow these steps to set a security option

Start with READY *in the display.*

1. Press **NEXT** until CONF * displays.
2. Press **ENTER**. CONF 0 displays. (The 0 is flashing.)
3. Press **NEXT** until the number of the option you want to change displays.
4. Press **ENTER**. CODE 1 and a flashing 0 displays.
5. Press **NEXT** or **PREV** until the first number of the security code displays.
6. Press **ENTER**. CODE 2 and a flashing 0 displays.
7. Press **NEXT** or **PREV** until the second number of the security code displays.
8. Press **ENTER**. CODE 3 and a flashing 0 are displayed.
9. Press **NEXT** or **PREV** until the third number of the security code displays.

   NO CONFIG displays if you entered the wrong security code.
10. Press **ENTER**. Choose the option number you want by pressing **NEXT** or **PREV**.
11. Press **ENTER**. OFF or ON displays. Choose the option you want and press **ENTER**. SET displays briefly. The security option is set.
12. Press **CANCEL** two times to return to READY.

CAUTION

The next step is to turn off the jukebox.

Do not turn off power to the jukebox until you are sure the SCSI bus is inactive. Removing power from a SCSI peripheral when the bus is active can result in data loss and/or indeterminate bus states. Check the host system manuals for information about checking the SCSI bus status.

13. Turn the jukebox OFF, then ON to save the code to the jukebox flash ROM.

Setting Non-Security Configurations

Start with READY *in the display.*

1. Press **NEXT** until CONF * displays.
2. Press **ENTER**. CONF 0 and a flashing 0 displays.
3. Press **NEXT** until the number of the option you want to change displays. NO CONFIG displays if you choose an invalid number.
4. Press **ENTER**.

   The current default setting displays. It may be any one of these settings

   - OFF or ON
   - a number
5. Select the option you want by pressing **NEXT** or **PREV**.
6. Press **ENTER**. SET displays.
7. Press **CANCEL** to exit.

CAUTION

The next step is to turn off the jukebox.

Do not turn off power to the jukebox until you are sure the SCSI bus is inactive. Removing power from a SCSI peripheral when the bus is active can result in data loss and/or indeterminate bus states. Check the host system manuals for information about checking the SCSI bus status.

8. Turn the jukebox OFF, then ON to save the code to the jukebox flash ROM.

Table 3-1 Configuration Choices

Number	Function	Default	Options
0	Clear/Save Error Log (Information Log 0)	Save	Clear - clears the error log immediately. Save - saves the error log until Clear is configured.
8	No Break on Failure	Off	Off - if a test encounters a failure, the test stops. On - if a test encounters a failure, the test continues.
10	Clear/Save Move Log (Information Log 10)	Save	Clear - clears the move log immediately. Save - saves the move log until Clear save is configured.
11	Clear/Save Runtime Log (Information Log 11)	Save	Clear - clears the runtime log immediately. Save - saves the runtime log until Clear is configured.
Configurations 15 - 20 require a security code			
15	Prevent Media Removal (security code required)	On = No Mailslot I/O Off = Normal Mailslot I/O	Off
16	Set Default Configurations (security code required)	Save	Clear - restores default configurations immediately. Save - maintains all set configurations.
17	Set New Security Code (security code required)	0-0-0	

Number	Function	Default	Options
18	Set Configurations (security code required) Clears/zeros these logs: #4 - Drive Load Count #5 -Poweron Hours #9 - Move Count #12 - Flip Count #14 - Mailslot Rotations	Save	Clear - clears/zeros the specified logs. Save - maintains the specified logs until Clear is configured.
20	Poweron Cartridge Security (security code required)	Off	On - maintains the status of configuration 15 through a power cycle or power fail. Off - Configuration 15 is not maintained through a power cycle or power fail.
21	Enable Jukebox Retries	On	On - jukebox attempts to correct itself when it encounters difficulty. Off - jukebox does not attempt to correct itself when it encounters difficulty.
22	Clear Drive Load Count Log (Information Log 4)	Save	Clear - clears the drive Load Count Log immediately. Save - saves the drive Load Count Log until CLEAR is configured.
27	Report Recovered Error	Off	On - reports any SCSI-level errors to the host. Off- does not report SCSI-level errors to the host.

Number	Function	Default	Options
31	Secured Mailslot Rotation (security code required; see “Setting a New Security Code” earlier in this chapter.	Off	Off - Normal mailslot operation. On - The mailslot rotates IN when the configuration is set to ON or a Prevent Media Removal command is received. The mailslot remains closed until configuration 15 is set to OFF or an Allow Media Removal command is received. If the jukebox is full, the mailslot will open only for an EJECT command.
32	Mailslot Rotation (security code required; see “Setting a New Security Code” earlier in this chapter	Off	Off - Normal mailslot operation. If the host sends a Rotate Mailslot command and this configuration is set to OFF, the host will receive a Check Condition followed by a sense key of Illegal Request. On - When a Rotate Mailslot command is received (either from the host or via the control panel), the mailslot is toggled open or closed.
40	Select Inquiry Mode	Off	On - selects mode that returns standard, HP responses to an Inquiry command. Off - Selects downloadable inquiry mode.

Number	Function	Default	Options
41	Write Verify	On	On - verify pass after write Off - no verify pass after write
Select Check/No Check on Move to Picker	42	On	On - Normal “bump” check on a move to the picker to verify existence of a cartridge. Off - “Bump” check to verify existence of a cartridge is not done (an OEM configuration).
66	Zero all RAM (requires password 9-9-9)	Save	Save - RAM remains unchanged. Clear - Zeros all RAM locations and reboots. CAUTION - When this configuration is set to “clear,” the product ID and the vendor ID must be downloaded using the firmware upgrade procedure outlined in the Supplemental Information section at the back of this manual.

Retrieving Information Logged by the Jukebox

Display information about the operations of the jukebox by using the INFO * selection. A description of this information is in "Information Logs" on page 4-13.

Start with READY *in the display.*

1. Press **NEXT** until INFO * appears in the display window.
2. Press **ENTER**. A flashing 0 displays
3. Press **NEXT** until the desired log number displays.
4. Press **ENTER**. If you select any log except 4 or 16 (the drive logs), the log information displays. If you are in logs 4 or 16, DRIVE 1 displays and you can press **ENTER** for Drive 1 information. If the jukebox has two optical drives, you can press **NEXT** (DRIVE 2 displays) and **ENTER** to access Drive 2 information.
5. Press **ENTER** to stop the INFO * display
6. Press **ENTER**, then **NEXT** to choose another log.
7. Press **CANCEL** to return to READY.

Changing SCSI IDs

The jukebox controller uses two SCSI IDs if the jukebox has one drive and three IDs if the jukebox has two drives. The jukebox controller is assigned one ID and one ID is assigned to each disk drive.

The default SCSI IDs are as follows

- jukebox controller = 3
- disk drive 1 (lower drive) = 4
- disk drive 2 (upper drive in a two-drive model) = 5

If one of these IDs is already being used by the host computer or another SCSI peripheral device, follow the directions in one of the next two sections to change either the jukebox controller or a drive ID.

Changing the Jukebox Controller ID

Start with READY *in the display.*

1. Press **NEXT** until SCSI ID * displays.
2. Press **ENTER**. AC ID * displays. (“AC” is the “jukebox controller.”)
3. Press **ENTER**. AC ID 3 displays.
4. Press **NEXT** or **PREV** until the ID you want displays.
5. Press **ENTER**. SET # (# is a number from 0-7) displays briefly and then AC ID * displays again. The ID you chose is now set.
6. Press **CANCEL** two times to return to the READY state.

NOTE CONFLICT displays if you attempt to set the jukebox controller and a drive to the same ID. Repeat the procedure and reset one of the IDs to another, non-conflicting ID.

NOTE After you change an ID you may have to restart the host computer for the new ID to be recognized.

CAUTION Do not turn off power to the jukebox until you are sure the SCSI bus is *inactive*. Removing power from a SCSI peripheral when the bus is active can result in data loss and/or indeterminate bus states. Check the host system manuals for information about checking the SCSI bus status.

Changing an Optical Drive ID

Start with READY *in the display.*

1. Press **NEXT** until SCSI ID * displays.
2. Press **ENTER**. AC ID * displays. ("AC" is the "jukebox controller.")
3. Press **NEXT** until DRV 1 ID * or DRV 2 ID * (if the jukebox has two drives) displays.
4. Press **ENTER**. DRV # ID? displays, where "#" is the number of the drive you selected in step 3 and "?" is the ID to which the selected drive is currently set.
5. Press **NEXT** until the ID you want displays.
6. Press **ENTER**. SET # (# is a number from 0-7) displays briefly and then DRV # ID # displays again. The ID you chose is now set.
7. Press **CANCEL** two times to return to the READY state.

NOTE CONFLICT displays if you attempt to set the jukebox controller and a drive to the same ID. Repeat the procedure and reset one of the IDs to another, non-conflicting ID.

NOTE After you change an ID you may have to restart the host computer for the new ID to be recognized.

CAUTION Do not turn off power to the jukebox until you are sure the SCSI bus is *inactive*. Removing power from a SCSI peripheral when the bus is active can result in data loss and/or indeterminate bus states. Check the host system manuals for information about checking the SCSI bus status.

4 Troubleshooting and Diagnostics

Overview

This chapter gives information in the following topics:

- diagnostic tests: sequence tests, exerciser tests, electronic core tests
- error and performance logs
- the Find Home sequence
- micro-moves
- operation/installation error information
- troubleshooting using the control panel
- verification/recovery from hardware errors
- getting error information through the SCSI bus

Diagnostic Tests

This section describes sequence, exerciser, and electronic core tests, as well as the following:

- **Operation/Installation Error Information**:

  Lists common problems encountered during operation and installation of the optical disk jukebox, and gives suggestions for solving these problems (top-level troubleshooting).

- **Control Panel Error Information**:

  Provides error messages and log information which are available through the control panel display. This level of troubleshooting is used when hard (repeatable) errors are encountered (intermediate-level troubleshooting).

- **Error Information through SCSI Commands:**

  Error messages and log information available by issuing SCSI commands via an external host computer. This level of troubleshooting is used when soft (intermittent) errors are encountered (in-depth level troubleshooting).

Sequence Tests

Table 4-1 **Sequence Tests**

Number	Test Name	Description
1	Poweron	Checks all digital data paths/normal machine operation. This test runs the same sequence of tests when the power is on, but does NOT do all operations (see below). **Sequence Order:** 3 - Controller test Motor Connection tests (no number) 5 - Initialize Mechanism Restore - If power failed during a move, it will try to restore the last move. 10 - Initialize Element Status 38 - Light show in the control panel indicators Mailslot Rotation (if not secured). This rotation could fail (poweron sequence would fail). POWERON ONLY.
2	Wellness Test	Checks out the general capability of the autochanger. **Sequence Order:** 1 - Poweron Test 11 - Mechanical Exercise Test
3	Controller Test	This sequence is run by the autochanger controller at poweron to check out all paths and operation of the servo and autochanger motor circuitry. **Sequence Order:** 30 - Processor Test 31 - ROM Checksum Test 32 - RAM Checksum Test 33 - Non-Destructive RAM test 34 - SCSI Interface Controller IC Test 36 - Motor Control IC Test 37 - Drive Connect Test

Number	Test Name	Description
5	Initialize Mechanism	Prepares the unit for movement. **Sequence Order:** Initialize RAM variables to defaults 50 Find Home

Exerciser Tests

Table 4-2 Exerciser Tests

Number	Test Name	Description
10	Initialize Element Status	Functions the same as the SCSI Initialize Element Status command. This test physically scans the entire unit to determine which storage slots contain disks and if the drive contains a disk.
11	Mechanism Exercise Test	Makes a combination of moves with a PASS/FAIL result. This exerciser is a sequence of other exerciser tests-- 12, 14, 15, 16, and 17. This exerciser returns an error code 57H, “Invalid Configuration”, if there are no cartridges loaded into the unit or if all storage slots are full. Needs one cartridge loaded; the drive and mailslot must be empty.
12	Carriage Picker Move Test	Moves the carriage/picker assembly the full length of the rail. Returns PASS/FAIL. No cartridges are required.
14	Flip Test	Makes a combination of moves with a PASS/FAIL result. It does several flips at various locations. No cartridges are required.

Number	Test Name	Description
15	Storage Slot Test	Makes a combination of moves with a PASS/FAIL result. It moves a cartridge from a randomly-chosen full to a randomly-chosen empty slot, with a random flip. It then moves the cartridge back to its original storage slot with its original orientation. This exerciser returns an error code 57H, “Invalid Configuration”, if there are no cartridges loaded into the unit or if all storage slots are full. Needs one cartridge loaded.
16	Drive I/O Test	Makes a combination of moves with a PASS/FAIL result. It moves a cartridge from a randomly- chosen full slot to the drive, with a random flip. It then moves the cartridge back to its original slot with its original orientation. Returns an error code 57H, “Invalid Configuration”, if there are no cartridges loaded into the unit or if the drive already contains a disk. Needs one cartridge loaded; the drive must be empty.
17	Mailslot I/O	Makes a combination of moves with a PASS/FAIL result. It moves a cartridge from the lowest- numbered full slot to the mailslot with a random flip. It then moves the cartridge back to its original slot with its original orientation. Returns error code 57H “Invalid Configuration” if there are no cartridges loaded into the unit or if the mailslot is full. Needs one cartridge loaded; the mailslot must be empty.
18	Speed Factor Setting Utility	Allows the setting of the speed factor as the first parameter given. The speed factor determines how fast the system moves the mechanics. The number chosen provides 1/Parameter speed (e.g., Parameter=3 runs the motors at 1/3 of full speed). May only be run through the SCSI interface.

Number	Test Name	Description
19	Zero Maximum Force Log	The maximum force log is initialized to all 0s.
20	Set Speed Factor to Full Speed	Allows the mechanics to be run at full speed.
21	Set Speed Factor to Half Speed	Allows the mechanics to be run at half speed.
22	Set Speed Factor to Quarter Speed	Allows the mechanics to be run at quarter speed.
23	Shipping	Moves the picker to the appropriate position for preparation for shipping.
24	Fill Picker	Moves a cartridge into the picker from the first storage slot containing a cartridge.
25	Empty Picker	Moves a cartridge from the picker to the first empty storage slot.
26	Zero Runtime Log	The entire runtime log is initialized to all zeros.
27	Set Minimum Retries	This sets the number of retries to 1. This may be set to see if the chosen test is doing what you want it to do. After you are satisfied that the test is what you want, run test 28 which resets the number of retries to default values.
28	Set to Default Number of Retries	Resets the number of retries to powerup default values. Used after setting retries to 1 by test 27.
29	Zero Error Log	The entire error log is initialized to all zeros.

Electronic Core Tests

Table 4-3 Electronic Core Tests

Number	Test Name	Description
30	Microprocessor Operation Test	Does a functional check of the microprocessor. This test must shut down the servo system; a FIND HOME sequence is run when this test finishes.
31	ROM Checksum Test	Does a checksum verification of the ROM.
32	RAM Checksum Test	A checksum of the “controlled” area of RAM is kept on a continuous basis. This test verifies that the checksum is still valid.
33	Non-Destructive RAM Test	Tests all the controller's RAM, checking for data acceptance and retention. The test is non-destructive unless interrupted by power failure. To run correctly, this test must shut down the servo system; as a result, a FIND HOME sequence runs when this test finishes.
34	SCSI Interface Controller Chip Test	Checks out operations of the SCSI interface controller chip. This test will not be run if initiated via SCSI and will report PASS.
35	Not used	Always returns PASS.
36	Motor Control Chip Test	Exercises the registers of the motor control chip. To run correctly, this test shuts down the servo system; a FIND HOME sequence runs when this test finishes.
37	Drive Connect Test	Checks for expected drive configuration. This is done by polling the drive connect signal on the drive. This line is grounded at the drive end if the drive is connected. If the physically-connected drive does not match the expected configuration, an error is reported.

Number	Test Name	Description
38	Control Panel Light Show	Lights each portion of the display individually and then together. No feedback; always passes.
39	Control Panel Button Check	Displays the name of the button pressed. Press **CANCEL** twice to exit.
40	Not used	Always returns PASS.
41	SCSI Connector Loopback Test	Runs a loopback through SCSI connectors, checking proper operation of the SCSI drivers, receivers, and cables. Requires an external loopback hood with terminator power. Will not run if initiated via SCSI and will report error FEH "Test Did Not Run."
42 43 44	Mailslot Sensor Test (interactive through the control panel)	Tests 42, 43, and 44 all execute the same test — the Mailslot Sensor Test. The display shows MOO VO BOO. MOO - is the portion of the display that is used in the mailslot sensor test. The two "OO"s are two sections of the display next to the "M" The left "O" is an indicator for the FRONT mailslot sensor; the right "O" is an indicator for the REAR mailslot sensor. When a sensor is manually blocked, the corresponding segment will fill with lit LED segments. VO and BO are not used. The "O" position in each of these portions of the display will always show clear. No FRU is returned.
45	Not used	Always returns PASS.

Number	Test Name	Description
50	Find Home Sequence	Moves the picker to a known “home” spot. This test assumes nothing about the state of the mechanics. The “home” location is at the lower position of the box. The servo system is initialized to the “home” location. It then automatically runs test 51.
51	Carriage/ Picker Assembly Calibration Test	Runs mechanism recalibration, establishes which picker side is up, and determines the reference points in the picker travel path. This test assumes that the mechanics and servo system are functional.
60	FRU Isolation Test	Assumes that something has physically failed, either electronic or mechanical. A series of special low-level tests are run to select the three (or fewer) FRUs that are most likely to be at fault. Tests 30, 31, 33, 36, and 50 are executed as a part of the isolation process. Returns an error code, three suspect FRUs in decreasing order of fault probability, and a time stamp.
65	Calibrate Magazines	Calculates a min/max clearance of the second (near-center) storage slot in each storage slot group. Storage slots 2,6,10, and 14 must be empty.) Requires a disk in the mailslot. The test passes if clearance for each of the storage slots tested is 85 encoder counts (1 mm) up and down. (See Info 23 for actual values.) The test returns: Byte 2-3 - clearance up Byte 4-5 - clearance down
66	Clear Magazine Min/Max	Clears the value calculated in test 65.

Number	Test Name	Description
67	Calibrate Mailslot	Calculates a min/max clearance for the mailslot. A disk must be in the mailslot. The test passes if clearance is 85 encoder counts (1 mm) up and down. (See Info 23 for actual values.) The test returns: Byte 2-3 - clearance up Byte 4-5 - clearance down.
68	Clear Mailslot Min/Max	Clears the value calculated in test 67.
71 to 74	Reserved	For production use only.
75	Not used	Always returns `FAIL`.
76 to 80	Reserved	For production use only.

Error and Performance Logs

These logs are accessible from the control panel by using the `INFO` option.

