HP Optical Jukebox
Models 660ex/1200ex/1200mx/2200mx

Service Manual

Edition 2

Manufacturing Part Number: HP Part No. C1104-90038

July 2003

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 C1104-90038 Edition 2 July 2003

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

Overview

This chapter gives information on the following topics:

- technical specifications
- environmental specifications
- replacing the control panel assembly
- other documents that apply to this product

Technical Specifications

Table 1-1 Technical Specifications

Characteristics	Description
5.2-GB Drive Characteristics	
Rotational speed (rpm)	• 3000 (5.2 Gb media) • 3600 (650 Mb, 1.2 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 (1.2 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

Table 1-1 Technical Specifications

Characteristics	Description
9.1-Gb Drive	
Rotational speed (rpm)	• 3000 (9.1 Gb media) • 3300 (5.2 Gb media) • 3600 (2.6 Gb media)
Average seek, typical (ms)	25.0
Average access time, typical (ms)	35
Write transfer rate - max sustained (Mb/s)	• 3.1 (9.1 Gb media) • 2.5 (5.2 Gb media) • 2.0 (2.6 Gb media)
Burst transfer rate -fast synchronous (Mb/s)	20
Burst transfer rate - synchronous (Mb/s)	5
Burst transfer rate - asynchronous (Mb/s)	6.7
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

Table 1-1 Technical Specifications

Characteristics	Description
Physical Characteristics	
Height (cm, inches)	180.8, 71.2
Width (cm, inches)	87.6, 34.5
Depth (cm, inches)	73.4, 28.9
Net weight (kg, lbs))	226.3, 498.8
Packaged weight (kg, lbs)	301.6, 665

Environmental Specifications

Table 1-2 Environmental Specifications

Characteristics	Robotics	Drive	Media
Temperature (o C)			
Operating	10 to 32	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

Table 1-2 Environmental Specifications

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		

Table 1-2 Environmental Specifications

Characteristics	Robotics	Drive	Media
Particulates (µg/cm3)			
	<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)	340, 1160.4
Power consumption (Watts, BTU)	560, 1911.2
Current	10 (120V) 5 (240 V)

Table 1-4 Reliability

Mean swaps between failure (MSBF) - robotics	2,000,000
Mean swaps between failure (MSBF) -drive	750,000

Table 1-4 Reliability

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 Class “A”, CISPR 22, Class “A” Class “A” EN 55022/CISPR 22, Level “A”; VCCI Level 2, C-TICK
Laser	CDRH 21 CFR Chapter 1, Subpart J IEC 825

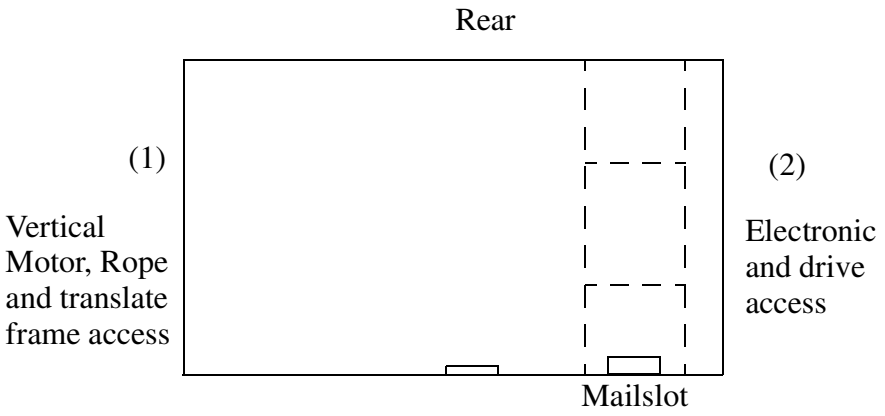
Clearance Requirements

The only clearance requirement is to keep the slots on the top panels of the cabinet free from cover or obstructions.

For service, all sides should have approximately 1-meter clearance. Service clearance is particularly important if the customer’s applications support online drive replacement. For online drive replacement, the right

side should be accessible without the need to remove power from the jukebox. Position the jukebox so that the right side has service access, or allow adequate power and SCSI cable length to move the jukebox to a clear area.

Figure 1-1 Clearance Requirements



Weight-Bearing Requirements

The weight of the jukebox is supported by four casters. The maximum load per caster is 150 pounds. The total weight of the jukebox is 600 pounds (when fully loaded with disks) over a footprint of 7 square feet. Therefore, to install this jukebox, the floor rating must meet or exceed 85 pounds per square foot.

If located on a raised-tile floor, position the jukebox as close to a corner post as possible. The tiles beneath and surrounding the jukebox should be solid. Special, air-conditioning tiles are not needed near the jukebox.

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.

Responsibilities

Customer site preparation/verification and installation are the

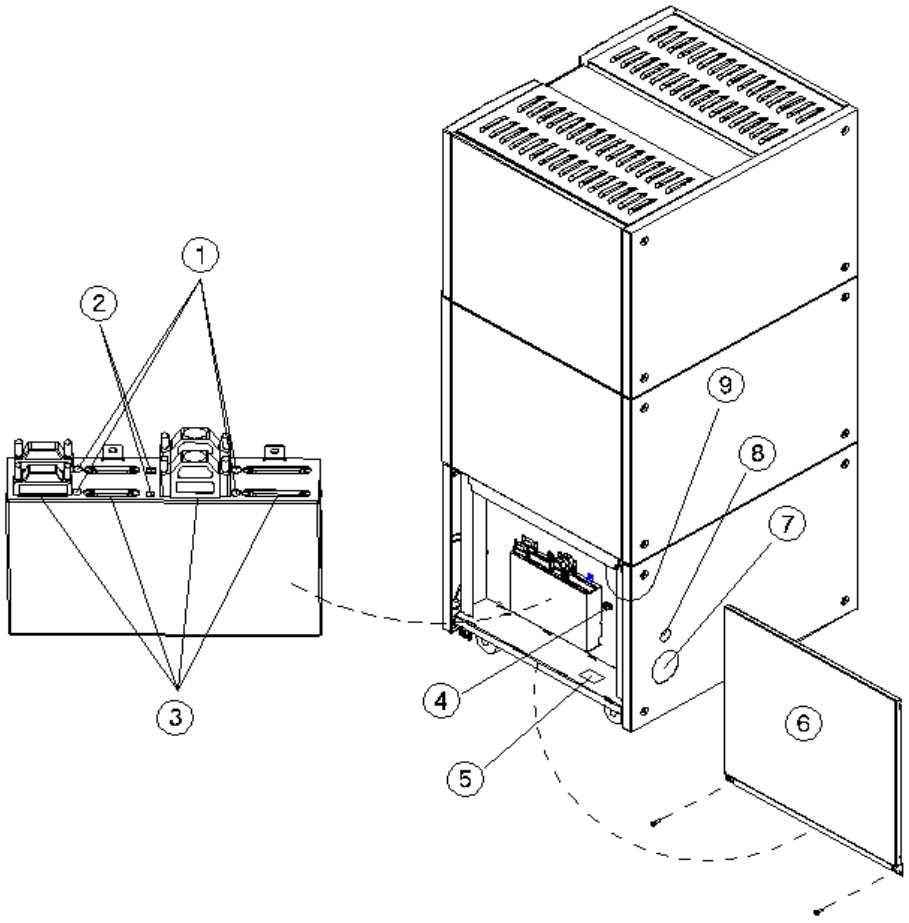
customer's or reseller's responsibility; HP will perform the site preparation/verification and/or installation on a time-and-materials basis.

2 Product Installation

Jukebox Overview

Identifying Right-Side Panel Features

Figure 2-1 Right-Side Panel Features — 10-Drive Jukebox Shown



1	Active bus indicator	Lit when the SCSI bus is active. There is an indicator for each single-ended and each differential interface in the jukebox.
2	SCSI interface selection switch	Selects either a single-ended or differential SCSI interface on the SCSI interface board. In 4- or 6-drive jukeboxes, there is one interface board. In 10-drive jukeboxes, there are two interface boards, designated Bus 1 and Bus 2. The interface selection switch must be set individually for each board
3	SCSI ports	Connectors for SCSI cables to the interface board. The interface board has two *types* of interface; single-ended and differential. Each *type* of interface has two ports
4	Power cord strain relief clip	Routes the power cord away from other connectors and provides strain relief for the power cord connection.
5	Product serial number label	Identifier of the specific jukebox.
6	Access panel and mounting screws	Covers the interface and power connection components. The panel is secured by two screws on the lower corners. (See the following note.)
7	Cable access hole	SCSI and power cables pass through this hole into the inside of the jukebox.
8	Power switch	*Removes power from secondary circuits only. AC power remains ON to the power distribution assembly and the 24-volt power supply.* Accessed through a hole in the rear panel.
9	Power receptacle	Receptacle for the jukebox power cord. Located on the bottom of the power distribution assembly.

NOTE Two screws secure the lower right-side access panel during shipment from the factory. The screws are removed during unpacking but should

be replaced after installation is complete. If the jukebox is reshipped, the screws should be reinserted. The screws are 6/32 X 0.437.

Connecting SCSI Cables to the Jukebox

In all configurations, the following cabling capabilities apply:

Interface types available	Single-ended or differential SCSI, selected by the interface selection switch on each interface card
Number of interface cards available	One card in 4- and 6-drive models, two cards in 10-drive models
Number of hosts	**This jukebox may be used in high availability environments. High availability environments can be complex and installation procedures are not described in this service manual. The customer should contact their high-availability vendor for installation and configuration.**

The maximum cable length available for connection to the host computer system or other devices depends on which interface *type* selected. The following table lists the maximum SCSI bus lengths available.

Table 2-1 Maximum SCSI External Cable Lengths (Assuming no devices internal to the host computer)

Interface Type	Maximum External Cable Length
Single-Ended SCSI (50-pin high-density connector)	3 meters (9.8 feet)
Differential SCSI (68-pin high-density connector)	25 meters (82.0 feet)

NOTE

Use SCSI cables with thumbscrew connectors. Clip type cables may be used if you first remove the mounted thumbscrew studs with a flat blade screwdriver. If the thumbscrew studs are not removed, interference between the cable and the studs may result. SCSI cables are listed in the replaceable parts list at the end of Chapter 5.

Cabling Configurations

Refer to the list below for the page describing configurations:

Connecting a 4- or 6-Drive Jukebox

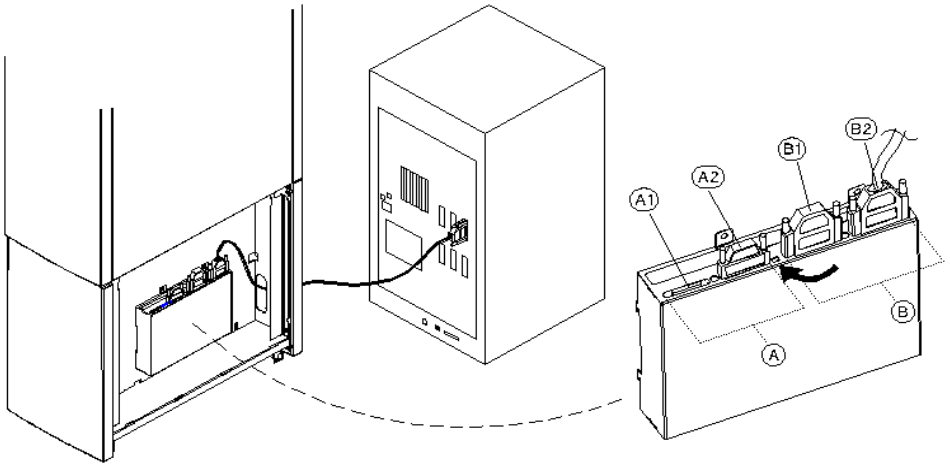
CAUTION Make sure that all peripheral devices connected to the host computer have been properly shut down. If the host computer is connected to a network, check with the system administrator before switching off power.

1. Switch off power to the host computer.
2. Remove the lower right-side access panel.

   You may have to remove two screws at the lower corners.
3. Select single-ended (“A”) or differential (“B”) interface using the SCSI interface selection switch (see the arrow on the diagram).

   The diagram shows connecting a cable to the differential (“B”) interface.

Figure 2-2 Connecting a 4- or 6-Drive Jukebox



4. Connect a cable between the host computer and either port of the jukebox SCSI connectors of the *type* of interface that will be used (single-ended or differenctial).The example diagram shows use of the

"B2" port on the differential interface.

Route the cable through the slot at the bottom of the right side ("C").

5. Plug a SCSI terminator into the unused SCSI port of interface type chosen (the example diagram shows the terminator at "B1" because "B2" was used for the cable).

   Use a 68-pin high-density terminator if the differential interface is selected.Use a 50-pin high-density active terminator if the single-ended interface is selected.

6. Plug a SCSI terminator into one of the SCSI ports on the unused interface. Only one terminator is necessary on the unused interface.

   The example diagram shows the terminator on the single-ended interface connector "A2" but the terminator could have been placed on "A1".

   Use a 68-pin high-density terminator for differential or a 50-pin high-density active terminator for single-ended interfaces.

7. Go to "Connecting Power" page 15 to continue with the installation.

Connecting a 10-Drive Jukebox as the Only Peripheral, Two Host Adapters, Basic SCSI Addressing

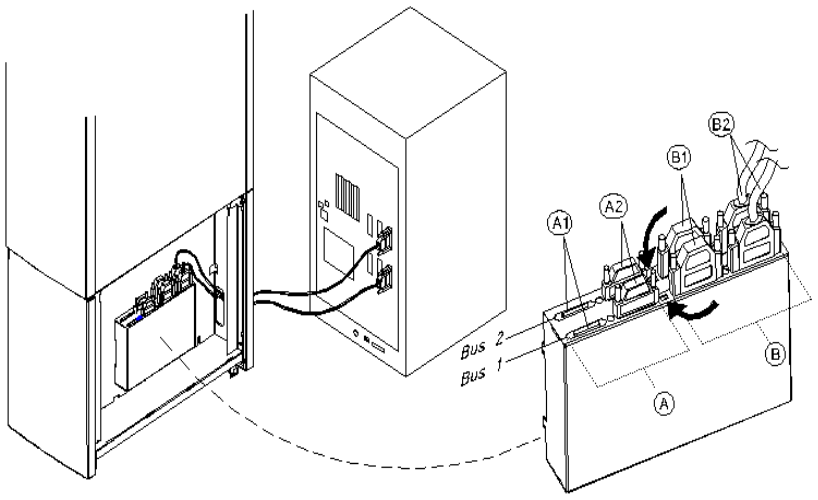
CAUTION Make sure that all peripheral devices connected to the host computer have been properly shut down. If the host computer is connected to a network, check with the system administrator before switching off power.

1. Switch off power to the host computer.
2. Remove the lower right-side access panel.

   You may have to remove two screws at the lower corners.
3. Select single-ended (“A”) or differential (“B”) interface using the SCSI interface selection switch (see the arrow on the diagram).

   The diagram shows connecting a cable to the differential (“B”) interface.

Figure 2-3 Connecting a 10-Drive Jukebox, Two Host Adapters, Basic SCSI Addressing



4. Connect cables between the two host adapters on the host computer and the two SCSI interfaces on the interface module.

   You can connect the two cables to two interfaces of the *same* type or *different* types (single-ended or differential). If two different types of interface will be used, check that the jukebox application software supports this configuration.

   The diagram shows cable connections to the differential SCSI interface on both interface PCAs at "B2." One cable is connected to Bus 1 and the other cable is connected to Bus 2.

   Route the cables through the slot at the bottom of the right side (C).

5. Plug a SCSI terminator into the unused SCSI connector of interface type chosen (the example diagram shows terminators for the two differential interfaces placed on the "B1" port for each interface).

   Use a 68-pin high-density terminator if the differential interface is selected.Use a 50-pin high-density active terminator if the single-ended interface is selected.

6. Plug a SCSI terminator into one of SCSI ports on each unused interface (the example diagram shows the terminators on the single-ended port at "A2" for both interfaces). The terminators can be placed on either port of the unused interface.

   Use a 68-pin high-density terminator for differential or a 50-pin high-density active terminator for single-ended interfaces.

7. Go to "Connecting Power" on page 15 to continue with the installation.

Connecting a 10-Drive Jukebox, One Host Adapter, Bus 1 and 2 Daisy-Chained, LUN Addressing

CAUTION Make sure that all peripheral devices connected to the host computer have been properly shut down. If the host computer is connected to a network, check with the system administrator before switching off power.

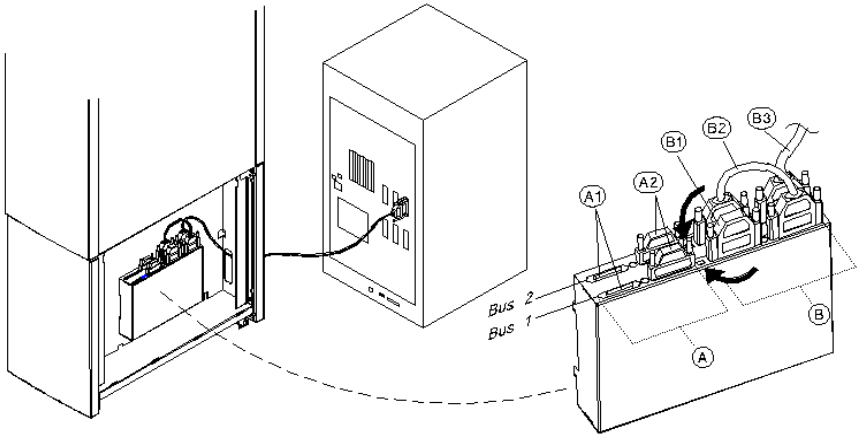
1. Switch off power to the host computer.
2. Remove the lower right-side access panel.

   You may have to remove two screws at the lower corners.
3. Select single-ended (“A”) or differential (“B”) interface using the SCSI interface selection switch (see the arrow on the diagram).

   The diagram shows connecting the host computer cable to a differential interface port (“B3”). This connection is on the rear interface card so it is Bus 2.

   Route the cable through the slot at the bottom of the right side.

Figure 2-4 **Connecting a 10-Drive Jukebox, One Host Adapter, Bus 1 and 2 Daisy-Chained, LUN Addressing**



4. Connect a short cable between the interface card chosen to the other Bus (the example diagram shows a cable (“B2”) between the second Bus 2 port over to a differential port on Bus 1).
5. Terminate the daisy-chained bus by plugging a terminator into the unused port of the second interface (the diagram show the terminator in port “B1”). In this example you would use a 68-pin differential terminator in “B1.”

   A differential interface port uses a 68-pin high-density terminator. A single-ended interface port uses a 50-pin high-density terminator.

   The same cabling can be done using the single-ended ports.

CAUTION Do not daisy-chain between single-ended and differential interfaces.

6. Plug a SCSI terminator into one of SCSI ports on each unused interface (the example diagram shows the terminators on the single-ended port at “A2” for both interfaces). The terminators can be placed on either port of the unused interface.

   Use a 50-pin high-density active terminator for the single-ended interface or a 68-pin terminator for the differential interface.
7. Go to “Connecting Power” on page 15 to continue with the installation.

Connecting the Jukebox With Other SCSI Peripherals

NOTE Operating this jukebox with other peripherals on the same bus is supported, but not recommended.

In most circumstances, the recommended configuration for this jukebox is as the only device on a SCSI bus. However, the customer may be using the jukebox in a way that connecting other devices to the same bus will not result in a loss of performance.

It is possible to connect this jukebox on a bus with additional peripherals in many different ways depending on the model:

- a 4- or 6-drive jukebox using basic SCSI addressing or Logical Unit Numbering (LUN) addressing
- a 10-drive jukebox with one host adapter and with LUN addressing, daisy-chaining Bus 1 and Bus 2 together or a 10-drive jukebox using two host adapters, LUN addressing, and using both BUS 1 and Bus 2 interfaces
- a 10-drive jukebox with two host adapters and using LUN addressing

Some issues that the customer should considered when evaluating whether other devices may be connected on the same bus as this jukebox include the following:

- How will the jukeboxes used: archiving, backup, near-line storage? What performance must be maintained?
- How will the other device under consideration be used? How much demand will the additional device place on the bus?
- Will “wide” and “narrow” devices have to be mixed?
- Are there devices on the internal part of the SCSI bus?
- Will a single-ended or differential interface be used?

Connecting Power

1. Ensure that the power switch on the jukebox is off (“8” on Figure 2-1).
2. Route the power cord through the strain relief clip (“4” on Figure 1-1) and close the clip snugly around the cord.
3. Plug the socket end of the power cord into the power port on bottom of the power distribution assembly (“9” on Figure 2-1).

NOTE Use the power cord shipped with the jukebox.

4. Route the power cable down through the long cable slot at the bottom of the jukebox right side panel, and out through the cable access hole at the lower left rear of the jukebox (“7” on Figure 2-1).
5. Plug the other end of the power cord into a power outlet.
6. Turn the power on.

   When power is applied, TESTING and NOT READY alternately display. Once the poweron test completes (approximately 1.5 minutes), READY displays.

NOTE If DEVICE FAILED displays. See “Troubleshooting” in Chapter 3 for troubleshooting procedures.

7. Refer to Chapter 3, “Operating the Jukebox” for instructions on setting the SCSI addresses, loading optical disks into the jukebox, entering a password, etc.

NOTE Go to “Configuring Write Verify” on page 16 to continue with the installation.

Configuring Write Verify

The write verify configuration ensures that data is written reliably to an optical disk. The jukebox ships with write verify enabled. Many software applications also default to this method of writing.

Writing data on a magneto-optical disk requires two passes. The first pass erases the data in the sector to which data will be written. The second pass writes new data to that sector.

When write verify is on, an additional pass is made over the sector to verify that all data is written correctly to the sector. The recommended setting is on (write verify enabled). Note that when write verify is enabled, write operations take more time.

To set write verify to off, refer to “Configuring Operating Configurations” in Chapter 3.

NOTE The last step in the installation process is to set the SCSI IDs for the jukebox and drives. Setting SCSI IDs is explained in “Setting the SCSI IDs” in Chapter 3.

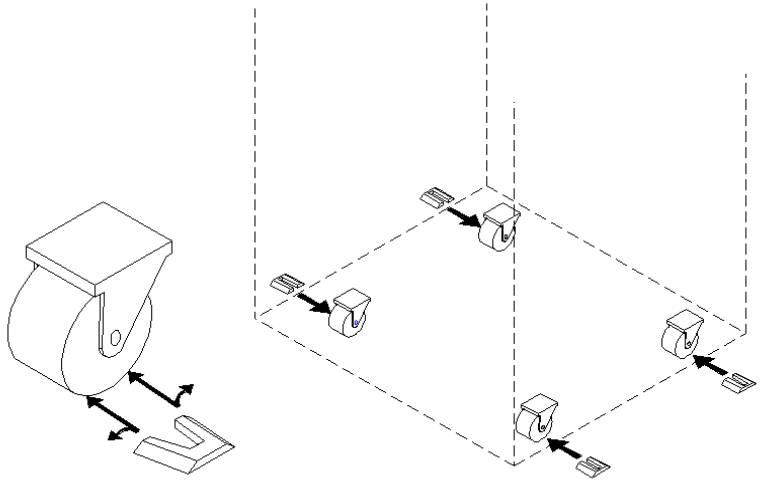
Installing the Wheel Chocks

WARNING

This jukebox rolls easily and could cause injury or damage if allowed to move unintentionally.

Four wheel chocks are provided to stabilize the jukebox in position. Install the wheel chocks after the jukebox is moved to its operating position and all cables are in place.

Figure 2-5 Installing the Wheel Chocks



1. After all cables and panels are mounted, roll the unit to its final position.
2. Spread the chock apart slightly and slide it around the bottom of the wheel as shown on the left side of the figure above.
3. Repeat Step 2 for the remaining three wheels.

NOTE This is the last step in the physical installation.

Default SCSI IDs in the Jukebox When Using Basic SCSI Addressing and When Using LUN Mode

Table 2-2 Default SCSI and LUN Settings in 4- and 6-Drive Jukeboxes

BUS 1	LUN Mode OFF		LUN Mode ON	
	ID	LUN	ID	LUN
JKBX ID	6	0	6	0
DRV 1 ID	5	0	6	1
DRV 2 ID	4	0	6	2
DRV 3 ID	3	0	6	3
DRV 4 ID	2	0	6	4
DRV 5 ID*	1*	0*	6*	5*
DRV 6 ID*	0*	0*	6*	6*

* if installed

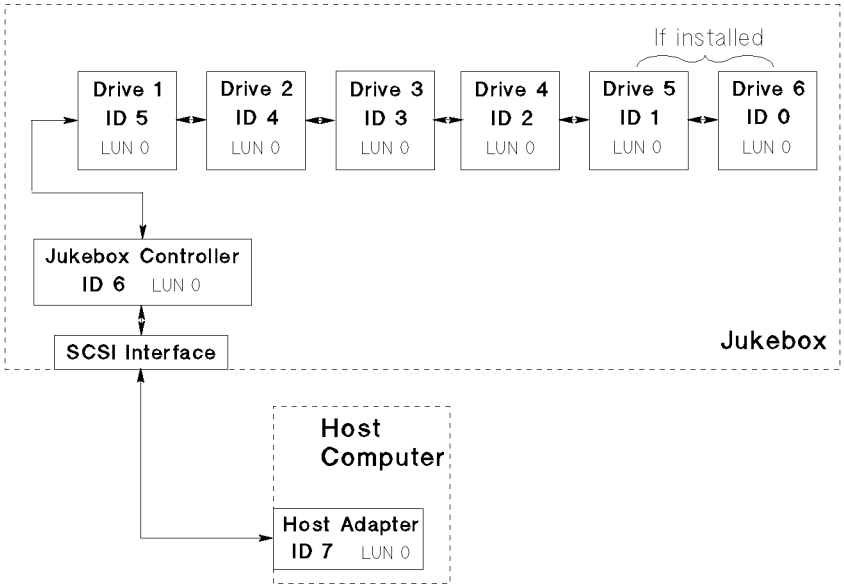
Table 2-3 Default SCSI and LUN Settings in the 10-Drive Jukebox

BUS 1	**LUN Mode OFF**		**LUN Mode ON**	
	ID	**LUN**	**ID**	**LUN**
JKBX ID	6	0	6	0
DRV 1 ID	5	0	6	1
DRV 2 ID	4	0	6	2
DRV 3 ID	3	0	6	3
DRV 4 ID	2	0	6	4
BUS 2	LUN Mode OFF		LUN Mode ON	
	ID	LUN	ID	LUN
DRV 5ID	5	0	5	0
DRV 6 ID	4	0	5	1
DRV 7 ID	3	0	5	2
DRV 8 ID	2	0	5	3
DRV 9 ID	1	0	5	4
DRV 10 ID	0	0	5	5

Table 2-4 LUN Mapping of a 10-Drive Jukebox if "DRVs BUS 1" ID is Changed to an ID Different Than the Jukebox Controller (IDs used are examples)

BUS 1	LUN Mode ON		BUS 2	LUN Mode ON	
	ID	LUN		ID	LUN
JKBX ID	6	0			
DRV 1 ID	5	0	DRV 5ID	4	0
DRV 2 ID	5	1	DRV 6 ID	4	1
DRV 3 ID	5	2	DRV 7 ID	4	2
DRV 4 ID	5	3	DRV 8 ID	4	3
			DRV 9 ID	4	4
			DRV 10 ID	4	5

Figure 2-6 Four or Six Drives, One Host Adapter, Basic SCSI Addressing



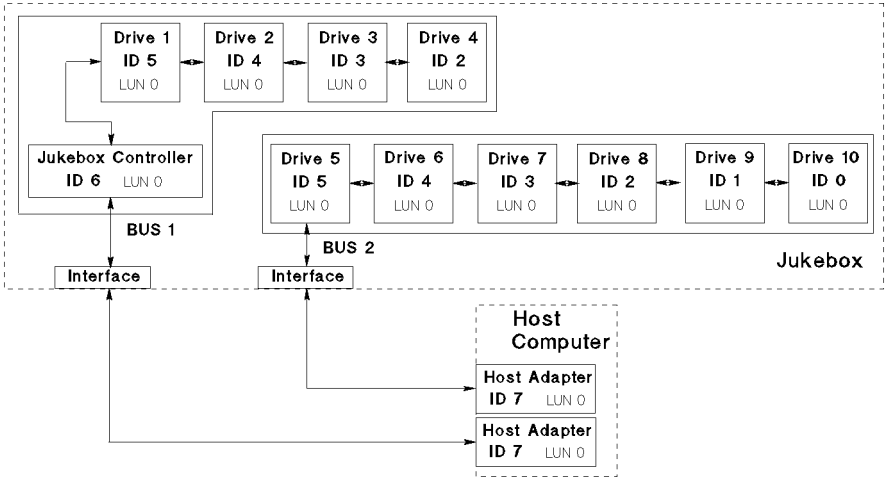
Displays on the Control Panel

Under CHOOSE LUN MODE * menu >> LUN MODE OFF

Under SCSI IDs * > VIEW IDs * >

BUS 1 * >> JXBX ID 6 LUN 0
DRV 1 ID 5 LUN 0
DRV 2 ID 4 LUN 0
DRV 3 ID 3 LUN 0
DRV 4 ID 2 LUN 0
DRV 5 ID 1 LUN 0 (if installed)
DRV 6 ID 0 LUN 0 (if installed)

Figure 2-7 10 Drives, Two Host Adapters, Basic SCSI Addressing



Displays on the Control Panel

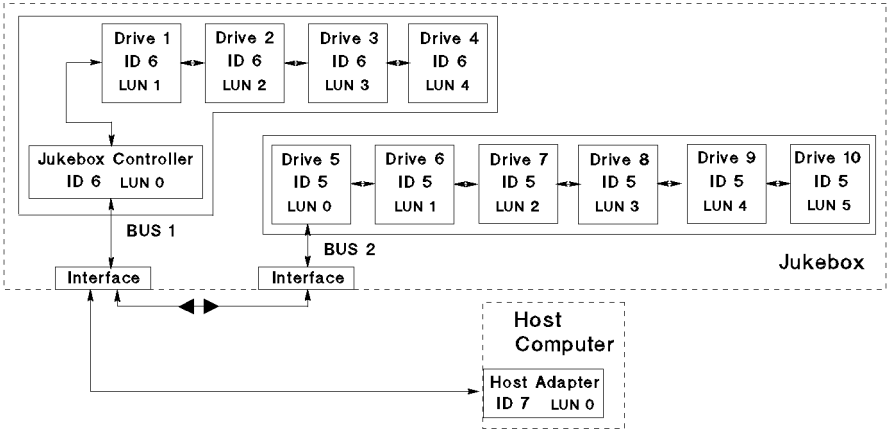
Under CHOOSE LUN MODE * menu >> LUN MODE OFF

Under SCSI IDs * > VIEW IDs * >

BUS 1 * >> JXBX ID 6 LUN 0
DRV 1 ID 5 LUN 0
DRV 2 ID 4 LUN 0
DRV 3 ID 3 LUN 0
DRV 4 ID 2 LUN 0

BUS 2 * >> DRV 5 ID 5 LUN 0
DRV 6 ID 4 LUN 0
DRV 7 ID 3 LUN 0
DRV 8 ID 2 LUN 0
DRV 9 ID 1 LUN 0
DRV 10 ID 0 LUN 0

Figure 2-8 **Ten Drives, One Host Adapter, LUN Addressing, Controller/Drives Use Same IDs**



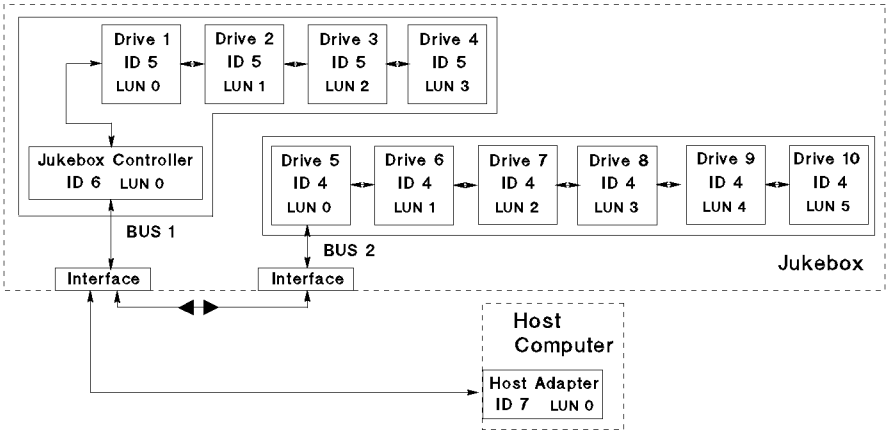
Displays on the Control Panel

Under CHOOSE LUN MODE * menu >> LUN MODE ON

Under SCSI IDs * > VIEW IDs * >

BUS 1 * >> JXBX ID 6 LUN 0
DRV 1 ID 6 LUN 1
DRV 2 ID 6 LUN 2
DRV 3 ID 6 LUN 3
DRV 4 ID 6 LUN 4
BUS 2 * >> DRV 5 ID 5 LUN 0
DRV 6 ID 5 LUN 1
DRV 7 ID 5 LUN 2
DRV 8 ID 5 LUN 3
DRV 9 ID 5 LUN 4
DRV 10 ID 5 LUN 5

Figure 2-9 **Ten Drives, One Host Adapter, LUN Addressing, Controller/Drives Use Different IDs**



Displays on the Control Panel

Under CHOOSE LUN MODE * menu >> LUN MODE ON

Under SCSI IDs * > VIEW IDs * >

BUS 1 * > JXBX ID 6 LUN 0
DRV 1 ID 5 LUN 0
DRV 2 ID 5 LUN 1
DRV 3 ID 5 LUN 2
DRV 4 ID 5 LUN 3

BUS 2 * >> DRV 5 ID 4 LUN 0
DRV 6 ID 4 LUN 1
DRV 7 ID 4 LUN 2
DRV 8 ID 4 LUN 3
DRV 9 ID 4 LUN 4
DRV 10 ID 4 LUN 5

Table 2-5 Possible Additional SCSI Addresses Available

No. of Drives	LUN Mode OFF (basic SCSI addressing)	LUN Mode ON - (drives and jukebox controller use the same ID)[a]	LUN Mode ON - (drives and jukebox controller use different IDs)
4	Two SCSI addresses are available for connecting other devices.	Six SCSI addresses are available for connecting other devices to Bus 1.	Five SCSI addresses are available for connecting other devices to Bus 1.
6	No additional devices can be connected.		
10	Two SCSI addresses are available on Bus 1 and 1 SCSI address is available on Bus 2 for connecting other devices. (In a 10 drive jukebox, four drives are mounted on Bus 1 and 6 drives are mounted on Bus 2.)	If Bus 1 and Bus 2 are daisy-chained, five SCSI addresses are available for other devices. If Bus 1 and Bus 2 are NOT daisy-chained, six SCSI addresses are available on Bus 1 and six SCSI addresses are available on Bus 2.	If Bus 1 and Bus 2 are daisy-chained, four SCSI addresses are available for other devices. If Bus 1 and Bus 2 are NOT daisy-chained, five SCSI addresses are available on Bus 1 and six SCSI addresses are available on Bus 2.

a. Not recommended. This configuration may cause a negotiated slower rate of data transfer.