Table 4-4 Information Logs

Number	Log Name	Description
0	Autochanger Error Log	A time-stamped history of diagnostic test errors. The message logged for each error shows the error and the possible Field Replaceable Units (FRUs) that may have failed and caused the error. Displays as follows: Err n y - n th error; actual error code FRU A - suspect FRU #1 FRU B - suspect FRU #2 FRU C - suspect FRU #3 Test n - test that failed abcdefgh- time stamp
1	Firmware Version Number	Displays the current autochanger firmware version number.
2	Element Status	Displays the status (`EMPTY` or `FULL` of the selected autochanger element. Displays three numbers: First Number = Element number 0 = picker 1 = drive 1 2 = drive 2 10 = mailslot 11 - 26 = storage slots Second Number = Element type 1 = picker 2 = storage slot 3 = mailslot 4 = drive Third Number = Data mask 00 = empty 01 = full

Number	Log Name	Description
3	Software Clock	Displays the current “count” in seconds of the software clock (hexadecimal).
4	Drive Load Count	Displays the number of cartridge loads into the drive.
5	Poweron Hours	Displays the number of hours the operation switch is ON.
6	Current Move Success Count	Displays the number of successful Count moves since the most recent autochanger hard failure.
7	Move Success Average	Displays the average of the values in Log 10 - Move Success Log.
8	Current Move Retry Count	Displays the number of move retries done since the most recent autochanger failure.
9	Total Move Count	Displays the total number of moves and move attempts.
10	Move Success Log	Contains the number of successful moves that have occurred without a failure. Each time a failure occurs, the number of good moves is entered into the log and a new count is started. This `INFO` display shows the most recent 10 (or less) entries in the log. This log also shows the retry counts corresponding to each log entry. Example (2 displays for each entity): 1 33482 3 First display: 1 = entry number and 33482 = number of moves Second display: 3 = number of retries

Number	Log Name	Description
11	Display Runtime Log	Flashes to each display until **CANCEL** is pressed. A - Moves done B - Retries C - Automatic recoveries D - Hard errors
12	Display Flip Count	Displays total number of picker flips.
13	Display Translate Count	Displays total number of picker translates (will always return “0”).
14	Display Mailslot Rotation Count	Displays total number of mailslot rotations.
15	Number of Drives	Displays the number of disk drives in the unit.
16	Drive 1 SCSI Address	Displays drive 1 SCSI address.
17	Drive 2 SCSI Address	Displays drive 2 SCSI address (2-drive versions only).
20	Sensor Height	Remains for backward compatibility with previous code. This value, rather than being read from sensor in front of the drive, is computed from the top limit of the picker travel point. Value is hexadecimal format.
21	Picker Cone Angle	This value is determined from historical data. Value is hexadecimal format.
22	Not used	Reports 0.

Number	Log Name	Description
23 24 25 26	Minimum Clearance Storage Slot group 1 Storage Slot group 2 Storage Slot group 3 Storage Slot group 4	Minimum clearance for cartridge insertion into a magazine or storage slot. Up/down clearance is the value calculated by test 65. Up clearance/down clearance(hexadecimal) Example: 00DC 0028 = 220, 40 FFEC 0014 = -20, 20
60	Extended Info Log	Displays (in the following order): Entry n n - Entry number MC - Number of moves that have occurred since error logs were rezeroed MACRMV n n - Macro-Move ID number MVIDI n n - First Micro-Move ID number ERRIDI n n - First Micro-Move error code MVID2 n n - Second Micro-Move ID number (only shown if applicable) ERRID2 n n - Second Micro-Move Error code Source n n - Source element number of disk involved in failing move Dest n n - Destination element number of disk involved in failing move Refer to the *Optical Drive and Library SCSI-2 Command Reference* for error codes and move ID listings/explanations.
61	Firmware Checksum	For manufacturing use only.

The Find Home Sequence

When running the FIND HOME sequence, you can see what the mechanism is attempting when an error occurs by setting `RETRIES` to 1 (test 27). When limited to a single execution, the autochanger is prevented from entering any error recovery sequences. If you want to examine movements more closely, set the speed to half or quarter speed (test 21 or test 22).

Possible errors are not accessible or displayed through the control panel. Errors returned are micro-move errors. A complete listing of micro-move errors is included in the *Optical Drive and Library SCSI-2 Command Reference* (HP Part No: 5966-9711, Edition 1).

The following sequence lists each large movement in the FIND HOME sequence. If there is a problem during a movement, the most likely hardware errors are listed below in descending order of probability.

NOTE Error numbers are in hexadecimal notation.

1. Clear the transport of any obstructions.

   Possible error: 40: unable to free the transport fingers for transport movement.

2. Initialize the transport position by moving it toward the drive-end of the unit until it hits a hard stop.

   Possible error: 46--transport motion failed while initializing home position during the FIND HOME sequence.

3. Find orientation of the transport.

   Possible error #1: 4A--motion error while determining the orientation of the transport.

   Possible error #2: 4C--failed flip motion during the Find Home sequence.

4. Determine if there is a cartridge in the transport by plunging the fingers against a hard stop.

   Possible error #1: 4D--motion error while checking for cartridge in the transport.

5. Flip the transport assembly with the nut facing upward if necessary.

   Possible error: 4C--failed flip motion during find home sequence.

6. Initialize the mailslot.
   Possible error: B0--mailslot will not rotate.

Micro-Moves

The following tables lists the micro-moves.

Table 4-5 Micro-Moves

Micro-Move ID (hex)	Description
0	No motion; no commands pending
1	Carriage motion; full speed; away from drive
2	Carriage motion; full speed; toward the drive
3	Carriage motion; move fingers forward during full speed; away from the drive
4	Carriage motion; move fingers forward during full speed; toward the drive
5	Full speed finger motion
7	Pull fingers back to depress flip button
8	Flip
9	Verify flip complete
A	Push fingers out to release flip button
11	Move fingers toward storage slot; with intent to grab cartridge
12	Detect cartridge in storage slot before grab and during Initialize Element Status
13	Take up the slack in the fingers before grabbing the cartridge
14	Pull cartridge back from storage slot with cartridge
15	Push cartridge forward into storage slot
16	Detect cartridge in storage slot after insert

Micro-Move ID (hex)	Description
17	Pull fingers back from storage slot after releasing cartridge
18	Move fingers toward drive; prepare to grab cartridge
19	No motion; waiting for the drive to eject the cartridge
1A	Carriage shake; to assist the cartridge ejected from the drive to slide into the picker
1B	Move fingers toward drive with intent to grab cartridge
1C	Pull fingers back from drive with cartridge
1D	Insert cartridge into drive until slider engages
1E	Insert cartridge into drive after slider has engaged
1F	Move fingers with cartridge toward the drive, determining distance of cartridge in drive. Look for drive to accept cartridge
20	Drive failed to accept the cartridge; pull cartridge back
21	Drive accepted cartridge; release cartridge and pull fingers back
22	Carriage motion during mailslot access
23	Move fingers toward mailslot with intent to grab the cartridge
24	Detect cartridge in the mailslot before grab
25	Take up the slack in the fingers before grabbing the cartridge
26	Pull cartridge back from the mailslot with cartridge
27	Carriage motion during mailslot access
28	Push cartridge forward into the mailslot
29	Detect cartridge in the mailslot after insert
2A	Pull fingers back from mailslot after releasing cartridge

Micro-Move ID (hex)	Description
2B	Move leadscrew tab toward actuator arm before pulling mailslot in
2C	Carriage motion toward actuator arm where mailslot is engaged before pulling mailslot in
2D	Move leadscrew tab to mailslot actuator arm before pushing mailslot out
2E	Carriage motion toward actuator arm where mailslot is engaged before pushing mailslot out
30	Release tension on the mailslot rotate arm
31	Release tension on the mailslot rotate arm
32	Rotate the mailslot
33	Rotate the mailslot
34	Verify the rotation of the mailslot is complete
35	Rotate the mailslot when rotational position unknown
36	Check for a cartridge in the picker; same motion is used to check for a cartridge in mailslot or storage slot when picker contains a cartridge
37	Pull fingers back during test for a cartridge
38	Move fingers at full speed during test for a cartridge
39	Positioning before and after test for a cartridge in drive
3A	Check for a cartridge in the drive
3D	Move carriage to drive bang position
3E	Verify the presence of a cartridge by pressing cartridge against drive face
3F	Short carriage motion to check for cartridge sticking out of a storage slot after insertion (toward drive)

Micro-Move ID (hex)	Description
40	Short carriage motion to check for cartridge sticking out of a storage slot after insertion (away from drive)
41	Short carriage motion to check for cartridge sticking out of the drive after insertion (toward drive)
42	Short carriage motion to check for cartridge sticking out of the driver after insertion (away from drive)
43	Short carriage motion to check for cartridge sticking out of the drive during error recovery (toward, then away from drive)
47	Carriage motion toward drive; looking for hard stop in the FIND HOME sequence
48	Release forces after finding hard stop
49	Carriage motion away from drive finding room to flip in FIND HOME sequence
4A	Fast carriage motion toward drive to flip position
4B	Carriage motion toward drive finding room to flip in FIND HOME sequence
4C	Fast carriage motion when flip area found in needed direction
4D	Slow flips during FIND HOME sequence
4E	Push fingers slowly out of picker after flips in FIND HOME sequence
4F	Check for picker belts in FRU isolation tests, or slow finger motions during error recovery
50	Carriage motion toward the drive looking for hardstop before measuring carriage travel
51	Verify the maximum required carriage travel from the drive
52	Test for presence of cartridge by pushing against hard stop

Micro-Move ID (hex)	Description
53	Long carriage motion during carriage/picker assembly calibration
54	Short carriage motion during carriage /picker assembly calibration (fine measure)
57	Error occurred while inserting cartridge, push cartridge farther into storage slot
59	Move fingers toward storage slot during storage slot recovery
5A	Pull fingers back from storage slot during storage slot recovery
5B	Carriage motion during drive recovery
5C	Carriage motion during storage slot recovery
5D	Carriage motion during drive insert recovery
5E	Slowly push fingers out then in during drive recovery
5F	Drive recovery
60	Drive recovery
61	Short carriage motions during drive recovery (wiggle motion)
62	Long carriage motion in drive recovery (toward, then away from the drive)
64	Pull fingers back into picker during recovery
65	Pull fingers back from storage slot during storage slot recovery
66	Carriage motion while testing for cartridge in drive during drive insert recovery
67	Pull back fingers from drive after releasing cartridge during recovery

Micro-Move ID (hex)	Description
68	Move fingers with cartridge towards drive, using short steps, look for drive to accept the cartridge during recovery
69	Carriage motion during initial recovery (away from drive)
6A	Carriage motion during initial recovery (toward drive)
6B	Push fingers out of picker during initial recovery
6C	Pull fingers back into picker during initial recovery
6D	Carriage motion during initial recovery (away from drive)
6E	Carriage motion during initial recovery (toward the drive)
6F	Checking for carriage motor belt in FRU isolation tests

Operation/Installation Error Information

CAUTION

DO NOT CYCLE POWER until you are sure the system SCSI bus is INACTIVE and will REMAIN INACTIVE. Removing power while the bus is active can cause data loss and/or indeterminate bus states. Check the host system reference manuals for information on checking the status of the SCSI bus

Table 4-6 Troubleshooting

Problem	What to do
Jukebox won't power on	• Check that the power indicator light on the drive front panel is ON ("3" on Figure 3-1). • If light is not ON, make sure the power switch on the rear panel is ON and that the jukebox is plugged in. • Is the power cord good? • Is the power outlet operating?
Poweron selftest failed	• Ensure that shipping screw is removed. • Ensure that the shipping bracket (in the mailslot) is removed. • Power cycle the jukebox. (See the note at the bottom of this page.) If the jukebox continues to fail poweron selftest, press **ENTER** and record the error codes. Refer to "Hardware Errors Verification/Recovery" on page 5-34.
Before turning power OFF, ensure that the SCSI bus is inactive and will remain inactive while you are troubleshooting. Turning power OFF in this jukebox while the SCSI bus is active can cause data loss and/or SCSI bus problems.	

Problem	What to do
Power to the jukebox failed while a disk was in the drive and did not return to READY after the power came back on	• Power cycle the jukebox. (See the note below.) If the poweron test is unsuccessful, place the power switch to OFF. Do not move the jukebox! Moving the jukebox when there is a disk cartridge inside the drive risks damaging the drive. Go to "Hardware Errors Verification/Recovery" on page 5-34.
No display messages	Check that the fan in the front of the jukebox is running (or the fan in the rear on the power supply). If the fans are not running, check that the jukebox is receiving power. See "Jukebox won't power on" previously discussed in this troubleshooting list. If the jukebox is not powering on or if the jukebox is powering on but there are no display messages, refer to Chapter 4, "Troubleshooting.".
Changed a drive or jukebox ID but the host does not recognize the new ID	• Ensure that no other device IDs conflict with the new ID. If you find a conflict, change the ID and reboot the system (or rescan the bus). (If rebooting, see the note at the bottom of this page.) • Refer to the host adapter documentation for adding devices to a SCSI bus.
Changed a drive or jukebox ID but the jukebox rejected the ID	You are trying to set an ID that is already in use by either the jukebox or by the other drive (in two-drive models). Select another ID.
Customer forgot the security code	• Enter the default password (`0 0 0`). • If the default password is not accepted,download the current jukebox controller firmware.
Before turning power OFF, ensure that the SCSI bus is inactive and will remain inactive while you are troubleshooting. Turning power OFF in this jukebox while the SCSI bus is active can cause data loss and/or SCSI bus problems.	

Problem	What to do
Disk inserted in the mailslot, `LOAD ERR`, or `MISLOAD` displays	• Press **CANCEL** and re-insert the disk in the mailslot. See "Loading an Optical Disk into the Jukebox" in this chapter for the correct disk loading orientation. • If re-inserting the disk results in the same message, record the information logs and refer to "Hardware Errors Verification/Recovery" on page 5-34.
Disk inserted in the mailslot, but `RESERVED` displays	A security configuration is set that prevents disks from being loaded into, or ejected from, the jukebox. If you want to change the security configuration, see "Changing a Jukebox Security Configuration" in this chapter.
Disk eject attempted but `EMPTY` then `READY` displays	This is not an error. There are no disks in the jukebox.
Disk eject attempted but `FULL` then `READY` displays	A disk is in the mailslot. • Remove the disk from the mailslot. • Select EJECT *, select the slot you want the disk ejected from again, and eject the disk.
Disk eject attempted but `MISLOAD` displays	• If there is no disk in the mailslot, press **CANCEL** and attempt another eject. • If MISLOAD continues to display, check the infomration logs and refer to "Hardware Errors Verification/Recovery" on page 5-34.
Disk eject attempted but RESERVED displays	The host computer or application software has reserved the disk for its own use. You will not be able to eject this disk. If you want to change this configuration, refer to the host and/or application software documentation.
You want to stop a running test	Press **CANCEL**. The current test loop continues until finished, then the test stops.

Problem	What to do
INIT ELEM displays	• The jukebox is inventorying the disks and drives. The jukebox or host computer may have initiated this process. Wait for this process to finish. • If this process does not complete, if READY does not appear in the display, or if no motion is seen in the jukebox, power cycle the jukebox. (See the note at the bottom of the table.) • If the jukebox does not come up READY, record the information logs and refer to "Hardware Errors Verification/Recovery" on page 5-34.
Can't write to the disk	• Check the host computer or network file system access permissions. • Check the host computer messages and host system documentation for interpretation of the error messages.
Before turning power OFF, ensure that the SCSI bus is inactive and will remain inactive while you are troubleshooting. Turning power OFF in this jukebox while the SCSI bus is active can cause data loss and/or SCSI bus problems.	

Poweron Selftest

CAUTION If the controller senses that the optical drive is not connected to a host system via the SCSI interface, additional selftests are run on the SCSI circuitry. If these tests run while a terminator is attached, voltage levels at the SCSI bus connector are different than expected and a selftest failure results.

CAUTION DO NOT CYCLE POWER during any troubleshooting until you are sure the system SCSI bus is INACTIVE and will REMAIN INACTIVE. Removing power while the bus is active can cause data loss and/or indeterminate bus states. Check the host system reference manuals for information on checking the status of the SCSI bus.

To run the poweron selftest, follow these steps:

1. Insert a formatted disk into the drive either from a storage slot location or through the mailslot/control panel.

2. Turn jukebox power switch ON.

   If the poweron selftest completes successfully, the control panel displays READY and both LEDs on the drive will turn off. If poweron selftest fails, an error message displays and the drive fault LED remains lit.

   The drive LED lights can be seen through the window on the side of the jukebox or you may take the cover and side access panel off to get a clearer view.

To remove the cover and side access panel, refer to “Accessing the Chassis Interior” on page 5-4.

Troubleshooting Using the Control Panel

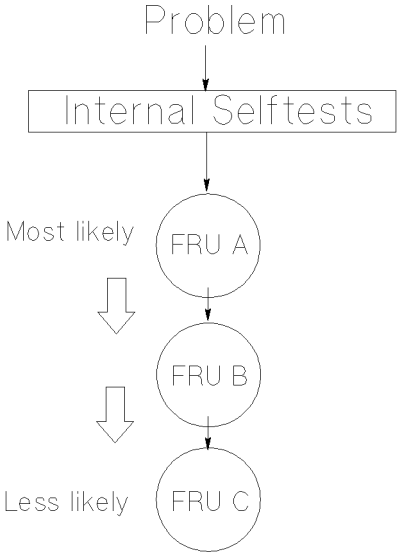
When there are errors in autochanger movements, use these approaches to get information and to run exerciser tests:

- Troubleshooting Using the Control Panel and Observation - used in situations where you have a hard error.
- Troubleshooting Through the SCSI Bus - used in situations where you have a intermittent, recoverable) error.

Internal Selftests

At poweron, and after every failed move, the autochanger automatically runs an initialization sequence that comprehensively tests the autochanger. If a hard failure occurs, a list of possible FRUs that may have been at fault is returned.

Figure 4-1 **Suspect FRUs**



NOTE

This test sequence returns possible failed FRUs only if there has been a hard failure. This test sequence, called the "FRU Isolation Test" (test 60), can also be run from the control panel.

The FRU Isolation Test

The FRU Isolation Test assumes the following:

- There was a failure.
- The cause of the failure was physical (either mechanical or electrical).
- There is only one failed component. Simultaneous failures of unrelated items are not considered possible for purposes of this test.
- Service will be done, if necessary, if a problem is found (i.e., the unit does not have to be left in a "clean" state).

  If the picker starts this test with a disk in it, the position and orientation of that disk is unknown.

When an error occurs, the cause may be the power supply, cables, drive electronics, motors, encoders, belts, gears, sensors, or picker. No assumption is made about the integrity of any of these components. To isolate the actual cause of the failure, a process of elimination is used.

The components are tested in a sequence that starts with the most basic functions and builds to the more complex, and interrelating components (i.e., the motors cannot be tested if the power supply is dead).

Whenever the initialization sequence is run, FIND HOME is attempted. If the home position cannot be found, the FRU isolation test automatically runs. When the FRU isolation test is run from the control panel, the FIND HOME sequence is run.

FRU Isolation Test Execution

The following list traces the execution of Test 60, the FRU Isolation Test from the viewpoint of the autochanger.

If one of the tests in this sequence fails, the isolation sequence stops, and you will have to run additional tests to determine the actual cause of the failure.

During the FRU isolation procedure, the autochanger —

1. Looks at the error code generated by the FIND HOME sequence to see if some codes may have obvious, implied FRUs.
2. Runs autochanger controller PCA tests that do not cause host communication loss (Tests 30, 31, 33, and 36) to eliminate power supply, power supply cables, ROMs, RAM, motor control IC, and microprocessor).
3. Checks that the motors are capable of movement by attempting to move them very small distances in both directions to eliminate motor assemblies (except belts), motor cables, PCA drivers.
4. Pulls picker fingers back. The autochanger expects that the fingers should come to a hard stop with the leadscrew nut completely at the end of the leadscrew.
5. Moves the carriage/picker assembly toward the drive to eliminate the carriage belt. The assembly should come to a hard stop.
6. Moves carriage/picker assembly away from the drive to eliminate the leadscrew assembly. The move is made back far enough to be certain that the leadscrew can move, but not so far that a jammed cartridge will cause the test to fail.

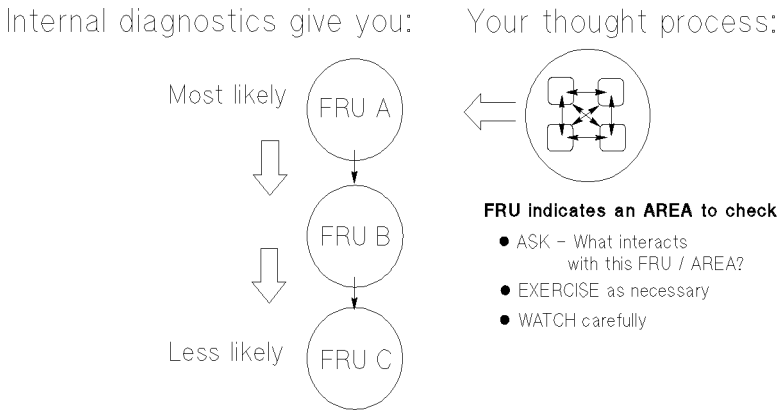
   If the FRU isolation test has been run from the front panel, the FIND HOME sequence will automatically be executed at this point.

At this point, there is some level of confidence that the system is capable of moving the carriage/picker assembly. Using the new information learned by running these tests, the autochanger looks at the error codes, the move ID that failed, and how the recovery system failed. The FRUs that may have caused the failure are chosen and ordered in most-to-less likely.

Using the Internal Test Results

Similar to treating symptoms rather than the real problem, the suspect FRUs given by the FRU isolation test may actually mask the root cause of the problem.

Figure 4-2 **Viewing the suspect FRUs**



If you consider the suspect FRU as a POINTER to the problem area rather than the problem itself, an educated visual inspection, with perhaps some cable and connector wiggling, should reveal the real problem.

An example:

Say the autochanger fails with an error code of 4D (hexadecimal), *Motion error checking for cartridge in the picker*, and lists the picker (FRU 27) as the most likely failure. However, when you observe the unit while running the Wellness Test (test 2), you see that the picker is having trouble flipping. As you manually move the carriage/picker assembly around and touch the components that are involved, you notice that the picker belt is abnormally tight. The belt is tight because the picker motor is skewed.

The error (4D) and suspect FRU provides an area to look at when troubleshooting. Visual inspection (concurrent with physical checks) helps to link the suspect FRU with the root cause by providing an area to examine.

Error and Performance Logs

The optical autochanger control panel diagnostic tests have two major purposes:

- Provide diagnostic information.
- Provide fault isolation tests.

All the logs are maintained within non-volatile RAM, and so are not affected by cycling autochanger power. These logs are accessible in the INFO menu.

NOTE If more in-depth troubleshooting is needed, an external diagnostic tool like SCSI Toolbox from Peripheral Test Instruments or SCSI Pro from CoComp may be used to access the error and information logs.

To display information about the autochanger (e.g., the error log or move success log) access the INFO option using these steps:

1. With the autochanger power on and in the READY state, press **NEXT**. TEST* displays.
2. Press **NEXT** until INFO* displays. Press **ENTER**.
3. Press **NEXT** or **PREV** until the desired log number displays.
4. Press **ENTER**. The log information will display.

NOTE Some logs will display more information when **NEXT** or **PREV** is pressed. Press **CANCEL** to stop the INFO display. Press **ENTER** to choose another log.

Verification/Recovery from Hardware Errors

When a hardware failure occurs, a message is displayed on the control panel. If the failure occurs during the poweron sequence, `FAIL 1` displays. If the failure occurs at some other time, `MISLOAD` or `FAIL 0` displays. If a failure occurs while you are running a test, `FAIL #` displays, where # is the number of the test that failed.

When you press **ENTER**, the autochanger displays information about the hardware failure.

The autochanger firmware can detect broken components such as a dead motor, a missing belt, etc., but if failures are due to marginal or random problems, the failing component may induce errors in other components.

Table 4-7 shows the hardware error codes possible and recovery procedures for specific hardware errors.

Table 4-7 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
00 No error	No action.
Autochanger Controller PCA Errors	
01 ROM Checksum Error	Run test 31 -- ROM Checksum Test -- verify failure.
03 RAM Test Error	Run test 33 -- RAM Test -- verify failure.
05 Controlled Area of RAM Checksum Error	Recovery procedures for error codes 05, 06, and 07 are handled in the same manner: Recycle Power -- verify failure. If error repeats, run configuration 16 -- resets default values. Recycle power. If error repeats, replace autochanger controller PCA (FRU 01). Poweron -- check fix.

Error Code (hex)	Verification/Recovery Procedures
04 Microprocessor Test Error	Run test 30 -- Microprocessor Operation Test-- verify failure.
06 Illegal interrupt seen by microprocessor	See error 05.
07 Illegal CPU exception seen by microprocessor	See error 05.
09 Firmware Error	Run test 3 -- Controller Test -- (may not be able to duplicate).

Error Code (hex)	Verification/Recovery Procedures
SCSI Interface-Specific Errors	
Procedure: All recovery procedures for SCSI interface-specific errors are handled in the same manner: Run test 34--SCSI Interface Controller Chip Test -- verify failure.	
0B SCSI Controller Register Error	See procedure above.
0C SCSI Controller IC's RAM Failed	See procedure above error 0B.
0D SCSI Controller Message Error	See procedure above error 0B.
0E SCSI Controller Command Error	See procedure above error 0B.
10 SCSI Controller FIFO Error	See procedure above error 0B.
0F SCSI Controller Kill Error	See procedure above error 0B.
11 SCSI Controller Target Sequence Error	See procedure above error 0B.
12 SCSI Controller Command Sequence Error	See procedure above error 0B.
13: SCSI Controller Status Sequence Error	See procedure above error 0B.

Error Code (hex)	Verification/Recovery Procedures
Loopback Errors	
Procedure: Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure	
18 SCSI Connector Loopback Error in DBO or I/O	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
19 SCSI Connector Loopback Error in DB1 or C/D	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
1A SCSI Connector Loopback Error in DB2 or MSG	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
1B SCSI Connector Loopback Error in DB3 or REQ	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
1C SCSI Connector Loopback Error in DB4 or ACK	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
1D SCSI Connector Loopback Error in DB5 or ATN	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
1E SCSI Connector Loopback Error in DB6 or SEL	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure

Error Code (hex)	Verification/Recovery Procedures
1F SCSI Connector Loopback Error in DB7 or BSY	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
20 SCSI Connector Loopback Error in DBP or RST	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
2B Timer A did not count down as expected	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
Motor Control IC Errors	
Procedure: Run test 36 -- Motor Control Chip Test -- verify failure.	
2C Failed read\ write test to motor control IC	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
2D Motor Control Loopback Test failed	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
2E Motor Control IC RAM Test failed	Run test 41 -- SCSI Connector Loopback Test (using loopback connector 88780-60095) -- verify failure
Drive Connect Errors	
Procedure: On error code 37, 38, and 39 be sure to check: drive cabling good contacts no cut or exposed wires	
37 Neither drive 1 or 2 connected	See procedure above. Run test 37 -- Drive Connector Test -- verify failure
38 Drive 1 not connected	See procedure above error 37. Run test 37 -- Drive Connector Test -- verify failure.

Error Code (hex)	Verification/Recovery Procedures
39 Drive 2 not connected	See procedure above error 37. Run test 37 -- Drive Connector Test -- verify failure.
Mechanism Errors	
Procedure: Check carriage/picker for free motion. The carriage should travel easily along the rail.	
3C Unspecified failure	See procedure above. Run test 11 -- Autochanger Mechanism Exercise Test. On error -- go to error code in this table.
3E Unspecified servo failure	See procedure above error 3C. Run test 11 -- Autochanger Mechanism Exercise Test -- verify failure.
40 Unable to free picker fingers for carriage motion	Check the following assemblies in the autochanger for loose labels or other obstructions -- picker, mailslot, drive, and storage slots. Run test 50--Find Home Sequence -- verify failure
41 Unable to verify picker is at home position	Check the following assemblies in the autochanger for loose labels or other obstructions -- picker, mailslot, drive, and storage slots. Run test 50--Find Home Sequence -- verify failure
42 Unable to find home position	Check the following assemblies in the autochanger for loose labels or other obstructions -- picker, mailslot, drive, and storage slots. Run test 50--Find Home Sequence -- verify failure
44 Carriage motion failure during Find Home sequence	Check the following assemblies in the autochanger for loose labels or other obstructions -- picker, mailslot, drive, and storage slots. Run test 50--Find Home Sequence -- verify failure.
45 Unable to free picker fingers	Check the following assemblies in the autochanger for loose labels or other obstructions -- picker, mailslot, drive, and storage slots. Run test 50--Find Home Sequence -- verify failure.

Error Code (hex)	Verification/Recovery Procedures
46 Carriage motion failed while initializing Home position (during Find Home)	Check the following assemblies in the autochanger for loose labels or other obstructions -- picker, mailslot, drive, and storage slots. Run test 50--Find Home Sequence -- verify failure.
48 - 49 Carriage motion failed during carriage/picker assembly calibration	Run test 51 -- Carriage/Picker Assy Calibration-- verify failure.
4A Motion error while determining orientation of the picker	Run test 50--Find Home Sequence -- verify failure.
4C Failed flip motion during Find Home sequence	Run test 50--Find Home Sequence -- verify failure.
4B No sensor found	Run test 50--Find Home Sequence -- verify failure.
4D Motion error checking for cartridge in the picker	Run test 50--Find Home Sequence -- verify failure.
4E - 4F Unable to measure height of sensor	Check the optical sensor, if necessary. Run test 51 -- Carriage/Picker Assy Calibration -- verify failure.
50 Excessive tilt of the carriage/ picker assembly (away from the drive)	Check the optical sensor, if necessary. Run test 51 -- Carriage/Picker Assy Calibration -- verify failure.
51 Excessive tilt of the carriage/ picker assembly (toward drive)	Check the optical sensor, if necessary. Run test 51 -- Carriage/Picker Assy Calibration -- verify failure.

Error Code (hex)	Verification/Recovery Procedures
52 Excessive cone angle on picker	Check the optical sensor, if necessary. Run test 51 -- Carriage/Picker Assy Calibration -- verify failure.
54 Unable to complete an interrupted move (at powerup)	Run test 60 -- FRU Isolation Test -- verify failure If no error, monitor for re-occurrence. If test 60 shows an error code -- Look up the hardware error code in this table and follow the recovery procedures for that error.
55 Unable to find top of unit	Run test 51 -- Carriage/Picker Assy Calibration -- verify failure.

Error Code (hex)	Verification/Recovery Procedures
Exerciser Test Errors	
56 Need to issue Initialize Status command	No FRUs failed. Run test 10 to initialize the element status.
57 Invalid test configuration	No FRUs failed. Check cartridge configuration. Check that the cartridge configuration (number and location) are correct for the test you are doing.
59 Exerciser unrecovered error	No FRUs failed. Exerciser had an unrecovered error. Rerun exerciser. If exerciser fails again -- Access the recovery log. The Recovery log is available only through the SCSI interface. Use a diagnostic tool like SCSI Toolbox from PTI, or SCSI PRO from Co Comp.
5A Invalid test configuration (elements reserved)	No FRUs failed. Can't do the selected test on a reserved cartridge. Check cartridge reservations. Rerun the test.
5B Initialize Element Status command failed	No FRUs failed. The initialization of an element status failed. Rerun initialization. If initialization fails again -- Access the recovery log. The Recovery log is available only through the SCSI interface. Use a diagnostic tool like SCSI Toolbox from PTI, or SCSI Pro from Co Comp.

Error Code (hex)	Verification/Recovery Procedures
5C Shipping diagnostic run with cartridges in drive mechanism	No FRUs failed. Shipping warning. Take all disks out of the optical drive mechanism.
Calibration Sensor System Errors	
60 - 61 Home sensor failed	Run test 51 -- Carriage/Picker Assy Calibration -- verify failure.
Lan-connect Errors	
80 LAN timeout	Power cycle the jukebox Listen for the tone signalling that the LAN module CPU has initialized. Listen for the sounds made by the system disk loading the application software. If the same problem appears, call the Response Center.
81 NFS error	See error code 80.
82 File system error	See error code 80.
Mailslot/storage Slot Errors	
Procedure: Check for loose labels or other obstructions in errors that involve the mailslot (B0-B2).	
B0 Mailslot will not rotate	See procedure above. Run test 17 -- Mailslot I/O Test -- verify failure.
B1 Inside mailslot sensor failed	See procedure above. Run test 43 -- Mailslot Sensor Test -- verify failure.
B2 Mailslot will not accept or release cartridge	See procedure above. Run test 17 -- Mailslot I/O Test -- verify failure.

Error Code (hex)	Verification/Recovery Procedures
B3 Storage slot will not accept or release cartridge	Check for loose labels or other obstructions. Run test 15 -- Storage Slot Test -- verify failure.
B4 Outside mailslot sensor failed	Check for loose labels or other obstructions. Run test 43 -- Mailslot Sensor Test -- verify failure.
Drive Errors	
Procedure: The autochanger only checks for the PRESENCE of a drive. To run complete drive tests requires an external diagnostic. On drive error codes, check all cabling to/from the drive --no broken wires --no worn cables --no loose connections	
B8 Drive 1 access error	See procedure above. Run test 16 -- Drive I/O Test -- verify failure. Access the drive logs. The Recovery log is available only through the SCSI interface. Use a diagnostic tool like SCSI Toolbox from PTI, or SCSI Pro from Co Comp.
B9 Drive 2 access error	Run test 16 -- Drive I/O Test -- verify failure. Access the drive logs. The Recovery log is available only through the SCSI interface. Use a diagnostic tool such as SCSI Toolbox from PTI, or SCSI Pro from Co Comp.

Error Code (hex)	Verification/Recovery Procedures
Drive Eject Errors	
BC Drive 1 access failure	Run test 16 -- Drive I/O Test -- verify failure. Access the drive logs. The Recovery log is available only through the SCSI interface. Use a diagnostic tool like SCSI Toolbox from PTI, or SCSI Pro from Co Comp.
BD Drive 2 access failure	Run test 16 -- Drive I/O Test -- verify failure. Access the drive logs. The Recovery log is available only through the SCSI interface. Use a diagnostic tool like SCSI Toolbox from PTI, or SCSI Pro from Co Comp.
FRU Detection Test Errors	
Procedure: Check carriage/picker for free motion. The carriage should travel easily along the rail; you should be able to easily flip the picker using the picker belt.	
C8 Unable to gain proper servo control of motors	Run test 60 -- FRU Isolation Test -- verify failure.
C9 Unable to move picker motor	Run test 60 -- FRU Isolation Test -- verify failure.
CA Unable to move carriage motor	Run test 60 -- FRU Isolation Test -- verify failure.
CB Unable to move either motor	Run test 60 -- FRU Isolation Test -- verify failure.
CC Unable to find a hard stop while turning the picker motor	Run test 60 -- FRU Isolation Test -- verify failure.

Error Code (hex)	Verification/Recovery Procedures
CD Unable to find a hard stop while turning the carriage motor	Run test 60 -- FRU Isolation Test -- verify failure.
CE Excessive force needed to move the carriage leadscrew	Run test 60 -- FRU Isolation Test -- verify failure.
Miscellaneous Errors	
FC	The test can only be run from the control panel.
FD	The test can only be run from the SCSI interface.
FE	The test did not run; probably a configuration error.
FF	Invalid test number.

Getting Error Information through the SCSI Bus

Using data on the SCSI bus, you can determine exactly what the autochanger was doing when a failure occurred; all the way down to the macro-move and micro-moves.

Also, through the Log Sense and Request Sense commands, information can be obtained about the optical drive; which cannot be done through the control panel.

Diagnostic utilities available from Peripheral Test Instruments (PTI) and CoComp. The diagnostic tool from Peripheral Test Instruments is “SCSI Toolbox.” The tool available from CoComp is “SCSI Pro.”

5 Removal and Replacement

Overview

This chapter gives information on the following topics:

- replacing the robotics controller PCA
- replacing the cooling fan
- replacing the display
- replacing the mailslot assembly
- replacing the picker transport assembly
- replacing the vertical drive assembly
- replacing the power supply
- removing the magazine guides
- removing the SCSI cable

Protecting Yourself and the Equipment

WARNING **DO NOT DISASSEMBLE the optical drive mechanism. The optical drive mechanism becomes a Class 3B laser device when disassembled. If the drive is disassembled, exposure to the invisible laser beam and hazardous invisible laser radiation could result in blindness.**

NOTE An optical drive that has been disassembled will not be accepted as an exchange assembly.

Electrostatic Discharge (ESD) Precautions

The optical disk jukebox contains very sensitive electrical components. It is EXTREMELY IMPORTANT that you follow the proper procedures for preventing ESD (Electrostatic Discharge). Use wrist-grounding straps, anti-static mats, and anti-static work stations when removing and replacing the major assemblies.

NOTE Failure to follow proper procedures could lead to intermittent failures and/or premature hard failures in the disk controller and mechanism

Required Tools

The following tools are needed for assembly/disassembly:

- Pozidriv® magnetized screwdriver flatblade screwdriver
- Needle-nose pliers
- Flatblade screwdriver
- Torx® driver with the following bits: T-10, T-15, T-20 and an extension that holds a T-10 bit

Assembly/Disassembly Procedures

WARNING **Disconnect the power cord before taking the jukebox apart to prevent possible electrical shock.**

CAUTION Do not switch off power to the jukebox until you are sure the SCSI bus is *inactive*. Switching off the jukebox when the SCSI bus is active can cause data loss and/or indeterminate bus states.

When servicing the jukebox, be sure that disk cartridges are not moved from their original slot locations. If you need to remove the cartridges, record their SLOT LOCATIONS and ORIENTATION so they can be replaced to their ORIGINAL positions.