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 from the front panel.
3. Remove the right side lower access panel by pulling on the bottom of the panel and then lifting it off (see Figure 2-1).

   If screws are installed on the bottom corners of the panel, use a flatblade screwdriver or T-15 Torx driver to remove the screws.
4. Remove the power cord and the SCSI cable connections.
5. Loosen the 1/2-inch nut securing the leveler feet and screw the feet up to raise them away from the floor.
6. Remove the chocks from the four castor wheels on the bottom of the jukebox.

WARNING **Push the jukebox only from the right or left sides. Pushing the jukebox from either the front or back sides could result in the jukebox tipping over if a wheel catches on an obstacle.**

7. Carefully move the jukebox to its new destination.
8. Set up the jukebox at its new location.
9. Lower the leveler feet and tighten the 1/2-inch nut on each foot.
10. Place the wheel chocks around the four caster wheels.
11. 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 the jukebox power off from the front panel.
4. Remove the right side lower access panel by pulling on the bottom of the panel and then lifting it off (Figure 2-1).

   If screws are installed on the bottom corners of the panel, use a flatblade screwdriver or T-15 Torx driver to remove the screws.
5. Remove the power cord and the SCSI cable connections.
6. Loosen the 1/2-inch nut securing each leveler foot and screw the four feet up to raise them away from the floor.
7. Remove the chocks from the four caster wheels on the bottom of the jukebox.

WARNING **Push the jukebox only from the right or left sides. Pushing the jukebox from either the front or back sides could result in the jukebox tipping over if a wheel catches on an obstacle.**

8. Repackage the jukebox in the same way it was received.

3 Operation and Configuration

Overview

The following topics are included in this chapter.

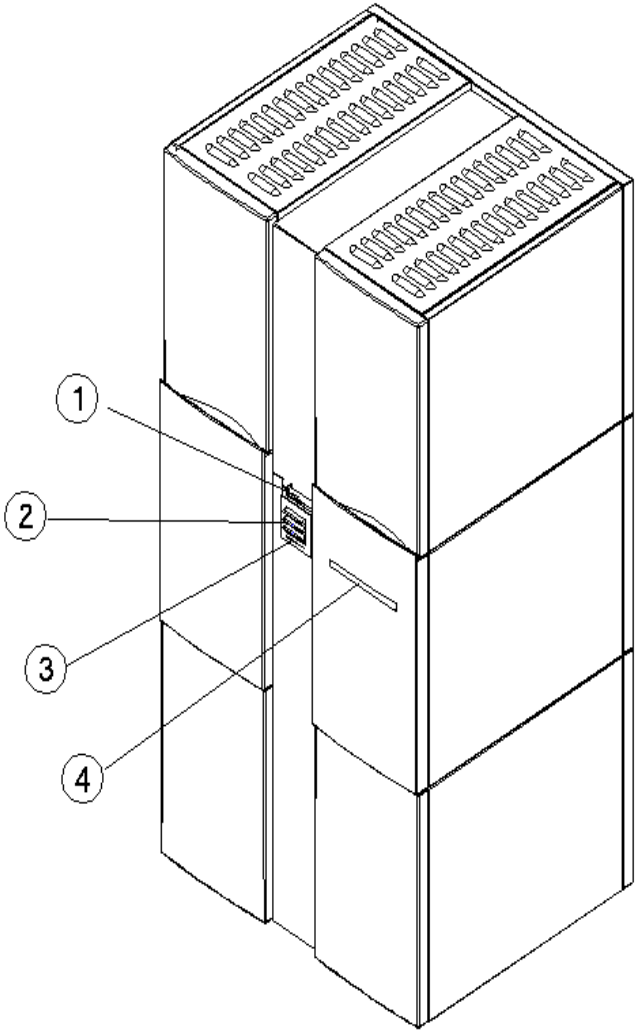
- operating the control panel
- using the selection buttons
- interpreting messages in the display window
- loading optical disks into the jukebox
- ejecting optical disks from the jukebox
- entering the administration menu password
- changing the administration menu password
- setting and changing SCSI IDs or logical unit numbers (LUNs)
- setting an operating configuration

Operating the Control Panel

The control panel enables manual control of all jukebox operations using six buttons and an LED display.

The SCSI IDs of the jukebox and its optical drives can be set and changed, disks may be loaded and ejected, configurations can be monitored and changed, performance information can be viewed, internal tests can be run, and the jukebox can be secured from unauthorized use.

Figure 3-1 The Jukebox Control Panel

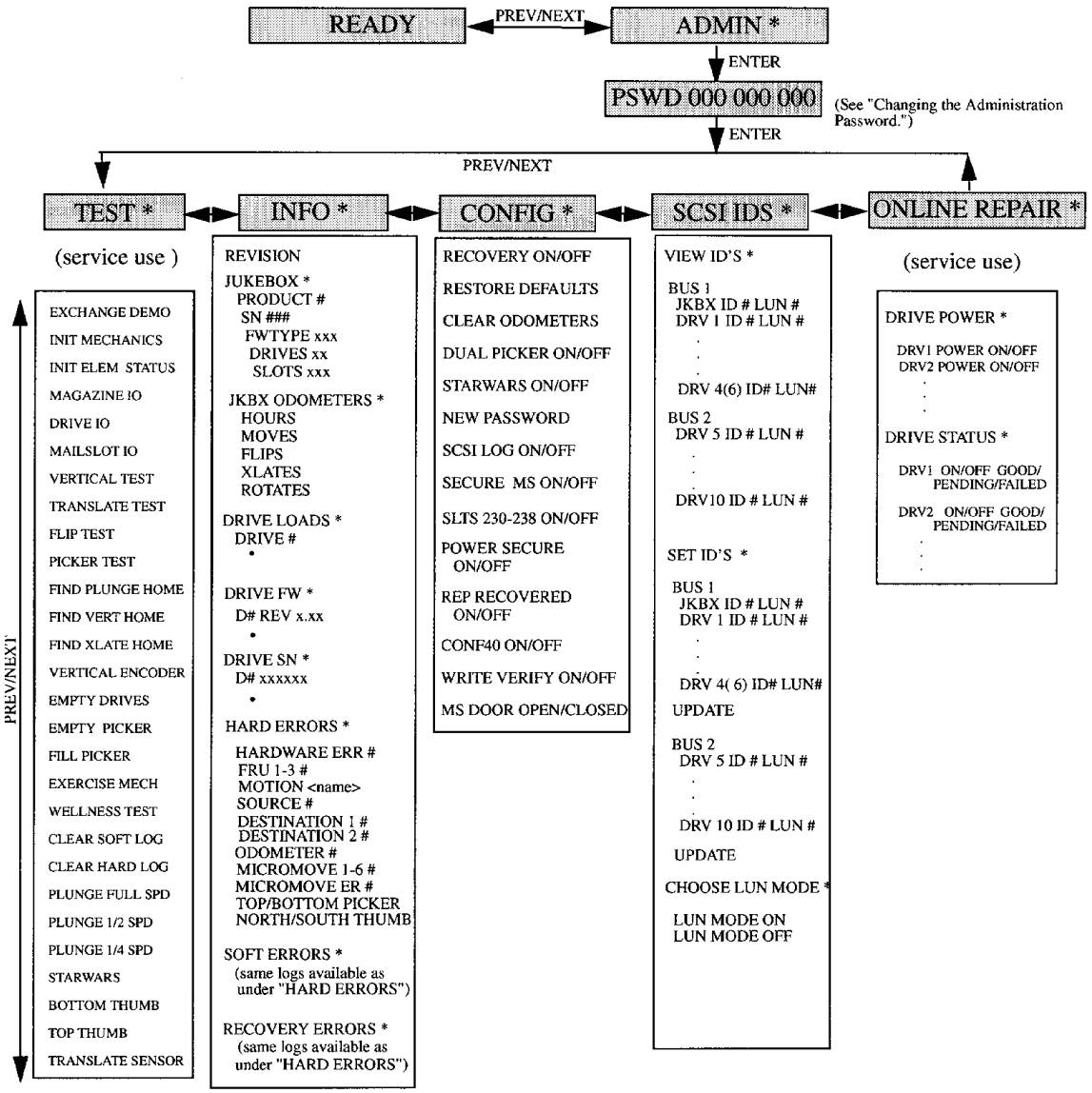


The numbers below refer to the numbers in Figure 3-1 on the previous page.

1	16-Character Display	Displays status information and control panel information
2	Selection buttons	Pressed to perform the following operations: **LOAD** used to load disks into the jukebox mailslot **EJECT** used to eject disks from the jukebox mailslot **PREV** scrolls the display choice backward by one **NEXT** scrolls the display choice forward by one **CANCEL** cancels the current operation or choice **ENTER** selects the displayed choice
3	Activity light	Lit differently to indicate the following: • Steady Green - power is on • Flashing Green - an optical drive is being accessed • Amber - a fault occurred
4	Mailslot	Used to load and eject optical disks

NOTE Figure 3-2 shows the jukebox menus available using the control panel selection buttons.

Figure 3-2 Jukebox Display Menu Tree



Using Selection Buttons

Use the **LOAD**, **EJECT**, **NEXT**, **PREV**, **CANCEL**, and **ENTER** buttons to select tasks. When you push these buttons, 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 choice appears.

- An "*" in the message indicates there is a menu beneath that choice, which you can access by pressing the **ENTER** key.
- Additional choices can be displayed by pressing the **NEXT** or **PREV** key.
- The display scrolls faster by holding the **NEXT** or **PREV** key.

NOTE

You can get 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 display window shows the operations you may select. Instructions for selecting or changing choices follows the explanation of the messages.

Top Level Menus

`READY`	The jukebox is ready for operation.
`ADMIN *`	Select to access second-level choices. You must enter a security code to access these choices.

NOTE

A * indicates that there are multiple selections available for that choice currently displayed. When a choice is flashing, press **ENTER** to select it or **PREV** or **NEXT** to display other choices.

Second Level Menus

A security code is required to access these functions. See “Entering the Administration Menu Password” on page 13. A default password of `000 000 000` is set at the factory. The customer should consider changing this default code to a new, private code to prevent unauthorized access to the jukebox. See “Changing the Administration Menu Password” in this chapter.

`TEST *`	Select to run internal tests.
`INFO *`	Select to retrieve performance information stored in the jukebox logs.
`CONFIG *`	Select to customize the way the jukebox functions.
`SCSI IDs *`	Select to view and/or change the SCSI IDs and logical unit numbers (LUNs).
`ONLINE REPAIR *`	Select to view and change drive settings for online drive replacement.

NOTE

When a menu selection flashes, press **ENTER** to choose that selection, or press **PREV** or **NEXT** to display other choices that available in that part of the menu.

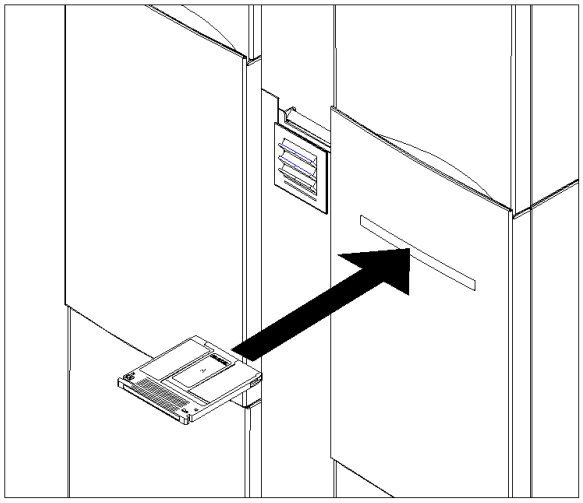
You can display the selections listed in boxes below the *shaded* choices in "Jukebox Display Menu Tree" on page 6 by pressing **ENTER** when one of the shaded choices displays. Press **PREV** or **NEXT** to scroll through the list. To perform the displayed operation, press **ENTER**.

Loading a Disk

Start with READY, LOAD * or EJECT * *in the display*.

1. Press **LOAD** on the jukebox control panel. (If none of these messages displays, press **CANCEL** until READY displays.)

Figure 3-3 Loading a Disk



2. When the mailslot opens, insert a disk into the mailslot with Side A of the disk facing up. The shutter end of the disk goes in the mailslot first.

   When the disk is inserted, it is automatically pulled into the mailslot. An incorrectly inserted disk is rejected, CART IN WRONG displays briefly, and then LOAD SLOT # displays. ("#" is flashing and is the number of the first available storage slot in the jukebox.)

3. To select the storage slot number that shows in the display, press **LOAD** or **ENTER**. To choose a different storage slot, press **NEXT** or **PREV** until the desired slot number displays, and then press **ENTER**.

4. LOADING displays as the jukebox moves the disk to the slot. After the disk is loaded into the selected storage slot, the display returns to LOAD *. Load additional disks by repeating steps 2 and 3.

5. Press **CANCEL** to return to the READY state.

Ejecting a Disk

Start with READY, LOAD * or EJECT * *in the display*.

1. Press **EJECT** on the jukebox control panel.
2. EJECT SLOT # displays. ("#" is flashing and the number of the first storage slot in the jukebox that contains an optical disk.)
3. If you want to select the storage slot number that shows in the display, press **EJECT** or **ENTER**. If you want to choose a different storage slot, press **NEXT** or **PREV** until the desired slot number displays and then press **ENTER**.

   EJECTING displays as the jukebox moves the disk to the mailslot. When the disk is in the mailslot, the display returns to EJECT SLOT #.
4. Remove the disk from the mailslot.

   You may now eject additional disks by pressing the **EJECT** or **ENTER** key and then following steps 2 through 4 until you are finished ejecting disks. When the last disk is ejected, EMPTY displays briefly before returning to EJECT *.
5. Press **CANCEL** to return to the READY state.

Entering the Administration Menu Password

`READY > ADMIN * > PSWD 000 000 000`

A numeric password is required to access choices in the `ADMIN *` menu (see Figure 3-2). A three-part password of 000-000-000 was set at the factory. The customer may have set a new password. Coordinate with the system administrator, if necessary, to access choices in the `ADMIN *` menu.

The following steps describe how to enter the password. For your reference, a description of changing the password is in "Changing the Administration Menu Password" on page 14. Changing the password is an operation normally used only by the customer.

Start with `READY` *in the display*.

1. Press **NEXT** until **ADMIN *** displays.
2. Press **ENTER**. `PSWD 000 000 000` displays and the first set of three zeros flashes.

NOTE

If the default password, `000 000 000`, is still in effect, accept this password by pressing **ENTER** three times (once for each set of three zeros). `TEST *` displays which indicates you are in the menu tree below `ADMIN *`.

Entering a private password is described in steps 3-5 below. You may have to coordinate with the system administrator to enter this password.

3. Press **NEXT** or **PREV** until the first number of the password displays. Press **ENTER**. The middle set of three zeros flashes.
4. Press **NEXT** or **PREV** until the second number of the password displays. Press **ENTER**. The third set of three zeros flashes.
5. Press **NEXT** or **PREV** until the third number of the password displays. Press **ENTER**. `TEST *` displays.

To access menu choices under the `ADMIN *` menu press **NEXT** or **PREV** or until the desired choice displays, and then press **ENTER**.

Changing the Administration Menu Password

`READY > ADMIN * > PSWD 000 000 000 >CONFIG *`

NOTE The following procedure is normally a customer operation.

1. Follow the steps on the previous page to enter the password (or the default, factory-set password `000 000 000`).
2. `TEST *` displays. Press **NEXT** until `CONFIG *` displays, and then press **ENTER**.
3. Press **NEXT** or **PREV** or until `NEW PASSWORD` displays and then press **ENTER**.
4. `NEW 000 000 000` displays and the first set of three zeros flashes. Press **NEXT** or **PREV** until the new number you want to assign to the first part of the password displays and then press **ENTER**. The second set of three zeros flashes.
5. Press **NEXT** or **PREV** until the new number you wish to assign to the second part of the password displays and then press **ENTER**. The third set of three zeros flashes.
6. Press **NEXT** or **PREV** until the new number you wish to assign to the third part of the password displays and then press **ENTER**.
7. `PASSWORD CHANGED` displays. Press **CANCEL** three times to return to `READY`

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 device when the bus is active can result in data loss and/or indeterminate bus states. You may have to check the host system manuals for information about checking the SCSI bus status. If the jukebox is connected to a LAN, be sure to check with the system administrator before turning off power

to the jukebox.

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

Setting the SCSI IDs

Tables showing default SCSI IDs for basic SCSI addressing and LUN addressing are in Chapter 2, “Installation.”

Setting the LUN Mode

```
READY > ADMIN * > SCSI ID'S * > CHOOSE LUN MODE *
```

NOTE LUN mode can only be configured if the host system and jukebox application software support the use of LUNs.

Start with READY *in the display*.

1. Press **NEXT** until ADMIN * displays and then press **ENTER**.
2. Enter the administration password.

   You may have to coordinate with the system administrator to enter the password.
3. Press **NEXT** until SCSI ID'S displays, and then press **ENTER**.
4. VIEW ID'S displays. Press **NEXT** until CHOOSE LUN MODE * displays and then press **ENTER**. LUN MODE ON or LUN MODE OFF displays and ON or OFF is blinking.
5. Press **NEXT** to change the setting and then press **ENTER**. WAIT FOR UPDATE and then TURNED OFF or TURNED ON display briefly. Then SCSI ID'S displays.

   You may now view the SCSI ID and LUN numbers using VIEW ID'S, or set a new SCSI ID number using SET ID'S.

Viewing the Current SCSI IDs

```
READY > ADMIN * > SCSI ID'S * > VIEW ID'S >
                                              BUS 1*
                                              BUS 2*
```

Start with READY *in the display*.

1. Press **NEXT** until ADMIN * displays, and then press **ENTER**.
2. Enter the administration password.

   You may have to coordinate with the system administrator to enter the password.
3. Press **NEXT** until SCSI ID'S displays, and then press **ENTER**.
4. VIEW ID'S displays. Press **ENTER**.
5. BUS 1 * displays. If you want to view the IDs on Bus 1, press **ENTER**.

   If you want to view the IDs on Bus 2, press **NEXT** until BUS 2 * displays and then press **ENTER**.
6. JKBX ID # LUN # or DRV # ID # LUN # displays. (JKBX ID # stands for the current ID of the jukebox controller, DRV # ID # is the current ID setting of the displayed drive number, and "LUN #" is the current logical unit number.)

   Press **NEXT** or **PREV** to scroll through the current SCSI IDs and LUNs.

NOTE Tables showing default SCSI IDs for basic SCSI addressing and LUN addressing are in Chapter 2, "Installation."

7. Press **CANCEL** twice to exit VIEW ID'S.

Changing the Current SCSI IDs

READY > ADMIN * > SCSI ID'S * > SET ID'S *

Start with READY *in the display*.

1. Press **NEXT** until ADMIN * displays, and then press **ENTER**.
2. Enter the administration password.

   You may have to coordinate with the system administrator to enter the password.
3. Press **NEXT** until SCSI ID'S displays, and then press **ENTER**.
4. VIEW ID'S displays. Press **NEXT** until SET ID'S displays and then press **ENTER**.

BUS 1 * displays. If you want to change the IDs on Bus 1, press **ENTER**.

If you want to change the IDs on Bus 2, press **NEXT** until BUS 2 * displays and then press **ENTER**.

If the jukebox configuration uses basic SCSI addressing (LUN mode OFF):

JKBX ID # LUN # or DRV # ID # LUN # displays. (JKBX ID # stands for the current ID of the jukebox controller, LUN # is the current logical unit number, and DRV # ID # is the current ID setting for the displayed drive number.) When using basic SCSI addressing, the LUN # is always 0.

If the jukebox configuration uses LUN addressing (LUN mode ON):

JKBX BUS 1 # or DRVs BUS 1 # displays on Bus 1, or DRVs BUS 2 # displays on Bus 2. ("#" is the current ID for the jukebox controller and drives when LUN mode is ON.)

5. Press **NEXT** until the setting you wish to change displays, and then press **ENTER**. The # (current ID) begins flashing.

NOTE

This jukebox, by default, assigns ID 6 to the jukebox controller. When in LUN mode, the jukebox controller ID uses LUN 0 for itself and assigns the drives on Bus 1 to LUNs 1 to 4 or LUNs 1 to 6 depending on whether there are four or six drives on Bus 1 in the jukebox. In the default configuration, two types of devices, controller and drives, are assigned to ID 6.

Some host computer systems do not allow assigning different device types to the same ID. If the host computer system does not support multiple device types at the same ID and the customer will use LUN mode, select *different* IDs for the jukebox controller (JKBX ID #) and the drives (DRV #).

Tables near the end of Chapter 2 show jukebox default settings and an example of setting the jukebox controller and drives to different IDs, one digit apart.

Placing a device ID between the jukebox controller ID and the ID for the drives can cause bus management problems. For this reason, the jukebox *will not accept* IDs for the jukebox controller and drives that are more than one digit apart. An attempt to set IDs more than one digit apart will

cause a CONFLICT message.

6. Press **NEXT** or **PREV** until the desired ID displays and then press **ENTER**.

   If the jukebox is set to LUN MODE ON, go to Step 8. Only one ID can be changed and the ID automatically updates when you press **ENTER**.

7. (If using basic SCSI addressing - LUN mode OFF) Press **NEXT** until UPDATE displays, and then press **ENTER**.

8. UPDATE or WAIT FOR UPDATE and then ID'S SAVED displays briefly.

   - If the new settings do not conflict with other SCSI IDs on the bus, SCSI ID'S displays.
   - If the new settings conflict with other IDs on the SCSI bus, CONFLICT-ABORTED displays briefly and then VIEW ID'S displays. Any changes entered are lost, and you must repeat steps 3 through 6 to set a new ID.

NOTE

When in LUN mode:
If the new ID chosen results in the IDs for the jukebox controller and the drives being more than one digit apart, the jukebox displays CONFLICT and rejects the ID.

9. Press **CANCEL** until READY displays.

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 device 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. If the jukebox is connected to a LAN, be sure to check with the system administrator before turning off power to the jukebox.

10. Turn the jukebox OFF, then ON to save the IDs to the jukebox flash ROM.

Setting an Operating Configuration

READY > ADMIN * > CONFIG *

Configurations customize the way the jukebox operates.

Start with READY *in the display*.

1. Press **NEXT** until ADMIN * displays.
2. Enter the administration password.

   You may have to coordinate with the system administrator to enter the password.
3. TEST * displays. Press **NEXT** until CONFIG * displays, and then press **ENTER**.
4. Press **NEXT** or **PREV** until the name of the configuration you want to set displays and then press **ENTER**. (Configurations are described on the following pages.)

   If the configuration has multiple settings, the current setting flashes. Otherwise, the configuration is set and a confirmation message displays.
5. If the current configuration setting is flashing, press **NEXT** or **PREV** until the desired setting displays, and then press **ENTER**. OPTION SAVED displays and then the configuration's name and setting displays.
6. Press **CANCEL** to return to READY.

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 device 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. If the jukebox is connected to a LAN, be sure to check with the system administrator before turning off power to the jukebox.

7. Turn the jukebox OFF, then ON to save the configuration to the

jukebox flash ROM.

Configurations are described in the following table.

Table 3-1 Configuration Choices

Configuration Name	Description
RECOVERY ON/OFF	Toggles between ON and OFF. If set to ON, the jukebox attempts to recover from errors. If set to OFF, the jukebox immediately stops moving if an error condition occurs. The default configuration is RECOVERY ON, and recovery should remain ON under normal conditions.
RESTORE DEFAULTS	Sets all jukebox configurations to default settings.
CLEAR ODOMETERS	Sets all jukebox odometers to zero.
DUAL PICKER ON/OFF	Toggles between ON and OFF. If set to ON, the jukebox runs with dual picker addressing ON. If set to OFF, the jukebox runs with dual picker addressing OFF. The default setting is DUAL PICKER ON and this mode should remain ON under normal conditions. Single and dual-picker addressing is described in Chapter 6 on page 6-18.
STARWARS ON/OFF	Toggles between ON and OFF. If set to ON, the vertical sensors are enabled. If set to the vertical sensors are disabled The default configuration is ON and should remain ON during normal operation.
NEW PASSWORD	Allows changing the numerical password required to access the menu choices under the ADMIN * menu on the jukebox control panel. Menu choices include configurations, tests, and information logs. To change the security code, see “Changing the Administration Menu Password” on page 14.

Table 3-1 Configuration Choices

Configuration Name	Description
SCSI LOG ON/OFF	Toggles between ON and OFF. If set to ON, SCSI states are tracked and saved to a log. If set to OFF, SCSI states are not tracked or saved. The default configuration is OFF and should remain OFF during normal operation.
SECURE MS ON/OFF	Toggles between ON and OFF. If set to ON, loading and ejecting disks is disabled. If set to OFF, loading and ejecting disks is enabled. The default configuration is ON.
SLTS 230-238 ON/OFF	Toggles between ON and OFF. If set to ON, Slots 230 to 238 are made accessible to a software application. If set to OFF, slots 230 to 238 are made unavailable; slot 229 becomes the last available slot. The default configuration is ON This configuration accommodates applications that do not support slots 230 to 238.
POWER SECURE ON/OFF	Toggles between ON and OFF. If set to ON, the selection of the SECURE MS configuration is retained through power cycling (or power outage). If set to OFF, the jukebox returns to the default setting of this configuration after a power cycling. The default setting of this configuration is OFF).
REP RECOVERED ON/OFF	Toggles between ON and OFF. If set to ON, recovered errors are reported. If set to OFF, recovered errors are not reported. Default setting is ON.
CONF40 ON/OFF	Toggles between ON and OFF. If set to ON, Select Inquiry Mode ON selects standard inquiry mode. If set to OFF, Select Inquiry Mode ON selects downloadable inquiry mode. Default is OFF.

Table 3-1 Configuration Choices

Configuration Name	Description
WRITE VERIFY ON/OFF	Toggles between ON and OFF. If set to ON, write verify is forced. When set to OFF, the drives may write verify or not, depending on how they are manually configured or how they are configured by the jukebox application software. The default configuration is ON.
MS DOOR OPEN/CLOSED	Toggles between OPEN and CLOSED. If set to OPEN, the mailslot door always remains open. If set to CLOSED, the mailslot door remains open for ten seconds after disks are loaded or ejected, automatically closes when the mailslot is empty, and does not reopen until the **LOAD** button is pressed.

4 Troubleshooting and Diagnostics

Overview

This chapter gives information in the following topics:

- troubleshooting using the control panel
- recovery procedures for operating/installation errors
- recovery procedures for specific hardware errors
- micro-move error codes
- description of robotic micro-moves
- running internal tests

Troubleshooting Using the Control Panel

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

- Troubleshooting Using the Control Panel and Observation - used when there is a hard error.
- Troubleshooting Through the SCSI Bus - used when there is an intermittent, recoverable error.

Obtaining Troubleshooting Information

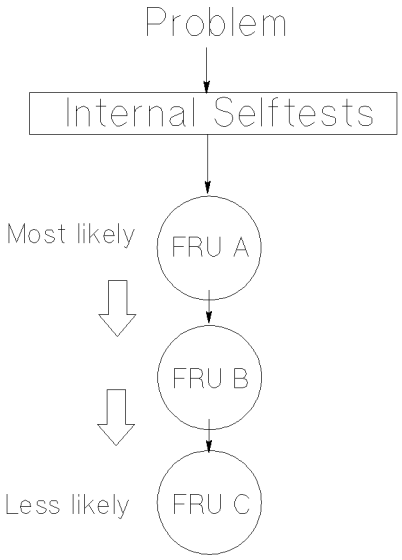
Error information is available through both control panel and though the SCSI bus, using an external diagnostic tool.

In most instances, running internal tests and reading error logs in the control panel display will be enough to troubleshoot problems in the jukebox.

List of Possible Suspect FRUs

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

Figure 4-1 **Suspect FRUs**



How Suspect FRUs Are Evaluated

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

The hard move error that caused the robotics to run the FRU isolation test may only be a product of the actual problem. Blindly and repeatedly replacing the suspect FRU(s) will not reliably solve a problem.

If you consider the suspect FRU as a pointer to the problem area rather than the problem itself, an educated visual inspection should reveal the real problem.

A good visual inspection requires an understanding of how the jukebox normally operates. To understand what the robotics do in normal operation, run the various movements available from the control panel and watch it closely. Reading the descriptions in the “Micro-Move ID” table in this chapter will also help you understand the small moves that comprise jukebox operation.

Recovery Procedures for Operation/Installation Errors

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 4-1 Troubleshooting

Problem	What to do
Jukebox won't power on.	• Ensure that power cord connections are tight. • Ensure that the power switch is on (located on the lower right side of the jukebox rear panel). • Ensure that the power outlet is operating. • Ensure that at least one drive fan is plugged into each interposer PCA (if eight- or ten-drive jukebox). Requires removal of the two lower right-side panels and the lower RFI panel (see Figure 5-1). • Replace the power cord with a known good one. • Check for an inoperable power supply.
Jukebox power fails or is interrupted.	• Take any action, as directed, by the customer's application software. • If no other actions are directed by the application software, unmount and remount all disk surfaces when power returns. *Do not eject any disks until the surfaces are unmounted / unreserved.*

Table 4-1 Troubleshooting

Problem	What to do
Host computer power fails or is interrupted, but the jukebox power remains on.	Usually you will not have to intervene unless the customer's jukebox application specifies some action. Ensure that a the customer's application or you do a file system check (*fsck* or equivalent) on any write-mounted surfaces after the host reboots. Do not eject any disks until the surfaces are unmounted/unreserved
Both host computer system and jukebox power fails or is interrupted.	Same as "Host computer power fails" on previous page.
Host does not recognize the jukebox	• Ensure that the jukebox is supported on the host operating system. • Ensure that the jukebox is installed and configured as described in the user's guide and the appropriate host system manuals. • Check the SCSI connections. • Check the SCSI interface address as it relates to the device files. • Power cycle the jukebox, let it come `READY` and then reboot the host.
Poweron selftest failed and `DEVICE FAILED` displays	• Power cycle the jukebox.* • If the poweron test continues to fail, press **ENTER**, record the displayed error code. Refer to Table 4-2, "The following table shows the hardware error codes possible and recovery procedures for specific hardware errors." for corrective action.

Table 4-1 Troubleshooting

Problem	What to do
DEVICE FAILED displays. Hardware Error #61 (External SCSI cables) is reported.	• Ensure that only one SCSI device type (single-ended OR differential) exists on the SCSI bus. • Verify that the SCSI interface selection switch is set correctly (either single-ended or differential). • Verify that the terminator is the correct type (single-ended or differential). • Run the WELLNESS TEST. Record any errors and refer to Table 4-2, "The following table shows the hardware error codes possible and recovery procedures for specific hardware errors." for corrective action.
**Ensure that the SCSI bus is inactive* before removing power to the jukebox. Removing power to a device on an active SCSI bus can cause data loss and/or problems with the SCSI interface.	
Power to the jukebox failed while a disk was in the drive and the display did not return to READY after the power came back on.	• Power cycle the jukebox.* • If READY does not display (poweron test is unsuccessful), display the error code and refer to Table 4-2, "The following table shows the hardware error codes possible and recovery procedures for specific hardware errors." for corrective action.

Table 4-1 Troubleshooting

Problem	What to do
No display messages.	• Ensure that the power cord is connected. • Ensure that the power switch is on. • Ensure that at least one drive fan is plugged into each interposer PCA (if eight- or ten-drive jukebox). Requires removal of the two lower right-side panels and the lower RFI panel (see Figure 5-1). • Power cycle the jukebox.* • If problem remains, remove the rear panels (see Chapter 5, Figure 5-1) and check the connections to the display PCA. Power cycle the jukebox.* • If problem remains, consider changing the display PCA, controller PCA, and cables in that order.
Changed the drive ID but the new ID isn't recognized.	• Ensure that the new drive ID was saved (procedure was completed). • Ensure that the ID is not a duplicate of another ID on the bus. • Power cycle the jukebox.* (Some computers require a restart to recognize new SCSI IDs.)
**Ensure that the SCSI bus is inactive* before removing power to the jukebox. Removing power to a device on an active SCSI bus can cause data loss and/or problems with the SCSI interface.	
Customer forgot the password.	Restore the factory default settings: • Hold down the **ENTER** and **NEXT** key while power cycling the jukebox* or • Download the base code of the jukebox.

Table 4-1 Troubleshooting

Problem	What to do
Disk inserted in the mailslot but `LOAD ERROR` or `FAILED` displays.	• Press **CANCEL**. Insert the disk in the mailslot again. See "Loading an Optical Disk into the Jukebox" in this chapter for the correct disk loading orientation. • If the light bar on the front panel is orange, cycle power to the jukebox.* Try to load the disk again when `READY` displays. • Check to see if the mailslot rotates in. If the mailslot does not rotate in, the mailslot cabling or sensors may be the cause. Remove the mailslot assembly and check the mailslot cabling (refer to Chapter 5, "Replacing the Mailslot Assembly"). If the cables are good, replace the mailslot assembly.
Disk inserted in the mailslot but `RESERVED` displays	The `SECURE MS` configuration is set. Disks cannot be loaded. • If appropriate, change this setting. See "Setting an Operating Configuration" in Chapter 3. The current administration password is required.
Disk inserted in the mailslot but `MAILSLOT EMPTY` displays	The mailslot sensors do not detect a disk in the mailslot. • Remove and reinsert the disk. If the same error reappears, the mailslot sensors may be defective.
**Ensure that the SCSI bus is inactive* before removing power to the jukebox. Removing power to a device on an active SCSI bus can cause data loss and/or problems with the SCSI interface.	

Table 4-1 Troubleshooting

Problem	What to do
Disk inserted in the mailslot but `DEST NOW FULL` displays	The jukebox moved a disk into the slot you chose before your load command executed. • Press **CANCEL**, select another slot for the disk, and then reattempt a load. • If the jukebox is not in use, run `INIT ELEM STATUS`. Refer to Table 4-2, "The following table shows the hardware error codes possible and recovery procedures for specific hardware errors." for corrective actions.
Disk inserted in the mailslot but `TRANSPORT FULL` displays	The disk transport mechanism already contains a disk. • Select `EJECT`. If the disk is not ejected from the transport mechanism and you receive the same error, run the `EMPTY PICKER TEST`. • If problem remains, refer to the host and application documentation for recovery procedures.
Disk inserted in the mailslot but `MAILSLOT SENSOR` displays	The jukebox mailslot sensors may have failed. • Remove and then re-insert the disk. • If problems remain, check the mailslot sensors.
Disk eject attempted but an `EJECT ERROR` message displays.	• Press **CANCEL**. Attempt to eject the disk again. • If the light bar on the front panel is orange, cycle power to the jukebox* and try to eject the disk again when `READY` displays. • If there is no disk in the mailslot and this error message repeats, check the connections to the mailslot.