Service Access

Accessing the Chassis Interior

1. Turn off power from the jukebox (see #1 on Figure 5-1).
2. Unplug the power cord from the power module (see #2 on Figure 5-1).
3. Remove the four T-25 screws that secure outside cover to the rear panel.
4. Slide the outside cover toward the rear of the unit.

   The cover will slide off the tabs at the bottom of the chassis and enable you to lift the cover off.
5. Remove the eight T-15 screws around the access panel (see Figure 5-2).
6. Pull out the picker umbilical cable shield rod (see Figure 5-3).

Figure 5-1 Removing the Outer Cover

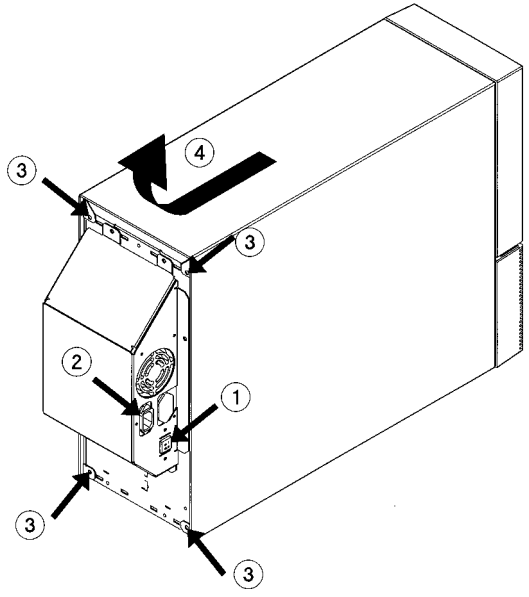


Figure 5-2 Internal Access Panel Screws

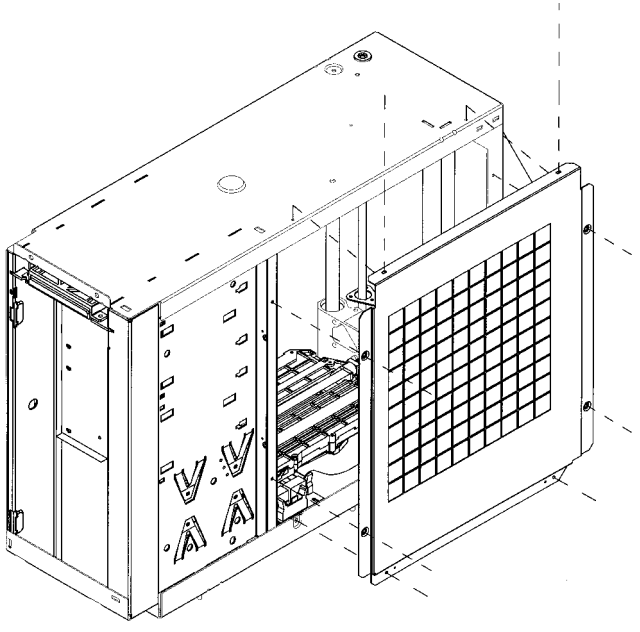
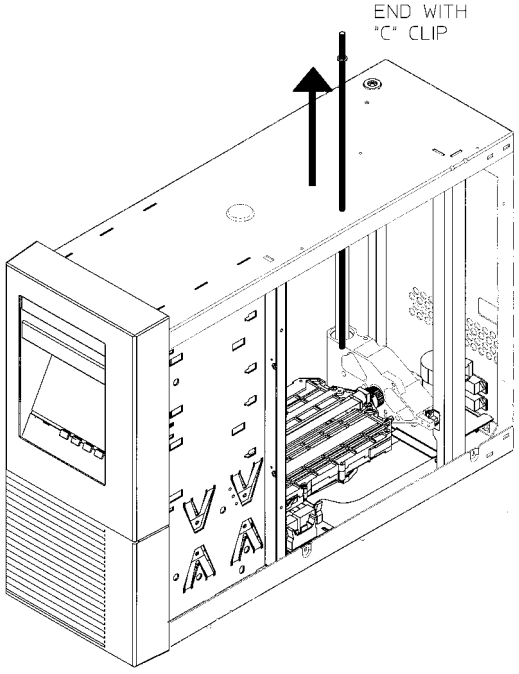


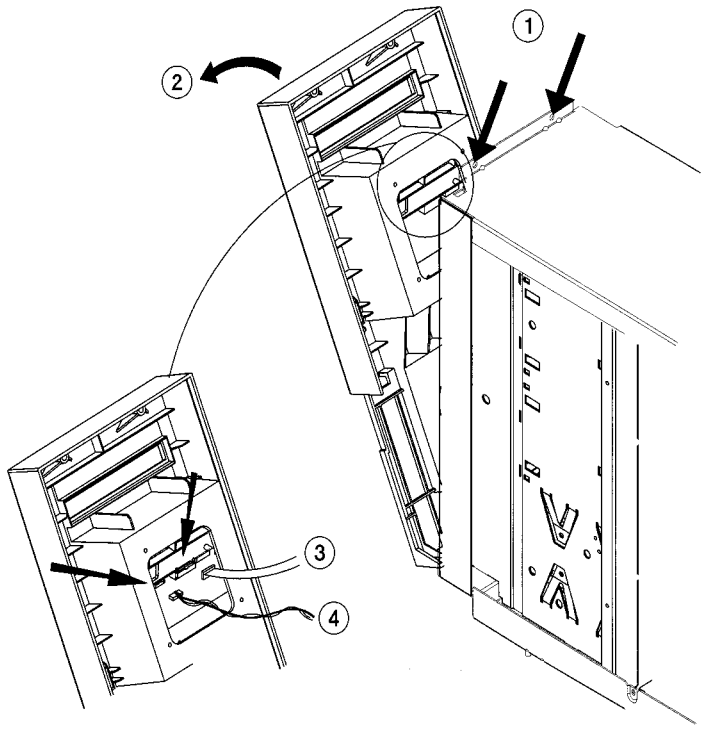
Figure 5-3 Removing the shield rod



Accessing Assemblies in the Front Bezel Assembly

1. Remove the outside cover (see “Accessing the Chassis Interior” in “Service Access” on page 5-4).
2. Remove the lower vent cover panel by reaching under the bottom of the bezel and pulling it up and out.

Figure 5-4 **Removing the Front Panel Bezel Mounting Screws and Cables**



3. Remove the two T-25 screws that secure the front bezel to the chassis (see #1 on page 5-4).

NOTE In the next step, you may have to use a small screwdriver to push on the release tab on the top of the mailslot sensor cable.

4. Rotate the front bezel out and disconnect the front panel cable and the mailslot sensor cable.

Replacing the Robotics Controller PCA

1. Remove the outside cover. See “Accessing the Chassis Interior” in “Service Access” on page 5-4.

CAUTION

In the next step, move the picker by pulling on the picker carriage block. Do not pull on the plastic cartridge holder assembly. The carriage block is the assembly that slides on the two vertical rails.

2. Move the picker assembly to the top of the chassis and secure it with one of the T-25 screws you removed from the rear of the outer cover. The screw hole is shown in Figure 5-5).

Figure 5-5 Holding the Picker Assembly at the Top of the Chassis

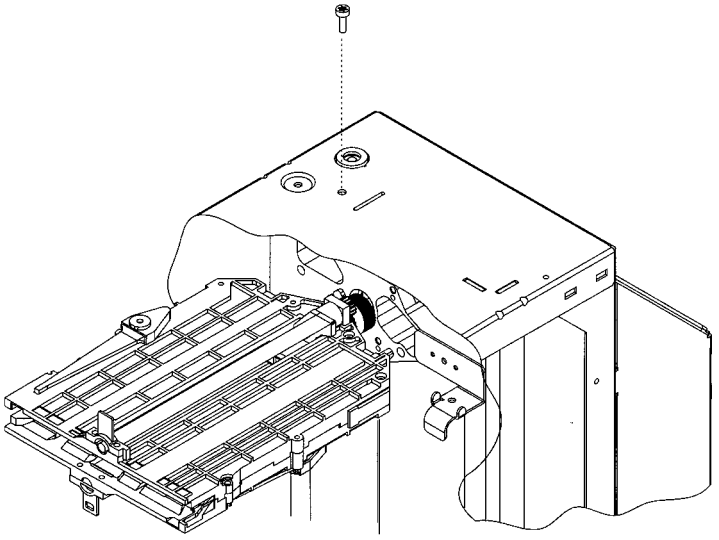
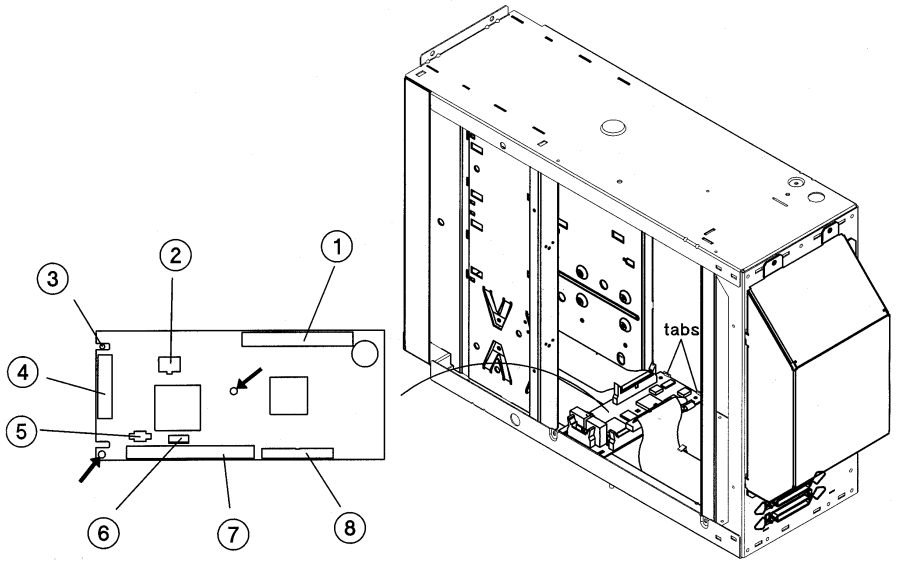


Figure 5-6 **Controller PCA Cables and Mounting Screws**



3. Unplug the cables from the controller PCA (see Figure 5-6)
4. Remove the three T-15 controller PCA mounting screws.

   Two screws are shown by arrows on Figure 5-6, the third screws is also used as the ground connection (#3) on Figure 5-6.
5. Pull the controller PCA away from the chassis wall and drives far enough to remove the remaining cables.

   - #8 - drive I/O cable
   - #1 - front panel cable
6. Remove the controller PCA from the chassis.
7. Insert the replacement controller in the chassis far enough to connect the drive I/O cable and the front panel cable.
8. Place the edge of the controller PCA into the slots on the chassis wall and secure the PCA with two T-15 screws.
9. Connect the remaining cables and screw to the controller PCA.

   - #3 - ground screw and PCA mounting screw

- #2 -power in cable
- #4 -picker umbilical cable
- #5 - encoder power cables
- #6 - encoder interface cables
- #7 - SCSI cable
- #8 - drive interface cable

10. Remove the screw holding the picker carriage block to the top of the chassis and let the picker assembly settle to the bottom of the chassis.
11. Plug the power cord into the power module on the rear of the jukebox.
12. Turn the jukebox on.
13. Use the SCSI Pro tool from CoComp or SCSI Toolbox from PTI to download the current firmware into the controller PCA.
14. Set CONF 16 to CLEAR to reset controller PCA to default configurations.
15. Run TEST 10 to initialize the jukebox.
16. Run TEST 2, WELLNESS TEST to check the operation of the jukebox.

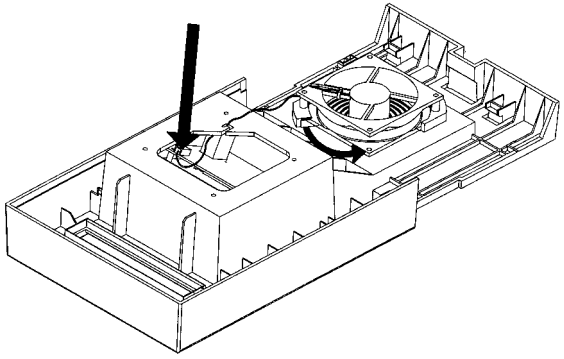
    If any errors occur, refer to “Hardware Errors Verification/Recovery,” Table 4-7 in Chapter 4. Otherwise, go to Step 16.
17. Turn the jukebox off.
18. Refer to the access procedures starting on page 5-4 to replace the following:

    a. Interior access panel

    b. Outer cover

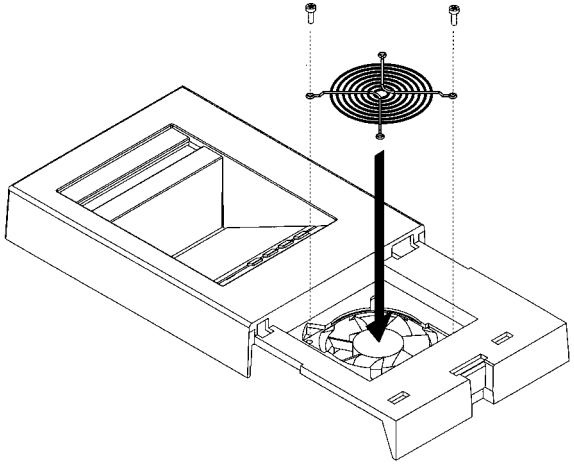
Replacing the Cooling Fan

Figure 5-7 **Replacing the Cooling Fan**



1. Remove the outside cover and front bezel assembly. See “Accessing the Chassis Interior” on page 5-4 and “Accessing Assemblies in the Front Bezel Assembly” on page 5-7.
2. Unplug the fan power cable from the display PCA (see Figure 5-7).
3. Remove the two T-15 screws that secure the fan to the outside of the front bezel (see Figure 5-8).

Figure 5-8 **Removing the Grill Screws**



4. Remove the fan.

   Turn the fan counterclockwise (looking from the back of the bezel) to release the two fan mounting tabs from the slots in the front bezel (see Figure 5-7).

Reassembly Notes

When replacing a fan, do the following:

1. Position the fan so that the cable faces toward the display assembly and the airflow indicator faces up.
2. Rotate the fan clockwise (looking from the back of the bezel) to engage the fan mounting tabs into the slots on the front bezel.
3. Connect the fan power cable to the display PCA.

Replacing the Display

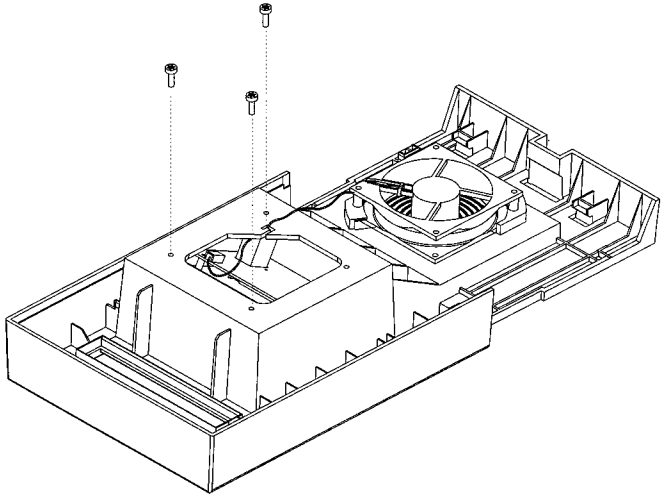
CAUTION

The display assembly could fall out during dismounting

Hold your hand over the front of the display while removing the display mounting screws.

1. Remove the outside cover and front bezel assembly. See “Accessing the Chassis Interior” on page 5-4 and “Accessing Assemblies in the Front Bezel Assembly” on page 5-7.
2. Remove the three T-15 screws holding the display (see Figure 5-9).

Figure 5-9 Replacing the Control Panel Display PCA

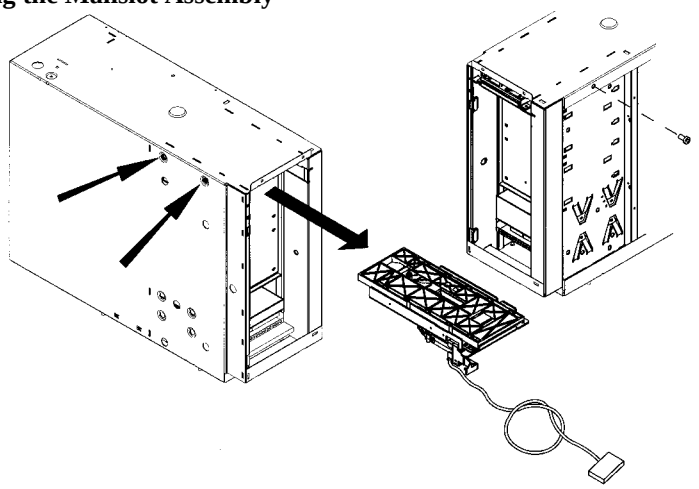


Replacing the Mailslot Assembly

1. Remove the outside cover and front bezel assembly. See “Accessing the Chassis Interior” on page 5-4 and “Accessing Assemblies in the Front Bezel Assembly” on page 5-7.
2. Remove the two T-15 mailslot mounting screws from the upper left side of the chassis (see arrows on the left of Figure 5-10).

   These mounting screws are recessed. Use a T-15 driver with an extended shaft.
3. Remove the slotted thumbscrew from the upper right side of the chassis (see the right side of Figure 5-10).
4. Slide the mailslot out of the chassis.

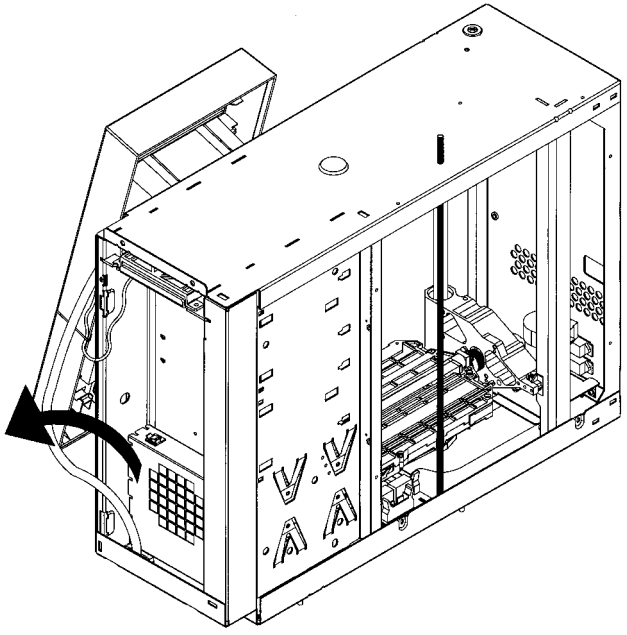
Figure 5-10 Replacing the Mailslot Assembly



Replacing a Drive

1. Remove the outside cover and front bezel assembly. See “Accessing the Chassis Interior” on page 5-4 and “Accessing Assemblies in the Front Bezel Assembly” on page 5-7.
2. Remove the RFI shield (see Figure 5-2).

Figure 5-11 Removing the RFI shield

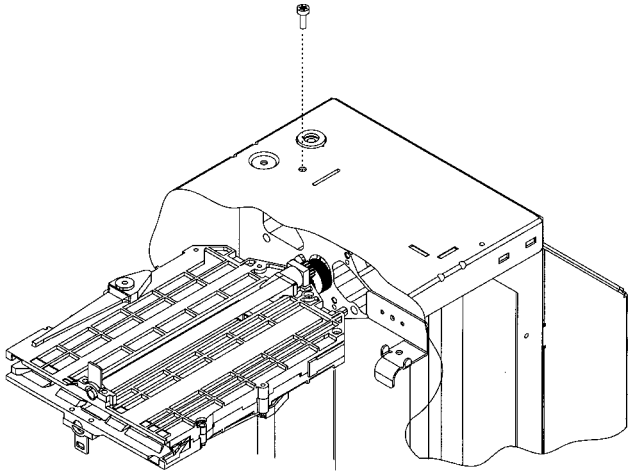


CAUTION

In the next step, move the picker by pulling on the picker carriage block. Do not pull on the plastic cartridge holder assembly. The carriage block is the assembly that slides on the two vertical rails.

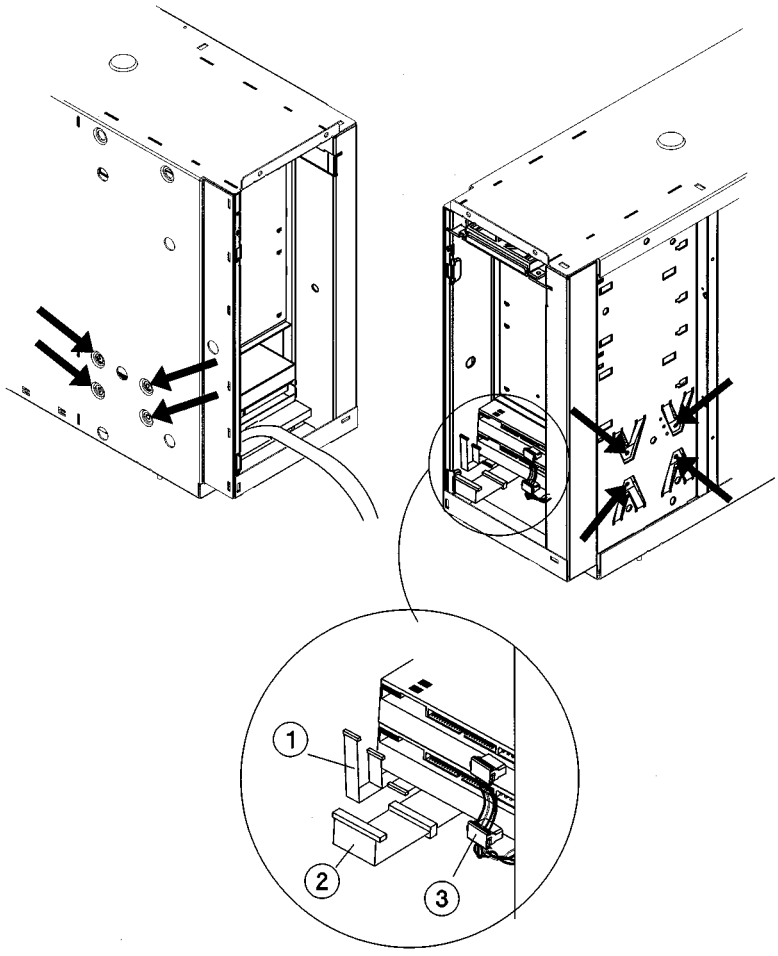
3. Move the picker assembly to the top of the chassis and secure it with a T-25 screw through the service hole (Figure 5-12).

Figure 5-12 Securing the Picker to the Top of the Chassis



4. Remove all cables from the rear of the drive mechanism. (Two drives are shown in Figure 5-13).

Figure 5-13 Removing Drives



5. Remove the two T-10 screws that hold the drive to the right side of the chassis (see Figure 5-13).

NOTE In the next step, use a Torx driver with at least a 4-inch shaft to reach the drive mounting screws through the screw access holes (see Figure 5-13).

6. Remove the two T-10 screws that hold the drive to the left side of the chassis (see Figure 5-13).

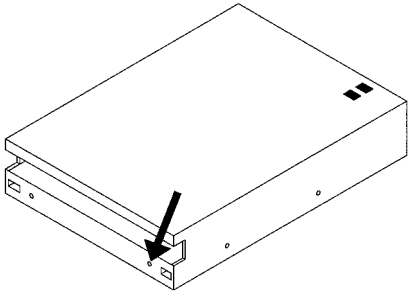
7. *If there is a disk in the drive*, use a disk eject tool to remove the disk from the drive.

   a. Insert the eject tool (or paper clip) into the disk eject access hole (see Figure 5-14). As you insert the tool, push slightly up so that the tip will tend to point downwards.

   b. When you feel firm pressure on the tip, push forward. The disk mechanism will eject the disk.

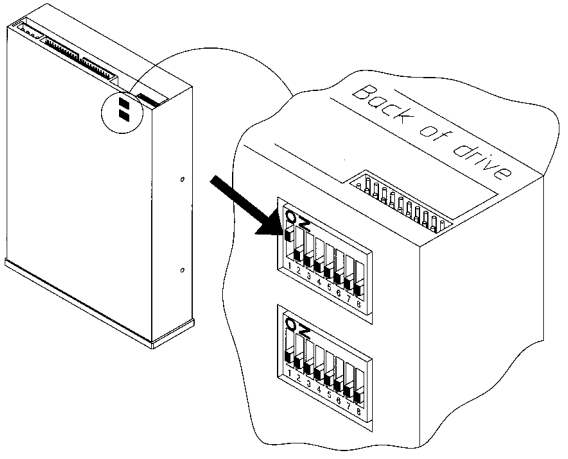
IMPORTANT Note whether the "A" or "B" side faces up when you remove the disk. The disk must be inserted into the replacement drive with the same orientation.

Figure 5-14 Manual Disk Eject Access Hole



8. Set the DIP switches on the rear of the drive as shown in Figure 5-15

Figure 5-15 Drive DIP Switch Settings



9. Insert the replacement drive and mount it in position by the two T-10 screws on each side.
10. Connect the drive cables to the rear of the drive (see Figure 5-13).
    - #1 - drive interface cables
    - #2 - SCSI cable (two connectors)
    - #3 - drive power cable (two connectors)
11. Check “Checking the RFI Adjustments” on page 5-30 to make sure that all RFI adjustments will be maintained after this service. Return here.
12. Plug the power cord into the power module on the rear of the jukebox.
13. Turn the jukebox on.
14. Connect your PC diagnostic tool to a SCSI interface port. Make sure there is a terminator on the unused port.
15. Use SCSI Pro from CoComp or SCSI Toolbox from PTI to download the current firmware into the drive.
16. Check for proper drive operation.

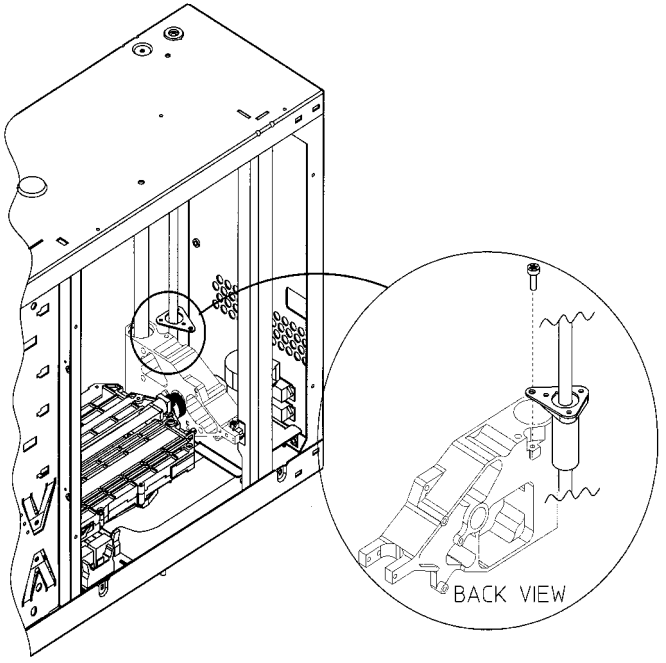
    Run a “random write and verify” for approximately two minutes to check the operation of the drive.
17. Set CONF 16 to CLEAR to reset controller PCA to default configurations.
18. Run TEST 10 to initialize the jukebox.
19. Run TEST 2, WELLNESS TEST to check the operation of the jukebox.

    If any errors occur, refer to “Hardware Errors Verification/Recovery,” Table 4-7 in Chapter 4. Otherwise, go to the next step.
20. Turn the jukebox off.
21. Remove your PC tool from the SCSI interface port.
22. Replace the following:
    a. Side access panel.
    b. Outer cover.
23. Reattach the customer’s SCSI cable.

Replacing the Picker Transport Assembly

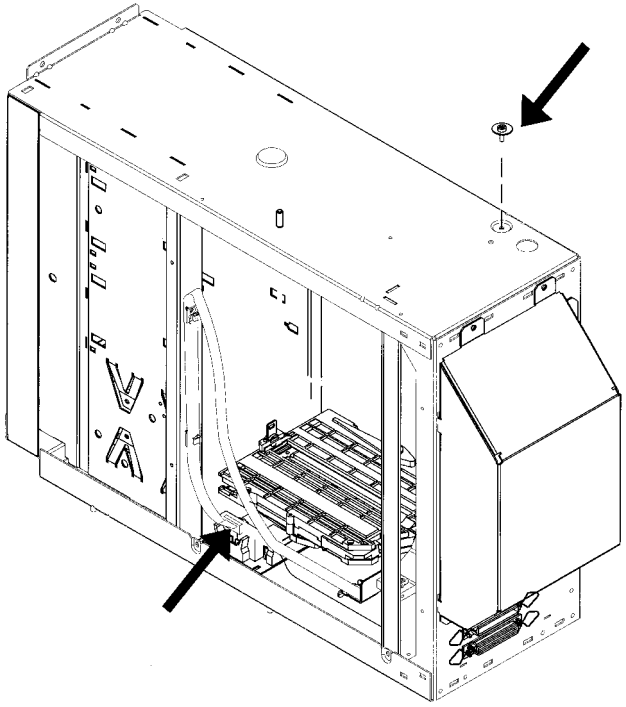
1. Remove the outside cover and front bezel assembly. See “Accessing the Chassis Interior” on page 5-4 and “Accessing Assemblies in the Front Bezel Assembly” on page 5-7.
2. Remove the T-15 screw that secures the carriage to the leadscrew assembly (see Figure 5-16).

Figure 5-16 **Preparing the Picker Transport Assembly for Removal**



3. Disconnect the umbilical cable from the controller PCA (see lower arrow on Figure 5-17).
4. Remove the T-25 screw that secures the carriage shaft to the top of the chassis (see upper arrow on Figure 5-17).

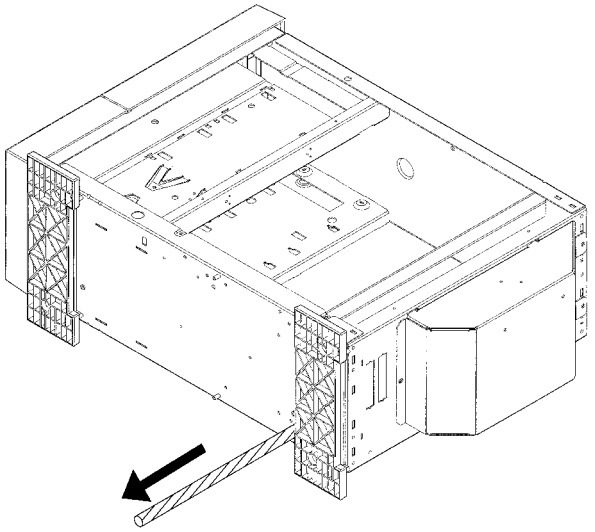
Figure 5-17 Removing the Umbilical Cable and Shaft Mounting Screw



5. Lay the jukebox on its side.

6. Slide the carriage shaft out of the opening in the bottom of the chassis (see Figure 5-18).

Figure 5-18 **Removing the Carriage Shaft**



CAUTION

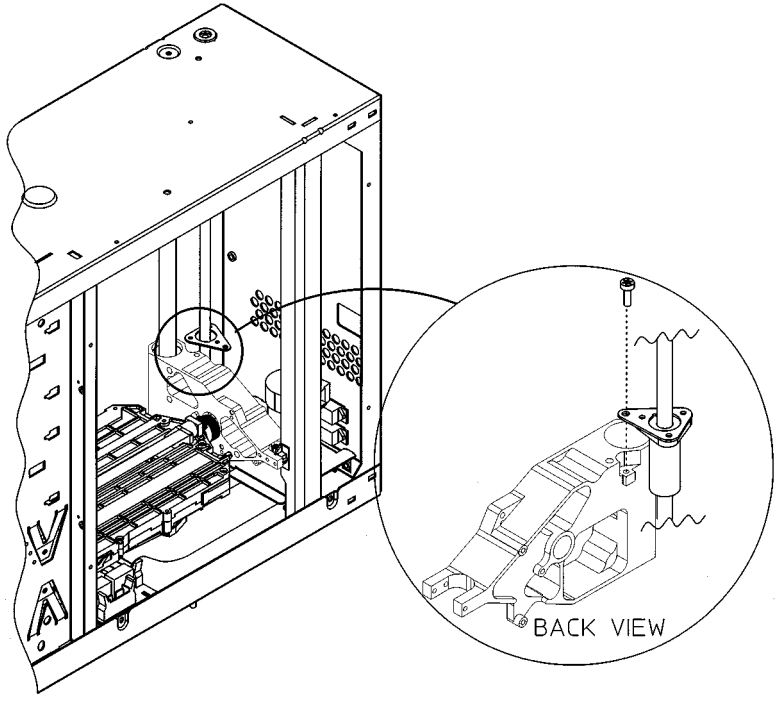
Do not damage the slider bearing on the right side of the picker carriage block as you rotate the block out of the chassis (see the arrow on Figure 5-16).

7. Carefully remove the picker transport assembly.

Replacing the Vertical Drive Assembly

1. Remove the outside cover and front bezel assembly. See "Accessing the Chassis Interior" on page 5-4 and "Accessing Assemblies in the Front Bezel Assembly" on page 5-7.
2. Remove the T-15 screw that secures the leadscrew assembly to the carriage/picker assembly (see the inset on Figure 5-19).

Figure 5-19 Preparing to Remove the Vertical Drive Assembly



3. Rotate the end of the bracket that was attached to the carriage picker assembly toward you (see inset on Figure 5-19), and slide the bracket up out of the way of the picker.

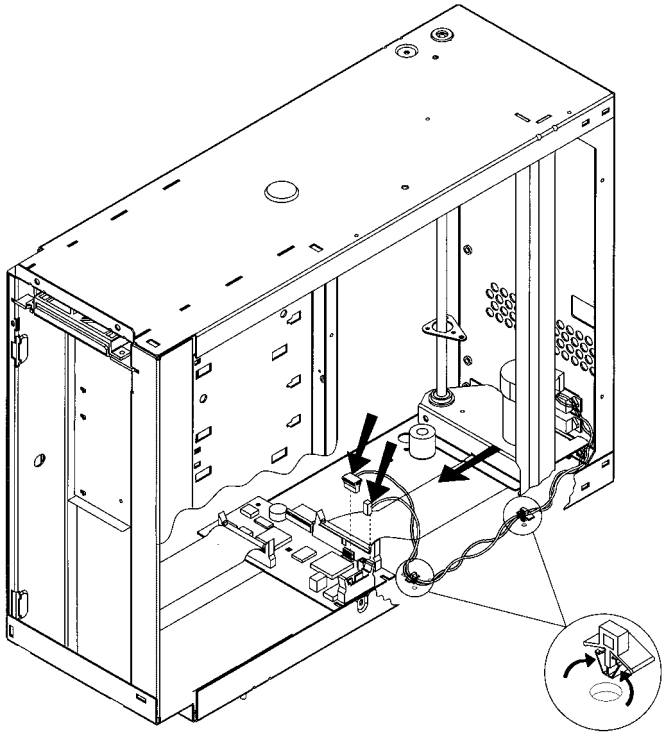
CAUTION

In the next step, move the picker by pulling on the picker carriage block. Do not pull on the plastic cartridge holder assembly. The carriage block is the assembly that slides on the two vertical rails.

4. Move the picker assembly to the top of the chassis and secure it with a T-25 screw through the service hole (see Figure 5-12).

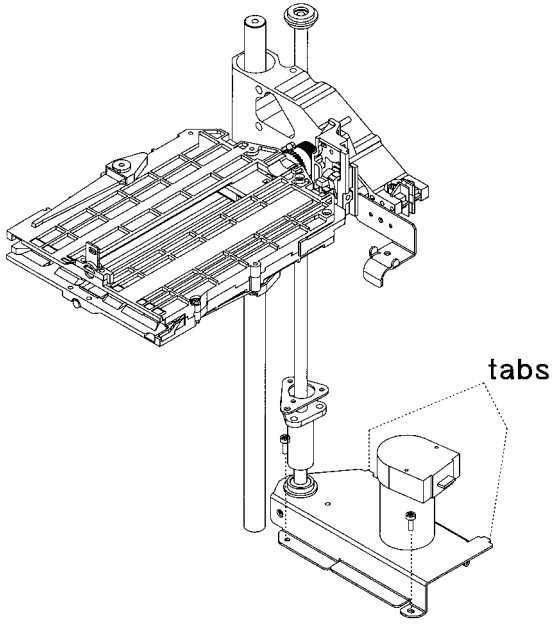
5. Disconnect the power and encoder cables from the controller PCA (see Figure 5-20).
6. Release (squeeze) the clamps on the cable bundle that runs along the bottom of the chassis (see inset on Figure 5-20).

Figure 5-20 Disconnecting Power and Encoder Connections to the Vertical Drive Assembly



7. Remove the two T-15 screws that secure the leadscrew base to the bottom of the chassis (see screws on bottom left of Figure 5-21).

Figure 5-21 Removing the Vertical Drive Assembly



NOTE Keep the bearings from falling off the top of the leadscrew in the next step.

8. Pull the tabs on the base of the vertical drive assembly out from the slots in rear wall of the chassis (see "tabs" in Figure 5-21).

   Rotate the base of the vertical drive assembly out from the interior. Lift the vertical drive assembly out of the chassis.

Reassembly Notes

Before placing the leadscrew into position, check that the bearings at the top of the leadscrew are positioned correctly (see Figure 5-22).