Table 4-1 Troubleshooting

Problem	What to do
**Ensure that the SCSI bus is inactive* before removing power to the jukebox. Removing power to a device on an active SCSI bus can cause data loss and/or problems with the SCSI interface.	
Disk eject attempted but `RESERVED` displays.	The jukebox application software reserved the element for its use or a security configuration was set to prevent disk ejection. • If appropriate, change this setting See "Setting an Operating Configuration" in Chapter 3. The current administration password is required.
Disk eject attempted but `EMPTY` and then `EJECT *` displays.	This is not an error. There are no disks in the jukebox.
Disk eject attempted but `TRANSPORT FULL` displays.	The disk transport mechanism already contains a disk. • Run the `EMPTY PICKER TEST`. • If problem remains, refer to the host and application documentation for recovery procedures.
Disk eject attempted but `SOURCE NOW EMPTY` displays.	The application software moved the disk from the slot you chose before your eject command executed. • Press **CANCEL**. You may have to wait for the application to replace the disk into the slot before attempting another eject. • If the jukebox is not in use, run `INIT ELEM STATUS`. Refer to Table 4-2, "The following table shows the hardware error codes possible and recovery procedures for specific hardware errors." for corrective actions.

Table 4-1 Troubleshooting

Problem	What to do
Disk eject attempted but `MAILSLOT FULL` 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.
**Ensure that the SCSI bus is inactive* before removing power to the jukebox. Removing power to a device on an active SCSI bus can cause data loss and/or problems with the SCSI interface.	
You want to stop a test that is running.	Press **CANCEL**. The current test loop continues until finished, then the test stops.
`RUN ISTAT TEST` displays (this initializes the element status)	`RUN ISTAT TEST` initializes the element status. • Run the `INIT ELEM` STATUS test from the TEST *menu. • Power cycle the jukebox.* • If the same display occurs, run the `WELLNESS TEST`. Do general troubleshooting.
Can't write to the disk.	• Check the host file system access permissions. • Eject the disk and check that the write-protect tab on each side of the disk is in the write-enabled position. • Ensure that the disk is either a 2.6 Gb or 5.2 Gb disk. • Check the application software. • Run online/offline diagnostics on drive.
**Ensure that the SCSI bus is inactive* before removing power to the jukebox. Removing power to a device on an active SCSI bus can cause data loss and/or problems with the SCSI interface.	

Recovery Procedures for Specific Hardware Errors

When a hardware failure occurs, a message displays on the control panel. If the failure occurs during the poweron sequence, `DEVICE FAILED` displays. If the failure occurs when loading a disk you may see `LOAD ERROR`, or `FULL`. If a failure occurs while you are running a test, `TEST FAILED` displays. When you press **ENTER**, the jukebox displays information about the hardware failure from the error log.

The jukebox firmware can detect broken components such as a dead motor, but if failures are due to marginal or random problems, the failing component may induce errors in other components. For example, if the electronics produce an intermittent error or if friction increases on a part, different components of the jukebox may appear to fail. Several error codes may be displayed as a result of one problem.

The following table shows the hardware error codes possible and recovery procedures for specific hardware errors.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
01 ROM checksum error	Errors 01 to 07 are only possible on powerup. errors only possible on powerup. Replace the controller PCA.
02 Register error	See error 01.
03 Microprocessor error	See error 01.
04 Controlled area of RAM checksum error	See error 01.
05 RAM test error	See error 01.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
06 SCSI chip error	See error 01.
07 Jukebox controller chip error	See error 01.
0F	ID configuration module failure. Occurs if: • A configuration module for another model of jukeboxes is installed • Theconfiguration module was removed while power was on • the configuration module chip failed during periodic polling Check the SLOTS display under INFO * / JUKEBOX * menu for correct number of slots detected for the jukebox.
10	Invalid drive configuration. Occurs if the following is detected: • 8 drives • 10 drives but *not* with 4 drives on the top interposer and 6 drives on the bottom interposer • 12 drives
11 Drive serial communications failure	1. Check that the drive communication cable to the interposer PCA is firmly connected. 2. Change the affected drive.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
1E Translate motor error	Cannot translate the picker and/or sense that it has moved. 1. Run FIND XLAT HOME test from the control panel. 2. If the picker does not move at all, check the connections on the umbilical cable. If the connections are good and the picker still does not move, change the umbilical cable. 3. If the picker moves a little but does not reach the side of the frame, the translate motor on the picker is probably defective. Change the picker. 4. If the picker moves properly to the side, the translate sensor is probably defective. Change the picker.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
1F Vertical motor error	Occurs when trying to sense a move of the carriage assembly. 1. If the translate assembly moves -- and you get a failure -- that means that we're not reading the encoder strip. Make sure the encoder strip is inside sensor. 2. If the translate assembly doesn't move -- it probably is the motor leads, motor, or 24-volt power supply. a. Make sure the motor leads are connected to the vertical motor. b. Check that the cable from the sensor is connected through the translate frame to the umbilical cable for the picker. c. Change the vertical motor. d. Change the 24-volt power supply. 3. Change the controller PCA.
20 Plunge motor error	1. Change the jukebox controller PCA 2. Change the picker 3. Check the plunge motor leads
28 Mailslot sensor error	1. Run the Mailslot I/O Test to see if sensors are registering or if they are intermittent 2. Check the mailslot-to-interposer cable. 3. Change the interposer PCA. 4. Change the mailslot.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
2B Top thumb sensor error	1. Change the picker. 2. Change the umbilical cable. 3. Change the controller PCA.
2C Bottom thumb sensor error	1. Change the picker. 2. Change the umbilical cable. 3. Change the controller PCA.
32 Invalid test number	User error.
33 Invalid configuration	User error. There might not be enough cartridges in the jukebox.
34 Need to initialize element status	Run Init Elem Status.
35 Exercise test failed	Run Exercise test again, watch where it fails. Continue troubleshooting from the movement/operation that failed.
36 Elements reserved	User error. The host probably has the jukebox elements reserved.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
3C Move to	Vertical motion failed in the middle of a move or exchange 1. Look at the micro-move error of the failure in the error log (under INFO *, and Hardware Error in the control panel display). Also check the Source and Destination entries in the error log to verify what move was in process. 2. Make sure the encoder strip is inside sensor 3. Make sure the motor leads are connected to the vertical motor. 4. Check that the cable from the sensor is connected through the translate from to the umbilical cable for the picker.
3D Flip	Change the picker.
3E Translate	Change the picker.
3F Put cartridge in	Failed plunging cartridge into a slot 1. Look at the micro-move error of the failure in the error log (under INFO * and Hardware Error in the control panel display). 2. Check that the picker assembly looks normal and is in the proper orientation. 3. Check that the picker is in the proper height with respect to the storage slot and that the vertical encoder strip is not damaged.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
40 Get cartridge out	Failed extracting a cartridge from a slot. 1. Look at the micro-move error of the failure in the error log (under INFO * and Hardware Error in the control panel display). 2. Check that the picker assembly looks normal and is in the proper orientation. 3. Check that the picker is in the proper height with respect to the storage slot and that the vertical encoder strip is not damaged.
41 Test magazine	Failed testing the magazine portion during an ISTAT. 1. Look at the micro-move error of the failure in the error log (under INFO * and Hardware Error in the control panel display) 2. Check that the picker assembly looks normal and is in the proper orientation. 3. Check that the picker is in the proper height with respect to the storage slot and that the vertical encoder strip is not damaged.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
42 Put cartridge in a drive	Failed inserting a cartridge into a drive. 1. Look at the micro-move error of the failure in the error log (under INFO * and Hardware Error in the control panel display). 2. Remove rear panel and run the Wellness Test, Drive I/O test, and Exercise Mechanics test. Note where the problem occurs. If indicates the drive, change the drive. If it indicates a picker error, change the picker.
43 Get cartridge from a drive	Failed extracting a cartridge from a drive. 1. Look at the micro-move error of the failure in the error log (under INFO * and Hardware Error in the control panel display). 2. Remove rear panel and run the Wellness Test, Drive I/O test, and Exercise Mechanics test. Note where the problem occurs. If indicates the drive, change the drive. If it indicates a picker error, change the picker.
44 Test drive	1. Look at the micro-move error of the failure in the error log (under INFO * and Hardware Error in the control panel display). 2. Remove rear panel and run the Wellness Test, Drive I/O test, and Exercise Mechanics test. Note where the problem occurs. If indicates the drive, change the drive. If it indicates a picker error, change the picker.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
45 Put mailslot in	1. Cycle power to the jukebox to initiate a poweron test sequence. 2. Check to see if mailslot rotation works. If the mailslot rotates in, change the picker. If the mailslot does not rotate in, change the mailslot.
46 Get mailslot out	1. Cycle power to the jukebox to initiate a poweron test sequence. 2. Check to see if mailslot rotation works. If the mailslot rotates in, change the picker. If the mailslot does not rotate in, change the mailslot.
47 Test mailslot	1. Cycle power to the jukebox to initiate a poweron test sequence. 2. Check to see if mailslot rotation works. If the mailslot rotates in, change the picker. If the mailslot does not rotate in, change the mailslot.
48 Rotate mailslot in	1. Cycle power to the jukebox to initiate a poweron test sequence. 2. Check to see if the mailslot rotates. If the mailslot rotates in, change the picker. If the mailslot does not rotate in, change the mailslot.
49 Rotate mailslot out	1. Cycle power to the jukebox to initiate a poweron test sequence. 2. Check to see if mailslot rotation works. If the mailslot rotates in, change the picker. If the mailslot does not rotate in, change the mailslot

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
4A Test picker	This may appear when testing for a cartridge in the picker during an ISTAT. Replace the picker.
4B Switch active picker	1. Check for loose cables 2. Replace the picker.
4C Restore picker	1. Check for loose cables 2. Replace the picker.
4D Find translate home	Cannot translate the picker and/or sense that it has moved. 1. Run FIND XLAT HOME test from the control panel. 2. If the picker does not move at all, check the connections on the umbilical cable. If the connections are good and the picker still does not move, change the umbilical cable. 3. If the picker moves a little but does not reach the side of the frame, the translate motor on the picker is probably defective. Change the picker. 4. If the picker moves properly to the side, the translate sensor is probably defective. Change the picker.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
4E Find vertical home	Because a motor test is called before a "find vertical home" is attempted, the vertical motor is assumed to be at least minimally functional 1. Check that the vertical path is physically clear. 2. Make sure that the cartridges are fully inserted into their slots. 3. Change the vertical motor.
4F Find plunge home	Change the picker.
50 Clear flip area	The vertical path is probably blocked and the picker might be falsely overforcing. 1. Check that the path is clear. 2. Exercise and visually check the operation of the vertical motor.
51 Clear magazine path	1. Check that the path from the picker to the magazine is clear. 2. Check that the vertical path is clear. 3. Test the vertical path sensor operation.
52 Clear drive path	1. Check that the path from the picker to the drive is clear. 2. Check that the vertical path is clear. 3. Test the vertical path sensor operation.
53 Clear mailslot path	1. Check that the path from the picker to the drive is clear. 2. Check that the vertical path is clear. 3. Test the vertical path sensor operation.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
5B Finish switching the picker	Change the picker.
5C Wait plunge	Change the picker.
5D Wait vertical	Vertical motion failed in the middle of a move or exchange. 1. Look at the micro-move error of the failure in the error log (under INFO * [Hardware Errors] in the control panel display). Also check the Source and Destination entries in the error log to verify what move was in process. 2. Make sure the encoder strip is inside sensor. 3. Make sure the motor leads are connected to the vertical motor. 4. Check that the cable from the sensor is connected through the translate from to the umbilical cable for the picker.
5E Powerfail clear path	1. Check that all paths are clear. 2. Test the vertical path sensor operation.
5F Powerfail restore cartridges	A cartridge was physically moved after powerfail and before powerfail recovery. Check that no cartridges have been moved.

Table 4-2 Hardware Errors Verification/Recovery

Error Code (hex)	Verification/Recovery Procedures
60 Repeater Controller	1. Check cables between the controller PCA and the SCSI repeater PCA. 2. Check the external cables. 3. Change repeater PCA. 4. Change the controller PCA. 5. Change internal SCSI cable
61 External SCSI cables	1. Check for correct terminator (single-ended or differential) for the type of SCSI interface chosen. 2. Check that single-ended / differential slide switch is selecting desired interface. 3. Change external SCSI cable. 4. Change SCSI repeater PCA. 5. Change the controller PCA

Micro-Move Error Codes

Table 4-3 Micro-Move Error Codes

Micro-Move Error Code (hex)	Description
01	Vertical over voltage exceeded limit set by firmware
02	Vertical over force exceeded limit set by firmware
03	Vertical servo error
04	Vertical time-out
05	Vertical open path
06	Vertical closed path
0A	Plunge over voltage exceeded limit set by firmware
0B	Plunge over force exceeded limit set by firmware
0C	Plunge servo error
0D	Plunge servo error
0E	Plunge open path
0F	Plunge closed path
10	Top picker expected to be active picker in plunge (run-time)
11	Bottom picker expected to be active picker in plunge (run-time)
12	Bottom thumb expected to be active in plunge home (powerup)
13	Top thumb expected to be active in plunge home (powerup)
14	Translate over voltage exceeded limits set by firmware

Table 4-3 Micro-Move Error Codes

Micro-Move Error Code (hex)	Description
15	Translate over force exceeded limits set by firmware
16	Translate servo error
1E	No load complete
1F	Unexpected load complete
20	Unexpected cartridge in drive
21	No cartridge in drive
22	Drive put in accept failed
23	Drive get out accept failed
24	Drive eject failed
25	Drive insert failed
26	Drive eject retry
27	Drive insert retry
28	Clear drive path
29	Drive signal (not used)
2A	Drive not connected
32	Magazine put in saturate failed
33	Magazine get out saturate failed
34	Magazine put in accept failed
35	Magazine get out accept failed
36	Magazine measure failed
37	Test magazine failed
38	Return magazine failed

Table 4-3 Micro-Move Error Codes

Micro-Move Error Code (hex)	Description
39	Clear magazine path
3C	Mailslot put in saturate failed
3D	Mailslot get out saturate failed
3E	Mailslot put in accept failed
3F	Mailslot get out accept failed
40	Measurement of mailslot depth failed
41	Recovery did not clear vertical path
42	Rotate mailslot in failed
43	Rotate mailslot out failed
46	Flipped too far
47	Did not flip far enough
48	Flip side incorrect
50	Failed to finish a translate
51	Extra force needed to translate
5A	Command received to rotate mailslot but both pickers are full
5B	Back sensor in mailslot is bad
5C	Front sensor in mailslot is bad
5D	Command received to eject from the mailslot, but both pickers are full
5E	Attempt to load from an empty mailslot
5F	Engaging the mailslot failed on a rotate in
60	Disengaging the mailslot failed on a rotate in

Table 4-3 Micro-Move Error Codes

Micro-Move Error Code (hex)	Description
61	Rotate in catch error (not used)
62	Rotate in push out error (not used)
63	Rotate in armed failed (not used)
64	Did not detect hard stop on a rotate in
65	Rotate in was too much distance
66	Engaging the mailslot failed on a rotate out
67	Disengaging the mailslot failed on a rotate out
68	Did not detect hard stop on a rotate out
69	Rotate out distance was too short
6A	Could not move thumbs out of the vertical path after a rotate out
6B	Vertical distance difference detected after error recovery
6C	Cartridge in mailslot incorrectly at rotate in

Description of the Robotic Micro-Moves

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
1	Move picker transport up. Fast.
2	Move picker transport down. Fast.
3	Move picker transport up slowly, checking for resistance. Used in the vertical find home sequence.
4	Move picker transport down slowly, checking for resistance. Used in the vertical find home sequence.
5	Move a small amount upward to relieve tension in the servos. Used after finding “home” in the vertical find home sequence.
6	Make a small vertical movement as a plunge is made into a drive. Used to “wiggle” the picker during error recovery.
8	Move picker transport up to the top of the jukebox, checking for a clear path. Used in the vertical find home sequence.
9	Move picker transport to the bottom of the jukebox, checking for a clear path. Used in the vertical find home sequence.
11	Move slowly up far enough to establish that there is enough room to flip the picker. Used in the plunge find home sequence.
12	Move slowly down far enough to establish that there is enough room to flip the picker. Used in the plunge find home sequence.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
13	Move slowly to the flip clear area (determined in micro-moves 11 and 12). Used in the plunge find home sequence. Also used in power fail recovery to move the picker off of a cartridge that was between the picker and the magazines when the power failed and the picker settled.
14	Move slowly downward to the flip clear area (determined in micro-moves 11 and 12). Used in the plunge find home sequence.
15	Move vertically to restore the picker to the position it had before an error (and error recovery, occurred. Only called in error recovery.
16	Move up. Used in the motor test during powerup.
17	Move down. Used in the motor test during powerup.
62	Move slowly to one side of the translate frame. Used to find translate home during powerup. Movements after powerup use the translate home ID, 63.
63	Move to one side of the translate frame. Used to find translate home.
67	Move a short distance back from the plunge position where an overforce shutdown error occurred. Relaxes the tension.
68	Retract the plunge assembly on the picker all the way back to find “home” in the plunge axis. May start a flip, depending on starting position. (One of three plunge find homes in the sequence; 68, 69, 6A).
69	Retract the plunge assembly on the picker all the way back and flip the picker at the same time. Used to find “home” in the plunge axis. (One of three plunge find homes in the sequence; 68, 69, 6A).

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
6A	Retract the plunge assembly on the picker all the way back and then flip the picker. Used to find "home" in the plunge axis. Second flip of the sequence. (One of three plunge find homes in the sequence; 68, 69, 6A).
6B	Plunge toward magazine to get cartridge.
6C	First time plunge into magazine (first "get"). Feels for resistance to learn the distance to the cartridge when it is seated.
6D	Retraction to pull the cartridge out of the magazine.
6F	First part of a two-step move to put a cartridge into a magazine. Puts the cartridge nearly all the way in. Next part of move is micro-move 70.
70	Second part of a two-step move to put a cartridge into a magazine. Continues movement of micro-move 6F and puts the cartridge in the rest of the way (the distance learned in micro-move 6C).
71	First time plunge into a magazine (first "put"). Feels for resistance to learn the distance to the cartridge when it is seated.
72	Retract picker plunge assembly after putting cartridge into a magazine. Assembly is retracted just far enough that the thumbs are clear of the picker vertical path.
75	First part of a two-step plunge move to put a cartridge into a drive. Cartridge is inserted to a point where the drive shutter arms start to engage.
76	First time "put" plunge into a drive. Slow. Feels for resistance to learn the distance to the cartridge when it is seated.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
77	First time “get” plunge into a drive. Slow. Feels for resistance to learn the distance to the cartridge when it is seated.
78	Fast “put” plunge into a drive (distance has been previously learned).
79	Retract picker plunge assembly after putting cartridge into drive. Assembly is retracted just far enough to that the thumbs are clear of the picker vertical path.
7C	(Used in an emergency cartridge eject). Plunge toward a drive, stopping at a position close to the drive. This the wait position until the drive ejects the cartridge.
7D	(Used in an emergency cartridge eject). Plunge to contact and get the cartridge from the drive. Follows micro-move 7C.
7E	Log ID (no motion). Logs that picker is in position in front of drive, waiting for the drive to eject the cartridge.
7F	Plunge forward to get cartridge from the drive. Thumbs wrap over the ears on the cartridge.
80	Retract a small amount o take up the slack between the picker thumbs and the cartridge ears.
81	Retract plunge assembly fully back into the picker.
83	Flip during plunge when cartridge is in the top picker.
84	Flip during plunge when cartridge is in the bottom picker.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
87	Short plunge out to test for a cartridge in the picker. If a cartridge is in the picker, the path clear beam will be interrupted. Used in an ISTAT.
88	Short plunge out to test for a cartridge in a magazine when the picker contains a cartridge. If resistance is felt, this is interpreted as a cartridge in the magazine. Used in an ISTAT.
89	Retract picker plunge assembly into the picker after executing micro-move 88. Used in an ISTAT.
8A	Short plunge to test for a cartridge in a drive when the picker contains a cartridge. If resistance is felt, this is interpreted as a cartridge in the drive. Used in an ISTAT.
8B	Plunge out. Used in error recovery. Is an attempt to push a cartridge out of the vertical picker path and into a magazine.
8C	Retract thumbs back into the picker. Used in error recovery. Is an attempt to pull a cartridge out of the vertical picker path and into the picker. Either this micro-move or micro-move 8D is used, depending on position of the picker at the start of recovery.
8D	Retract thumbs back into the picker. Used in error recovery. Is an attempt to pull a cartridge out of the vertical picker path and into the picker. Either this micro-move or micro-move 8C is used, depending the on the position of the picker at the start of recovery.
8E	Move picker plunge assembly out to rearm the picker mechanism before switching active picker.
8F	Retract picker plunge assembly to a point just short of tripping the thumb selection mechanism. First of two steps (second step is micro-move 90).

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
90	Retract picker fingers all the way back. Trips the mechanism that makes the opposite thumb "active."
91	Move picker plunge assembly forward, away from the full retracted position. Clears the tripping mechanism and makes the new thumb "active."
92 to 95	Factory use only. Does not run in normal operating code.
98 to 9F	Factory use only. Does not run in normal operating code.
A2	First of two plunge movements toward the drive during error recovery. Vertical movement is done before the second part of this movement (micro-move A3) is done.
A3	Second of two plunge movements toward the drive during error recovery. Done after a small vertical movement is done to "wiggle" the picker.
A4	Plunge out. Is an attempt to clear the vertical picker path during drive error recovery.
A5	Retract picker. Is an attempt to clear the vertical picker path during drive error recovery.
A5	First part of a two-step move to fully retract the picker plunge assembly. Retract assembly almost all the way back. Next part of move is micro-move A6.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
A6	Second part of a two-step move to fully retract the picker plunge assembly. Continues movement of micro-move A5 and brings picker plunge assembly all the way back.
A7	Move picker plunge assembly forward a small amount from full retracted position. Completes rearm of the picker mechanism.
A8	Move to a position where the picker thumb sensor can be read. Used in the find plunge home recalibration.
A9	Move to a position where the current active picker can be read. Used in the plunge home recalibration.
AA	Fully retract picker plunge assembly to switch the active picker. One of three moves used to make the top picker the active picker during a picker recalibration.
AB	Move picker plunge assembly forward a small amount to complete the rearm of the picker mechanism. One of three moves used to make the top picker the active picker during a picker recalibration.
AC	Move picker plunge assembly forward to normal position after a active picker has been change by micro-moves AA and AB. One of three moves used to make the top picker the active picker during a picker recalibration.
AD	Move the picker plunge assembly a small amount away from the flip mechanism so that the mechanism is rearmed for a flip. Used in a flip sequence.
AE	Move the picker plunge assembly out a small amount from the full retracted position to relieve the pressure on the mechanism after a flip.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
AF	First of two moves to move the thumb to the magazine during an ISTAT when no cartridge is in the picker. Next move is micro-move B0.
B0	Second of two moves to move the thumb to the magazine during an ISTAT when no cartridge is in the picker. Slow move to check for an overforce (cartridge in the magazine slot).
B1	Retract picker plunge assembly back into the picker to a point where the thumbs can unsplay. Used during an ISTAT, with no cartridge in the picker, when the thumbs are splayed and are they must be unsplayed.
B2	Retract picker plunge assembly into the picker to a point just short of where the thumbs would be released and unsplay. Used during an ISTAT, with no cartridge in the picker, when the thumbs are splayed and must be kept splayed.
B3	Retract picker plunge assembly back far enough to release the thumbs and let them go to an unsplayed position. Used during an ISTAT, and the thumbs are being returned to an unsplayed position after contacting, grabbing, and replacing the first cartridge.
B4	Retract picker plunge assembly into the picker to a point just short of where the thumbs would be released and unsplay. Used during an ISTAT, and the thumbs are being retained in the splayed position after contacting, grabbing, and replacing the first cartridge.
B5	Retract picker plunge assembly far enough to get the thumbs out of the vertical picker path. Used during an ISTAT, no cartridge in the picker, and no cartridge was contacted in the first magazine.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
B6	Pull picker plunge assembly fully back to rearm a “put.” Enable the picker to replace the cartridge it picked up during an ISTAT.
B7	First of two moves that put a cartridge back into the magazine after the cartridge is detected during an ISTAT. Moves the cartridge almost fully into the magazine. Followed by micro-move B8.
B8	Second of two moves that put a cartridge back into the magazine after the cartridge is detected during an ISTAT. Moves the cartridge fully into the magazine.
B9	Second of two moves to test for the presence of a cartridge in a magazine during an ISTAT when there is a cartridge in the picker. Slow move to check for an overforce (cartridge in the magazine slot). Follows micro-move BA.
BA	First of two moves to test for the presence of a cartridge in a magazine during an ISTAT when there is a cartridge in the picker. Fast plunge that places the cartridge and the picker close to the magazine. Followed by micro-move B9.
BB	Testing for media in picker. After the physical force check.
BC	Retract picker plunge assembly after detecting a cartridge in the drive. Used in an ISTAT when there is a cartridge in the picker.
BD	Retract picker plunge assembly to a point just short of where the thumbs would be released from their splayed position. Used if thumbs are splayed after checking magazines in an ISTAT.
BE	Retract picker plunge assembly after inserting a cartridge into a drive.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
BF	Quickly retract the picker plunge assembly if an error occurred while inserting a cartridge into a drive.
C0	Retract picker plunge assembly to a point where the thumbs are released and go to an unsplayed position. Used in an ISTAT.
C1	Insert cartridge into a drive, just past the shutters. Distance has not been learned.
C2	Insert cartridge into a drive, just past the shutters. Distance has not been learned. Part one of a two-stage move. Used in the sequence to return a cartridge into a drive after an emergency eject during an ISTAT.
C3	Insert cartridge into a drive, just past the shutters. Distance has been learned. Part one of a two-stage move. Used in the sequence to return a cartridge into a drive after an emergency eject during an ISTAT.
C4	Insert cartridge fully into a drive. Distance HAS been learned. Part two of a two-stage move. Used in the sequence to return a cartridge into a drive after an emergency eject during an ISTAT.
C5	Insert cartridge fully into a drive. Distance HAS been learned. Additional push in case the drive acknowledge signal was not seen. Used in the sequence to return a cartridge into a drive after an emergency eject during an ISTAT.
C6	Insert cartridge fully into a drive. Distance HAS been learned. Part two of a two-stage move. Used in the sequence to return a cartridge into a drive after an emergency eject during an ISTAT.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
C7	Retract picker to rearm position to splay the fingers. Used when an error in the drive acknowledge signal is seen and a drive eject will be done and the thumbs must be in the splayed position.
C8	Plunge thumbs out close to the end of the picker to get ready to “get” a cartridge. Done at the same time as vertical moves and in-transit translates and flips.
C9	Same as micro-move C8 but is a retry (if needed)
CB	Retract picker plunge assembly back far enough to clear the thumbs from the vertical picker path. Used after a cartridge is put in the mailslot.
CC	Plunge out to clear the mailslot path. Distance has not been learned. Used in error recovery.
CD	Short plunge out to fully seat a cartridge in the mailslot and to measure the distance of a fully-inserted cartridge.
CE	Plunge out to clear the mailslot path. Used in error recovery.
CF	Retract picker plunge assembly in an attempt to clear the mailslot path. Used in error recovery.
DO	Short plunge to push the cartridge to a fully seated position during a “get” to the mailslot. Distance is learned.
D1	Short plunge during a mailslot “put.” Ducks under the mailslot rotation mechanism and positions the picker so it can move up all the way to mailslot insertion position.
D2	Short plunge to put the cartridge all the way into the mailslot.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
D3	Short plunge during a mailslot “get”. Ducks under the mailslot rotation mechanism and positions the picker so it can move up all the way to the mailslot “get” position.
D4	Plunge to get the cartridge from the mailslot.
D5	Retract cartridge most of the way into the picker. Positions the picker so that it can duck under the mailslot rotation mechanism during a “get.”
D6	Continue retraction in micro-move D5. Pull cartridge all the way back into the picker.
D7	Retract thumbs to a point just inside the picker. Used to clear the vertical picker path during error recovery.
D8	Plunge to a position where the mailslot rotation actuator can be pulled in.
D9	Plunge to a position where the mailslot rotation actuator can be pushed out.
DA	Move picker plunge assembly to a position where the mailslot rotation actuator can be engaged to rotate the mailslot out. Used when the state of the mailslot is unknown and must be placed in a known state.
DB	Retract the picker plunge assembly a short distance to clear the thumbs away from the mailslot after rotating the mailslot out.
DC	Slow retract of the picker plunge assembly, pulling the mailslot in. Checks that the cartridge is in properly. First move of a rotate in.
DD	Retract thumbs back into the picker after rotating the mailslot out.

Table 4-4 Micro-Move IDs and Expanded Descriptions

Micro-Move ID (hex)	Description
E1	First of two moves rotating the mailslot in. Quickly retract the picker plunge assembly, pulling the mailslot most of the way in. Followed by micro-move E3.
E2	Plunge out to rotate the mailslot almost all the way out.
E3	Short retraction of the picker plunge assembly until pressure is felt. Used at end of rotating the mailslot in and ensures that the mailslot has been rotated fully in.
E4	Short plunge out to relieve the pressure after rotating the mailslot in.
E5	Short plunge out, feeling for pressure, to ensure that the mailslot is rotated all the way out.
E6	Retract picker plunge assembly a short distance to relieve the pressure after micro-move E5.
E7	On powerup, testing for motion in one direction on the plunge motor.
E8	On powerup, testing for motion in the plunge motor. Opposite direction than in micro-move E7.
E9	Plunge out to clear the picker vertical path. Used when path is blocked during powerup.
EA	Picker plunge assembly retraction to clear the picker vertical path. Used when path is blocked during powerup.

Running an Internal Test

`READY > ADMIN * >TEST *`

Start with `READY` *in the display*.

1. Press **NEXT** until `ADMIN *` displays.
2. Enter the administration password.

   You may have to coordinate with the system administrator to enter the password.I
3. `TEST *` displays. Press **ENTER**.
4. Press **NEXT** until the name of the test you wish to run displays and then press **ENTER** to start the test.

NOTE You may press **CANCEL** at any time to abort a test. A delay may occur while the current test loop completes.

Table 4-5 Internal Tests

Test Name	Description
EXCHANGE DEMO	*Do not run this test if the jukebox contains disks with customer data.* This test moves randomly-chosen optical disks to random storage slot locations. This test displays FAIL if there are no disks in the jukebox or if all storage slots are full. For best results, the jukebox should contain as many disks as there are drives, plus two additional disks. The transport and mailslot must be empty.
INIT MECHANICS	Runs the `FIND PLUNGE HOME`, `FIND VERTICAL HOME`, `FIND XLATE HOME`, and `INIT ELEM STATUS` tests. Each test is run one time per test loop.

Table 4-5 Internal Tests

Test Name	Description
INIT ELEM STATUS	Physically scans the entire unit to determine which storage slots contain disks and if the drives contain disks. NOTE: This test appears as “ISTAT TEST” in all control panel error messages.
MAGAZINE IO	Makes a combination of moves with a PASS/FAIL result. It moves an optical disk from a randomly-chosen full slot to a randomly-chosen empty slot with a random flip. It then moves the disk back to its original storage slot with its original orientation. This test displays FAIL if there are no disks in the jukebox or if all storage slots are full. The drives and mailslot must be empty.
DRIVE IO	Makes a combination of moves with a PASS/FAIL result. It moves an optical disk from a randomly- chosen full slot to a randomly-chosen drive with a random flip. It then moves the cartridge back to its original slot with its original orientation. This test displays FAIL if there are no disks in the jukebox or if all storage slots are full. The drives and mailslot must be empty.
MAILSLOT IO	Makes a combination of moves with a PASS/FAIL result. It moves an optical disk 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. This test displays FAIL if there are no disks in the jukebox or if all storage slots are full. The drives and mailslot must be empty.
VERTICAL TEST	Moves the disk transport mechanism up and down the full length of the rail. Returns PASS/FAIL. No disks are required.

Table 4-5 Internal Tests

Test Name	Description
TRANSLATE TEST	Moves the disk transport mechanism from side to side. No disks are required.
FLIP TEST	Makes a combination of moves with a PASS/FAIL result. Flips the disk transport mechanism at various locations. No disks are required.
PICKER TEST	Flips the disk transport mechanism and switches active thumbs. No disks are required.
FIND PLUNGE HOME	Calibrates the disk transport mechanism, establishes the mechanism's orientation, and determines the reference points in the picker travel path. Assumes that the mechanics and servo system are functional. No disks are required.
FIND VERT HOME	Recalibrates the vertical position of the disk transport mechanism and verifies that the vertical path is clear. No disks are required.
FIND XLATE HOME	Calibrates the reference points for the side-to-side motion of the disk transport mechanism. No disks are required.
VERTICAL ENCODER	Moves the disk transport mechanism down to the lower stop, moves it back up a short distance, and then moves it back down. On the second downward motion the number of digital pulses is counted and verified. Returns PASS/FAIL. No disks are required.
EMPTY DRIVES	*Do not run this test if the jukebox contains disks with customer data.* Moves disks out of the drive mechanism(s) and returns them to their home storage slot locations if the locations are known. If the home storage location is not known, the jukebox moves the disks into the first available empty storage slot.

Table 4-5 Internal Tests

Test Name	Description
EMPTY PICKER	*Do not run this test if the jukebox contains disks with customer data.* Moves a disk from the disk transport mechanism to its home storage slot location if that location is known, otherwise the disk is placed into the first available empty storage slot.
FILL PICKER	*Do not run this test if the jukebox contains disks with customer data.* Moves a disk into the disk transport mechanism from the first storage slot containing a disk. This test must be run twice to fill both containers in the disk transport mechanism.
EXERCISE MECH	Runs the VERTICAL TEST, TRANSLATE TEST, FLIP TEST, MAGAZINE IO, DRIVE IO, and MAILSLOT IO tests. Each test runs one time per test loop.
WELLNESS TEST	Checks the general capability of the jukebox. Requires one loaded disk. The drives, transport, and mailslot must be empty. Runs `INIT MECHANICS` and `EXERCISE MECHANICS`. Each test runs one time per test loop.
CLEAR SOFT LOG	Sets the soft error log to zero.
CLEAR HARD LOG	Sets the hard error log to zero.
PLUNGE FULL SPD	Allows the disk transport mechanics to run at full speed. This setting should always be used in normal jukebox operation.
PLUNGE 1/2 SPD	Allows the disk transport mechanics to run at half speed.
PLUNGE 1/4 SPD	Allows the disk transport mechanics to run at quarter speed.

Table 4-5 Internal Tests

Test Name	Description
STARWARS	The display shows `0 0 0`. Each "`0`" indicates one of the paths that the disk transport mechanism follows in front of each stack of optical disks. If the path is clear, a "`0`" displays; if the path is blocked (because of an optical disk that is not inserted fully into its storage slot for example), an "`*`" will be displayed. This display is automatically updated if the status changes.
BOTTOM THUMB	Reports `THUMB A`, `THUMB B`, or `NO THUMB`. Looks at the top and bottom thumb sensors and reports whether the thumbs on the disk transport mechanism are in the forward or back position. If `THUMB A` or `THUMB B` is returned, the specified thumb is the forward position. If `NO THUMB` is returned, both thumbs are in the back position.
TOP THUMB	Reports `ON` or `OFF`. Looks at the top thumb sensor which reports whether or not the thumb that is currently on the top side of the disk transport mechanism is in the forward position. If `ON` is reported the thumb is in the back position; if `OFF` is reported the thumb is in the forward position.
TRANSLATE SENSOR	Reports `ON` or `OFF` after checking the translate calibration sensor. (Display automatically updates if the status changes.)