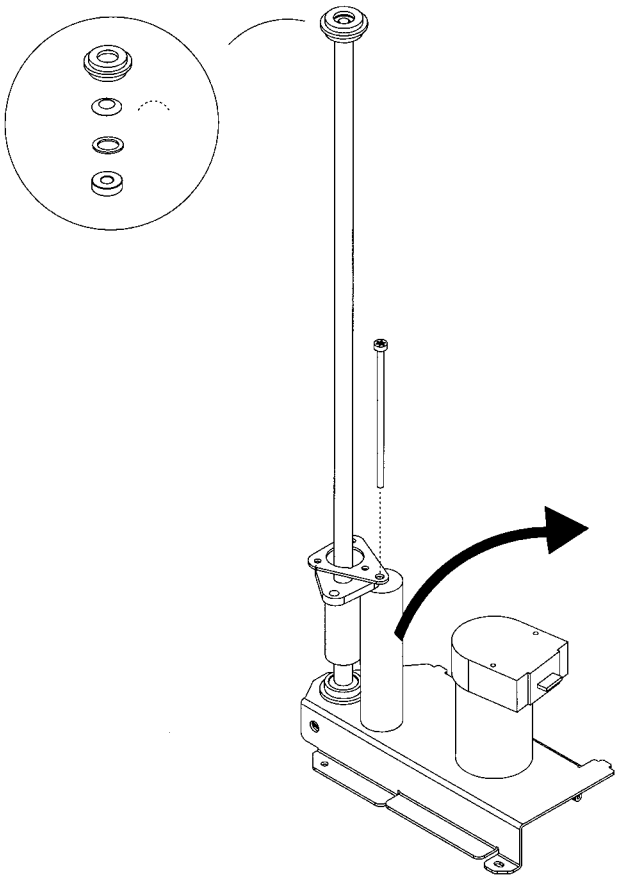
Note the curved washer just below the top bearing. The center of this washer must be curved upward (indicated by the dotted line to its right).

NOTE

The washer/bearing assembly is shown in its working orientation in Figure 5-22. You may find it easier to assemble the parts upside down, placing them into the top housing and then rotating the whole group onto the top of the leadscrew.

Remember to keep the curved washer (to the left of the dotted line) bowed *toward the top cap.*

Figure 5-22 **Bearings on the Top of the Leadscrew**

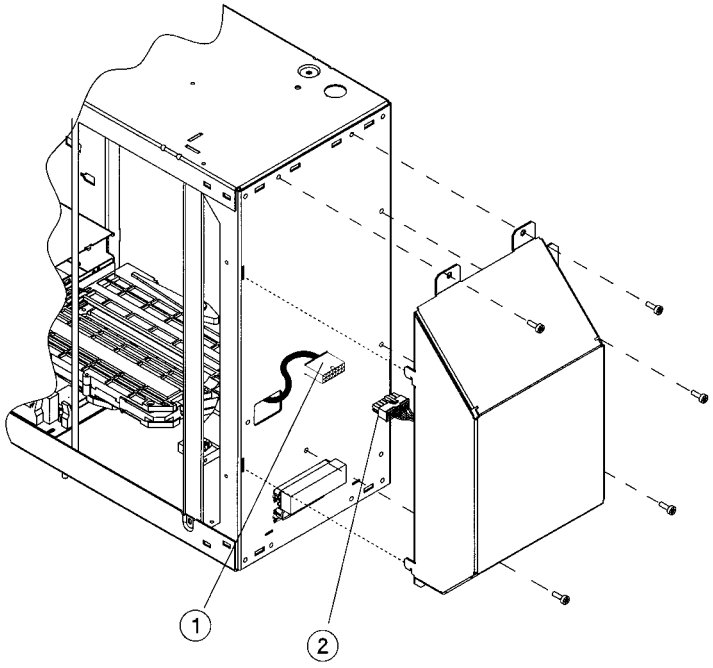


Check “Checking the RFI Adjustments” on page 5-30 to make sure that all RFI adjustments will be maintained after this service.

Replacing the Power Supply

1. Turn off power and unplug the power cord from the rear power module (see Figure 5-1).
2. Remove the five T-25 screws that secure the power supply assembly to the back panel (see Figure 5-23).

Figure 5-23 Removing the Power Supply

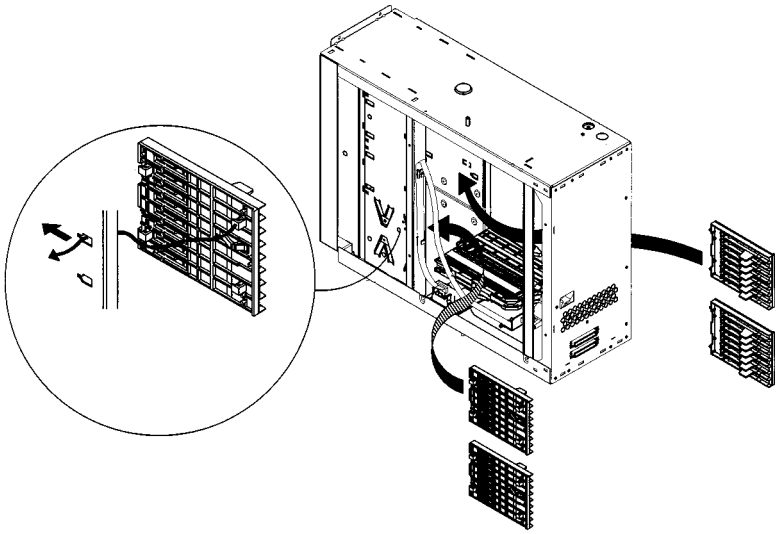


3. Swing open the right side of the power supply far enough to disconnect the power cable (see #1 in Figure 5-23)
4. Pull the power supply slightly up and then away from the chassis.

Replacing the Magazine Guides

1. Remove the outside cover and front bezel assembly. See “Accessing the Chassis Interior” on page 5-4 and “Accessing Assemblies in the Front Bezel Assembly” on page 5-7.
2. Push the catch on the side of the magazine to release the magazine’s lock on the side of the chassis.
3. Pull the magazine back to pull the four tabs out of their slots in the chassis.

Figure 5-24 Removing the Magazine Guides



Reassembly Notes

When replacing magazine guides into the chassis do the following:

1. Place the magazine guide against the chassis stack wall so that the tabs on the magazine line up with the slots (see inset in Figure 5-24.
2. Slide the magazine in and forward until the snap lock slips into its slot.
3. Repeat for the guide on the opposite side of the stack.

Replacing the SCSI Cable

To replace the SCSI cables, expose the cable by doing the removal preparatory procedures for removal in the following:

"Accessing Assemblies in the Front Bezel Assembly" on page 5-7

"Replacing the Robotics Controller PCA" on page 5-8.

"Replacing the Vertical Drive Assembly" on page 5-23.

Checking the RFI Adjustments

NOTE

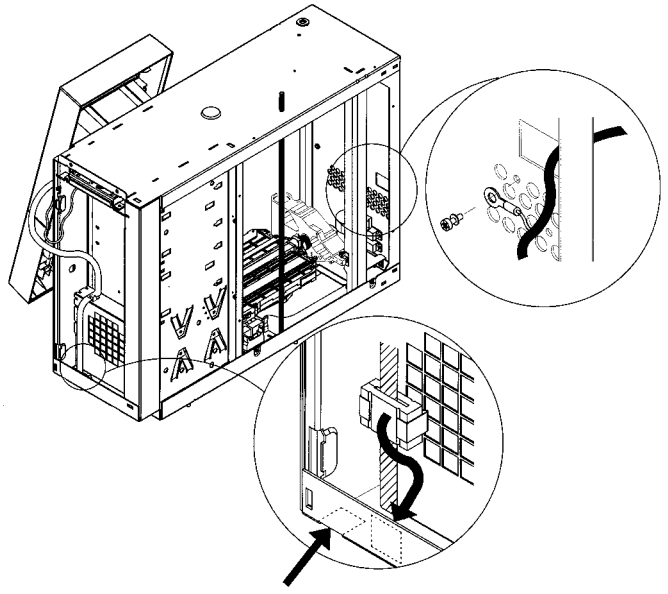
The following RFI adjustments must be maintained after servicing the jukebox.

Depending on the service performed, these configurations may be altered. The purpose of this section is to remind you of the RFI adjustments that must remain in place.

Power Cable Must Be as Close to the Chassis As Possible

1. Push the power cable bundle out to as close to the side of the jukebox as possible (see top right inset in Figure 5-25).
   a. Loosen the ground strap screw on the rear chassis wall.
   b. Rotate the power cable attached to the ground strap out toward the side of the jukebox as far as possible.
   c. Retighten the ground strap screw.

Figure 5-25 RFI Adjustments



2. Follow the power cable bundle you adjusted in Step 1 along the chassis floor and push the bundle as close to the side and bottom of the chassis as you can.

An RFI Cable Clamp Must be Installed on the Control Panel Cable

1. The two plates of the RFI cable clamp go over the front panel cable as shown in the lower inset of Figure 5-25.

   Clip the plates together with the metal end clips as shown in Figure 5-25. *The clips must be placed on the RFI clamps so that the side facing the front of the chassis is flat.*

2. Slide the RFI clip down as far as it will go toward the chassis bottom.

3. Take the cover off the back of the 2-sided adhesive strip attached to the RFI clamp. Stick the RFI clamp to the lower front edge of the chassis as shown by the dotted lines in Figure 5-25.

IMPORTANT

Note that the clip is to the right of the hole in the bottom of the chassis (see dotted lines on the bottom of the front edge in Figure 5-25). *This hole is used by a tab on the front panel and must be kept clear.*

Re-initializing the Robotics Controller PCA RAM

All the RAM on the controller PCA is kept alive through a charged capacitor, and is, therefore, relatively non-volatile. If this RAM is backed up to flash EEPROM after any changes, the values are held permanently. If not backed up to flash EEPROM, information bleeds off in approximately 10 to 60 days.

Most of the RAM is initialized to known values at powerup. Variables that are not changed are customer configurations, jukebox logs, jukebox odometers, element status variables, and variables that help the jukebox recover from power failures. These variables are set by Configs 16 and 18.

NVRAM must be re-initialized after replacing the controller PCA, after updating or changing the controller PCA firmware, and after replacing a drive mechanism.

Variables set by Configuration 16

- **SCSI address of the jukebox**
- **Configurable options set to system defaults (ROM-dependent)**

  Whether the jukebox should automatically initialize element status when cartridges are found in unexpected places (ROM-dependent)

  Whether the jukebox should rotate the mailslot inwards when in secure mode (CONF 31)

  Whether the jukebox should report recovered errors (CONF 27)
- **Drive status variables**

  Reported SCSI address of the drive set to system defaults

  Clear the source of the disk in the drive
- **Power fail variables**

  Whether the last move that was started is set to FALSE

  Clear the state of the last move

- **Recovery restore variables set to system defaults**

  Maximum number of Find Home retries = 3

  Maximum number of error recovery retries = 3

  Maximum number of restore retries = 1
- **Security variables**

  Clear Unit Reserved

  Clear Prevent Media Removal for each SCSI ID
- **Element Status variables**

  Clear exception bits

  Clear element reservations
- **Clear jukebox logs**

  Clear Error Log (INFO 0)

  Clear Move Success Log (INFO 10)

  Clear Recovery Log

  Clear Runtime Log (INFO 11)

  Clear number of major retries

  Clear number of inline retries
- **Reset the password to 0,0,0**

Variables set by Configuration 18

- Reset the move odometer to zero (INFO 9)
- Reset the flip odometer to zero (INFO 12)
- Reset the translate odometer to zero (INFO 13)
- Reset the mailslot rotation odometer to zero (INFO 14)
- Reset the number of poweron hours to zero (INFO 5)
- Reset the number of loads to each drive to zero (INFO 4)

Replaceable Parts

NOTE

The “x” in the part numbers listed in the following parts tables represents a number from “0” to “9” depending on the revision of the part. For example, if the part is newly released, the number will be “0”. The first time the part is revised, the number increments to “1”; the second time the part is revised, the number increments to“2”, and so on.

If you are unsure of the current part number, enter a “0” or a “1” in place of the “x” when checking your parts database and the current part number will display.

Table 5-1 **Exchange Parts**

FRU	Part Number	Description
2	C1113-69x08	Optical drive mechanism, 5.2 Gbyte

Table 5-2 **Non-Exchange Parts**

FRU	Part Number	Description
1	C1100-60x03	robotic controller PCA
2	C1113-60x08	optical drive mechanism (5.2 Gbyte)
22	C1100-60x77	front panel assembly
26	C1100-60x26	magazine guides (2)
28	C1100-60x28	power supply
29	C1100-60x29	mailslot assembly
32	C1100-60x32	leadscrew assembly
40	C1100-60x40	carriage/picker assembly
41	C1100-60x41	carriage/picker umbilical cable
42	C1100-60x42	carriage primary guide
48	C1100-60x48	fan assembly
51	C1100-60x51	drive/controller power cable

FRU	Part Number	Description
65	C1100-60x65	front panel cable
69	C1100-60x59	internal SCSI cable
75	C1100-60x76	RFI shield
78	C1708-60x78	vent cover
79	C1100-60x79	front bezel assembly, flint grey
79	C1103-60x79	front bezel assembly, parchment white
83	C1100-60x87	carriage umbilical cable shield rod
84	C1100-60x84	enclosure, gray
84	C1103-60x84	enclosure, white
A	1252-3920	terminator
	C1102-60x99	packaging kit (for reshipment)

Figure 5-26 **Exploded View (1 of 3)**

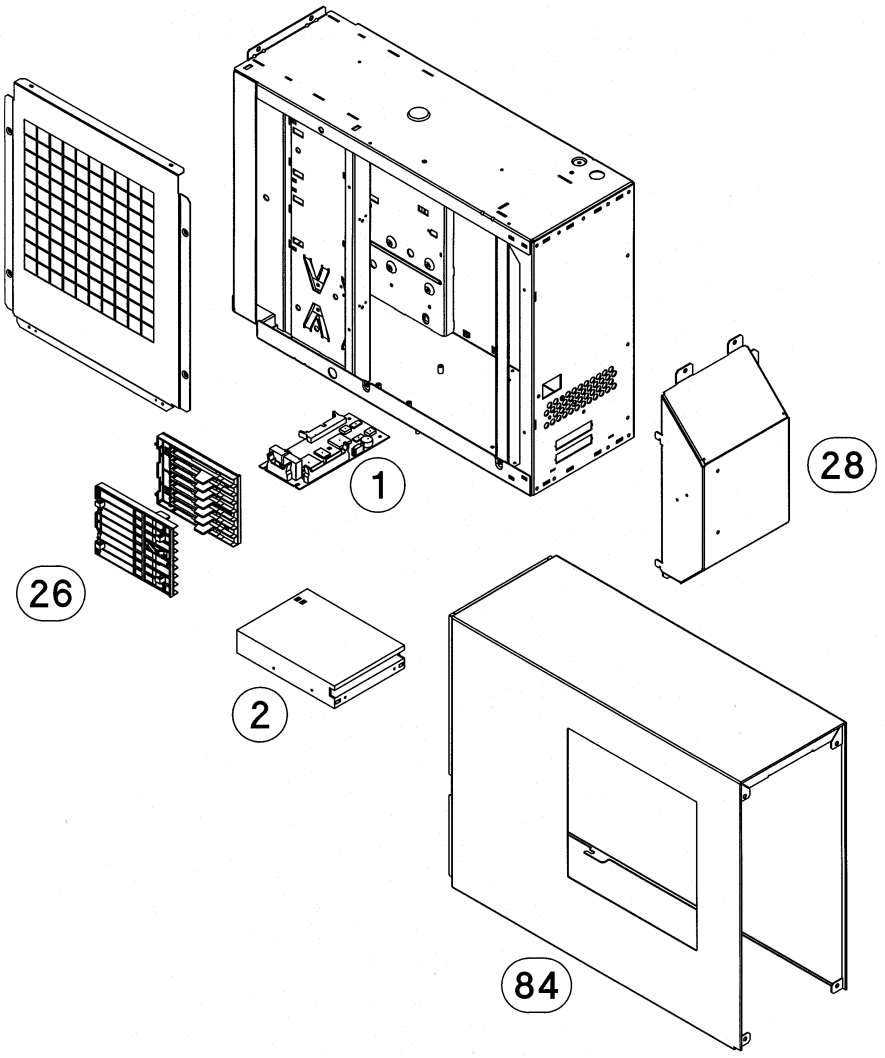


Figure 5-27 Exploded View (2 of 3)

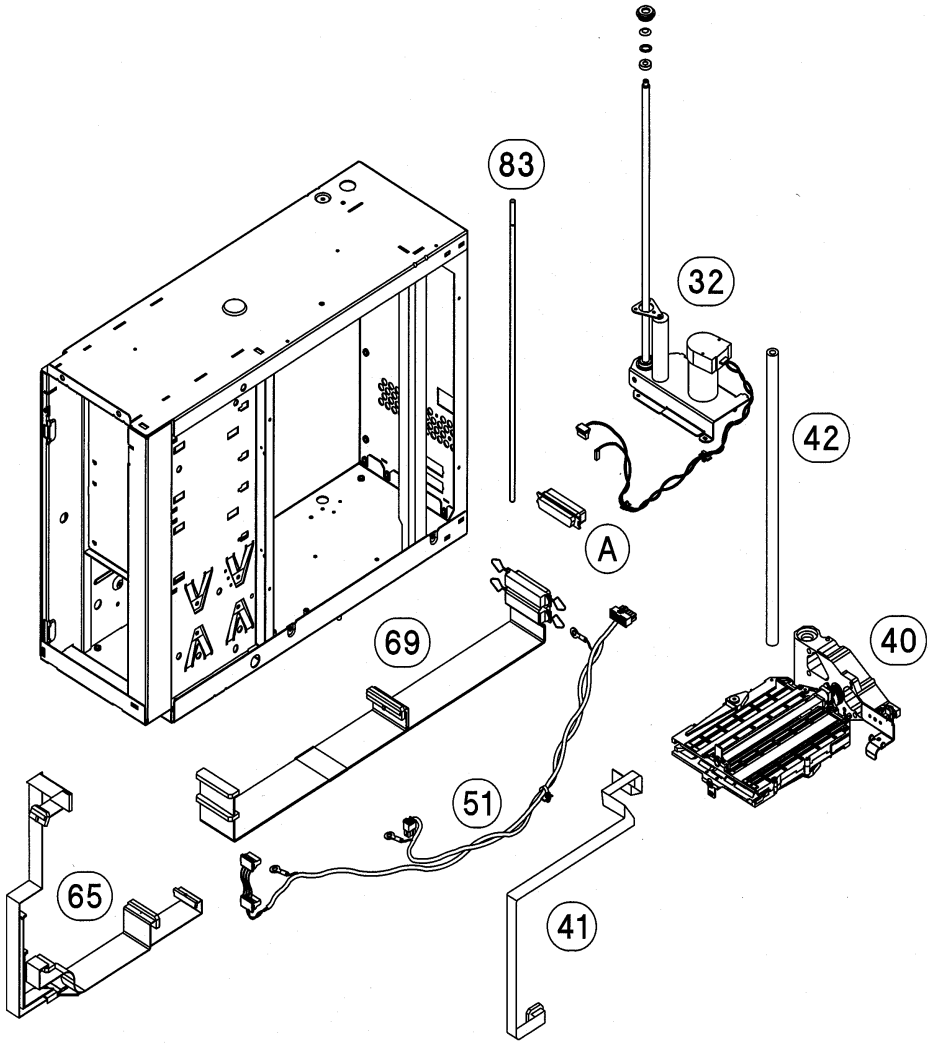
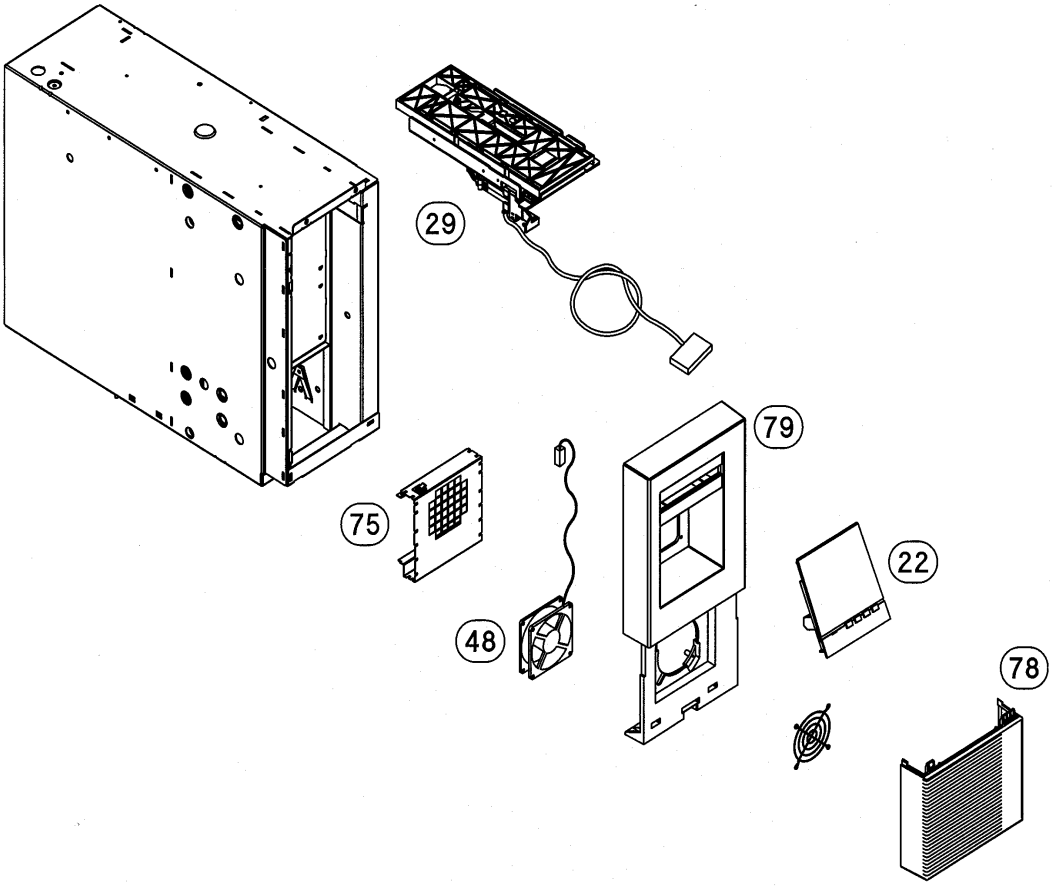


Figure 5-28 **Exploded View (3 of 3)**



6 Theory of Operation

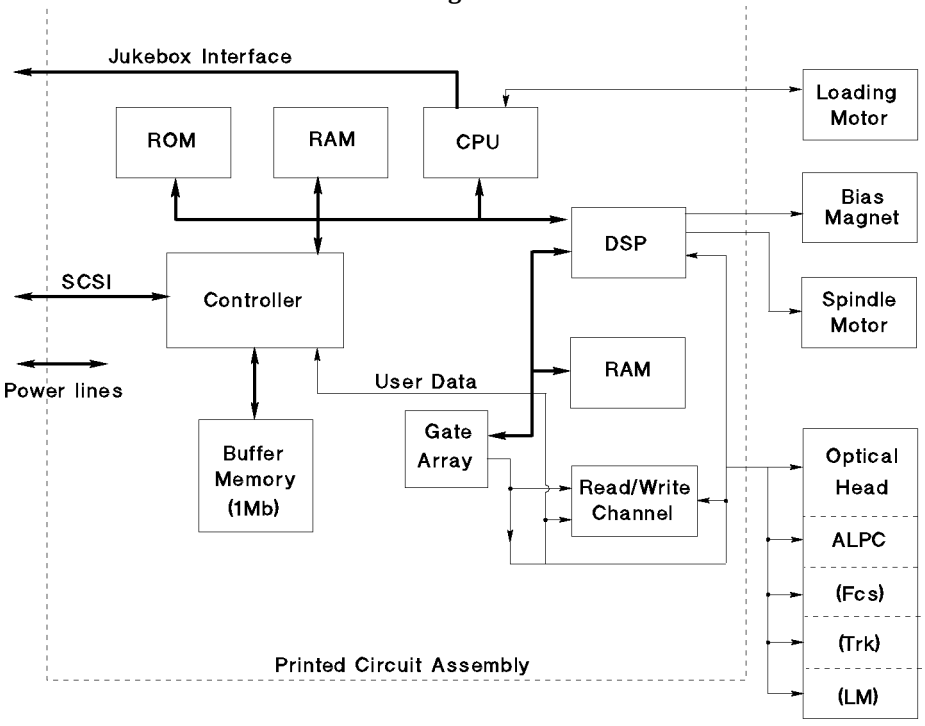
Chapter Overview

This chapter includes information about the following:

- drive mechanism
- robotics controller PCA
- power supply
- errors
- information logs
- SCSI interface

5.2 Gb Drive Mechanism

Figure 6-1 **5.2 Gb Drive Functional Diagram**



Controller

The controller is a highly-specialized integrated circuit that handles SCSI control, data buffering, and encode/decode.

The data buffer function provides a buffer to match transfers to and from the host computer and the optical disk. The data buffer provides a cache for read and write operations, optimizing the speed of these transfers.

This controller provides the SCSI interface connection to the host computer that consists of the electrical signals and the firmware, which decodes the various commands and messages on the SCSI bus and instructs the drive to take appropriate action.

The encode/decode function encodes and decodes data for read and write transfers. During a write function, user data is sent via the SCSI bus. The encoder converts the parallel data into an encoded serial bit stream that includes all the format and error correction features required to meet the ANSI and ISO specifications. During reads, the decoder converts the serial data stream, which includes format and error correction features, into parallel data.

Central Processing Unit (CPU)

The central processing unit for all drive functions includes the loading motor.

Gate Array

This component contains circuitry to interconnect the major blocks (CPU, DSP, write/read channel).

DSP (Digital Signal Processor)

The DSP controls the following servos: spindle motor/speed, laser power control, track following, seek/position maintenance, focus actuation, fine position actuation, and coarse position actuation. Whenever the drive is performing a read or write operation, all these servos are activated.

Read / Write Channel Electronics

Read/write channel electronics take analog data from the optical head and convert it into digital "transitions." These transitions are decoded by the encoder/decoder electronics in the controller chip to extract data from format and error correction features. The write channel electronics take the serial data stream from the encoder/decoder and convert the digital pulses into analog data. This analog data is then sent to the optical head.

Loading Motor

The loading motor loads and unloads the optical disk cartridge. The loader motor includes a gear train and rack-and-pinion system that allow the cartridge shuttle to raise and lower the cartridge within the loader housing.

Bias Magnet

The bias magnet subassembly sits on top of the cartridge shuttle and provides the correct polarity for erasing or writing data.

Optical Head

The optical head assembly contains both mechanical and electronic components and is a “split optics” design, which physically separates the laser diode.

The actuators and laser diode (and associated detectors) are on a small PCA on the optical head assembly. The main components are as follows:

- Auto Laser Power Control (ALPC): Controls the intensity and duration of the laser beam for erase, write, and read operations.
- Focus Servo (Fcs): Controls the vertical motion of the objective lens to focus the laser beam on the disk surface.
- Fine Tracking Servo (Trk): Controls the horizontal motion of the objective lens to follow the track of the disk.
- Linear Motor (LM): Positions the actuator in the vicinity of the desired track on the disk.

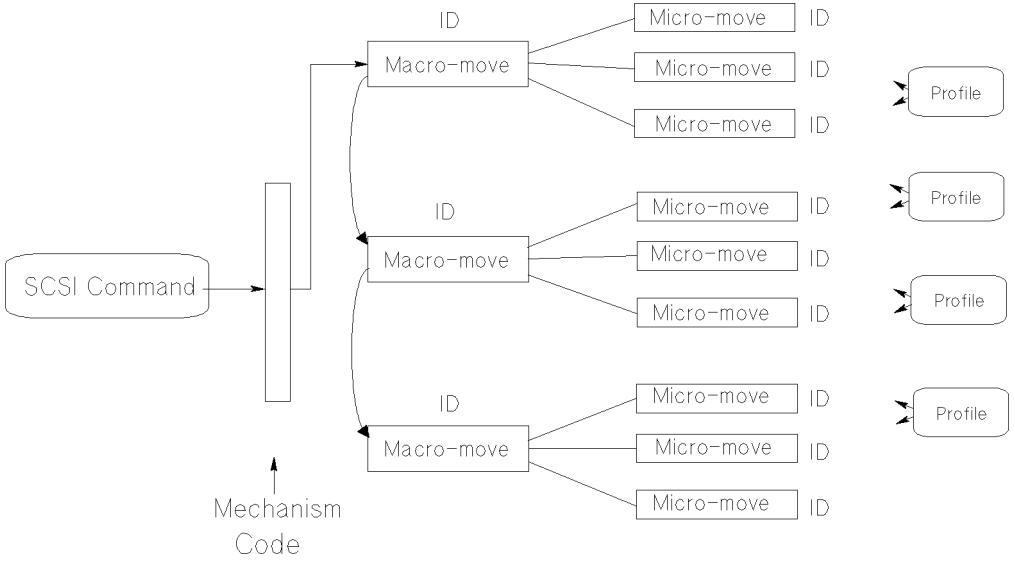
Robotics

Robotic Movements

The mechanism code of the jukebox accepts high-level SCSI commands from the interface, translates these commands into servo code for the robotics, executes the command, and reports status.

When a SCSI command is received, it is translated into a series of smaller submoves in the servo code of the robotics and executed.

Figure 6-2 **SCSI Command Translations**



The commands are translated into the following macro-moves, which are basic jukebox functions:

- Move carriage: positions the picker transport to a position along the rails.
- Flip: rotates the picker.
- cartridge I/O: Plunges and retrieves the picker finger assembly to move cartridges between the picker and magazines, drives, or the mailslot.
- Rotate mailslot: Plunges and retrieves the picker finger assembly/leadscrew nut to rotate the mailslot assembly toward and away from the user.

Macro-moves consist of one or more combinations of position or saturation type micro-moves.

There are two types of micro-moves:

- Position move: Moves the driving motors a given distance at peak speed and is used for high-speed, unobstructed movements of known distances.
- Saturation move: Same as a position move except that a high force is expected within a given distance; however, motion is halted if force exceeds a specified threshold. These moves are used for low-speed unobstructed movements that are adaptable.

Each micro-move within a specific macro-move has a unique set of stability, performance, error recovery, force, and reliability criteria. Therefore, each micro-move is assigned a unique identification code (ID), which is used to determine how the move should be performed.

Mechanics

The mechanics consist of the following major assemblies:

- Leadscrew assembly
- Picker/carriage assembly
- Mailslot (disk loading and ejecting assembly)

The picker/carriage assembly is the heart of the mechanism. This assembly positions disks in front of storage slots, drive, and the mailslot. The picker inserts, removes, and flips disks. It also activates the mailslot mechanism.

The disk insertion slot, referred to as the mailslot, accepts a disk (inserted shutter-end-first) and rotates the disk 180 degrees. This allows the picker to grasp the rear of the disk and insert the disk shutter-end-first into the drive or a storage slot.

The carriage motor rotates the carriage leadscrew, driving the carriage. The motor also monitors the amount of movement with a built-in encoder wheel.

The Robotics Controller PCA

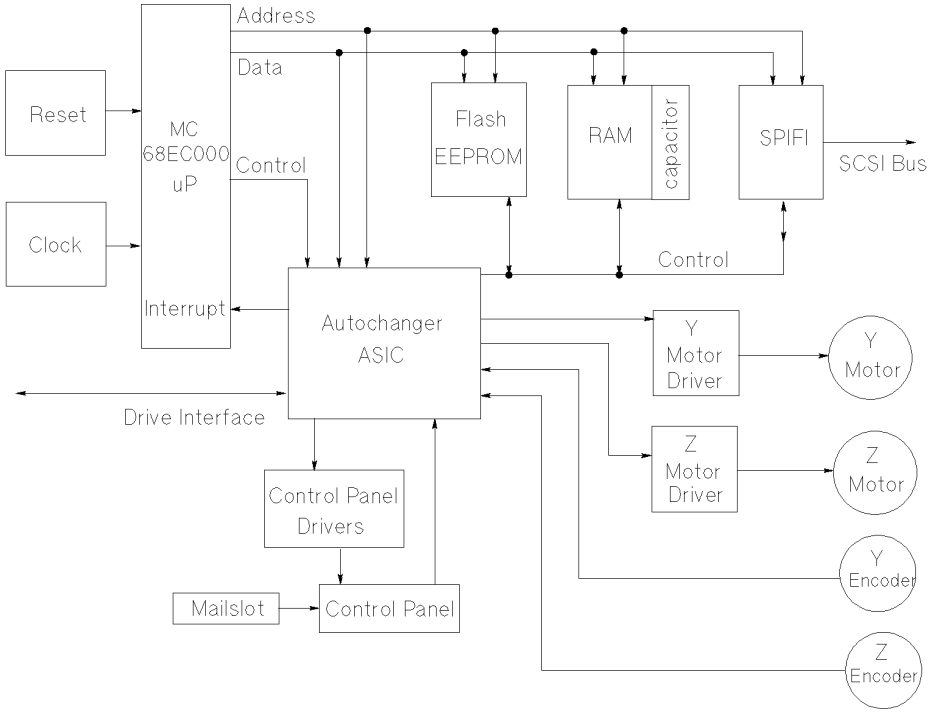
The robotics controller PCA contains the following major components, which are illustrated in Figure 5-3:

- **Microprocessor**: The MICROPROCESSOR is a Motorola MC68EC000 running at 12.288 MHz. This microprocessor controls all processes on the controller PCA such as servos, SCSI interface, and commands to the control panel. Associated with the microprocessor is clocking circuitry, RAM with standby power supplied by a capacitor, and ROM.
- **Robotics ASIC**: The ROBOTICS APPLICATION-SPECIFIC INTEGRATED CIRCUIT (ASIC) provides an interface to the processor interface, programmable features, and a servo system. The ASIC is also the interface between the processor and the motors. The ASIC reads the position encoders and uses that information to increment or decrement counters on the chip. The ASIC also provides pulse width modulation (PWM) output signals to drive the motor circuitry.
- **SPIFI Chip (SCSI bus control)**: The processor interface function of the chip includes the handling of internally- and externally-generated interrupt sources

  The programmable features section of the chip provides a control panel display state machine and firmware-configurable feature and general-purpose ports.

  The servo system section of the chip provides servo timers, three motor control pulse-width modulators, and three quadrature encoder channels.
- **Flash EEPROM**: FLASH EEPROM. The controller firmware resides in two flash EEPROMs. These flash EEPROMs allow new firmware versions to be downloaded to the controller in the field.
- **RAM**: RAM. The two RAM chips are special, low-power CMOS static RAMs. A standby capacitor on the PCA takes over powering these chips if main power is lost. The chips remain in standby mode (from about 10 to 60 days), providing a non-volatile memory storage capability when the unit is powered off.
- **Front panel control and filament drive**: The control panel drivers generate a vacuum filament display using a 7.5-volt supply tied to a 5-volt reference, which results in an excitation voltage of from two to three volts. The grids of the display are at approximately 20 volts. Buffers for incoming control panel switch signals and signals from the mailslot sensor are also handled by the control panel drivers.

Figure 6-3 Robotics Controller PCA Block Diagram



The Power Supply

The power supply is an autoranging supply that provides +5V at 22 amperes, +12V at 8 amperes, -5V at 0.5 ampere, and -12V at 0.5 ampere. The maximum continuous output power is 200 W.

AC line voltage is connected to the power supply through a line cord receptacle mounted on the power supply PCA. The ON/OFF switch controls both sides of the AC line. An input line filter is provided to reduce the level of AC line transients and the amount of switching noise leaving the supply.

An over-voltage protection device protects the supply from input over 240 volts.

Errors

Drive Errors

Although not directly related to disk format, the various error thresholds are the basis for deciding whether or not to spare a sector. This could happen during the certification process (i.e. the slip sparing algorithm) or auto-reallocation during a SCSI Write command (i.e. the replacement sparing algorithm). These error thresholds are related to the format of a sector in the User Zone.

Each sector in the User Zone consists of the following:

- Header
- User data
- Parity bytes for error correction

Each header consists of three copies of the sector's track number, sector number, and a Cyclic Redundancy Check (CRC). The error threshold is determined by the number of sectors found "good."

The other error threshold of interest pertains to the degree of error correction required on the data. The error correction code (ECC) used causes parity bytes to be written following the user data. During a data recovery operation, these bytes are used to detect and correct up to 8 defective bytes in an interleave. Each sector has 10 (5) interleaves with 120 (122) bytes in each interleave. The actual number of bytes per interleave requiring correction is used as an error threshold. Consult the ISO standard for more details.

The table below shows the error thresholds for the 5.2 Gb optical drive. The sector IDs column refers to the minimum number of sector IDs that must be read correctly for the corresponding operation to be deemed successful. The ECC level column refers to the to the maximum number of bytes per interleave that require correction in order for the corresponding operation to be deemed successful.

Operation	Sector IDs	ECC Level
Format	1	3
Write	2	-
Erase	2	-
Verify	2	4
Read (recovered)	1	7
Read	1	8

Robotics Error Detection

The robotics- error detection methods are extensive. Both processes and sensors detect errors.

Each of the processes that detect errors are interrelated. Depending on the error condition, the robotics expect feedback from one or more of the following processes before a diagnosis is made:

- **Overforce shutdown**: An overforce shutdown occurs when the motors exert more force than is expected or required. If this occurs, the servo automatically shuts itself down to prevent parts damage. After an overforce shutdown occurs, the robotics analyze the situation, self-calibrates, and attempts a retry
- **Sense of touch**: Sense of touch is the process where actual force used is compared to the recommended force for each move. The robotics use this information to detect errors or qualify moves. The difference between sense of touch and overforce shutdown is that the servo is not automatically shut down if sense of touch detects an error.
- **Motor position**: The positions of the motors are continuously monitored by the controller PCA. The position, along with the sense of touch feedback, is a valuable source of error detection.