Retrieving Log History

READY > ADMIN * > INFO *

Information stored in the jukebox operating logs is displayed by using the
INFO * menu.

Start with READY *in the display*.

1. Press **NEXT** until ADMIN * displays.
2. Enter the administration password.

   You may have to coordinate with the system administrator to enter the password.
3. TEST * displays. Press **NEXT** until INFO * displays, and then press **ENTER**.
4. Press **NEXT** until the name of the log you want to access displays and then press **ENTER**. (An "*" indicates that there are more selections beneath the displayed choice.)
5. After you are finished viewing log information, press **CANCEL** to return to READY.

   Information logs are described in the following table.

Table 4-6 Information Logs

Log Name	Description
REVISION	Jukebox firmware version number.
JUKEBOX *	Press **ENTER** to select the information described in the next five rows.
product #	Product identification string
SN #	Serial number of the unit.
FW TYPE ##	Type of firmware used in the unit.
DRIVES #	Number of drives in the unit.
SLOTS #	Number of available storage slots in the unit.

Table 4-6 Information Logs

Log Name	Description
JKBX ODOMETERS *	Press **ENTER** to select the odometer logs described in the next five rows.
HOURS	Number of operation hours (time the power was on). Some of the time may be while in power reduction mode.
MOVES	Total moves and move attempts by the disk transport mechanism.
FLIPS	Total disk transport mechanism flips.
XLATES	Total disk transport mechanism horizontal moves.
ROTATES	Total mailslot rotations.
DRIVE LOADS *	Press **ENTER** to select the logs under this selection.
DRIVE #	Total disk loads for the drive numbered "#."
DRIVE FW *	Press **ENTER** to select the logs under this selection.
D# REV x.xx	Drive firmware revision code. "D#" is the drive number and x.xx is the code. Press **NEXT** or **PREV** to select drive numbers.
DRIVE SN *	Press **ENTER** to select the logs under this selection.
D# xxxxxxx	Serial number of the drive where "#" is the drive number. Press **NEXT** or **PREV** to select drive numbers.

Table 4-6 Information Logs

Log Name	Description
HARD ERROR *	Log of unrecoverable errors (commands that did not successfully complete). Returns either NO HARD ENTRIES or ENTRY #. There may be multiple hard error numbers. Press **ENTER** to view the log for the currently displayed error, or press **NEXT** to select the next error. Log entries are described in the rows following RECOVERY ERROR * in this table)
SOFT ERROR *	Log of recovered errors (commands that complete successfully). Returns either NO SOFT ENTRIES or ENTRY #. There may be multiple soft error numbers as a result of multiple error recoveries. Press **ENTER** to view the log for the currently displayed error, or press **NEXT** to select the next error. Log entries are described in the rows following RECOVERY ERROR * in this table.
RECOVERY ERROR *	Log of errors during the most recent move. Returns either NO ENTRIES or the number of recovery errors. Press **ENTER** to view the log for the currently displayed error, or press **NEXT** to select the next error. Log entries are described in the following rows.
*HARDWARE ERR #	Internal diagnostics error number.
*FRU 1 #	Field replaceable unit most likely to be at fault.
*FRU 2 #	Field replaceable unit second most likely to be at fault.

Table 4-6 Information Logs

Log Name	Description
*FRU 3 #	Field replaceable unit third most likely to be at fault.
MOTION <name>	<name> indicates one of the following types of movements taking place in the jukebox at the time of the failure: • EXCHANGE • MOVE • POSITION • INIT ELEM • REZERO • ROTATE • DIAGNOSTIC • RESTORE
SOURCE #	Element number where the move started.Valid for MOVE, EXCHANGE, and POSITION movements only.
DESTINATION 1 #	Element where the move was directed first.Valid for MOVE and EXCHANGE movements only.
DESTINATION 2 #	Element where the move was directed second. Valid for the EXCHANGE movement only.
ODOMETER #	Move number in which the error occurred.
*MICROMOVE 1 #	First jukebox micro-move for the original move command issued prior to the failure.
*MICROMOVE 2 #	Second jukebox micro-move for the original move command issued prior to the failure.
*MICROMOVE 3 #	Third jukebox micro-move for the original move command issued prior to the failure.

Table 4-6 Information Logs

Log Name	Description
*MICROMOVE 4 #	Fourth jukebox micro-move for the original move command issued prior to the failure.
*MICROMOVE 5 #	Fifth jukebox micro-move for the original move command issued prior to the failure.
*MICROMOVE 6 #	Sixth jukebox micro-move for the original move command issued prior to the failure. This is the last micro-move logged.
*MICROMOVE ER #	Micro-move error that occurred.
TOP or BOTTOM PICKER	Displays either TOP or BOTTOM indicating which side of the disk transport mechanism was active at the time of the error.
NORTH or SOUTH THUMB	Displays either NORTH or SOUTH indicating which thumb on the transport mechanism was active at the time of the error.

* Press **ENTER** to display more information

5 Removal and Replacement

Protecting Yourself and the Product

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 of the jukebox:

- Pozidriv® magnetized screwdriver flatblade screwdriver
- Needle-nose pliers
- Flatblade screwdriver
- Torx® driver with the following bits: T-10, T-15, T-20, T-25

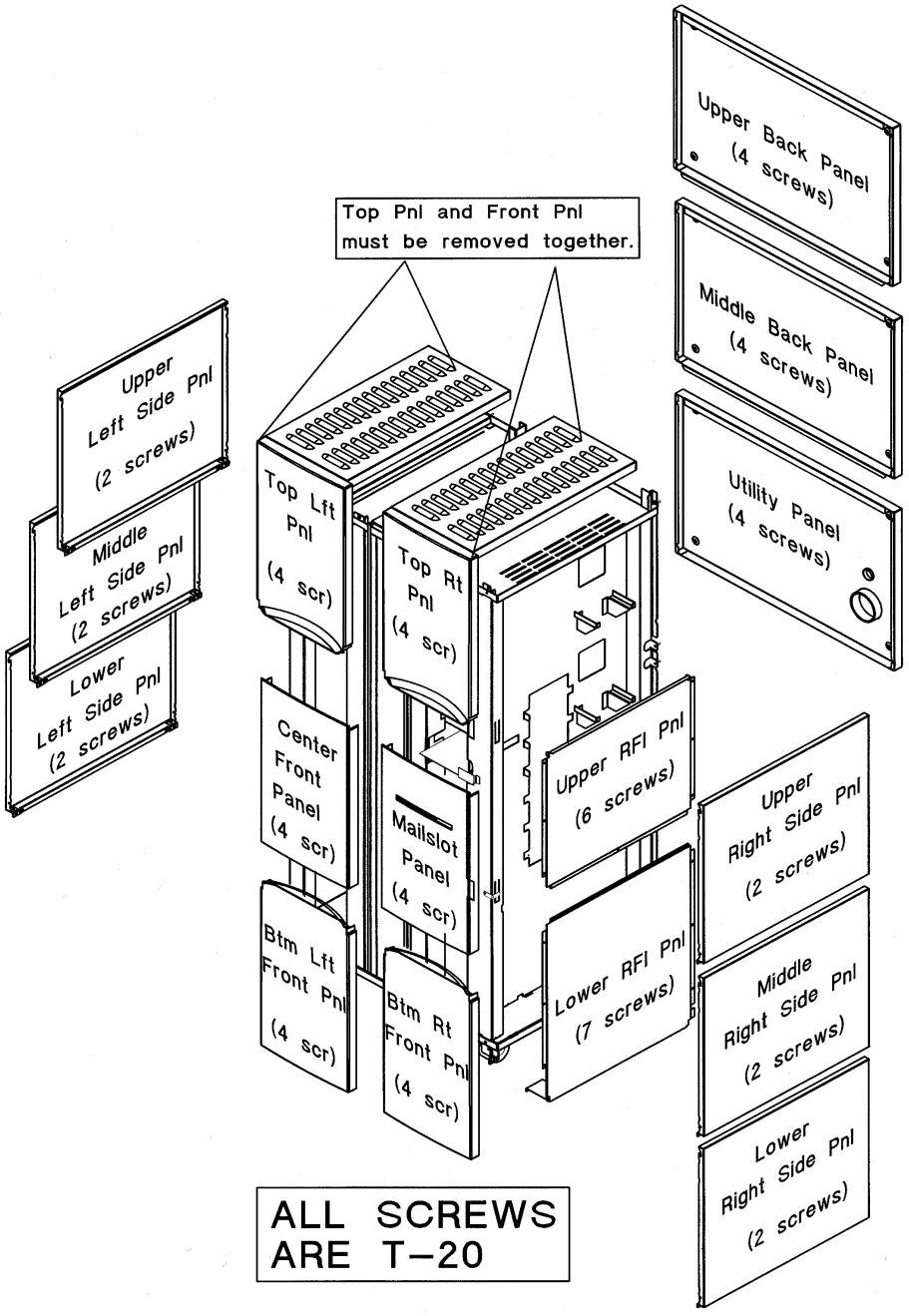
Service Access

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.

Figure 5-1 Locations of the Access Panels



Replacing an Optical Drive — Jukebox Offline

NOTE

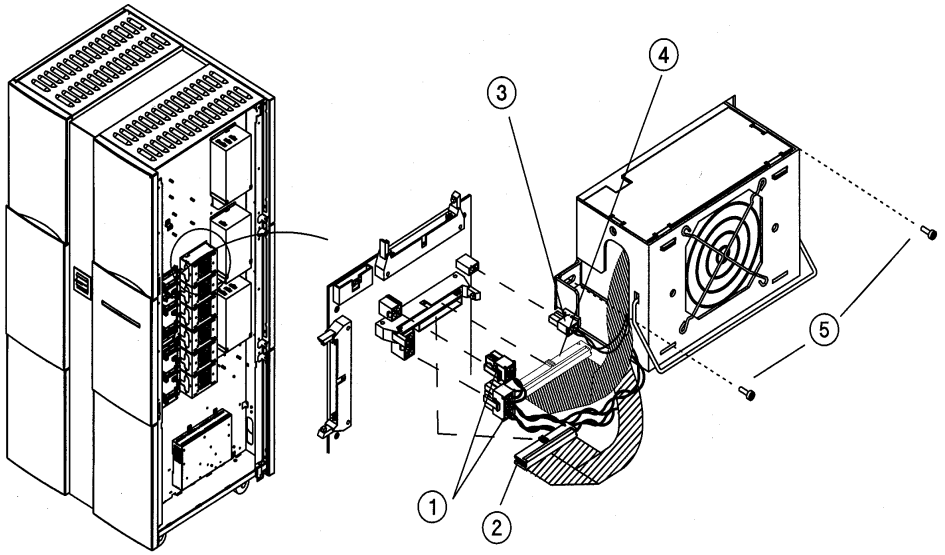
Before replacing a drive, obtain the most current version of the jukebox controller and drive firmware for the model and option of the jukebox you are servicing.

Firmware for all models and options of this jukebox is available for download at:

www.hp.com (select the “HP Services & Support” tab)

1. Remove the three right-side panels and the upper and lower RFI panels (see Figure 5-1).
2. Remove all drive cables for the drive enclosure that contains the failed drive (see Figure 5-2).
   - #1 - drive power cable (for both drives)
   - #2 - drive interface cable (split, one for each drive)
   - #3 - drive enclosure fan power cable
   - #4 - SCSI cable (to both drives)
3. Remove the T-20 screws from each side of the drive enclosure. Remove the drive enclosure from the chassis (see #5 on Figure 5-2).

Figure 5-2 Removing the Cables and Screws



4. Remove the four T-10 screws holding the top and bottom access plates on the drive enclosure (see #1 and #2 in Figure 5-3). Remove the plates.
5. Remove the four T-10 screws that hold the *failed* drive in the drive enclosure and slide the drive forward a small amount to give you room to remove the cables. (#3 screws on Figure 5-3 hold the upper drive, #4 screws hold the lower drive.)
6. Remove the drive cables from the rear of the failed drive (see Figure 5-4.
   - #1 - drive power cables
   - #2 - SCSI cable
   - #3 - drive interface cables
7. Slide the failed drive out of the enclosure.

Figure 5-3 Unmounting a Drive From the Enclosure

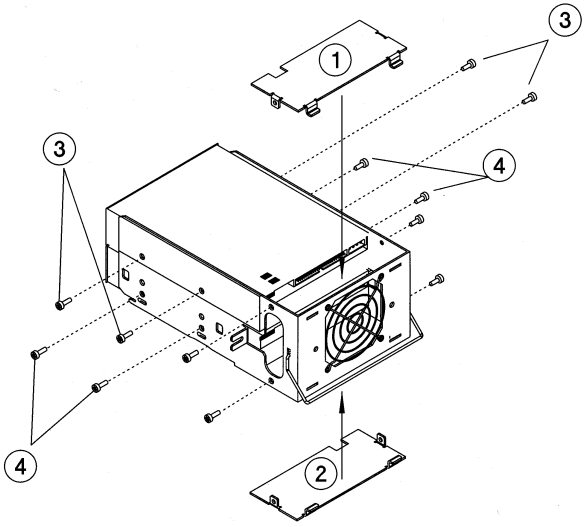
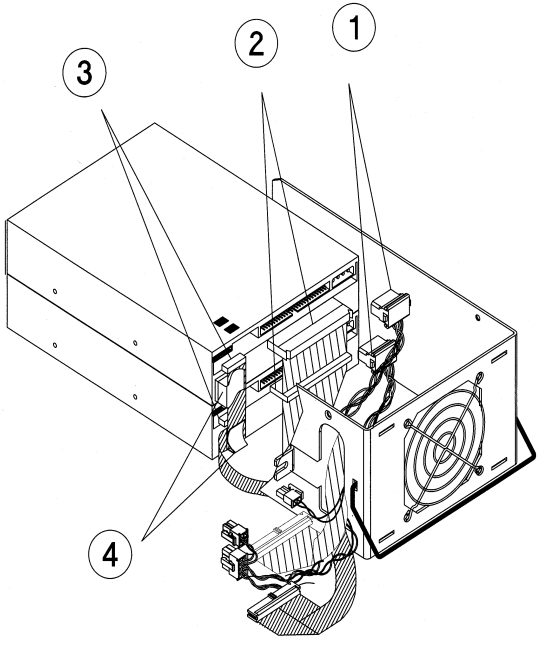


Figure 5-4 Removing Cables From a Drive



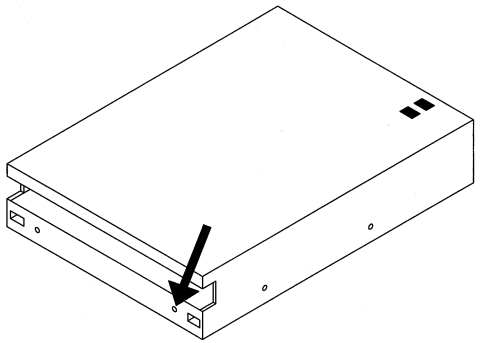
8. *If there is a disk in the drive*, use a disk eject tool to remove the disk from the drive.

   a. Insert the eject tool (or paper clip) into the disk eject access hole (see Figure 5-5). .

   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 5-5 Disk Eject Hole



9. Slide the replacement drive into the enclosure nearly all the way. Leave room to connect the drive cables to the rear of the drive.
10. Connect the drive power cable, SCSI cable,and drive interface cable to the rear of the drive (see Figure 5-4).

    While placing the drive interface cable onto the drive, slip the plastic cable guide around the interface cable, remove the adhesive backing, and stick the guide to the rear of the drive as shown in Figure 5-4.
11. Insert and tighten the four T-10 screws that mount the drive into the enclosure (see Figure 5-3).
12. *If a disk was removed from the failed drive*, replace the disk into the

drive in the same orientation.

13. Insert the drive enclosure into the chassisand secure the enclosure with two T-20 screws (see #5 on Figure 5-2).
14. Connect all drive cables to the interposer PCA (see Figure 5-2).
15. Turn on the jukebox.
16. Go the the INFO * menu and check the currrent firmware revision level of the jukebox under `REVISION` and for the drives under `DRIVE FW *`.
17. Download firmware if necessary. Refer to “Upgrading Firmware to the Current Revision Level” on page 63.
18. If a download is not necessary, replace the lower RFI panel and the three right-side panels.

Replacing an Optical Drive — Jukebox Online

NOTE

Before replacing a drive, obtain the most current version of the jukebox controller and drive firmware for the model and option of the jukebox you are servicing.

Firmware for all models and options of this jukebox is available for download at:

www.hp.com (select the “HP Services & Support” tab)

NOTE

Figure 5-6 shows the online drive replacement decal mounted on the upper RFI panel. The decal illustrates the procedures described in the following steps and can be used as a reminder of the major steps of this procedure when you are on site..

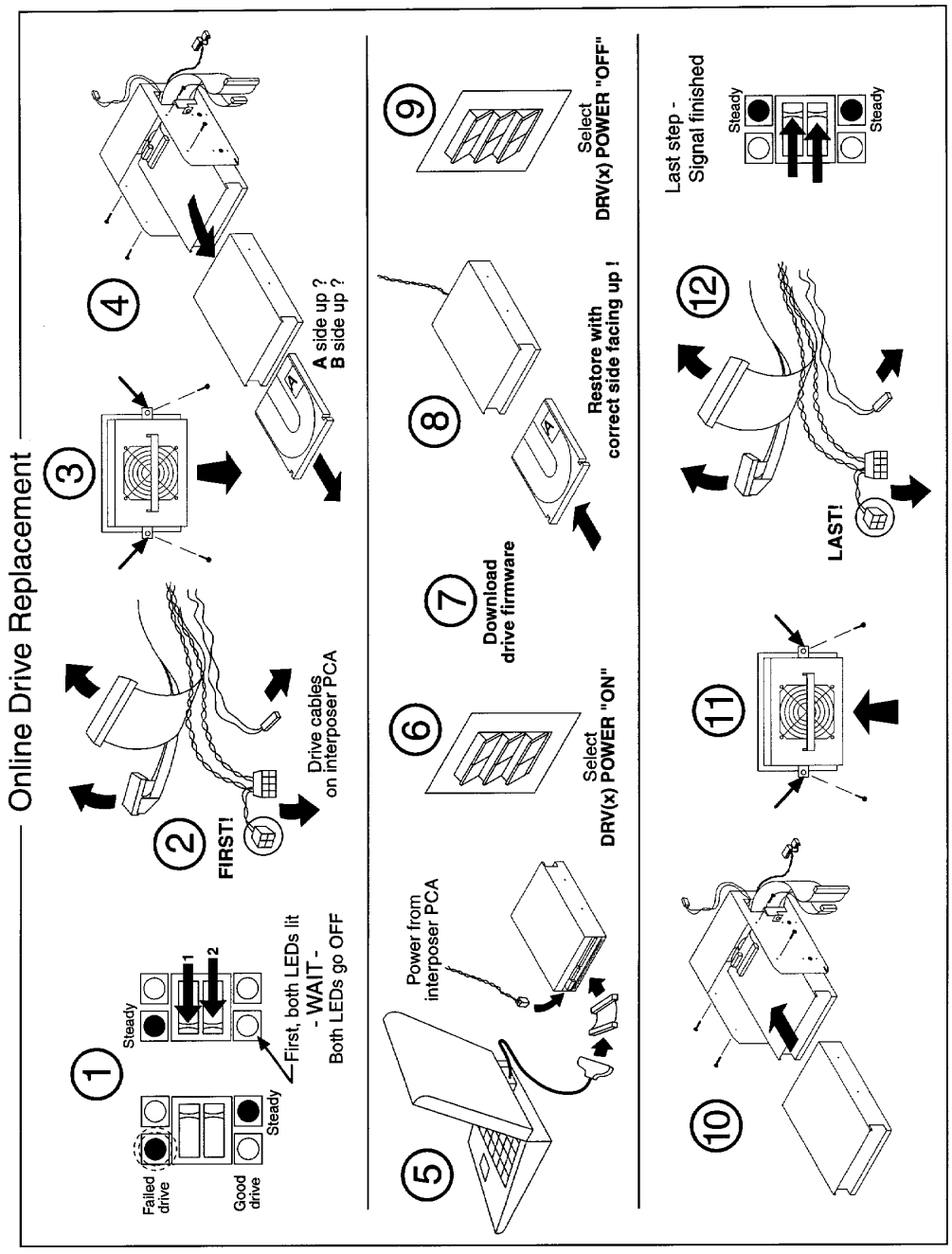
1. Remove the three right-side access panels and the upper and lower RFI panels. See Figure 5-1.
2. Note which drive status LED is blinking on the upper interposer PCA. Slide the communication switch to the left for this drive *and also for the other drive that shares the enclosure*. See #1 on Figure 5-6 for a drawing of the LEDs and communication switches.

   Both switches are placed to the left because there are two drives in each enclosure and both drives must be brought offline before removing the enclosure.

   The LEDs for that drive enclosure now show the following:

   - The orange LED is lit and the green LED is off for the failed drive.
   - The orange and green LEDs for the second drive in the enclosure both light and then go off.

Figure 5-6 Online Drive Replacement



3. Remove the drive power cables from the interposer PCA for the failed drive and the other drive in the enclosure (#1 on Figure 5-1 shows the drive power cables).

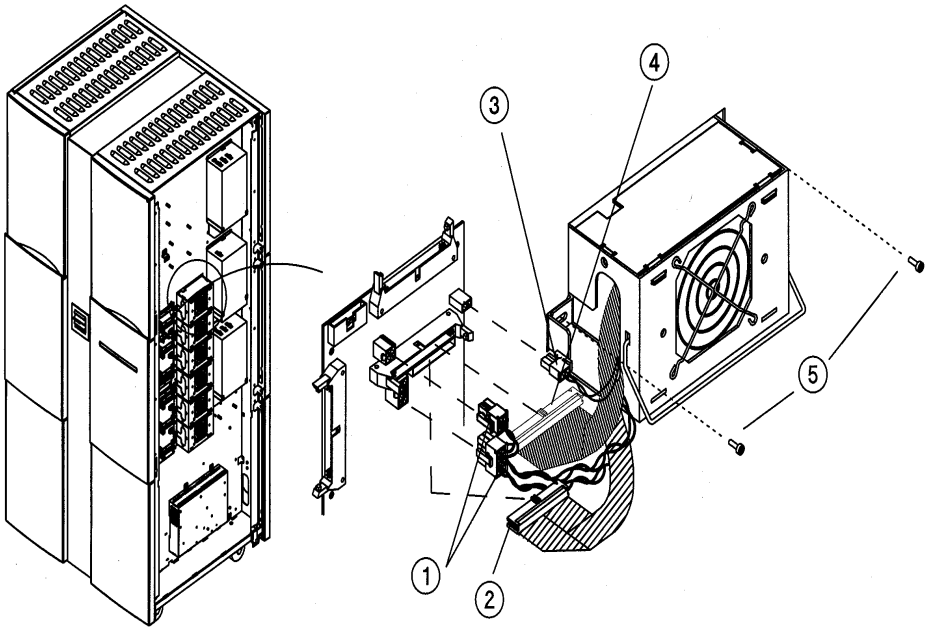
IMPORTANT

The 5/12 V power supplies for the upper and lower interposer PCAs sense current draw for the drive enclosure fans. If no current is being drawn, the power supply will shut down and the jukebox will be turned off.

On 4- and 10-drive jukeboxes there are two enclosures connected to the upper interposer PCA. Do not attempt to change drives in both these enclosures at the same time. Doing so will remove all fan current draw on the top interposer PCA and result in the jukebox being automatically turned off.

4. Remove all other cables between the drive enclosure and the interposer PCA (see #2, #3, #4 on Figure 5-7).
   - #2- drive interface cable (split, one for each drive)
   - #3 - drive enclosure fan power cable
   - #4 - SCSI cable (to both drives)

Figure 5-7 Removing the Cables and Screws

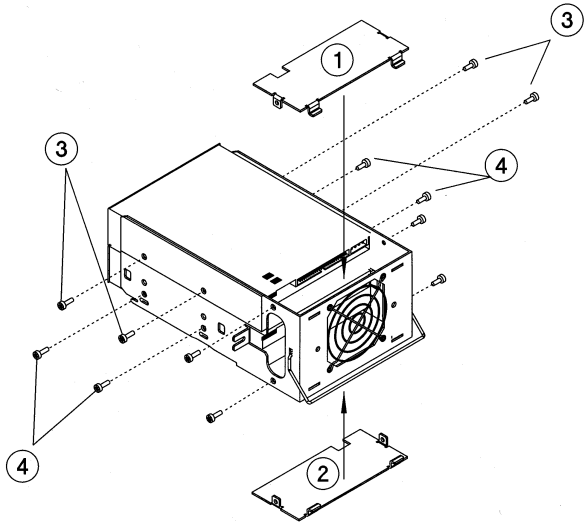


5. Remove the T-20 screws from each side of the drive enclosure. Remove the drive enclosure from the chassis (see #5 on Figure 5-7).

WARNING **The jukebox is active during an online replacement procedure — the picker may move at any time. Do not extend your hand through the chassis into the interior of the jukebox.**

6. Remove the four T-10 screws holding the top and bottom access plates on the drive enclosure (see #1 and #2 in Figure 5-8). Remove the plates.

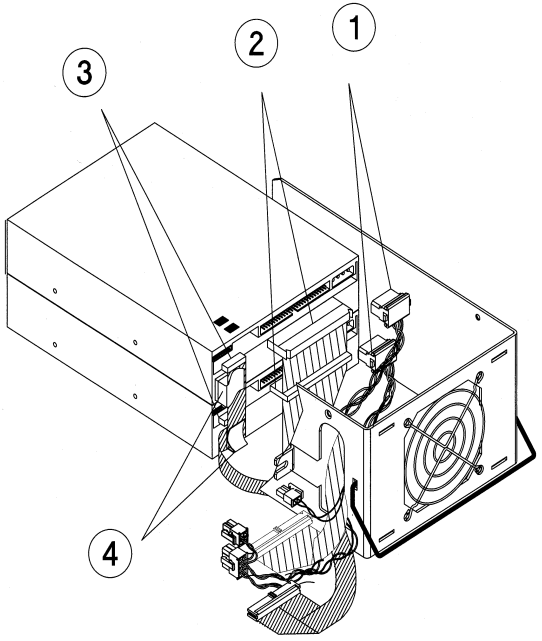
Figure 5-8 Unmounting a Drive From the Enclosure



7. Remove the four T-10 screws that hold the *failed* drive in the drive enclosure and slide the drive forward a small amount to give you room to remove the cables. (on Figure 5-8, #3 screws hold the upper drive, #4 screws hold the lower drive.)

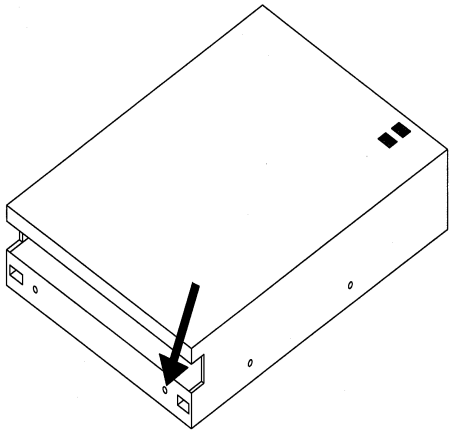
8. Remove the drive cables from the rear of the failed drive (see Figure 5-9).
   - #1 - drive power cables
   - #2 - SCSI cable
   - #3 - drive interface cables

Figure 5-9 Removing Cables From a Drive



9. Slide the failed drive out of the enclosure.
10. *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 5-10).
    b. When you feel firm pressure on the tip, push forward. The disk mechanism will eject the disk.

Figure 5-10 Disk Eject Hole



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.

11. Connect a SCSI cable between your diagnostic PC and the replacement drive.

    A cable adapter is stored on the chassis left of the upper interposer PCA for your use. This adapter has drive and external female connections you may need.

CAUTION *To provide proper ground and power sequencing, power the replacement drive in the next steps using the power connectors on the interposer PCA.*

12. Connect the long, *service* drive power cable between the replacement drive and one of the power connections on the interposer PCA that were made available when you removed the drives for this replacement.

    Use the end of the cable that has two connectors to connect to the power connectors on the interposer PCA.

13. Apply power to the replacement drive from the control panel using the following sequence:

    a. Press NEXT or PREV as needed to display ADMIN * on the control panel.

    b. If the default password is still in effect, you will only have to press **ENTER** three times to enter 000-000-000. If a private password is in effect, ask the system administrator to enter the password to give you access below ADMIN *.

    c. Press **NEXT** or **PREV** until ONLINE DRIVE REPAIR * displays. Press **ENTER**.

    d. Press **NEXT** or **PREV** to display DRIVE POWER *. Press **ENTER**.

    e. Press **NEXT** or **PREV** to display DRV<x> POWER OFF, (where DRV<x> is the number of the drive you are replacing).

    f. Press **NEXT** to select DRV<x> POWER ON. Press **ENTER**.

14. Check the revision level of the drive firmware with your SCSI tool.

15. If necessary, download the current firmware into the replacement drive. If updating the firmware is not necessary, go to the next step.

16. (*Before removing power —*) If a disk was removed from the failed drive, replace the disk into the drive in the same orientation.

17. Remove drive power from the replacement drive from the control panel using the following sequence.

    a. Press **NEXT** or **PREV** until ONLINE DRIVE REPAIR * displays. Press **ENTER**.

    b. Press **NEXT** or **PREV** to display DRIVE POWER *. Press **ENTER**.

    c. Press **NEXT** or **PREV** to display DRV<x> POWER ON, (where DRV<x> is the number of the drive you are replacing).

    d. Press **NEXT** to select DRV<x> POWER OFF. Press **ENTER**.

18. Remove the service SCSI cable and service power cable from the replacement drive and the interposer PCA. Place these cables back onto their storage position at the left of the upper interposer PCA.

19. Slide the replacement drive into the enclosure nearly all the way. Leave room to connect the drive cables to the rear of the drive.

20. Connect the drive power cable, SCSI cable,and drive interface cable to

the rear of the drive (see Figure 5-4).

While placing the drive interface cable onto the drive, slip the plastic cable guide around the interface cable, remove the adhesive backing, and stick the guide to the rear of the drive as shown by #4 on Figure 5-4.

21. Insert and tighten the four T-10 screws that mount the drive into the enclosure (see Figure 5-3).
22. Insert the drive enclosure into the chassis with the T-20 screws.

NOTE In the following step, connect the drive power cable *after* the SCSI cable. The two connectors on the drive power cable *straddle* the SCSI cable.

23. Connect all drive cables to the interposer PCA. Connect the drive power cable connectors last (see Figure 5-7).
24. Slide the communication slide switch over to the right for both drives to signal the jukebox that drive replacement is complete (see the last step on the decal on Figure 5-6).

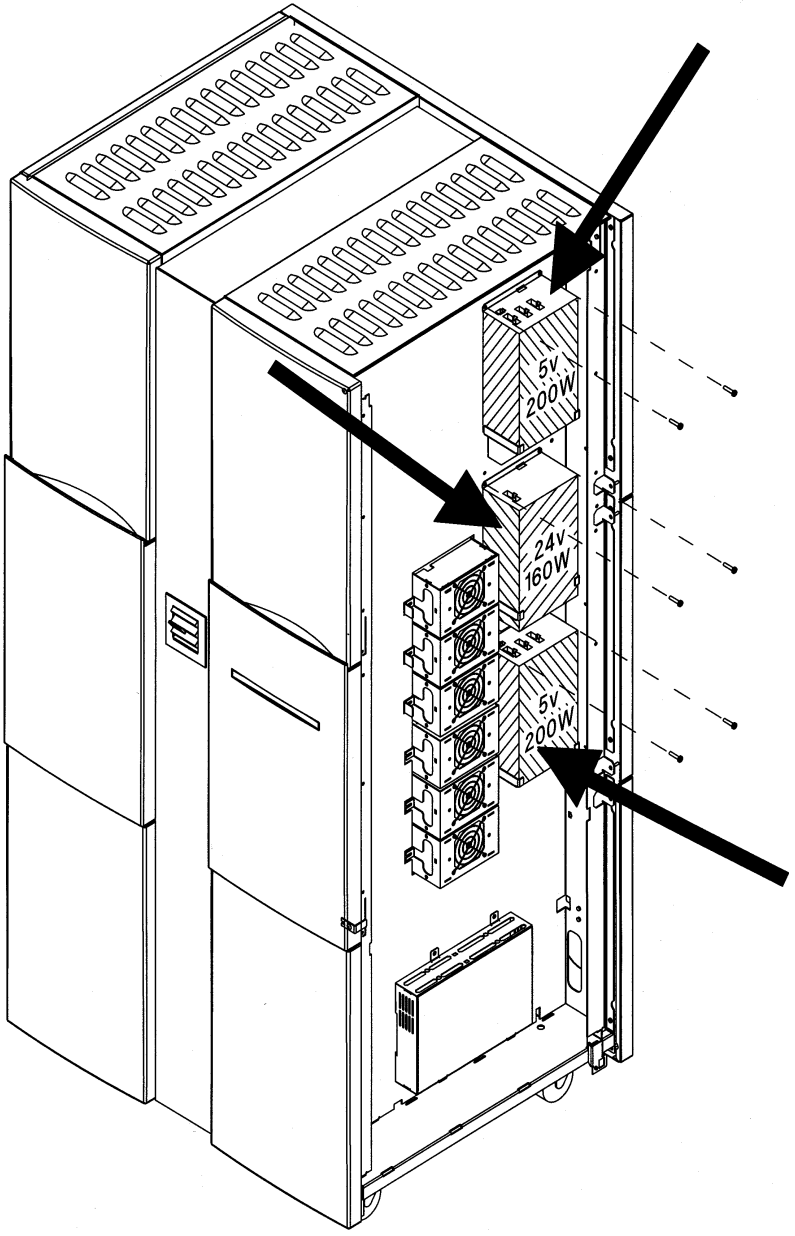
    The LEDs for both drives should come on steady GREEN.

Replacing a Power Supply

1. Remove the three right-side panels and the upper and lower RFI panels (see Figure 5-1).
2. Remove the cables from the power supply that you are replacing (see Figure 5-11).
   - The top and bottom arrows identify the 5/12 V power supplies
   - The middle arrow identifies the 24 V power supply
3. Remove the power supply.

   Remove the two mounting screws located on the top of the power supply bracket and rotate the power supply out and off the support bracket.