The physical parts of the error detection system are the sensors. These hard-wired sensors provide information that is impossible to determine through other means. This feedback information is fed to the robotics controller PCA.

There are two forms of sensors:

- Drive handshake - the drive provides a BUSY signal back to the robotics controller to indicate the status of certain loader operations.
- Optical sensor - detect conditions that are otherwise difficult to detect. There are two mailslot sensors to detect if a cartridge is properly inserted into the mailslot.

Error Recovery Processes

The robotics of the jukebox use the following processes to recover from errors:

- Inline recovery
- Find home sequence
- Calibrate

For certain well-defined error conditions, recovery operations that have little effect on position or performance of the jukebox are executed inline. These are used only if the error condition can be determined exactly, and in cases where further motion may make recovery difficult.

The purpose of `FIND HOME` is to initialize the machine to a known state. For poweron, this means finding a "home" (zero) position for the carriage/picker assembly.

The calibrate procedure is then called to further locate reference points other than the zero locations found during `FIND HOME`. Using sensors, the picker is characterized as to its relationship with the mechanism. The positions of the drive, mailslot, and storage slots are calculated based on the location of the sensors.

SCSI Detected Errors

For the vast majority of potential error conditions that may exist, the SCSI interface retrieves immediate information about the error with no motion required. Potential error conditions include:

- The machine not being ready for a new command due to another previously-issued command or a previously-detected hardware fault that prevents motion.
- An illegal request to move a cartridge from an empty location or to a full location.
- An illegal request to do an unsupported command or operation.
- Invalid syntax or parameters in a command.
- Various bus-level communication errors.

In all of these cases, the command is rejected immediately and the mechanics do not move.

Move Errors

If an error is detected during robotics motion, the state of the machine is recorded in internal memory and a retry procedure is called. Errors of this type may be either logical or physical and may be recoverable or unrecoverable. Results of the error recovery are returned to the host when the command completes. If possible, the cartridge is returned to its original location before command completion, putting the jukebox back into its original state.

Logical errors

Logical errors refer to conditions in which source locations were found unexpectedly empty or destination locations were found unexpectedly full. These conditions indicate that a cartridge was moved without the knowledge of the robotics, possibly during service. At this point, the host must become involved in locating the source of the error.

The host's actions can include issuing a Read Element Status command to find the difference between the host's location (element) list and that of the jukebox, followed by an Initialize Element Status command to find the actual locations of all disks. When the differences are determined, a final check of data on the disk should be done, and the disk must be returned to the appropriate location (element).

The picker element status always reflects the physical state of the picker. The robotics do not give a status when the picker is found unexpectedly full or empty because this logical error is not allowed. At poweron, the picker is checked to see if it contains a cartridge. The mechanical design of the picker prevents a cartridge from being fully inserted into the picker without first going through an initial poweron cycle in the jukebox.

Physical errors

Physical errors refer to conditions in which something physically changes in the system that prevents normal operation of the motion. These can be either temporary or permanent. Error recovery attempts to recover from every physical error without host intervention. Any error that is detected through overforce, sense of touch, or by a sensor calls a procedure to attempt the recovery.

One exception to the no-host-intervention rule is in the drive/jukebox interaction. If the robotics indicate that a cartridge has been inserted into the drive, but the drive does not read it, the host must become involved in identifying the source of the problem. Likewise, if the drive is commanded to eject a cartridge and does not do so, the drive is considered to be empty and the host must identify either the final position of the cartridge or determine if the drive has failed.

Hardware Error Codes

If an error is unrecoverable (i.e., something is broken or jammed to a point that manual intervention is required), the jukebox takes an additional step in an attempting to identify the Field Replaceable Unit (FRU) that is causing the failure.

A routine begins eliminating FRUs. This routine attempts to isolate the error to three (or less) FRUs. If no error can be found (or if recovery was made from the error), the unit returns a "no error" status. If an error is found, a hardware error code and a move error code is returned when the command completes. Up to three FRU numbers are returned. The FRUs, and a time stamp, are listed in decreasing order of probability.

Hardware Error Codes are listed in “Verification /Recovery From Hardware Errors” in Chapter 4.

Information Logs

The jukebox provides information logs about its operation and error history. These logs provide predictive information that can lead to early detection of robotics problems.

All logs are maintained within the non-volatile RAM and are accessible through the control panel and by the SCSI Log Sense command over the SCSI interface. The main functions provided with operational logs are described below.

Error Log

The jukebox maintains a history of past diagnostic test error that have occurred within the jukebox, along with a time stamp of when they occurred. The error message maintained for each error indicates the failure and the possible FRUs that may have caused the failure.

Move Success Log

A cumulative number of move recoveries and a total move count are maintained. This gives a view of the history of the robotics soft error rate. The last ten hard errors are marked in this log by indicating how many good moves occurred since the last hard error.

Force Log

Each cartridge move is actually a sequence of many small moves, known as micro-moves. This log is a record of the maximum force measure during every micro-move situation.

Recovery Log

This is a record of recoverable (soft) errors, and related information on error recovery methods used and their success or failure.

Drive Log

This data indicates the number of times the robotics use the drive.

Runtime Log

An entry is put into this log each time an error occurs that requires any form of recovery. Both "on-the-fly" and extensive recovery methods are logged. The type of error, the method of recovery, and the number of moves to that point are recorded.

Odometer

This value indicates the total number of moves executed since the non-volatile RAM was first initialized. Poweron hours are also recorded.

The SCSI Bus and This Jukebox

This jukebox is a “fast and narrow” SCSI device that uses a single-ended SCSI bus. This jukebox does not support logical unit number (LUN) addressing.

When considering adding other devices to the jukebox bus, consider the following:

- Will adding a device onto a bus with this jukebox interfere or degrade the performance of the jukebox or the device that is added?
- If the decision is made to add other devices to the jukebox bus, what SCSI requirements must be observed to make sure the bus will work?

The recommended configuration of this jukebox is as the only device on a bus. The recommendation is the same whether the bus is single-ended or differential. One reason for the recommendation is that interactions on a SCSI bus can be complicated. The more devices on the bus, the more chance for problems.

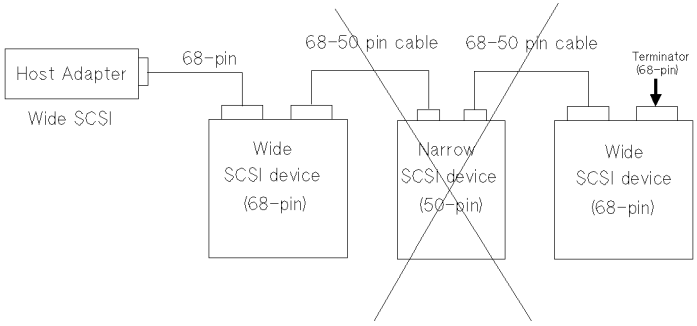
Consider the quantity of data that the bus will have to carry, the frequency of data transfer, and the priority of the data transfer under consideration. If the jukebox is used as a backup or archive device, the demands on the jukebox will be different than if the jukebox is used for near-online storage where requests for data are more random in both frequency and amount. If the jukebox will be used at the same time as the other device, or devices, you should expect a drop in performance.

Mixing Wide and Narrow Devices

Try to cable systems so that you do NOT mix wide and narrow buses.

Connecting devices of the same bus width, such as all narrow (50-pin) is a simple process of daisy-chaining the devices, and terminating both ends of the bus. However, mixing narrow and wide devices invites problems.

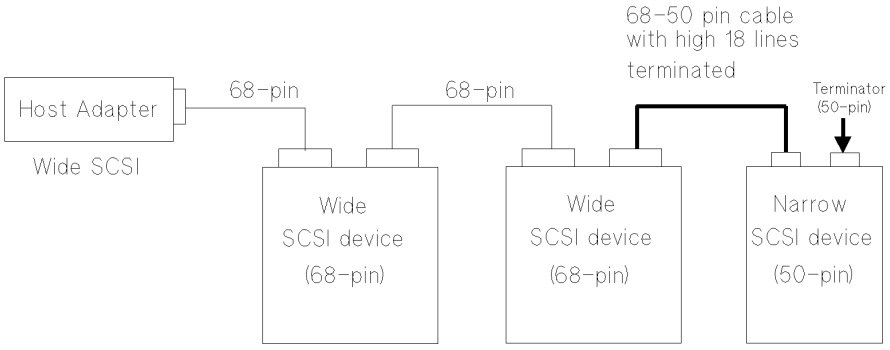
This method should only be implemented by an experienced systems integrator who is highly knowledgeable about SCSI. Since the wide (68-pin) buses need more data lines on the bus for their data transfer, it's necessary that the cables connecting the devices are 68 pin. The data would be lost if the devices were set up as depicted in the figure below.



Because a narrow device only has a 50-pin connector, it will not transmit the eight extra bits of data needed for the wide device on the end of the bus. Using only 50 lines also prevents the narrow device from passing along the IDs of devices at 8 or above.

The lower eight data lines transfer commands and messages, allowing all devices, regardless of size, to co-exist on the bus. However, data transfers and device addressing occur on the higher bits. Since a narrow device can't "see" the upper 8 data bits, that translates to it not being able to "see" wide devices with a SCSI ID above 8. Remember the host adapter is a device, so if you're mixing wide and narrow devices on the bus, the host adapter must be at an ID that all devices can address.

If mixing narrow and wide devices is unavoidable, use the configuration described below:



It is very important that the 68-pin to 50-pin cable is properly configured to assure that the eighteen truncated lines are properly terminated.

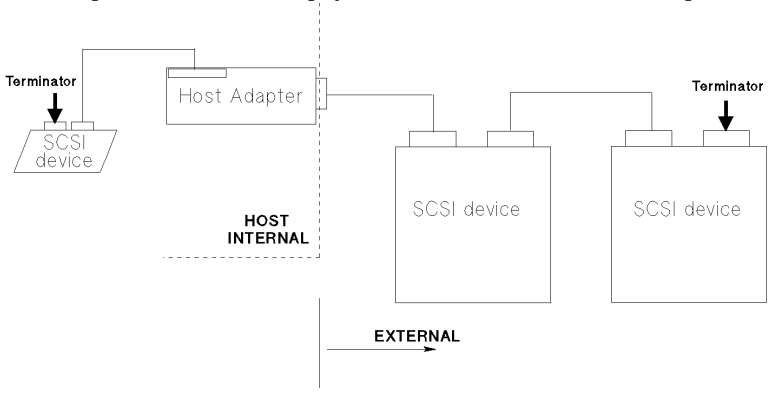
Cable Lengths

This jukebox uses a single-ended bus. The maximum bus length for this "fast" device on a single-ended bus is 3 meters (9.8 feet). The internal cable length of the jukebox is 1.5 meters (4.9 feet) which leaves 1.5 meters (4.9 feet) for the rest of the bus.

Termination

- Refer to the documentation that comes with the particular adapter to see how to apply termination.
- Use active terminators to reduce noise sensitivity.
- Never terminate the bus at any place except the physical ends. Terminating the bus in the middle will probably cause the bus to become inoperable or operate in a state that could cause data loss.

- If devices are on both sides of the host computer adapter (such as hard drives internal to the host computer and a jukebox external to the host computer) make sure that there is no termination on the host computer adapter. Termination must be only on the device inside the computer that is farthest away (on the bus) from the host adapter, and on the last physical device external to the computer.



General

- Do not connect a single-ended bus to a differential bus. Damage can occur.

NOTE

For current information on issues relating to installation, operation, and support of jukeboxes, go to:

HP Optical Storage
www.hp.com/isgsupport/optical/index.html

A Safety and Regulatory Information

Overview of this Appendix

This appendix contains important safety and regulatory information for the United States, Finland, Sweden, Germany, United Kingdom, European Union, and Japan.

CDRH Regulations (USA Only)

The Center for Devices and Radiological Health (CDRH) of the U.S. Food and Drug Administration implemented regulations for laser products on August 2, 1976. These regulations apply to laser products manufactured from August 1, 1976. Compliance is mandatory for products marketed in the United States. The labels and artwork shown below indicate compliance with CDRH regulations and must be attached to laser products marketed in the United States.

WARNING **Use of controls, adjustments or performing procedures other than those specified in this manual may result in hazardous laser radiation exposure.**

NOTE Complies with 21 CFR Chapter 1 Subchapter J.

Laser Class Information: A black on yellow label which reads, "Class 1 Laser Product" printed in English, French, German, Finnish, Japanese, and Spanish.

United Kingdom Telecommunications Act 1984

The HP SureStore Optical 80ex jukeboxe is approved under Approval Number NS/G/1234/J/100003 for indirect connection to Public Telecommunication Systems within the United Kingdom.

Declaration of Conformity

Declaration of Conformity

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Co.

Manufacturer's Address: Storage Systems Division
700 71st Avenue
Greeley, CO 80634 USA

declares, that the product

Product Name: Optical Disk Library

Model Numbers: C1100x, C1101x, C1102x, C1103x, C1115x, C1116x
(Where x = any alpha all w or w/o suffixes)

Product Options: All Options

conforms to the following Product Specifications:

Safety: EN 60950: 1992+A1+A2:1993+A3:1995/IEC950(1991)+A1+A2+A3
EN 60825-1 (1994) / IEC825-1 (1993), Laser Class 1

EMC: EN 55022 (1994) / CISPR 22 (1993), Class B
EN 50082-1 (1992)
prEN 55024-2 (1992) / IEC 1000-4-2 (1995), 4 kV CD, 8 kV AD
prEN 55024-3 (1991) / IEC 1000-4-3 (1995), 3 V/m
prEN 55024-4 (1993) / IEC 801-4-4 (1988), 1 kV Peak Power Lines
0,5 kV Signal Lines
EN 61000-3-2 (1995) / IEC 1000-3-2 (1995), Harmonics
EN 61000-3-3 (1995) / IEC 1000-3-3 (1994), Flicker

Supplementary Information:

The product herewith complies with the requirements of the following Directives and carries the CE marking accordingly: the EMC Directive 89/336/EEC -the Low Voltage Directive 73/23/EEC (including 93/68EEC)

The Manufacturer listed above declares that this product has been tested and found to comply with the limits of a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: a) Reorient or relocate the receiving antenna, b) Increase the separation between the equipment and receiver, c) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected, or d) Consult the dealer or an experienced radio/TV technician for help.

Change or modification of this equipment not expressly approved by Hewlett-Packard could void the user's authority to operate this equipment. Only use the cables, connectors, power cords, and accessories supplied with this equipment or expressly approved by Hewlett-Packard.

Storage Systems Division March, 1998 Greeley, Colorado, USA

For Regulatory Compliance Information ONLY, contact:

Australian: Product Regulations Manager, Hewlett-Packard, Australia Ltd., 31-41 Joseph Street, Blackburn, Victoria 3130, Australia

European: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department TRE, Herrenberger Strasse 130, D-71304 Boblingen (FAX:+49-7031-14 3143

USA: Product Regulations Manager, Hewlett-Packard Company, 700 71st Avenue, Greeley, CO 80634 USA, (Phone: 970-350-5600).

Herstellerbescheinigung

Diese Information steht im Zusammenhang mit den Anforderungen der Maschinenlärn information sverordnung vom 18 Januar 1991.

Schalldruckpegel Lp < 70 dB(A)

- am arbeitsplatz
- normaler betrieb
- nach ISO 7779:1988/EN 27779:1991 (Typprüfung)

English Translation of German Sound Emission Directive

This statement is provided to comply with the requirements of the German Sound Emission Directive, from 18 January 1991.

Sound pressure Lp < 70 dB(A)

- at operator position
- normal operation
- according to ISO 7779: 1988/EN 27779: 1991 (type test)

Turvallisuusyhteenveto

Laserturvallisuus

LUOKAN 1 LASERLAITE

KLASS 1 LASER APPARAT

HP SureStore Optical 80ex optiset levymuistiasemat ovat käyttäjän kannalta turvallisia luokan 1 laserlaitteita. Normaalissa käytössä levymuistiaseman kotelointi estää lasersäteen pääsyn laitteen ulkopuolelle.

Laitteen turvallisuusluokka on määritetty standardin EN 60825 mukaisesti.

VAROITUS !

Laitteen käyttäminen muulla kuin käyttöohjeessa mainitulla tavalla saattaa altistaa käyttäjän turvallisuusluokan 1 ylittävälle lasersäteilylle.

VARNING !

Om apparaten används på annat sätt än i bruksanvisning specificerats, kan användaren utsättas för laserstrålning, som överskrider gränsen för laserklass 1.

Huolto

HP SureStore Optical 80ex levymuistiasemien sisällä ei ole käyttäjän huollettavissa olevia kohteita. Laitteen saa avata ja huoltaa ainoastaan sen huoltamiseen koulutettu henkilö. Levymuistiaseman sisälle asennettujen luku-/kirjoitusyksiköiden suojakoteloa ei tule avata huoltotoimenpiteiden yhteydessä.

VARO !

Mikäli luku-/kirjoitusyksikön suojakotelo avataan ja suojalukitus ohitetaan, olet alttiina lasersäteilylle laitteen ollessa toiminnassa. Älä katso säteeseen.

VARNING !

Om skyddshöljet av den optiska drivmodulen öppnas och spärren urkopplas då apparaten är i funktion, utsättas användaren för laserstrålning. Betrakta ej strålen.

Tiedot luku-/kirjoitusyksikössä käytettävän laserdiodin säteilyominaisuuksista:

Aallonpituus	680 nm
Teho	60 mW
Turvallisuusluokka	3B

English Translation of Finland Regulatory Information

LASER SAFETY SUMMARY

LASER SAFETY

CLASS 1 LASER PRODUCT (The same in Swedish.)

HP SureStore Optical 80ex jukebox is for user safe class 1 laser products. In normal use the enclosure of the optical drives prevents the laser beam from escaping outside of the product.

The jukebox was type approved in Finland for laser safety by the National Board of Labour Protection. The safety class of the products was defined according to the resolution No 472/1985 of the Council of State and the standard EN 60825.

WARNING !

The use of the product otherwise than specified in the user's manual may expose the user to laser radiation exceeding safety class 1.

(The same warning in Swedish.)

SERVICE

There are no user serviceable parts inside the jukebox. The jukebox products can be serviced only by qualified service personnel. The optical drive mechanism(s) installed inside the library system shall not be opened or disassembled during service.

WARNING !

If the enclosure of the optical drive mechanism is opened and the safety interlock disabled, you may be exposed to the laser radiation when the drive is operating. Avoid exposure to the beam.

(The same warning in Swedish.)

The information about the radiation characteristics of the laser diode used in the optical drive mechanism:

Wavelength	680 nm
Power	60 mW
Class	3B laser

Japanese VCCI Statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＢ情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると受信障害を引き起こすことがあります。
取り扱い説明書に従って正しい取り扱いをして下さい。

This equipment is in the Class B category information technology equipment based on the rules of Voluntary Control Council For Interference by Information Technology Equipment (VCCI). Although aimed for residential area operation, radio interference may be caused when used near a radio or TV receiver. Read the instructions for correct operation.

Japanese VCCI Statement

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