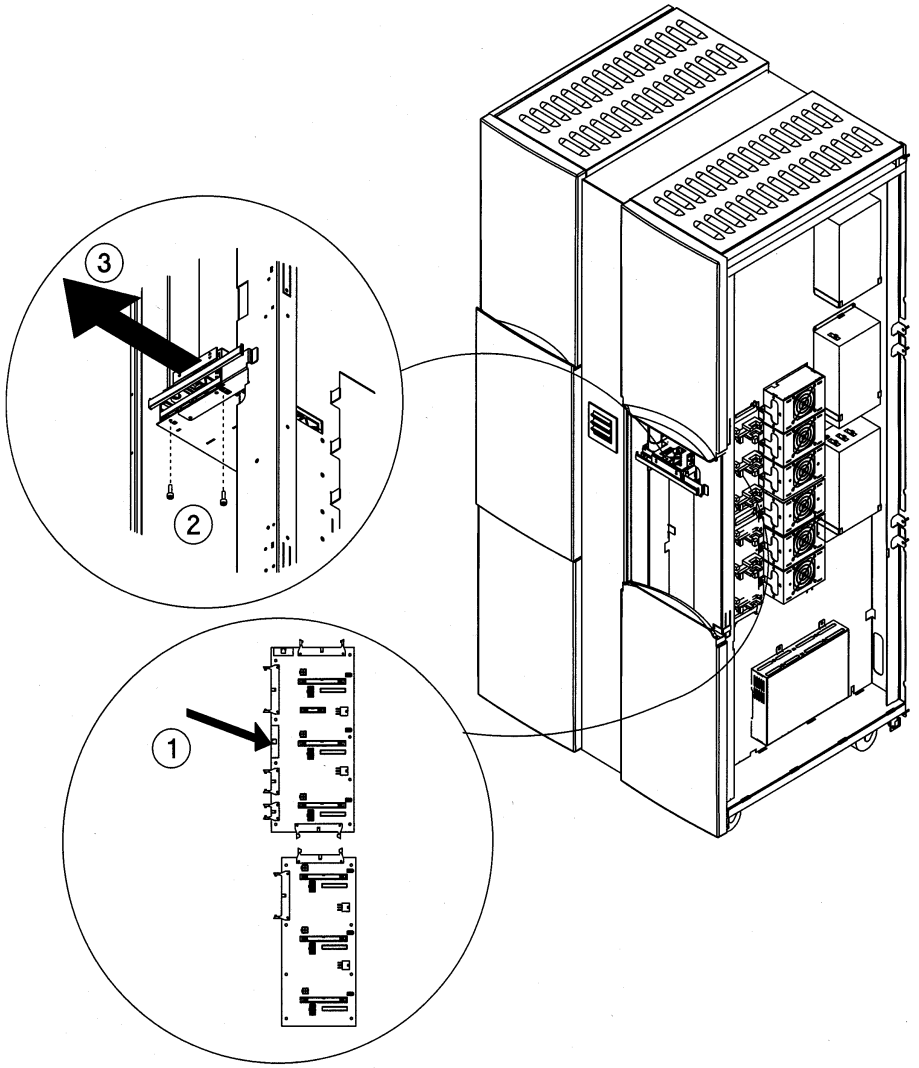
Figure 5-11 Cables and Mounting Screws on the Power Supplies



Replacing the Mailslot Assembly

1. Remove the three right-side panels and the upper and lower RFI panels (see Figure 5-1).
2. Ensure that the mailslot sensor cable is disconnected from the upper interposer PCA (see Figure 5-12).
3. Remove the two T-20 mailslot mounting screws from the bottom of the mailslot (#2 on Figure 5-12).
4. Slide the mailslot out of the jukebox (see #3 on Figure 5-12).

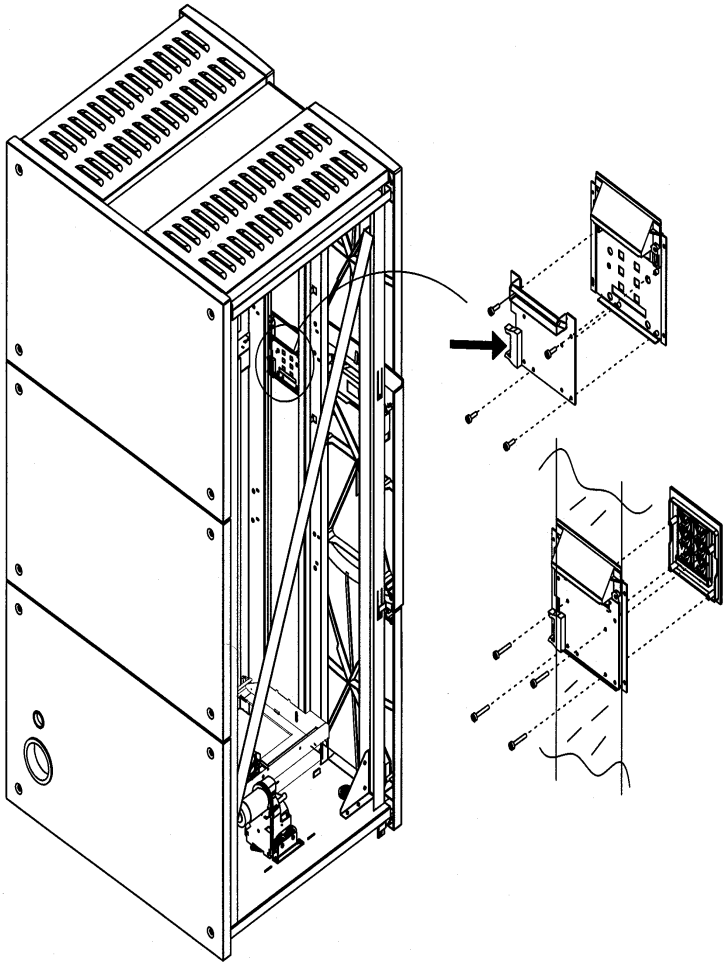
Figure 5-12 Removing the Mailslot Assembly



Replacing the Control Panel Assembly

1. Remove the three left-side panels (see Figure 5-1).
2. Disconnect the control panel cable from the control panel (#1 arrow Figure 5-13)..
3. Remove the eight T-15 screws that mount the control panel to the front window. Remove the control panel (see Figure 5-13).

Figure 5-13 Control Panel Mounting Screws and Interface Cable



Replacing An Interposer PCA (Upper and/or Lower)

IMPORTANT

IF YOU ARE REPLACING AN UPPER INTERPOSER PCA, CHECK TO SEE IF THERE IS A CONFIGURATION MODULE MOUNTED ON THE PCA (#9 ON Figure 5-14).

IF A CONFIGURATION MODULE IS INSTALLED, TRANSFER THE MODULE TO THE REPLACEMENT PCA.

1. Remove the lower and middle right-side access panels (see Figure 5-1).
2. Disconnect all cables to the PCA. See Figure 5-14.

   Upper interposer PCA:

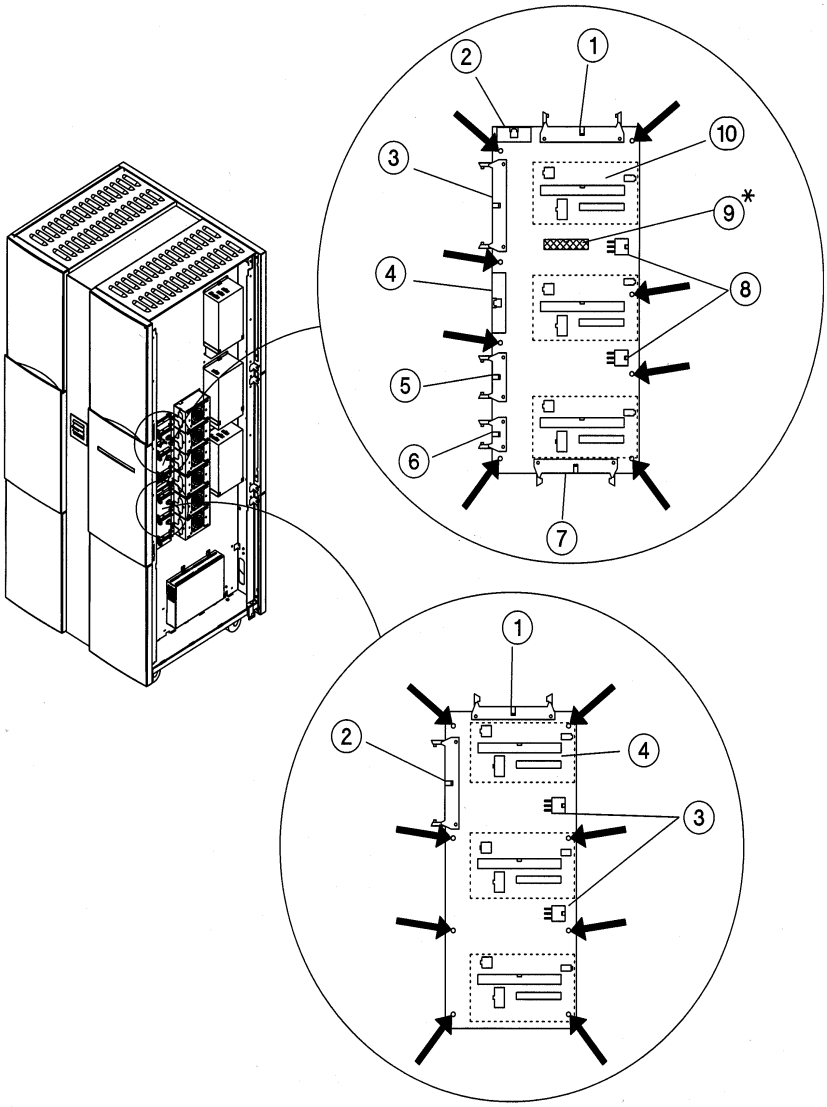
   - #1 - SCSI cable
   - #2 - vertical-path-clear transmitter
   - #3 - GPIO cable
   - #4 - mailslot sensor / motor cable
   - #5 - control panel input/output
   - #6 - vertical-path-clear receiver
   - #7 - SCSI cable
   - #8 - drive power input to interposer PCA
   - #9 - configuration module
   - #10 - drive cables (SCSI, drive interface, drive power, drive fan power - see Figure 5-2)

   Lower interposer PCA:

   - #1 - SCSI cable
   - #2 - GPIO cable
   - #3 - drive power input to interposer PCA

- #10 - drive cables (SCSI, drive interface, drive power, drive fan power - see Figure 5-2)

Figure 5-14 Disconnecting Cables and Screws on the Interposer PCAs



3. Remove the eight T-20 screws holding the PCA to the chassis (see arrows on Figure 5-14).

4. Remove the PCA.

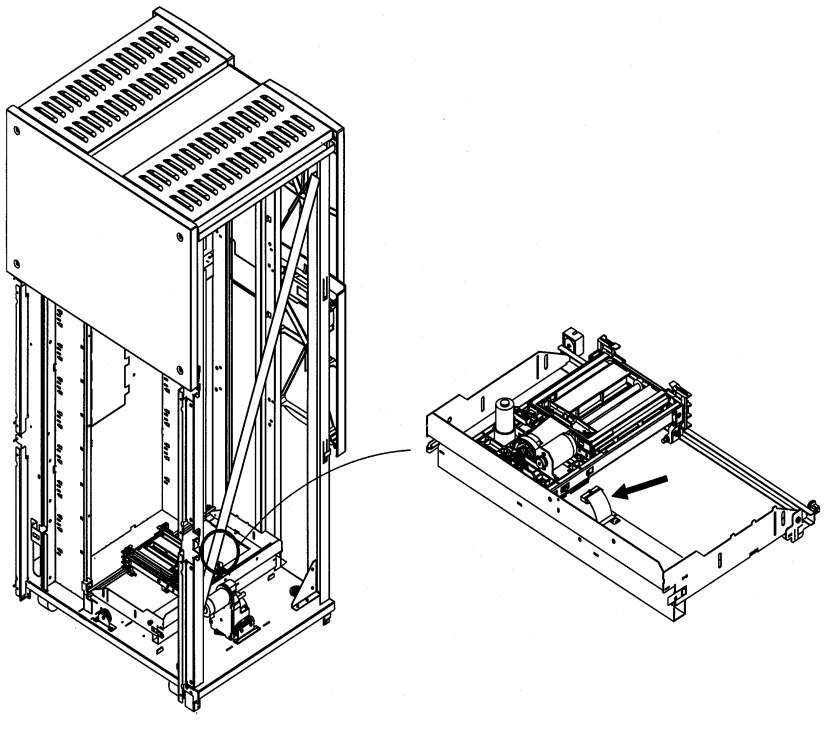
Replacing the Picker

1. Remove the lower and middle right-side access panels (see Figure 5-1).

   Extra panels are removed in Figure 5-15 for parts visibility in this description.

2. Pull the tab on the end of the picker umbilical cable to disconnect the cable from the bottom of the picker (see the arrow on Figure 5-15).

Figure 5-15 Picker Umbilical Cable



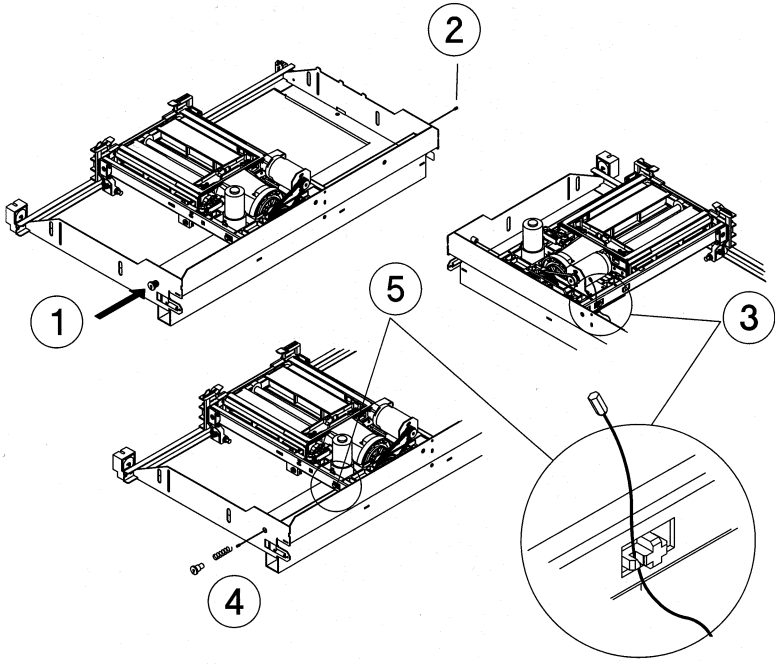
3. Release the translate cable from the side of the translate frame nearest the front of the jukebox (see Figure 5-16):

   a. Depress the tension spring (#!) on the side of the translate frame to release the tension on the cable and allow you to pass the cable

up through the slotted hole (#2).

b. Slide the cable into the pinch slot on the side of the picker (#3). Placing the cable in the pinch slot prevents the cable from unraveling from the central picker hub.

Figure 5-16 Releasing and Stowing the Picker Translate Cable



4. Release the translate cable from the side of the translate frame nearest the rear of the jukebox (see Figure 5-16):

   a. Remove the spring and slotted plug that holds the translate cable (#4).The cable passes through a hole in the side of the frame and into a slotted plug with a tensioner spring. Remove the spring and slotted plug.

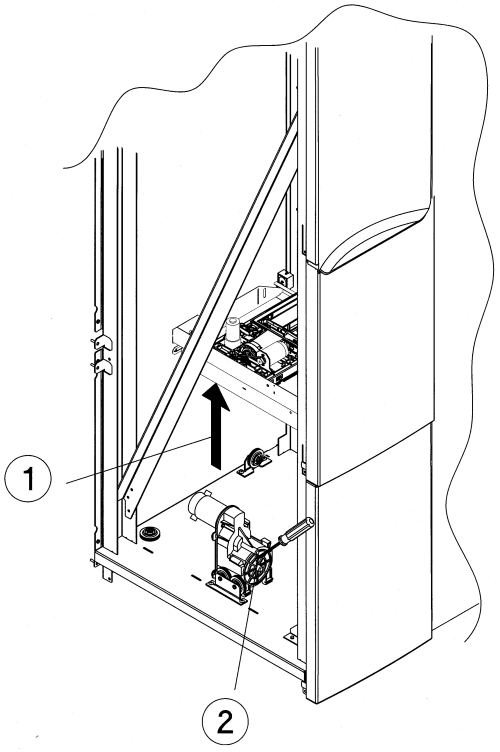
   b. Slide the cable into the pinch slot on the side of the picker (#5). Placing the cable in the pinch slot prevents the cable from unraveling from the central picker hub.

CAUTION Raise the translate frame only by pulling on the vertical drive rope. The frame can be twisted by pulling it by the sides. A twisted frame may cause various errors in operation.

5. Raise the translate frame and picker up to a convenient working height so that you can access the underside of the picker (see #1 on Figure 5-17).

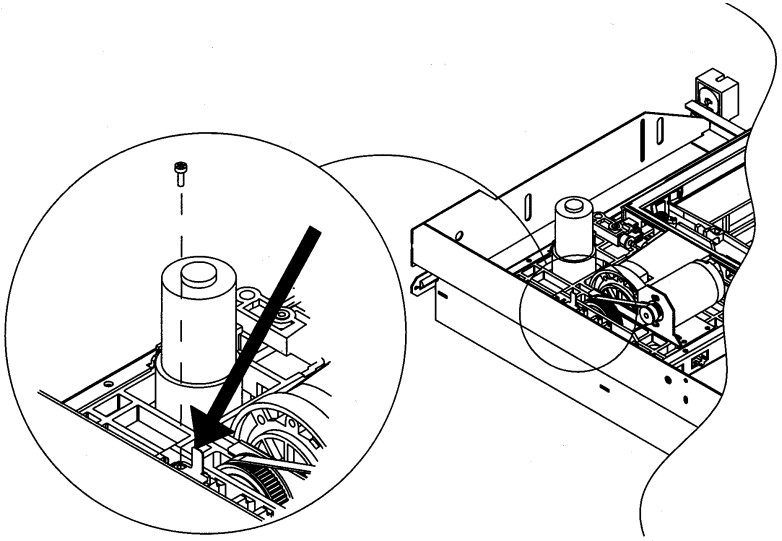
   Pull the frame up to the desired position, and insert a screwdriver into the hole at the rear of the vertical motor gear box to prevent the frame from descending (#2).

Figure 5-17 Holding the Translate Frame in Position



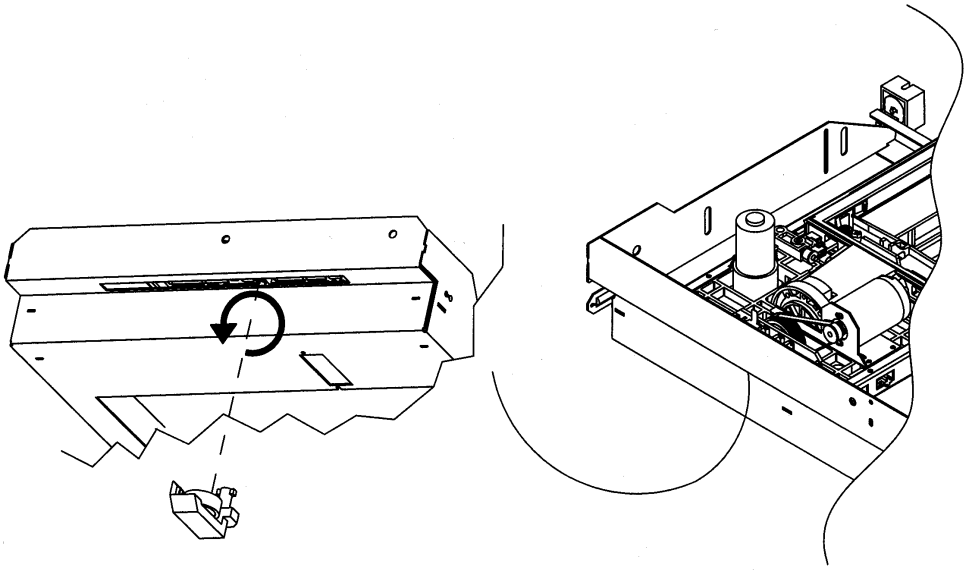
6. Remove the T-10 sheet metal screw that holds the capture spring down (see Figure 5-18).

Figure 5-18 Releasing the the Picker Capture Bracket



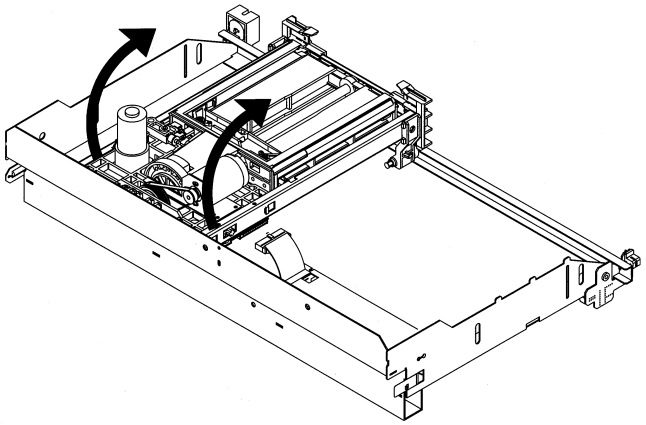
7. Remove the capture spring by pulling it up and out of the unit.
8. Rotate the capture bracket 90 degrees and pull the bracket down and out (see Figure 5-19).

Figure 5-19 Removing the Translate Frame Capture Bracket



9. Remove the tool you inserted into the rear of the vertical motor gear box and lower the translate frame and picker to the bottom of the jukebox.
10. Tilt up the rear end of the picker and slide it out toward the back (see Figure 5-20).

Figure 5-20 Rotating the Picker Assembly Out of the Translate Frame



Removing/Replacing the Translate Frame (Including the Picker)

1. Remove the three left-side access panels (see Figure 5-1).
2. Remove the lower and middle right-side access panels.

CAUTION Raise the translate frame only by pulling on the vertical drive rope. The frame can be twisted by pulling it by the sides. A twisted frame may cause various errors in operation.

3. Raise the translate frame up approximately midway up and secure it with a screwdriver inserted into the hole on the rear of the vertical motor gear box (see #2 on Figure 5-21).

Figure 5-21 Raising the Translate Frame and Holding the Frame in Position

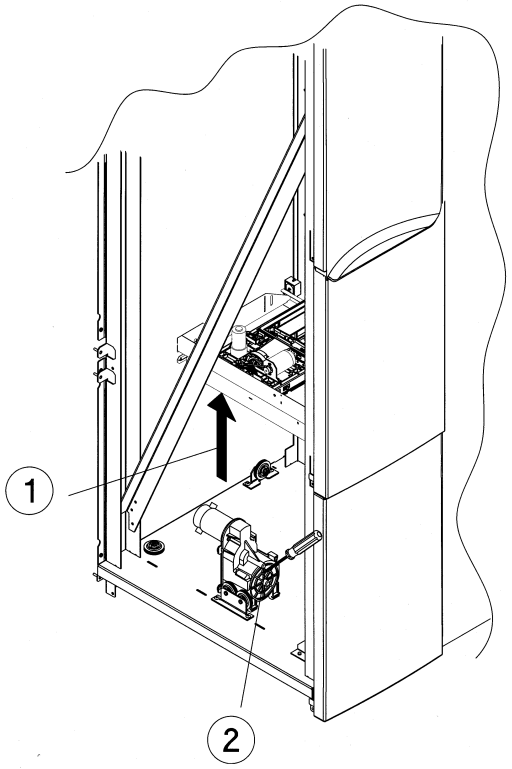
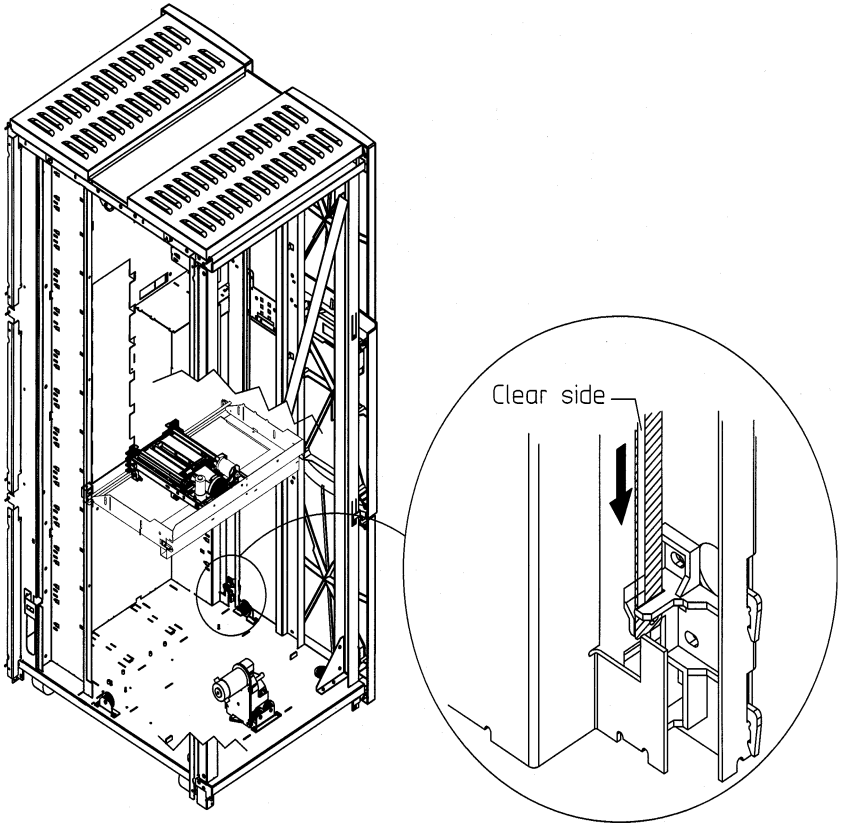


Figure 5-22 Releasing the Lower End of the Vertical Encoder Strip



4. Unhook the encoder strip and hang it out of the way (see Figure 5-22).

   Pull down on the bottom of the encoder strip to release the strip from its retaining peg. Once released, the strip will slide up and out of the plastic guide.

WARNING **The edges of the vertical encoder are sharp. Be careful.**

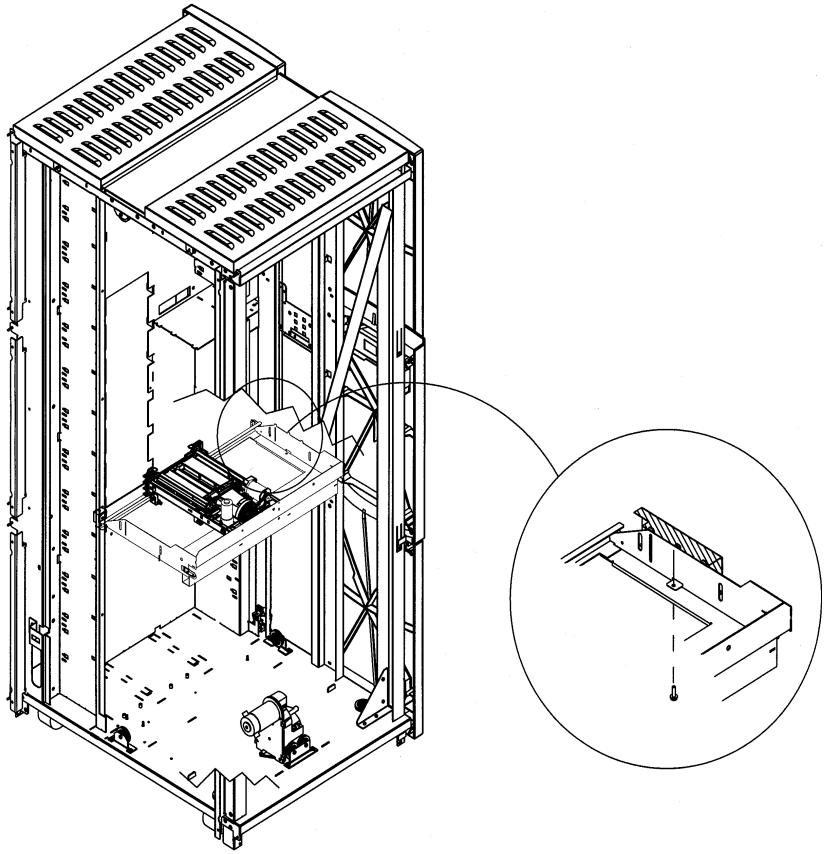
CAUTION Handle the encoder strip with care and ONLY BY THE SOLID SIDE (see Figure 5-22). The CLEAR side is made up of very fine slits and CAN

BE EASILY DAMAGED.

5. Remove the “visual locator” bracket on the (front) side of the picker translate frame (see Figure 5-23).

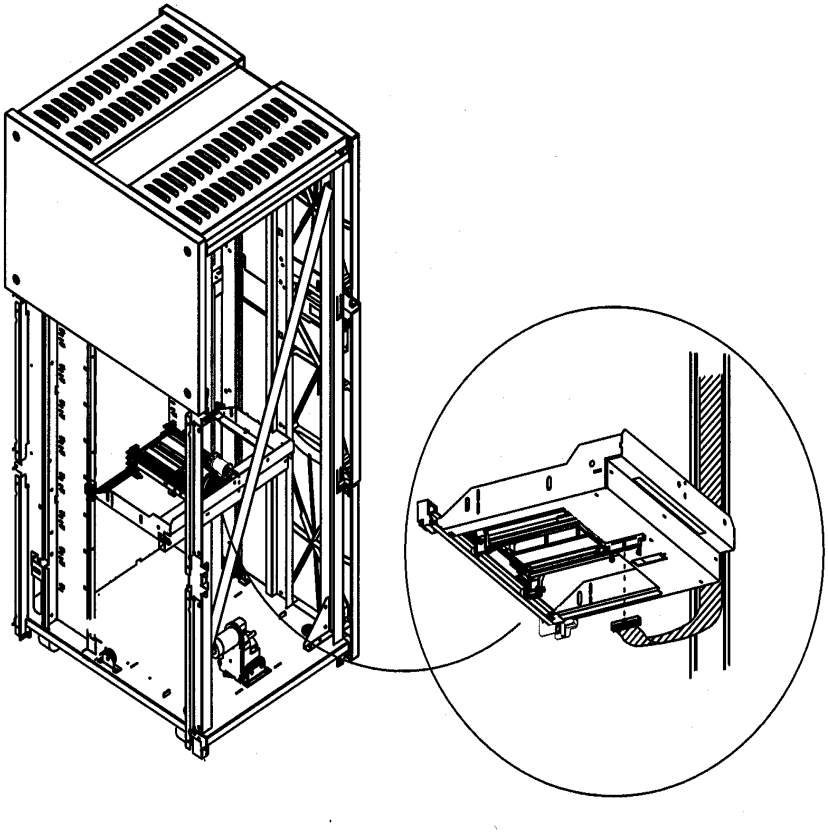
   Remove the T-20 screw holding the bracket and rotate the bracket off..

Figure 5-23 The Visual Locator Bracket



6. Disconnect the umbilical cable on the underside of the translate frame (see Figure 5-24.

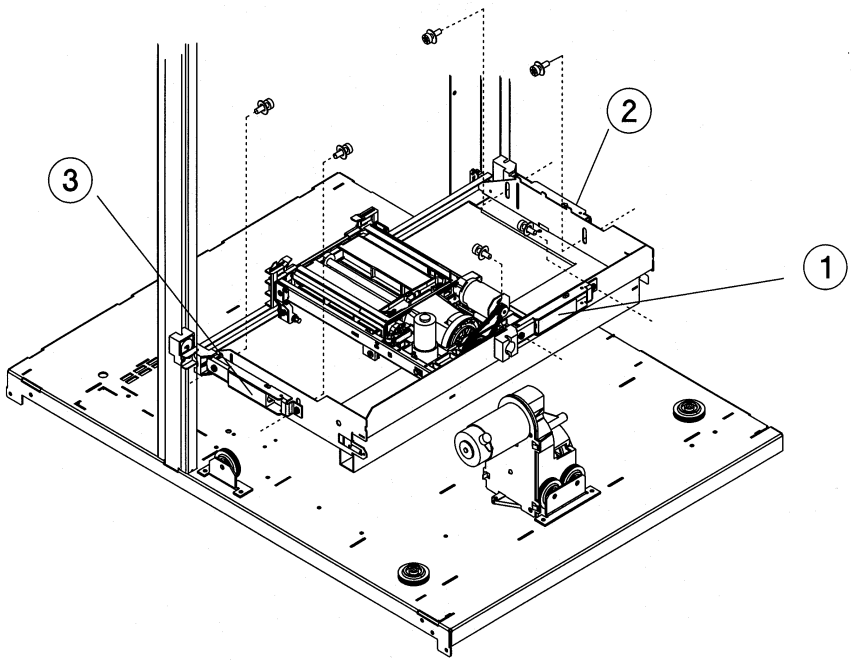
Figure 5-24 Disconnecting the Vertical Umbilical Cable From the Translate Frame



7. Remove the tool you inserted into vertical motor gear box and move the translate frame down to the bottom of the jukebox.

8. Remove the three rope tensioners from the frame (#1, #2, and #3 on Figure 5-25).
   a. Remove two T-25 long screws per tensioner. Start with the tensioner at the rear end of the frame (#1 on Figure 5-25).
   b. Pull all three rope tensioners free of the translate frame.
   c. Pull the *rear* tensioner upwards to raise all three tensionsers up and out of your way.

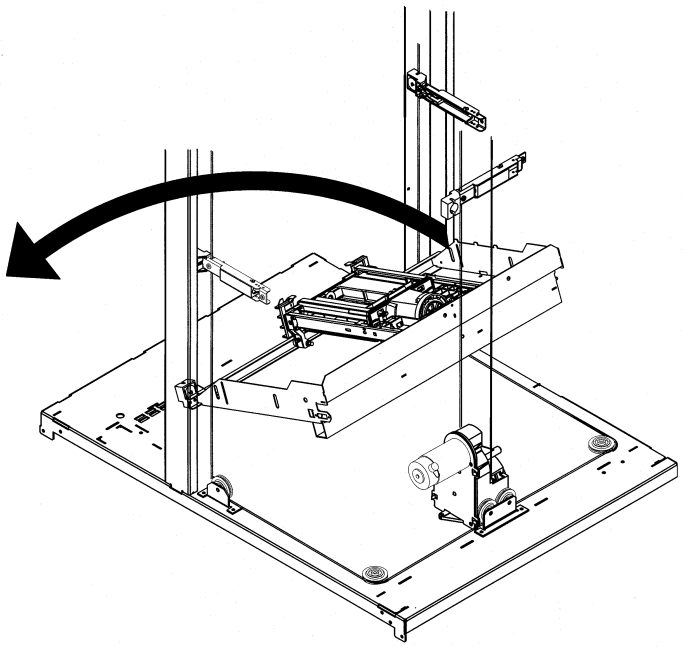
Figure 5-25 Removing the Tensioners From the Translate Frame



CAUTION In the next step, ensure that the plastic rail guides are not damaged when the translate frame is removed.

9. Rotate the rear of the translate frame up and then remove the frame out to the side (see Figure 5-26).

Figure 5-26 Rotating the Translate Frame Out of the Chassis



Reassembly Notes

IMPORTANT Take care to install the translate frame properly

If the frame is not mounted level, errors will be caused that will prevent the library from operating.

The following steps explain proper mounting of the frame.

1. Place the frame back in the chassis . Let it rest on its support points. The rear of the frame rests on a ledge on the vertical motor.
2. Pull the tensioners down so that they are next to their mount points on the sides and rear of the translate frame. Press them into the side of the translate frame.
3. While tightening the mounting screw in a tensioner, push down on the frame at that point to make sure that the translate frame remains on its lower stop while you tighten the mounting screw.
4. Check that the translate frame is mounted level on the cables by centering the picker and pushing the frame down lightly and quickly. If you hear a “click” it means that the frame has slack and needs adjustment.

   If adjustment is necessary, remount the frame on the tensioners as described in Step 3 and retest.

Mounting the Vertical Encoder Strip

Move the translate frame up and lock it while reinstalling the encoder strip.

Ensure that the encoder strip passes through the sensor slot on the sensor PCA mounted on the side of the picker frame. The strip may be moved off its mounting peg while you are replacing the translate frame in the chassis.

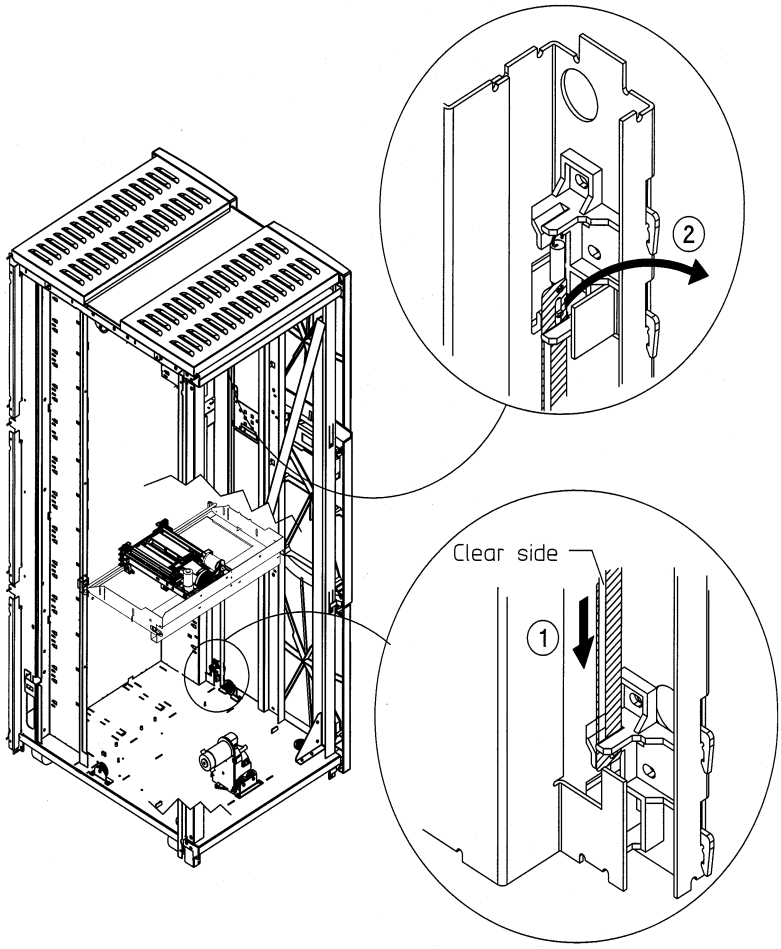
Removing/Replacing the Encoder Strip

1. Remove the three left-side and three rear access panels (see Figure 5-1).

CAUTION Raise the translate frame only by pulling on the vertical drive rope. The frame can be twisted by pulling it by the sides. A twisted frame may cause various errors in operation.

2. Raise the translate frame up approximately midway up and secure it with a screwdriver inserted into the hole on the rear of the vertical motor gear box (see #2 on Figure 5-21).

3. **Releasing Both Ends of the Vertical Encoder Strip**



WARNING **The edges of the vertical encoder are sharp. Be careful.**

CAUTION Handle the encoder strip with care and ONLY BY THE SOLID SIDE (see Figure 5-22). The CLEAR side is made up of very fine slits and CAN BE EASILY DAMAGED.

4. Pull the lower end of the encoder strip down (#1 on Figure 3).

   The strip will come off its mounting peg.

5. Take the upper end of the encoder strip off the spring on the upper strip mount (see #2 on Figure 3).

Reassembly Notes

Carefully mount the encoder strip on the top spring. Route the strip to the lower encoder mount while making sure that the strip passes through the strip reader on the front corner of the translate frame.

Replacing the Vertical Motion Motor

1. Remove the lower left-side access panel (see Figure 5-1).

   Extra panels are removed in Figure 5-27 for parts visibility in this description.

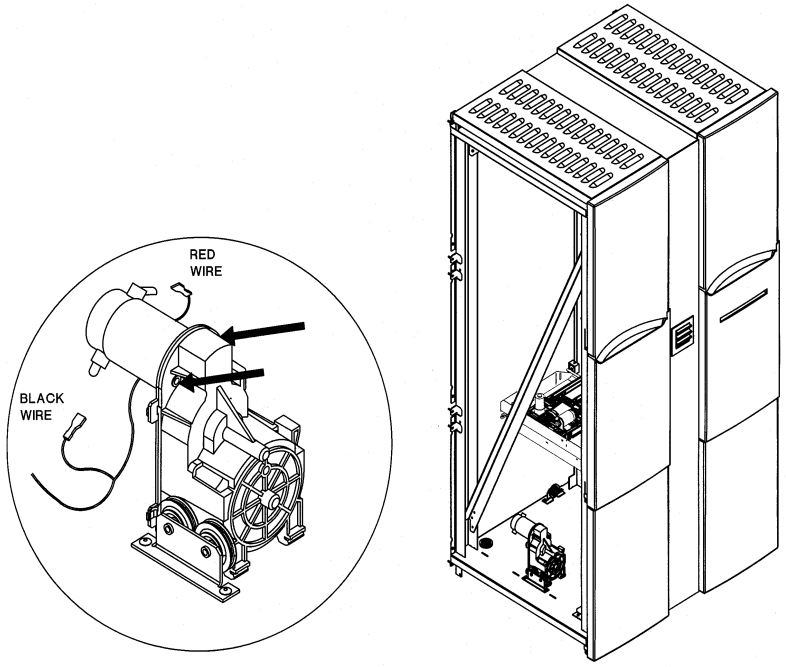
2. Disconnect the red and black power cables to the vertical motor (see Figure 5-27).

NOTE

Note the orientation of the motor before removing it in the next step. The motor must be replaced in the same position on reassembly.

3. Remove two T-15 motor mounting screws on the gear box. Remove the motor (see the arrows on Figure 5-27).

Figure 5-27 **Cables and Mounting Screws on the Vertical Motion Motor**



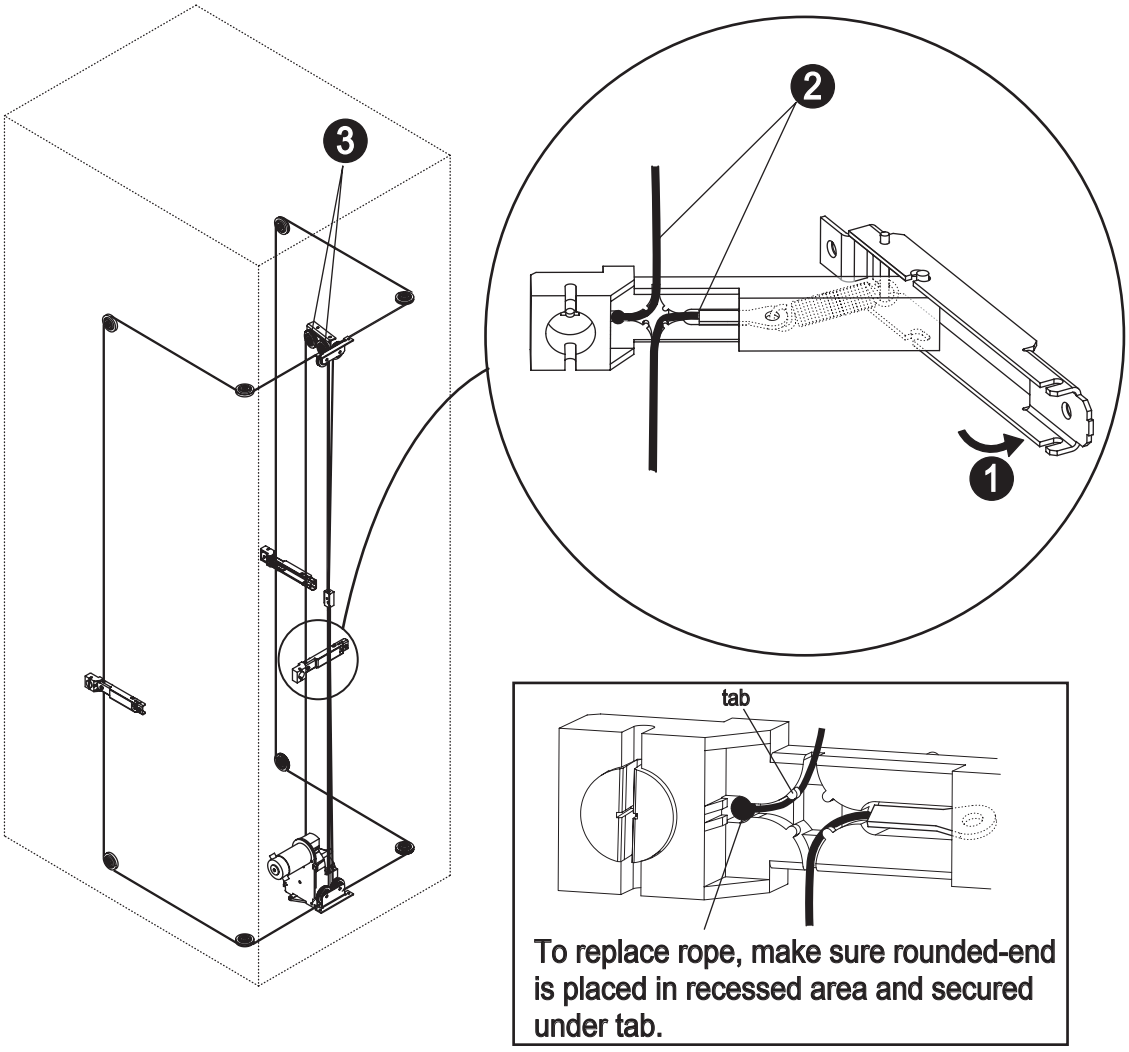
Reassembly Notes

When replacing the motor, use the orienting pegs on the motor to place the motor correctly on the gear box.

Replacing the Vertical Motor Gear Box

1. Remove the three left-side access panels (see Figure 5-1).
2. Follow the steps in “Removing/Replacing the Translate Frame (Including the Picker)” to remove the picker and translate frame.
3. Pull the rear tensioner upwards to raise all three tensioners up to a convenient working height (see #1 on Figure 5-25).

Figure 5-28 Opening the Tensioners to Relieve Cable Tension



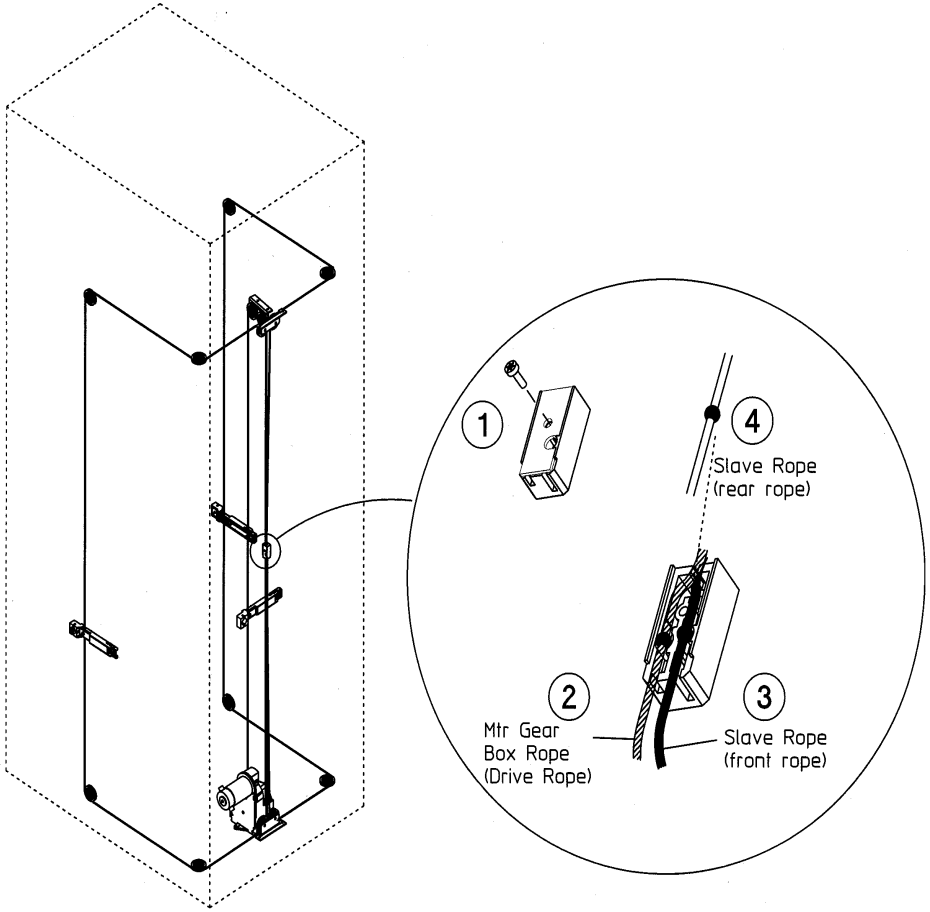
4. Release the tension on the rear rope tensioner (drive rope) using the following steps (see Figure 5-28):

   a. Pull back the metal section (#1) to release tension on the metal securing tab seated in the plastic section.

   b. Swing the metal section out and off the pivoting pegs on the plastic section.

5. Remove the drive rope from the rear tensioner.
   a. Unfasten the spring.
   b. Pull both ends of the rope out of the tensioner.
6. Remove the drive cable from the top pulleys (#3 on Figure 5-28).
7. Remove the T-15 screw from the rope coupler cover (see #1 on Figure 5-29).

Figure 5-29 Disconnecting the Rope Coupler

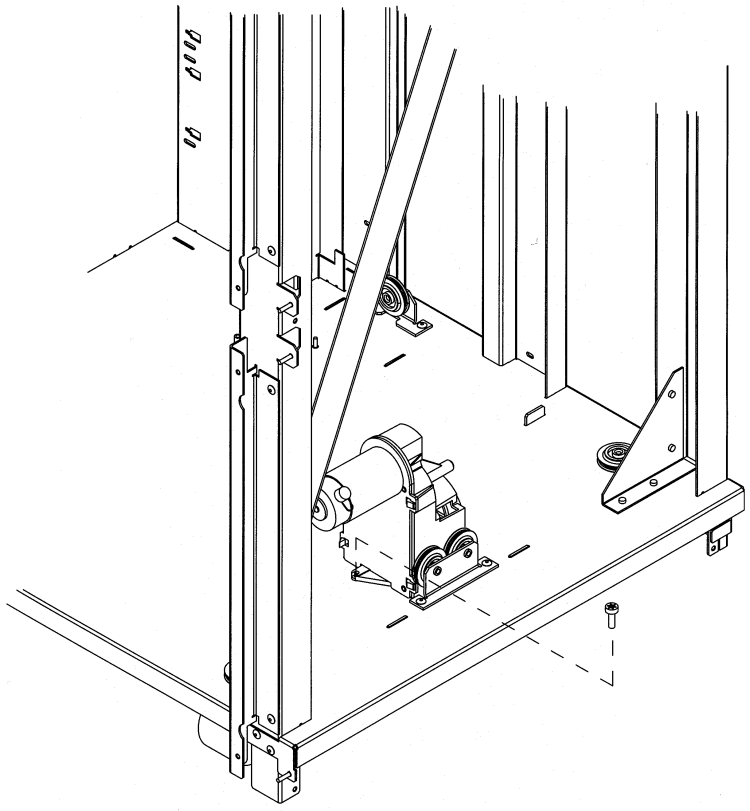


8. Remove the front and center ropes from the rope coupler (#2 and #3 on Figure 5-28).

NOTE The top and bottom ropes in the coupler are slave ropes. The center rope is the drive rope.

9. Remove the gear box by removing one T-25 screw from the base of the gear box. Tip the gear box forward and lift it out (see Figure 5-30).

Figure 5-30 Vertical Motor Gear Box Mounting Screw

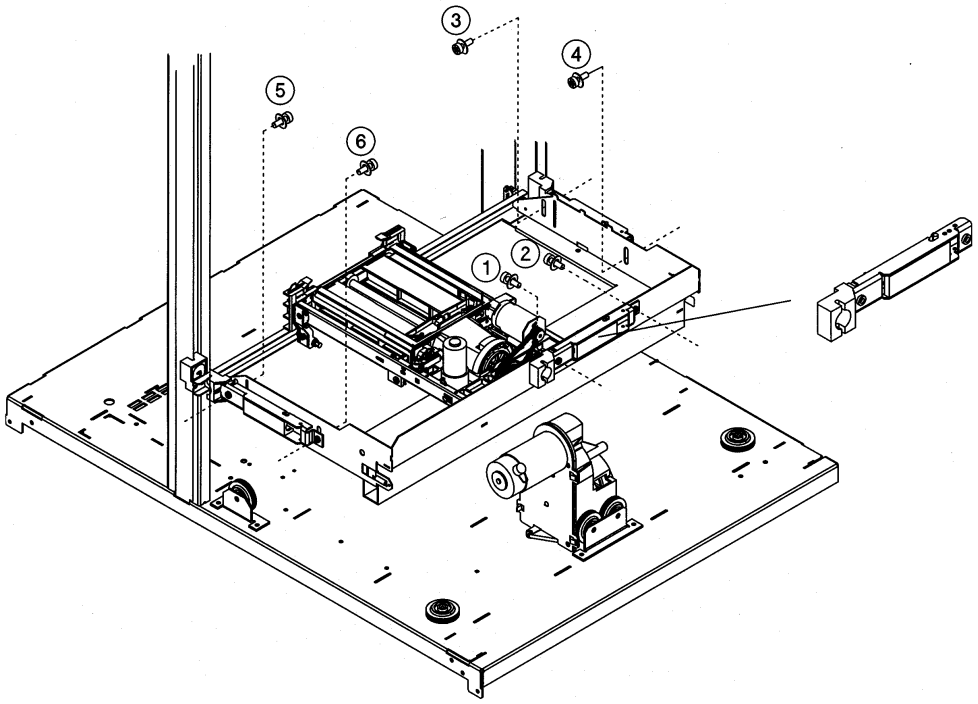


Reassembly Notes

When remounting the rear rope tensioner on the drive rope, position the tensioner so that the spring is on the right side. The position of the tensioner is shown in the enlarged tensioner in Figure 5-31.

It is recommended that you mount and secure the tensioners on the translate frame in the order shown on Figure 5-31

Figure 5-31 Positioning the Tensioner to Mount on the Translate Frame



To give yourself enough rope slack, fasten the drive rope ends to the rope tensioner *before* hanging the drive rope over the top two pulleys (see #2 Figure 5-28).

Before applying tension by setting the rope tensioners, insert the ropes into the rope coupler and attach the coupler cover plate (see Figure 5-29).

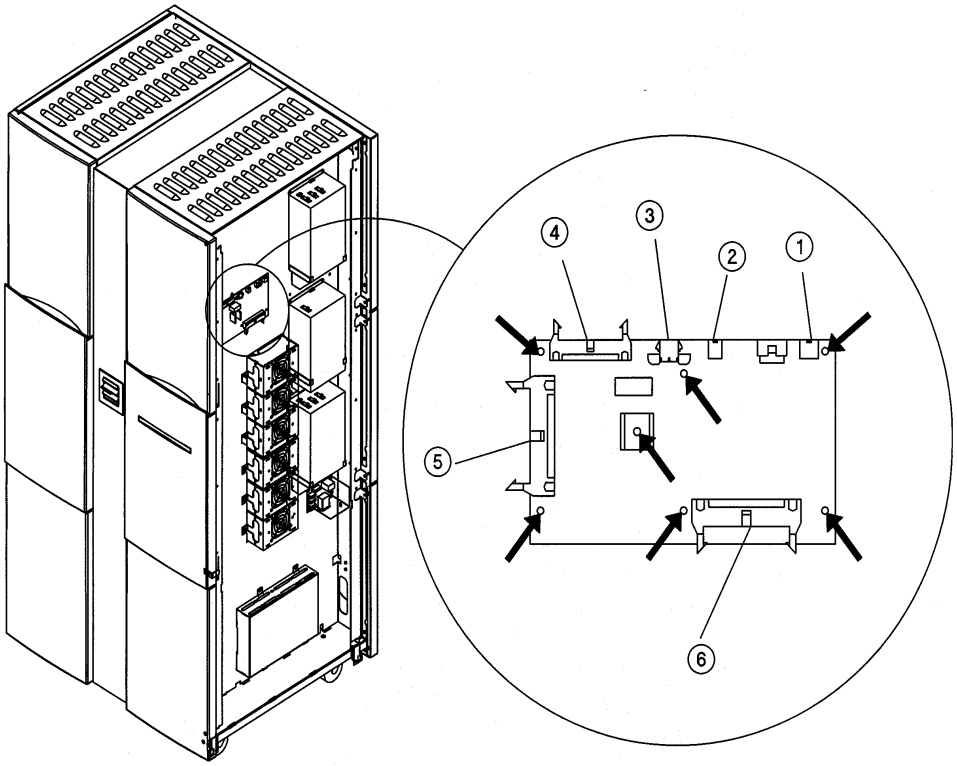
Reinstall the translate frame on the ropes as described in the "Reassembly Notes" on page 40 in the procedure for

“Removing/Replacing the Translate Frame (Including the Picker)” on page 34.

Replacing the Controller PCA

1. Remove the three right-side access panels and the lower and upper RFI panels (see Figure 5-1).
2. Remove all cables from the controller PCA (see Figure 5-32).
   - #1 - input power to the PCA
   - #2 - 24 V output
   - #3 - 24 V output to vertical motor
   - #4 - picker umbilical cable
   - #5 - GPIO
   - #6 - SCSI cable
3. Remove the seven T-20 screws holding the controller PCA to the chassis (see arrows on Figure 5-32).
4. Remove the PCA.

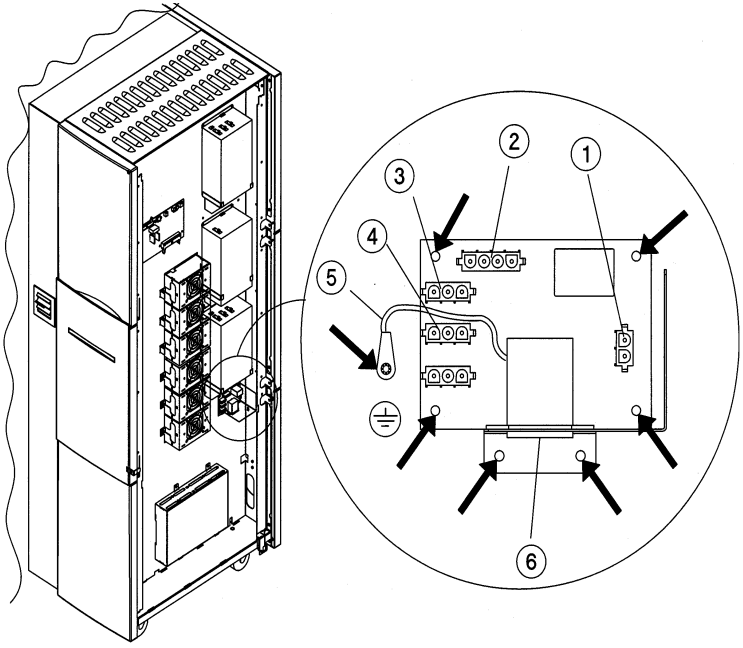
Figure 5-32 Controller PCA Cables and Mounting Screws



Replacing the Power Distribution PCA

1. Remove the lower right-side access panel (see Figure 5-1).
2. Remove the power cable and other power distribution cables from the PCA. See Figure 5-33.
   - #1 - 24 V input to the controller PCA
   - #2 - 24 V from 24 V supply
   - #3 - input to the lower 5/12 V power supply
   - #4 - input to the upper 5/12 power supply
   - #5 - ground strap
   - # 6 - line input
3. Remove the power distribution PCA.
   a. Remove the T-20 screw on the static strap (strap is #5 on Figure 5-33).
   b. Remove the other six T-20 screws holding the PCA. Four screws are on the PCA and two are on the power plug bracket (see Figure 5-33).

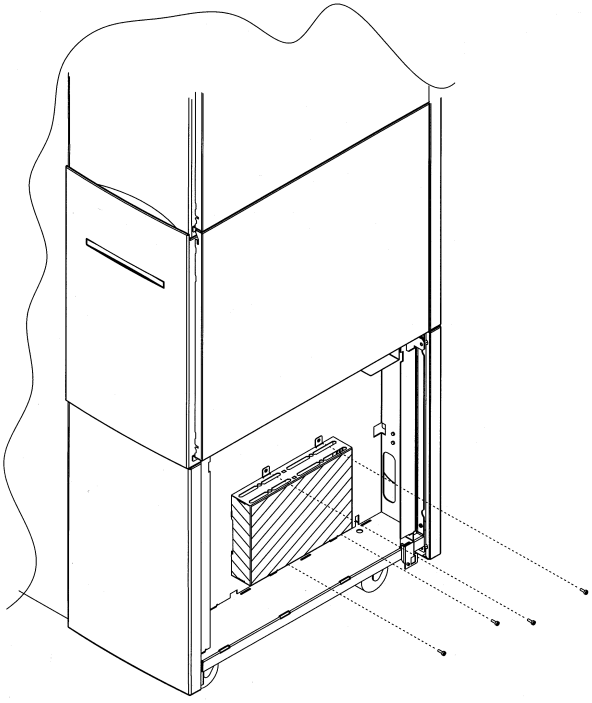
Figure 5-33 **Power Distribution PCA**



Replacing a SCSI Interface PCA

1. Remove the lower right-side access panel (see Figure 5-1).
2. Remove the four T-20 screws that mount the interface enclosure. Remove the enclosure.

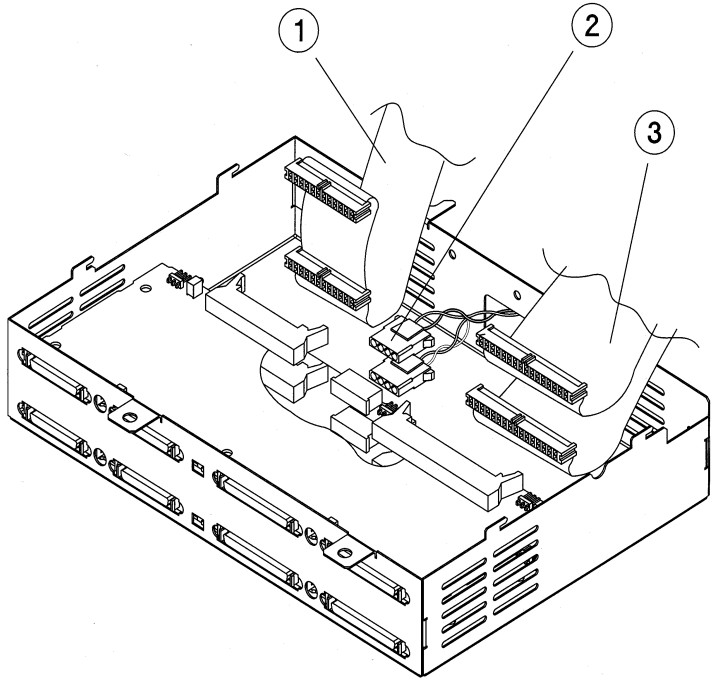
Figure 5-34 Unmounting the SCSI Interface Module



3. Remove all cables from the SCSI interface PCA.
   - #1 - drive interface cable (two connectors)
   - #2 - power input to the SCSI interface PCA
   - #3 - SCSI cable (one for each PCA)
4. Remove the six T-15 screws that mount the interface PCA to the inside of the module.

NOTE Depending on the model, one or two SCSI interface PCAs may be mounted in the module.

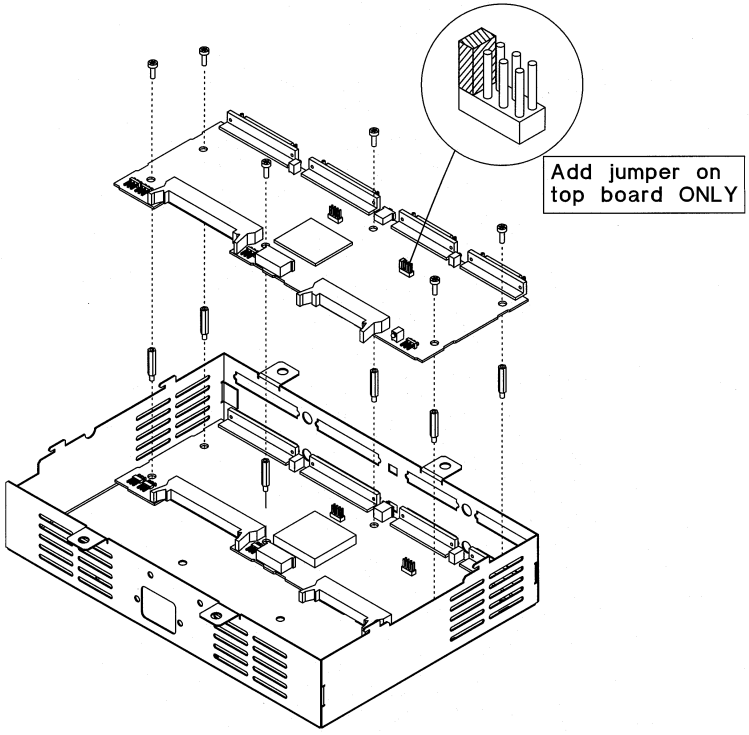
Figure 5-35 Interface PCA Cabling (Figure Shows a Two-PCA Configuration)



Reassembly Notes

If you are replacing the PCA for Bus #2 (top PCA), transfer the jumper from the previous PCA and mount it as shown in Figure 5-36.

Figure 5-36 Jumper Setting When Two PCAs Are In the Interface Module



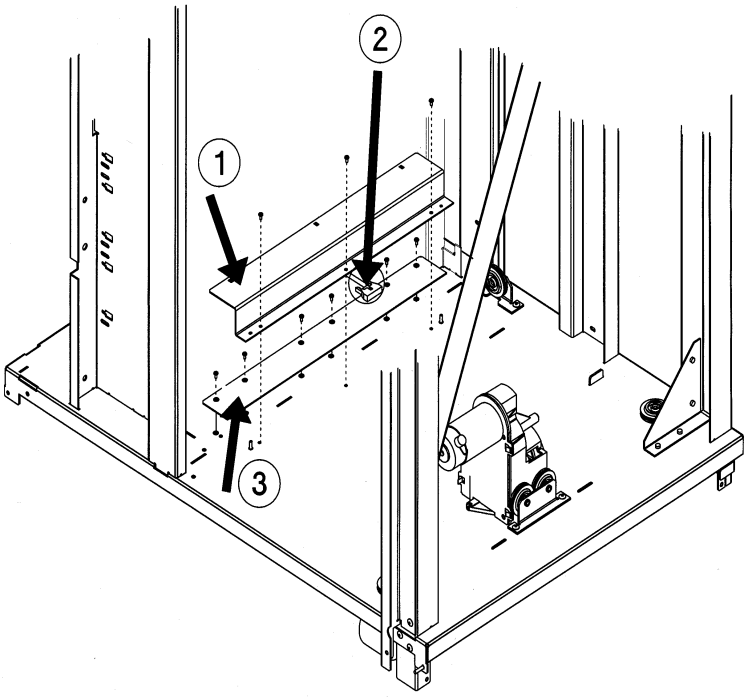
Replacing the Vertical-Path-Clear PCA

1. Remove the lower rear access panel (see Figure 5-37).

   Extra panels are removed in Figure 5-37 for parts visibility in this description.

2. Remove the three T-20 screws that mount the PCA cover (#1 on Figure 5-37).
3. Remove the cable from the rear of the PCA (#2 on Figure 5-37).
4. Remove the six T-20 screws that mount the PCA to the chassis (#3 on Figure 5-37). Remove the PCA.

Figure 5-37 Vertical-Path-Clear Enclosure and Mounting Screws



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.

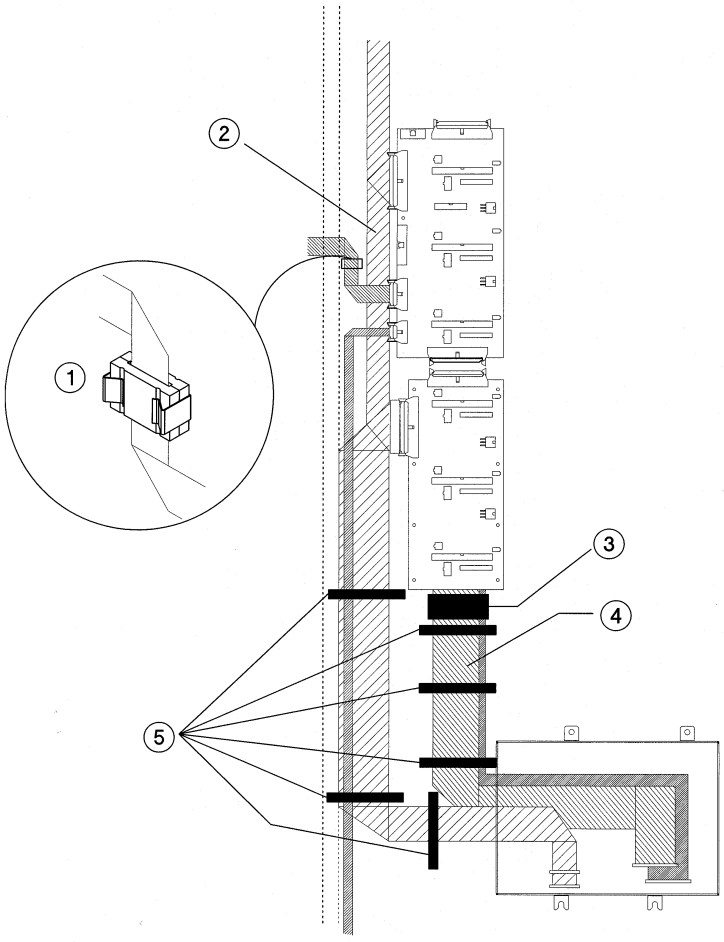
Refer to Figure 5-38 on the next page for the discussion below.

Be sure that there is an RFI clamp holding the front panel cable to the chassis as shown by #1.

Be sure that the RFI clamps (#3) around the SCSI cable (or cables) below the lower interposer PCA (#4) are placed as close to the bottom of the interposer PCA as possible.

Place the thin cable clamps on the cables as shown by #5. The goal is to hold the cables as close to the chassis body as possible.

Figure 5-38 RFI Adjustments



Upgrading Firmware to the Current Revision Level

What is Needed

- IBM AT-compatible computer
- Adaptec interface board
- A firmware download utility such as SCSI Toolbox® by Peripheral Test Instruments (PTI)
- An MO scratch disk for testing the drives.

Current Jukebox and Drive Firmware

Obtain the most current version of the jukebox controller and drive firmware for the model and option of the jukebox you are upgrading/converting.

Firmware for all models and options of this jukebox is available for download at:

www.hp.com (select the “HP Services & Support” tab)

Tools

- T-10 and T-20 Torx® drivers

Check the Firmware Revision Level

1. Ensure the jukebox is powered on.
2. Press **NEXT** to select `INFO *`, then press **ENTER**.
3. `REVISION #` displays. Press ENTER to view the robotics controller firmware revision.
4. Write down the revision number, then press **CANCEL**.
5. Press NEXT until `DRIVE FW *` displays, then press **ENTER**.

   UPDATING displays briefly, then `Dx REV zzzz` displays (where x represents a drive number and z represents the revision level of that

drive).

6. Press NEXT or PREV to select other drives and press ENTER.
7. After viewing the revision level for all drives, press **CANCEL**.
8. Determine if the jukebox and/or drives have the current firmware revision level.
   - If the firmare is current, no download is necessary.
   - If the jukebox controller and/or drive firmware is not the latest, go to the next section, “Download Firmware as Necessary.”

Download Firmware as Necessary

NOTE Ensure that the jukebox is not in LUN mode. Downloads must be done in basic SCSI addressing mode (LUN mode off).

IMPORTANT I*f you are going to download firmware for the jukebox controller*, the customer’s default configurations should be recorded so that the jukebox can be correctly restored. Go to the CONF * menu on the control panel to access and display the current jukebox configurations.

1. Turn the jukebox off.
2. Ensure that your PC tool is off.
3. Remove any cable connections to the single-ended ports on the interface module.

NOTE A service SCSI cable is stowed on the chassis left of the upper interposer PCA. This cable is provided in case you need it in the next step.

4. Connect a SCSI cable between your PC tool and one of the single-ended ports on the interface module. (Connectors on the module are high-density.)

   Place the interface select switch to the “single-ended” position, if

necessary.

5. Turn the jukebox on.

   Wait until the jukebox shows `READY` in the display.

6. Turn your PC tool on.
7. Follow your download utilities instructions to download the firmware needed (jukebox and/or drives).
8. Verify the operation of the drives by running a “random write” for approximately two minutes using your PC tool.
9. Veify the operation of the jukebox by running the “Wellness Test” from the control panel.
10. Turn off the PC tool and the jukebox.
11. Remove PC tool SCSI cable from the jukebox interface module.
12. Reconnect the customer’s cable to the single-ended port (if that was the configuration).

    Reset the interface select switch to differential, if necessary.

13. If you downloaded jukebox controller firmware, go to the CONF * menu and reset any customer configuration that is not default. The default configurations are as follows:

Table 5-1 Default Configuration Settings

Configuration	Default Value
RECOVERY	ON
DUAL PICKER	ON
STARWARS (vertical-path-clear)	ON
SCSI LOG	OFF
SECURE	OFF
SECURE MAIL	OUT
POWER SECURE	OFF
REP RECOVERED	ON

Table 5-1 Default Configuration Settings

Configuration	Default Value
CONF 40	OFF
WRITE VERIFY	ON
LUN Mode	OFF
SCSI Addresses (4- or 6-drive jukeboxes)	robotics controller = 6 drive 1 = 5 drive 2 = 4 drive 3 = 3 drive 4 = 2 drive 5 = 1 (if installed) drive 6 = 1 (if installed)
SCSI Addresses (10-drive jukebox)	robotics controller = 6 Bus 1 drive 1 = 5 drive 2 = 4 drive 3 = 3 drive 4 = 2 Bus 2 drive 5 = 5 drive 6 = 4 drive 7 = 3 drive 8 = 2 drive 9 = 1 drive 10 = 0

Table 5-1 Default Configuration Settings

Configuration	Default Value
Password	000-000-000

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 5-2 Exchange Parts

FRU No.	Part Number	Description
2	C1113-69x14	optical drive mechanism, 9.1 Gbyte
2	C1113-69x08	optical drive mechanism, 5.2 Gbyte
19	C1110-69x03	configuration module

Table 5-3 Non-Exchange Assemblies

FRU No. or Diagram Locator	Part Number	Description
1	C1104-60x01	robotics controller PCA
2	C1113-60x14	optical drive mechanism,9.1 Gbyte
2	C1113-60x08	optical drive mechanism, 5.2 Gbyte
4	C1110-60x04	upper interposer PCA
5	C1110-60x05	lower interposer PCA
6	C1107-60x06	vertical-path-clear PCA

Table 5-3 Non-Exchange Assemblies

FRU No. or Diagram Locator	Part Number	Description
8	C1150-60x08	SCSI interface PCA
19	C1110-60x03	configuration module
21	C1107-60x21	operator panel key pad assembly - purple keys
21	C1109-60021	operator panel key pad assembly - black keys
22	C1107-60x22	display PCA
23	C1107-60x23	vertical motor gearbox assembly
24	C1107-60x24	vertical motion motor
25	C1160-60x25	idler pulley (maximum of 9 in the rope system)
26	C1100-60x26	magazine (pair) 8-slots
27	C1107-60x27	picker/guide assembly
29	C1107-60x29	mailslot assembly
30	C1107-60x30	vertical encoder strip
31	C1160-60x26	magazine (pair) 6-slots
32	C1107-60x32	power supply (200W, 5/12V)
33	C1107-60x33	power supply (160W, 24/42 V)
34	C1107-60x34	slave rope
36	C1160-60x36	coupler assembly
37	C1160-60x37	tensioner assembly
38	C1107-60x38	translate encoder strip

Table 5-3 Non-Exchange Assemblies

FRU No. or Diagram Locator	Part Number	Description
39	C1107-60x39	encoder mount
40	C1107-60x40	translate frame assembly
41	C1107-60x41	vertical umbilical cable
42	C1160-60x42	mount guide - slider
43	C1107-60x43	translate umbilical cable
44	C1107-60x44	vertical motor power cable
45	C1107-60x46	SCSI cable stub (1 per 2 drives in enclosure)
46	C1160-60x46	capture roller assembly
47	C1107-60x47	drive bracket assembly
48	C1160-60x48	drive cooling fan
49	C1107-60x49	SCSI cable - top interposer PCA to controller PCA
50	C1107-60x50	lower 5/12 V power supply AC input cable
51	C1107-60x51	logic power cable
52	C1107-60x52	motor power cable
54	C1107-60x55	optical drive power cable (1 per 2 drives used in enclosure)
57	C1107-60x57	vertical path-clear emitter cable with emitters
58	C1107-60x58	vertical path-clear receiver cable

Table 5-3 Non-Exchange Assemblies

FRU No. or Diagram Locator	Part Number	Description
60	C1107-60x60	lower SCSI cable
61	C1107-60x61	upper SCSI cable
62	C1107-60x63	drive interface cable (1 per 2 drives in enclosure)
65	C1107-60x65	control panel cable
66	C1107-60x66	interposer cable
67	C1107-60x67	upper drives power cable
68	C1107-60x68	lower drives power cable
70	C1107-60x70	service power cable
71	C1107-60x71	service SCSI cable
78	C1107-60x78	display window assembly
80	C1107-60x80	AC power cord assembly
86	C1107-60x86	AC distribution PCA
A	C1107-60x98 C1109-60x98	side panel - flint grey side panel - parchment white
B	C1107-60x97 C1109-60x97	top panel - flint grey top panel - parchment white
C	C1107-60x96 C1109-60x96	back panel - flint grey back panel - parchment white
CA	C1107-60x95 C1109-60x95	lower back panel - flint grey lower back panel - parchment white

Table 5-3 Non-Exchange Assemblies

FRU No. or Diagram Locator	Part Number	Description
D	C1107-60x98 C1109-60x98	intf. access panel - flint grey intf. access panel - parchment white - strikes may be removed from the bottom of this panel to be used on new panel. If strikes are needed (“U” in diagram locator), order two.
E	C1107-60x94	lower RFI shield
F	C1107-60x93	upper RFI shield
G	C1107-60x92	vertical path-clear cover
H	C1107-60x81	SCSI interface enclosure
I	C1107-60x82 C1109-60x82	front panel - flint grey front panel - parchment white
IA	C1107-60x90 C1109-60x90	front panel - flint grey front panel - parchment white
J	C1107-60x89 C1109-60x89	center panel - parchment white center panel - parchment white
K	C1107-60x88 C1109-60x88	mailslot panel - flint grey mailslot panel - parchment white
L	C1107-60x87	front window
M	C1107-60x85	top window
N	C1107-60x09	feedthru umbilical PCA
O	C1107-60x42	umbilical jumper cable

Table 5-3 Non-Exchange Assemblies

FRU No. or Diagram Locator	Part Number	Description
P	C1160-60x80	power switch cable
Q	C1192-84304 C1192-84307	interface module label - 2 PCAs interface module label - 1 PCA
R	1400-2124	clamp for vertical umbilical cable
S	C1700-41202	vertical sensor bracket
T	C1715-40531	latch-style cable clamp —(used to hang C1107-60071 service SCSI cable)
U	1390-1040	strike - order two, if needed, when replacing lower side panel (D)
V	1390-1041	latch (used with strike (U) - order two)
W	1400-2124	round, ratchet latch cable clamp — used for input AC power cord
X	1250-2548	SCSI hi-density, single-ended terminator
Y	A1658-62024	SCSI wide differential terminator
Z	1400-0611	clip-style cable clamp — holds long interposer cable
AA	1400-1611	latch-style cable clamp —used for power cable routing and other purposes
AB	3160-0214	drive fan grille
AC	C1107-60084 C1109-60084	mailslot door, flint grey mailslot door, parchment white
AD	Cl107-60035	translate rope

Table 5-3 Non-Exchange Assemblies

FRU No. or Diagram Locator	Part Number	Description
AE	4320-0448	wheel chocks
	0515-2382	small, flat-head screw, T-10 head
	0590-2251	sheet-metal u-shape nut
	0624-0647	4 x 20 self-tapping screw, T-10 head
	2220-0020	small, T-10 head machine screw
	2360-0524	conehead screw, 6-32x.625SQ
	2360-0541	short T-10 screw
	2360-0552	short, T-15 head screw with captive washer
	2680-0321	large, T-25 head screw with captive flat
	0515-2282	T-20 head screw with captive washer
	0624-0520	T-15 head self-tapping screw

Figure 5-39 Exploded View (1 of 6)

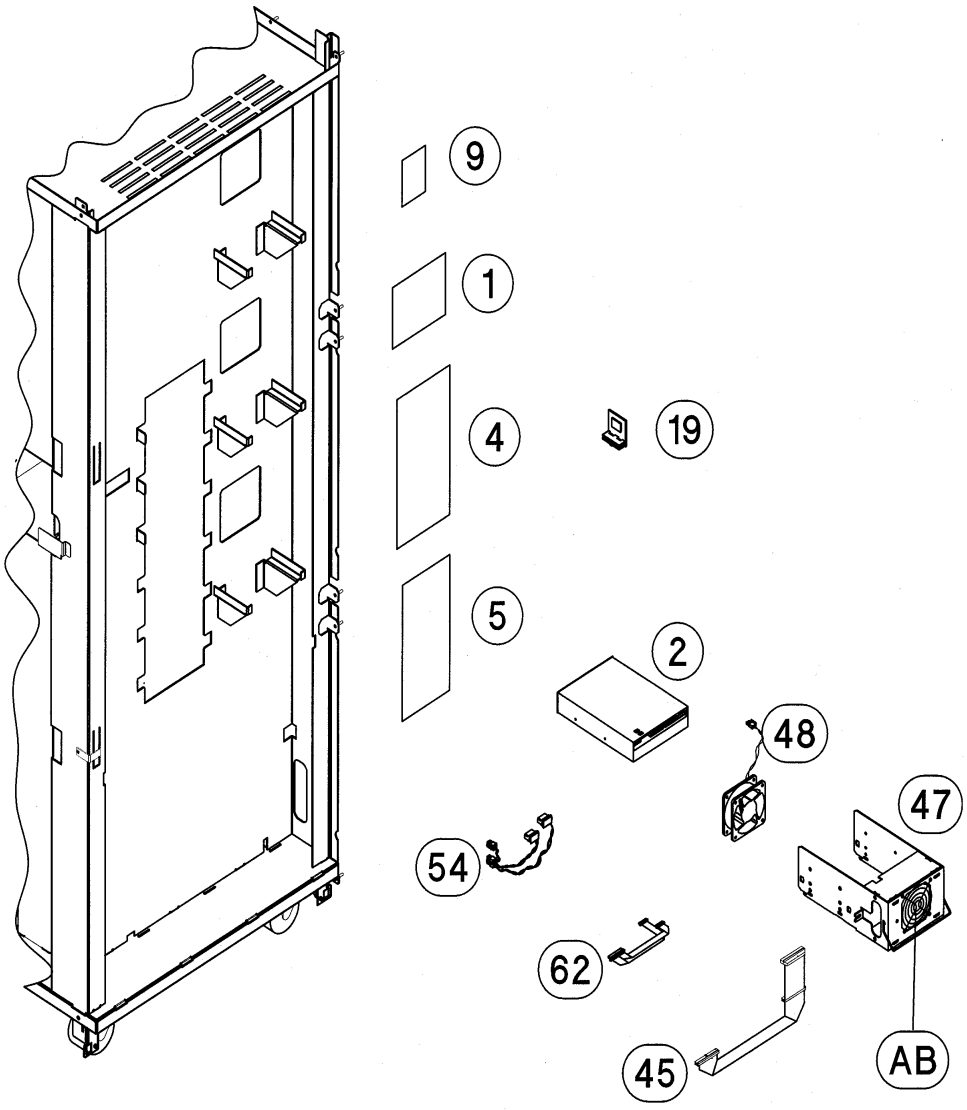


Figure 5-40 Exploded View (2 of 6)

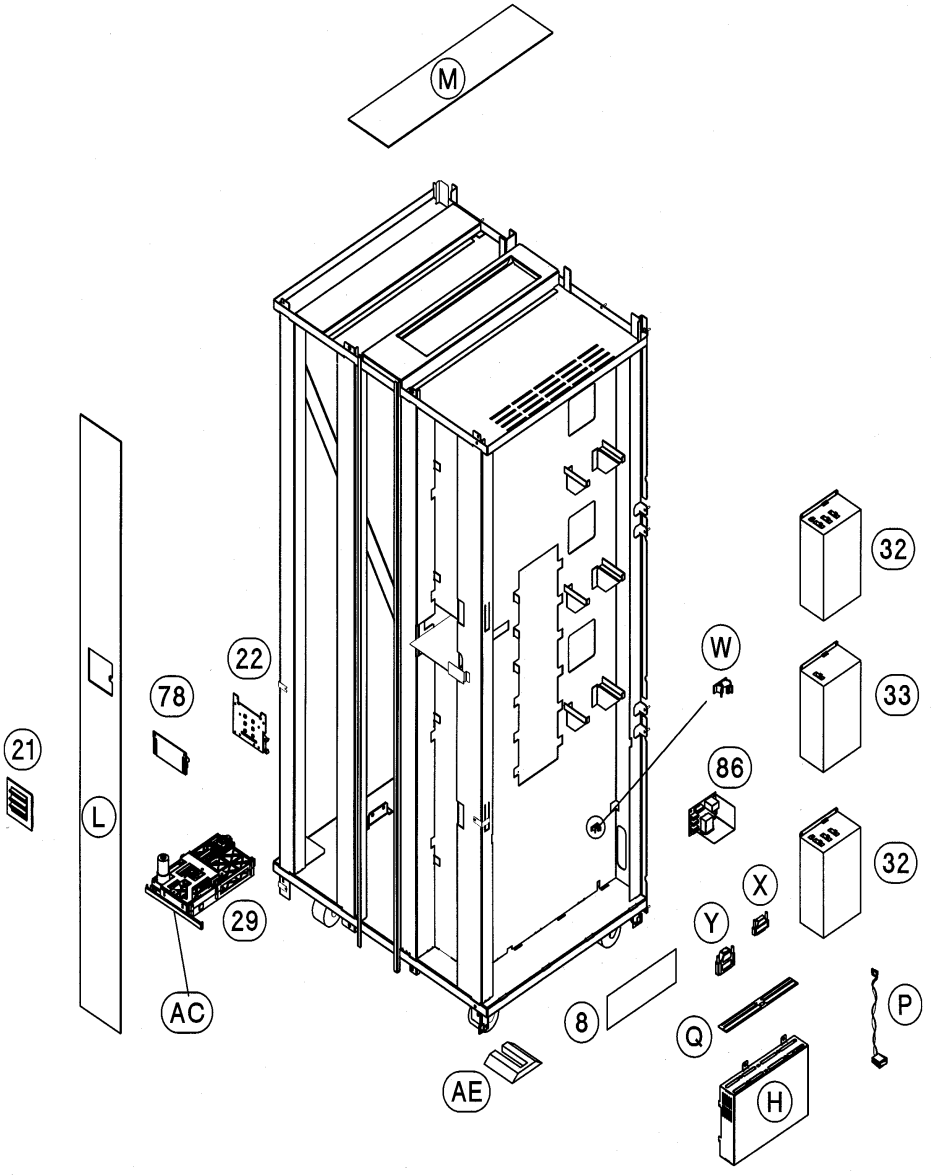


Figure 5-41 Exploded View (3 of 6)

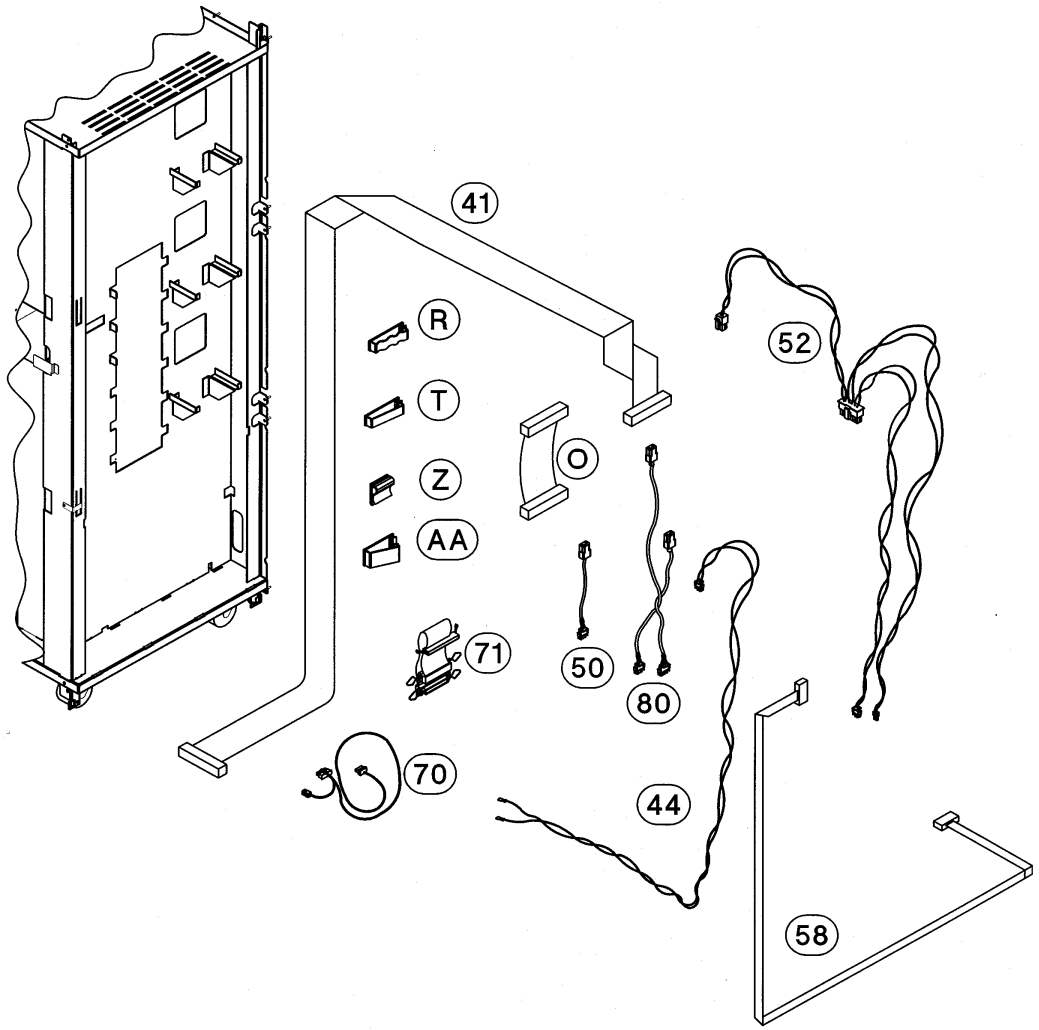


Figure 5-42 Exploded View (4 of 6)

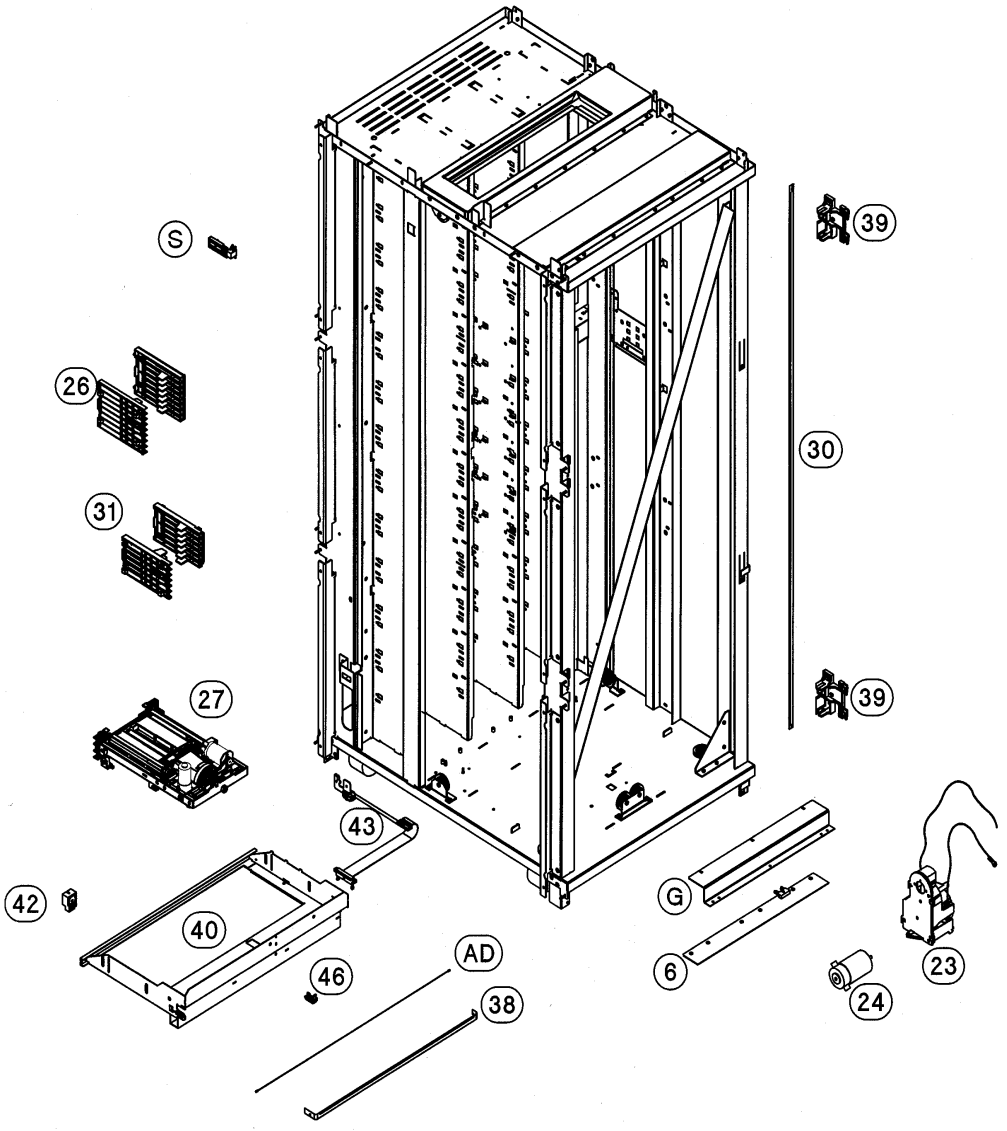


Figure 5-43 Exploded View (5 of 6)

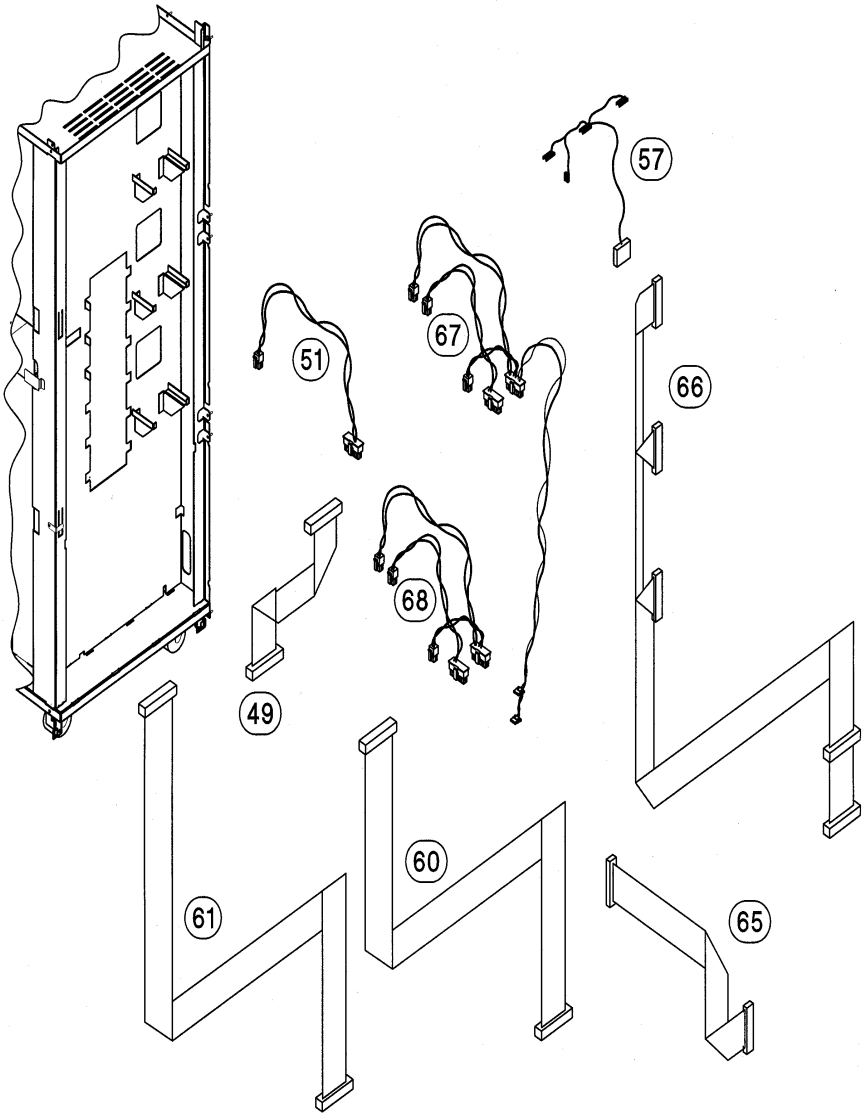


Figure 5-44 Exploded View (6 of 6)

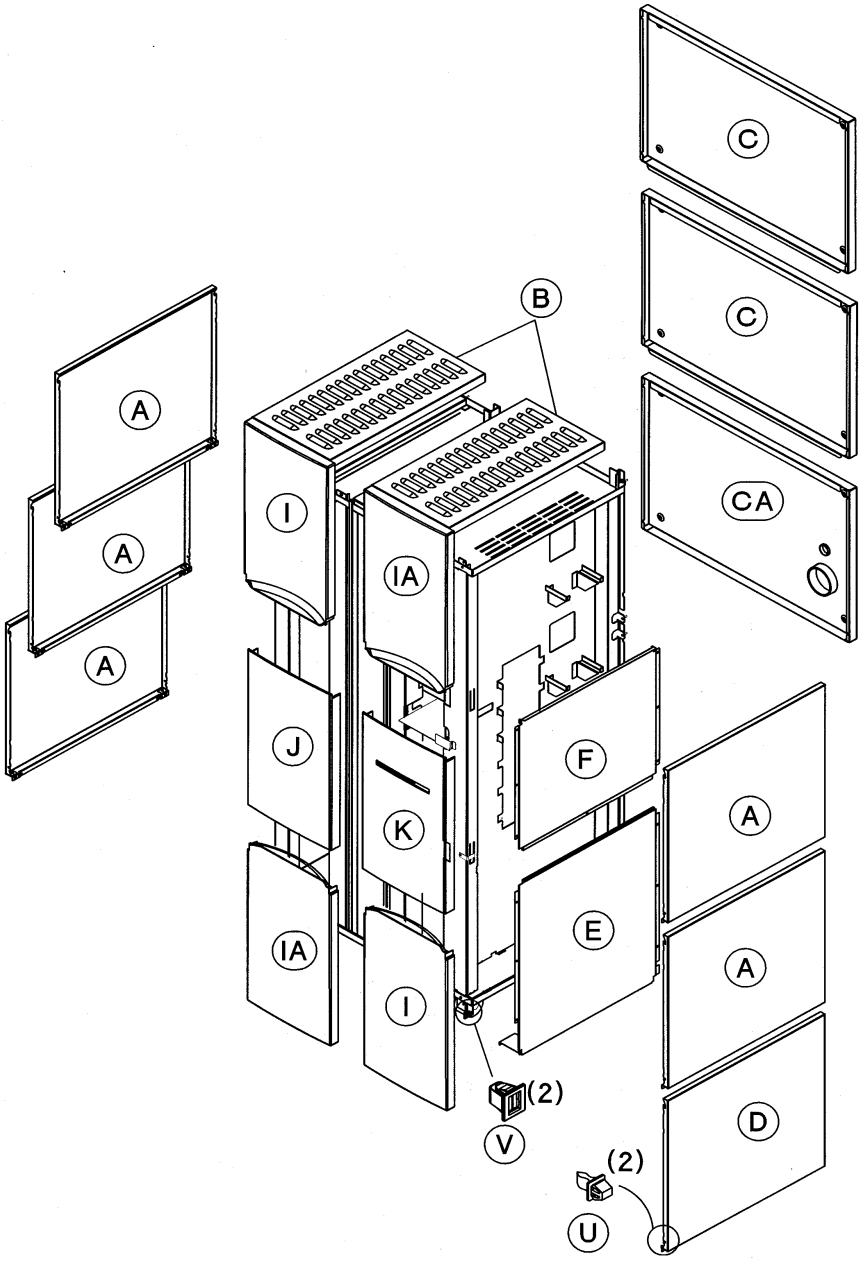
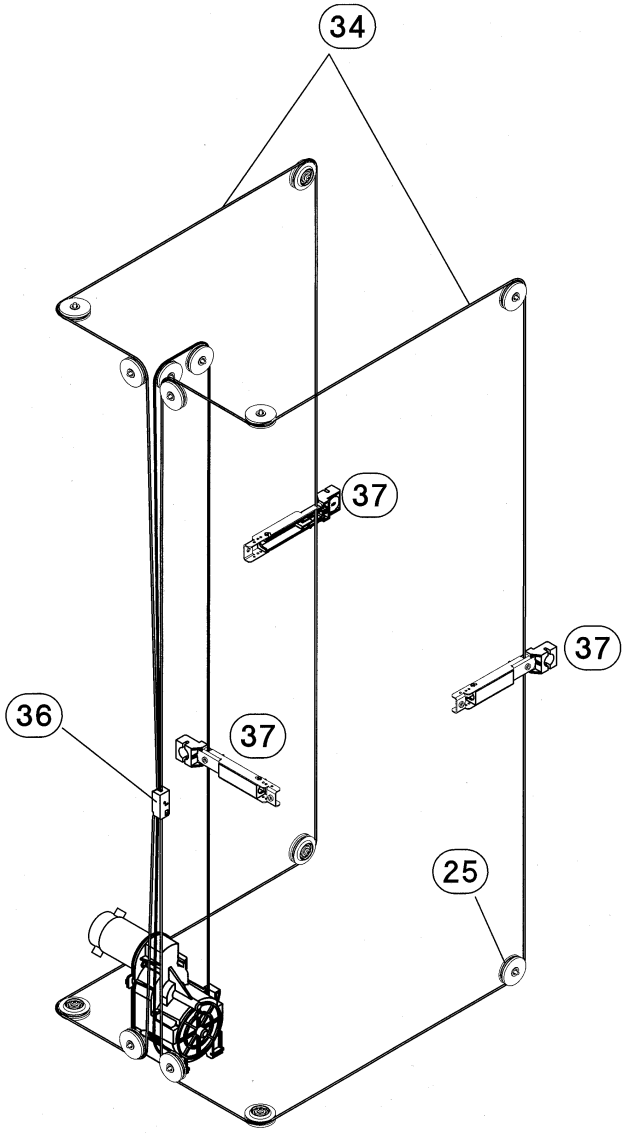


Figure 5-45 Pulley and Rope Diagram



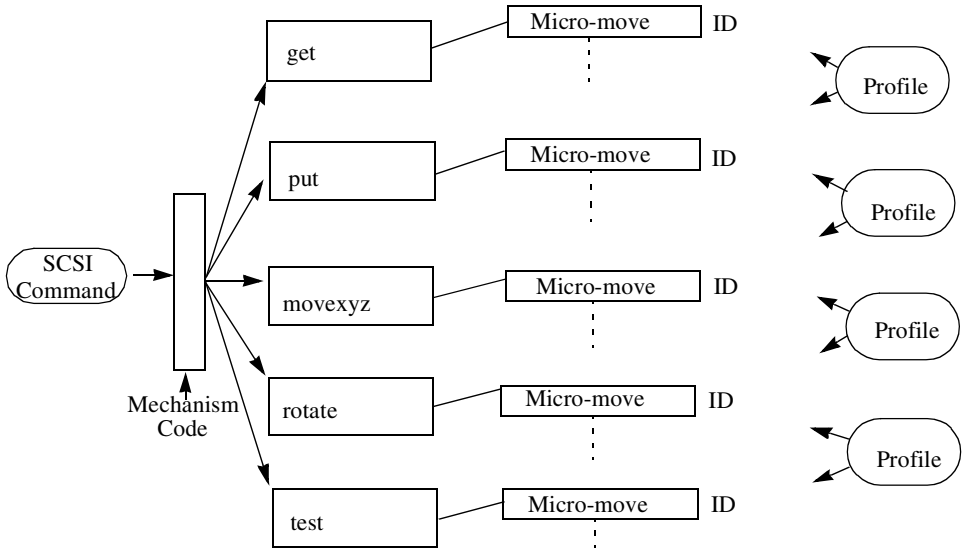
6 Theory of Operation

SCSI Command Execution to Mechanics

The mechanism code of the jukebox accepts high-level SCSI commands from the interface, translates these commands into servo code for the jukebox, 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 jukebox and then executed.

Figure 6-1 SCSI Command Translation for Jukebox Operation



Examples of high-level SCSI-2 commands are:

- Move Medium: move a cartridge from element A to element B.
- Exchange Medium: move a cartridge from element B to element C and from element A to element B.
- Position to Element: position the transport at a target element.
- Initialize Element Status: test for the presence of a cartridge at a target element.
- Rotate mailslot: rotate the mailslot assembly to perform I/O with the user.

The commands are translated into a series of moves which are basic jukebox functions. Each called function (listed below) is then broken into submoves called micro-moves. In this jukebox, the basic jukebox functions include:

- Get cartridge: gets the cartridge with the picker finger from the magazine, drives or mailslot.
- Put cartridge: puts the cartridge with the picker finger into the magazine, drives or mailslot.
- Movexyz: positions the picker transport to a specific vertical position.
- Rotate mailslot: plunges and retrieve the picker finger assembly to rotate the mailslot assembly in and out of the jukebox.
- Test cartridge: runs inventory test to see if a cartridge is present.

For example, “Move element 33 to element 2" is transformed into the following sequence of jukebox functions:

1. Determine that element 33 is a storage slot and element 2 is a drive.
2. Move the picker to the front of the storage element.
3. Get the cartridge from the storage element.
4. Move the picker to the front of the disk insertion slot on the drive element.
5. Put the cartridge into the drive element.

Each of the basic jukebox functions are divided into a series of smaller movements called “micro-moves.” There are two types of micro-moves:

- Position move: move the driving motors a given distance at peak

speed.

- 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.

Position moves are used for high-speed, unobstructed movements of a known distance. Saturation moves are used in low-speed, adaptive movements of variable distance.

Basic jukebox functions consist of one or more combinations of position or saturation type micro-moves. Each function has a tailored set of these submoves to ensure that the basic jukebox function will be gentle. As a function is executed, servo gains are adjusted to allow for changes in load characteristics.

Each micro-move within a specific function 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.

The Robotics Controller PCA

The robotics controller PCA contains the following major components, which are illustrated in Figure 6-2 on page 6-7:

- **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.
- **Jukebox ASIC**: The JUKEBOX 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.
- **NCR 53C80 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.

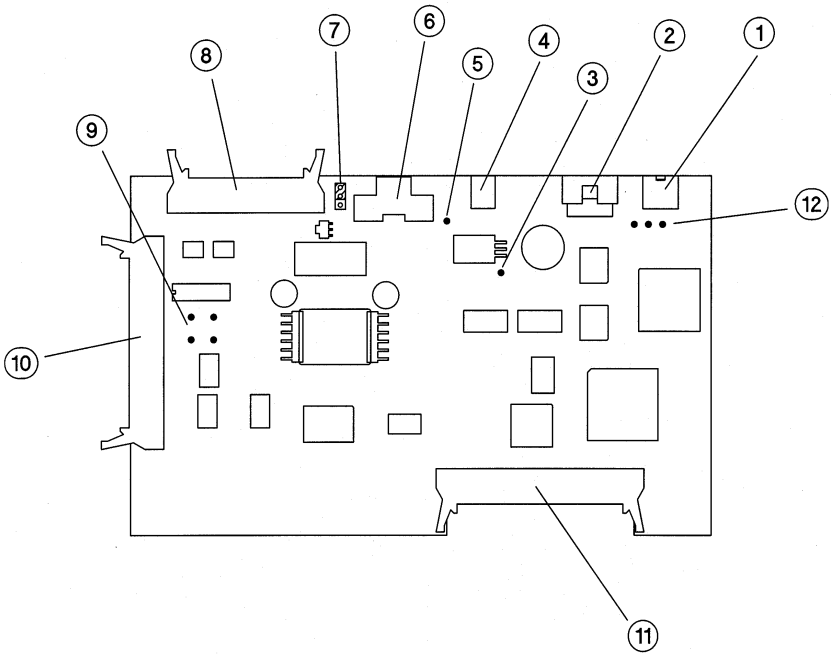
  The servo system section of the chip provides servo timers, three motor control pulse-width modulators, and three quadrature encoder channels.

  Drive interface signals EJECT and BUSY are also handled by this chip.
- **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.
- **SCSI Interface**: All SCSI signals are handled by the NCR 53C80 chip under control of the MC68EC000 processor and the autchanger ASIC chip.

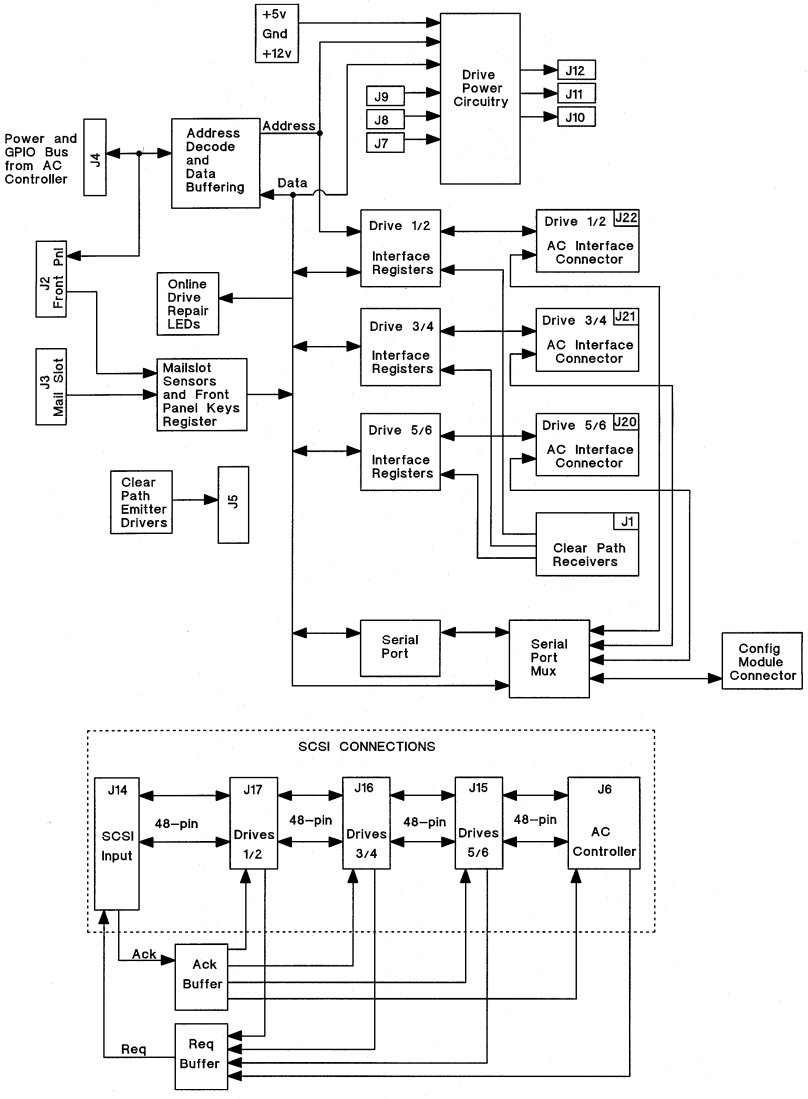
Figure 6-2 **Robotic Controller PCA**



Upper and Lower Interposer PCAs

The interposer PCA is an extension of the controller PCA.

Figure 6-3 **Upper Interposer PCA Block Diagram**



(Use the top portion of the diagram for the following explanation.)

The single, GPIO and power connection from the controller PCA is J4. Address decode and data buffering takes addresses from the controller PCA and sends the data to proper locations and takes received data and routes the data to the proper destination.

Ground, 5 V, and 12V are supplied to the optical drives directly through their own power circuitry on the interposer PCA (see the top of the diagram). The controller can control power application to the drives through this circuitry. In the event of a drive failure, the controller sets the displays of the online drive repair LEDs.

Power to the drives can also be removed by unplugging the J9, J8, and J7 connectors. These connectors are the four-pin connectors on the drive power cables and act like power on/off switches. Power to the drives is supplied through the eight-pin connectors J12, J11, and J10.

The controller communicates to the drives through each drive's "AC interface connector." Status signals and commands available include: requesting a drive eject, spin-down requests, drive sensing, error status detection, sensing presence of a cartridge, resetting the drive, sensing a loaded cartridge, setting write with verify, and setting the SCSI ID for the drive.

The controller can talk (serial protocol) to each drive individually through the serial port multiplexer (MUX). This communication path, which is also routed through the "AC interface connector," enables the controller to request the drive's serial number and revision of firmware being used. The controller can also use the serial MUX to directly talk to the configuration module.

The vertical-clear-path emitter drivers on the interposer PCA output to the emitters in the vertical-path-clear LEDs through connector J5.

J3 receives mailslot information and front panel key strokes. The controller can read key strokes through the J3 connection, but the controller sends front panel display information directly to J2.

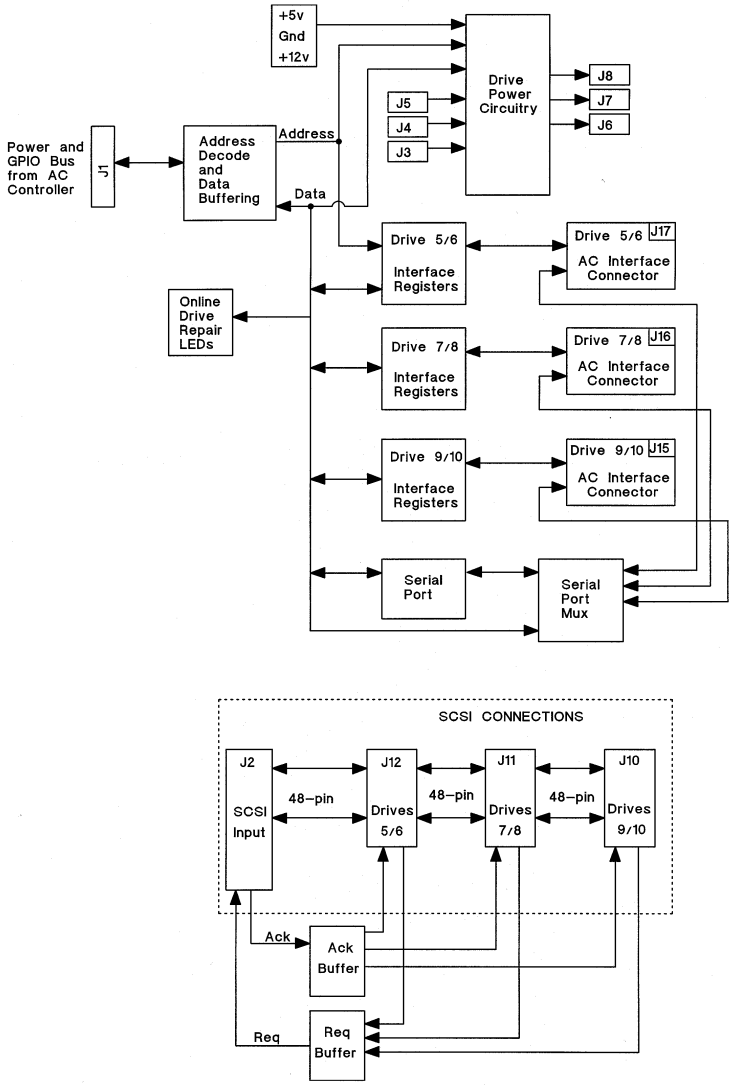
(Use the bottom portion of the diagram for the following explanation.)

J14 is the SCSI input from the host computer. The input is directly bused to connectors J17, J16, J15, and J6, which are the connections to drives 1/2, 3/4, and 5/6 respectively.The bus uses 48 of the 50 pins of the SCSI bus.

SCSI is *totally separate* from any other electronics on the interposer PCA

except for two signals, Req and Ack.The Ack signal comes from the host computer, is buffered on the interposer PCA, and sent to each drive individually. Req signals come from the drives and are buffered into *one* signal going back to the host computer. If a drive problem occurs, there is a possibility that this problem could be from the interposer's buffering of the Req and Ack signals. But if the problem is due to Req and Ack, it will probably affect only *one* drive.

Figure 6-4 Lower Interposer PCA Block Diagram



The lower interposer PCA performs the same general functions of the upper interposer PCA for drives 5/6, 7/8 and 9/10.

There are some functions that are not present on the lower PCA such as clear-path drivers, mailslot sensor input, front panel output, and a connection for a configuration module.

Configuration Module

The configuration module is a “key” that enables activation of the full complement of slots in the jukebox.

The module is plugged into a connector on the upper interposer PCA (see #9 on Figure 5-14).

All jukeboxes are shipped with a full complement of slots installed. The jukebox may however be sold and used as a “half” version using 128 slots. When a configuration module is plugged into the interposer PCA, and power is turned on, the jukebox will sense the additional slots and automatically begin operating as a full, 238-slot jukebox.

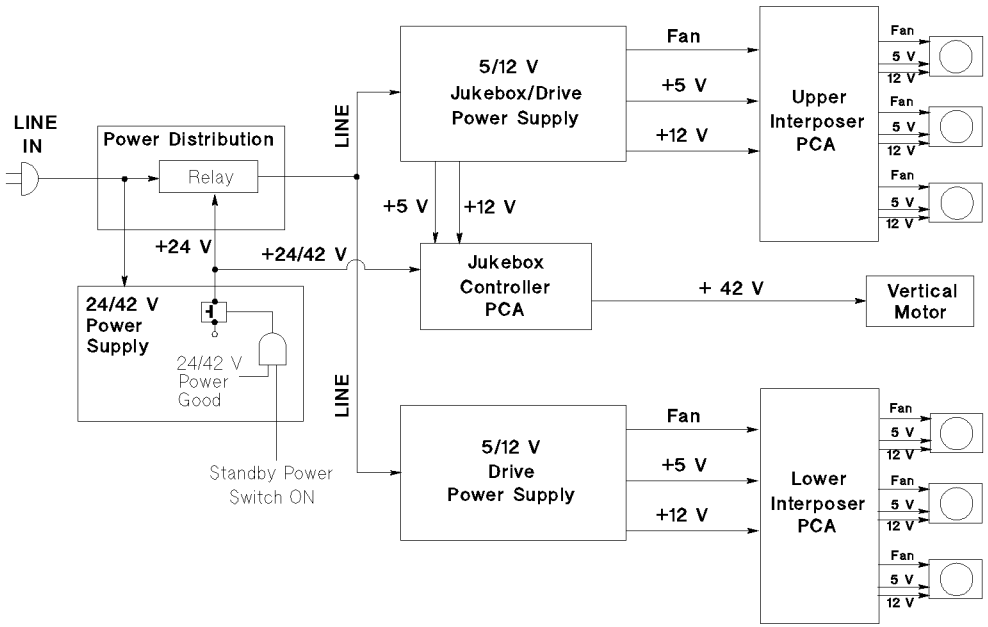
This presence of this module is confirmed regularly by the jukebox firmware. If the module is removed, the jukebox will fail. When restarted, the jukebox will once again operate in the “half” mode.

Power Supplies

There are two power supplies, both autoranging.

- One supplies +5 volts at 15 amperes and +12 volts at 10 amperes, which powers the drives and the jukebox logic.
- The other supply provides +24 volts and +42 at 4 amperes, which powers the vertical motion motor (+42 V) and the poweron sequence relay (+24 V).

Figure 6-5 Power Supplies and Poweron Sequence



Line power is connected through the power distribution PCA in the interface enclosure. Connection is direct to the 24/42-volt power supply. When the 24/42 -volt power supply comes up and is good AND if the power standby switch on the right side of the jukebox is in the ON position, the output of the 24/42 -volt power supply is enabled. The 24-volt output closes the relay on the power distribution PCA, allowing line power to be applied to the 5/12-volt power supply for the jukebox.

SCSI Interface PCA

The SCSI interface PCA has two major functions:

- Logically connect the active host SCSI bus (single-ended or differential) to the internal single-ended SCSI device bus.
- Operate in a LUN mapping mode.

Internally, the jukebox has a single-ended SCSI bus. The external differential and single-ended connections are on the top of the PCA and the single-ended bus connection to the jukebox is on the bottom. A slider switch between the two external connectors on the top of the PCA selects which type of input will be accepted. See Figure 6-6.

Figure 6-6 SCSI Interface PCA Block Diagram

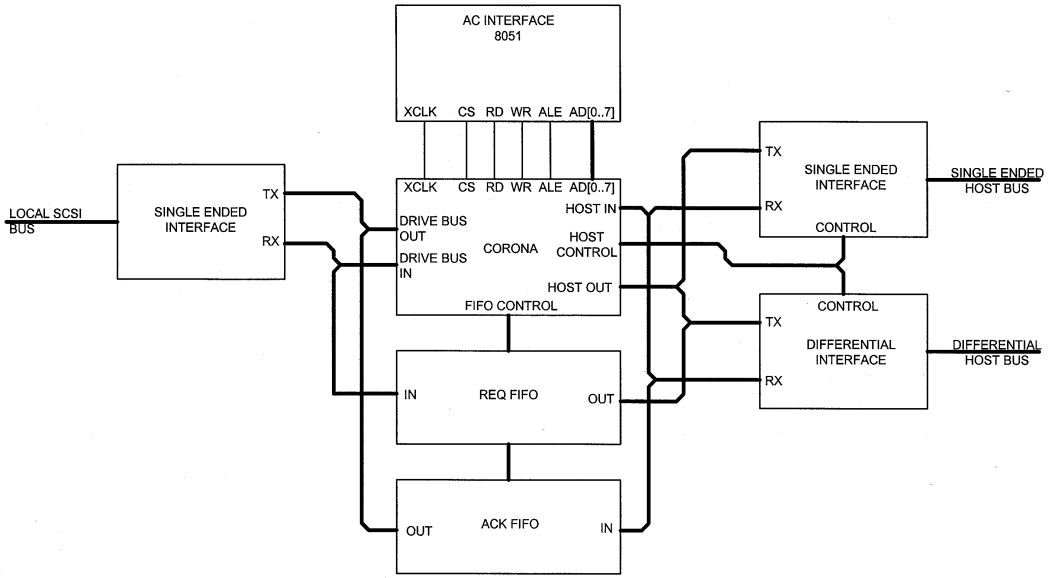
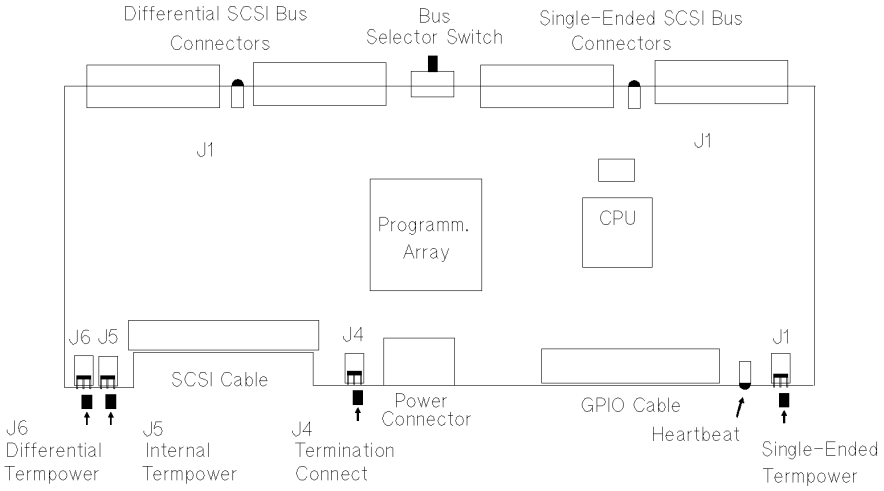


Figure 6-7 **SCSI Interface PCA**



The jukebox communicates to the PCA through a GPIO bus.

The differential and single-ended connectors are on the top of the PCA and the single-ended bus connection to the jukebox is on the bottom. A slider switch between the two external connectors selects which type of input will be accepted.

Four jumpers select the configuration for termination alternatives

-
  - — J6 - enable/disable differential host TERMPOWER. PIN 1 and 2 jumpered together allows the PCA to provide TERMPOWER to the differential external [host] SCSI bus (default).
  - — J5 - enable/disable internal bus TERMPOWER. PINS 1 and 2 jumpered together allows the PCA to provide TERMPOWER to the internal SCSI bus (default).
  - — J4 - bus terminator configuration. PIN 1 and 2 jumpered together enable bus termination (default). When enabled, active termination is supplied for the internal bus at this PCA; termination at the other end of the SCSI cable is by a clamp terminator attached to the SCSI cable near the last drive connection.
  - — J1 - enable/disable single-ended host TERMPOWER. PIN 1 and 2 jumpered together allows the PCA to provide TERMPOWER to

the single-ended external [host] bus (default).

The two large components on the PCA are the Field-Programmable Gate Array and the microprocessor. The microprocessor is an 80C52 that has flash-programmable memory on board. (There are no boot ROMs on this PCA).

After the jukebox runs it selftest on wakeup, in instructs the PCA to come up in whichever mode has been selected by the user. It can come up either as a repeater or in LUN mode. Communication from the robotic controller is through the GPIO bus cable. (If the GPIO cable is not connected at startup, the PCA will come up as a repeater.)

A “heartbeat” LED is located on the bottom edge of the board. This LED will continuously flash at a slow rate when power is applied. If the LED is either on steady or off, this indicates a problem with the PCA.

An LED, visible through the top of the interface enclosure, is mounted between the interface connectors on each side. These LEDs light to show which interface has been selected. If the wrong interface type is connected to the interface connector on this PCA, the LED will continuously and rapidly flash to alert the user to this error. No damage is caused to the chips on the PCA by having connectors in the wrong position.

During powerup, the position of the interface selector switch is checked to see which external bus is active and if the proper bus type is on the selected interface port.

If the differential bus is active, the DIFFSENSE signal on the SCSI bus is checked. If this signal is LOW, it means that a single-ended bus has erroneously been connected to the differential connector. The bus is immediately made inactive to protect the chips.

In addition to checking the position of the interface select switch on powerup, the controller is informed of any change to this switch during normal operation. If the switch position is changed, a BUS RESET signal is sent to the robotics controller on the internal SCSI bus

NOTE

It is important to provide proper termination on whichever external SCSI bus (single-ended or differential) that is in use. If the SCSI bus is not being daisy-chained to another peripheral (and terminated there) then termination must be provided at this PCA.

Logical Unit Number Mapping Capability

LUN means Logical Unit Number. The SCSI interface PCA enables connecting up to seven jukeboxes (theoretically) on a single SCSI bus. Also, the SCSI bus may be either single-ended or differential. Internally, the jukebox has a single-ended SCSI bus.

The LUN converter function operates in either of two modes: Passthru (no LUN mapping — default) and LUN mapping active.

The LUN of the addressed device is specified though an IDENTIFY message immediately following the SELECTION procedure (setting the LUN in the command Control Data Byte is not supported). After the LUN is set, commands, data, status, and messages are routed to the appropriate device. The Read Element Status command that is sent to the jukebox controller will report the drive's SCSI ID and LUN through a Read Element Status placed in the Data Transfer Element Descriptor Block.

Optical Cartridge Picker

A major performance parameter is the read-to-read time — the time between the reception of an “exchange” disks command to the time that reading starts on the new disk.

This series of jukeboxes has a dual picker which can optimize exchange times, but taking advantage of this optimization depends on whether the application running the jukebox implements the “exchange” capability.

The picker is capable of holding two disk cartridges at the same time and capable of operating in 2 modes — single-picker mode and dual picker mode.

The default configuration of the picker is to operate in dual-picker mode. When the application controlling the jukebox issues an EXCHANGE command, the jukebox firmware automatically chooses the most efficient way to exchange the disks. While the disk is ejecting from the drive, the picker uses this time to retrieve the new disk from the stacks. When the picker arrives at the drive to take the ejected disk, it is prepared to remove the disk from the drive and immediately insert the new disk. After this exchange, the ejected disk is returned to the stacks.

Applications which use the sequential MOVE command instead of the EXCHANGE command will not benefit from the dual picker.

If the jukebox is under the control of an application that expects only a single picker element, the picker should be configured to single-picker mode to prevent the application from becoming confused when executing a Read Element Status command.

Element Numbering

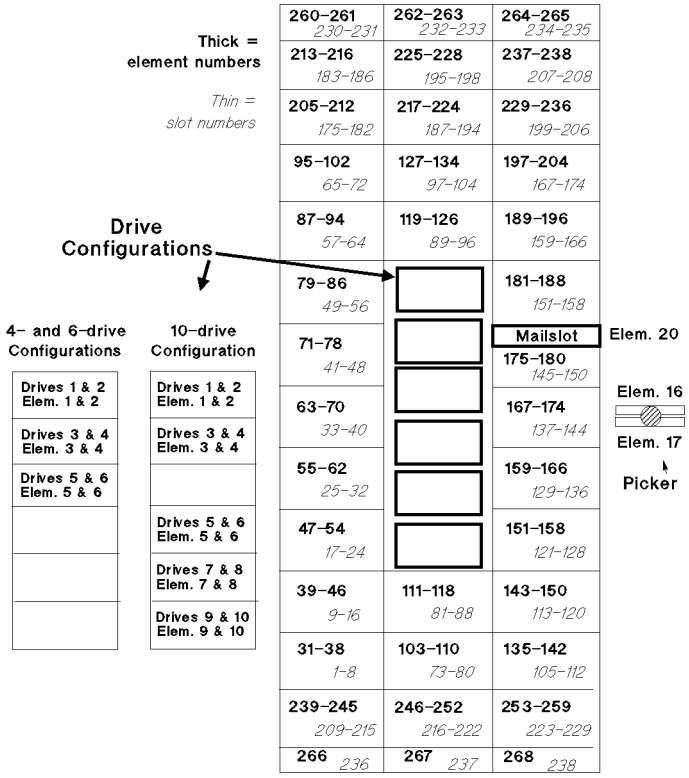
Element numbers designate any location that a disk can occupy in the jukebox.

Table 6-1 Element Numbering in the Jukebox

Element Name	Element Number
Optical drives	1 to 10
Reserved	11 to 15
Dual picker	16 and 17
Reserved	18 and 19
Mailslot	20
Reserved	21 to 30
Disk storage slots 1-128 (half configuration)	31 to 158
Disk storage slots 129 - 268 (continuation to full configuration)	159 to 268

Disk Storage Slot Numbering Sequence

Figure 6-8 **Element and Slot Numbering**



To improve access times, cartridge slot numbering starts close to the drives and expands out.

The lower-numbered slots are close to the optical drives and the higher-numbered slots are farther away from the drives. See Figure 6-8.

Element numbers start at drive 1. The first 10 elements are drives 1 to 10.

Slot 1 (element 31) starts at the lower left as you look at the stacks. SLOT numbering increases up to 72, drops down to continue with 73 up to 104, drops down again to continue with 105 and goes up to 174.

The pattern covers the slots from 175 to 208 — passing just below the

limited-access slots at the top.

The sequence continues with 209 though 229 across the bottom — just above the limited-access slots on the bottom.

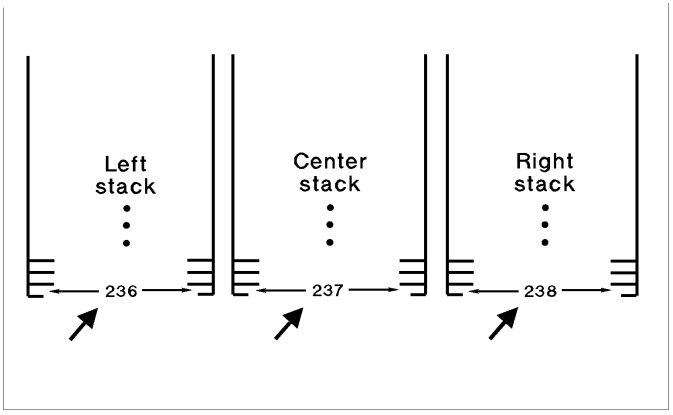
Next, back up to the top to include slots 230 through 235. Finally, the numbering jumps down to the bottom to include the limited access slots 236 to 238.

A decal that shows the slot numbering is inside the left-side panels on the jukebox.

Limited Access Slots

Because of physical constraints, some physical slots can have either limited access or cannot be accessed at all. At the lower limit of picker transport travel, there are 3 slots, 1 in each stack, that can only be accessed by the lower picker. Also, at the upper limit of picker travel, there is a level of slots that can be accessed only by the topmost picker.

Figure 6-9 **Limited Access Slots at the Bottom of the Stacks**



These picker limitations will normally be transparent to you, except in dual-picker high-speed exchanges.

Because the optical drives are located in the middle of the center stack instead of across the bottom, and the mailslot is mounted within the right-hand stack, the physical magazines are staggered upwards.

This results in some slots at the top that are inaccessible. The top TWO slots on the right stack and the TOP slot in the center stack can not be accessed by the picker at all. Never manually load a disk into any of these slots; the disk will be unavailable to the jukebox. The slot just below the top slot in the middle stack may only be accessed by the top picker and is used by the firmware for a special, error-recovery case — to recover when a cartridge has been grabbed by only one finger..

If the recovery does not work, you will find the cartridge left in this slot. You must manually replace the cartridge in the slot from which it came before it can be used again.

Never put a cartridge into this slot; it will be unavailable to the jukebox.

Figure 6-10 **Limited Access Slots at the Top of the Stacks**

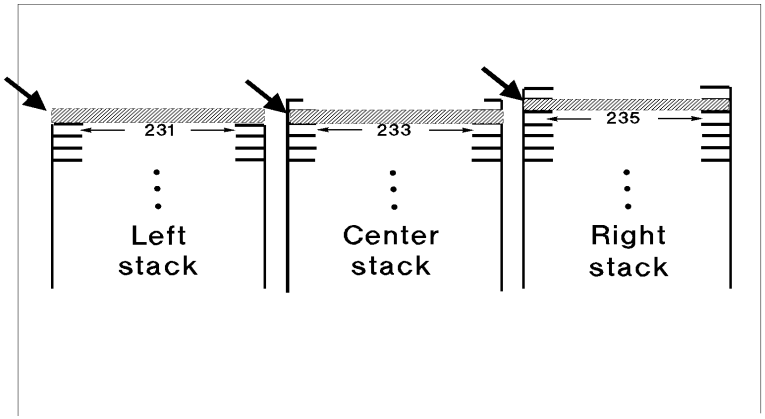


Figure 6-11 **One-Finger Grab Recovery Areas at the Bottom of the Stacks**

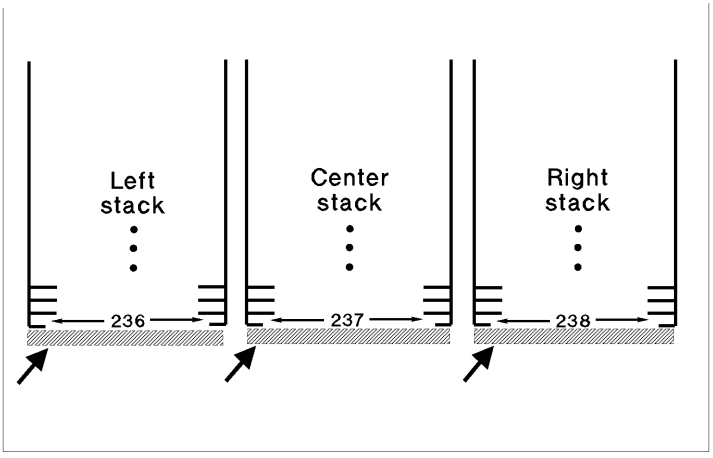
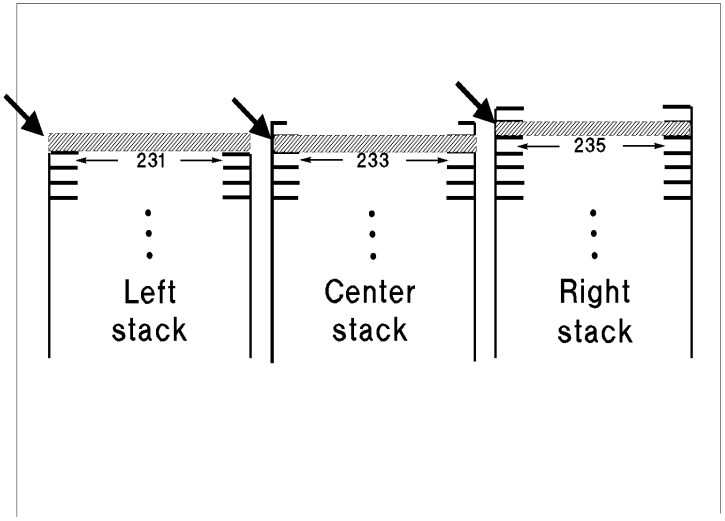


Figure 6-12 **One-Finger Grab Recovery Areas at the Top of the Stacks**

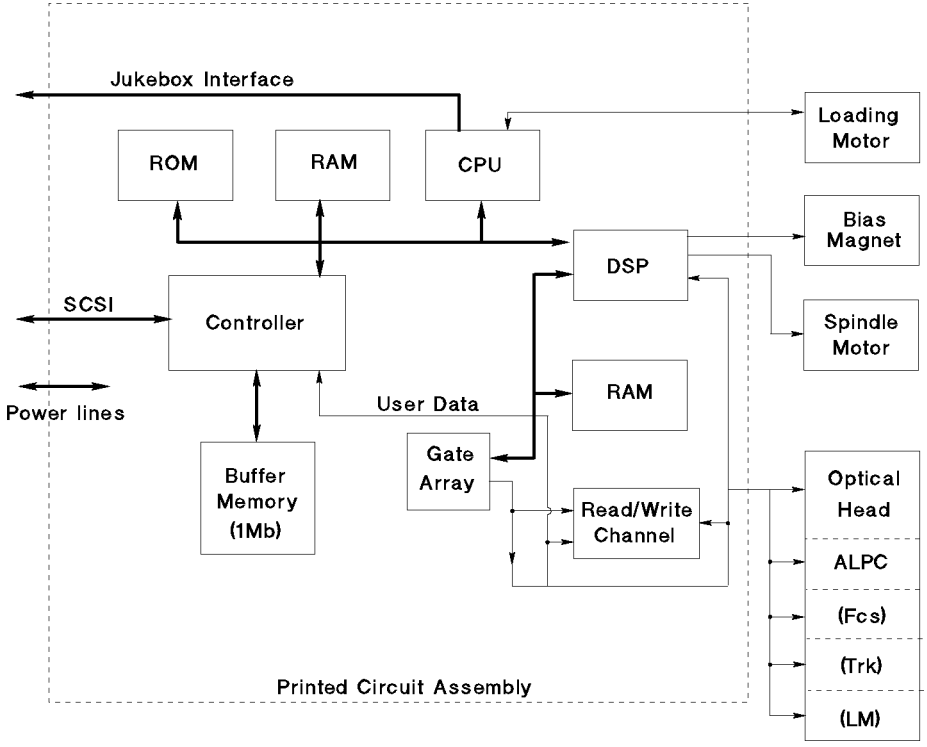


Warning decals next to the two top slots in the center and right-hand stacks remind you that you should never manually load disks in these slots.

Optical Drive Mechanism

Figure 6-13 provides an overview of the optical drive mechanism.

Figure 6-13 Optical 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.

Errors

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 on the next page shows the error thresholds for the 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.

Table 6-2 Error Thresholds

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

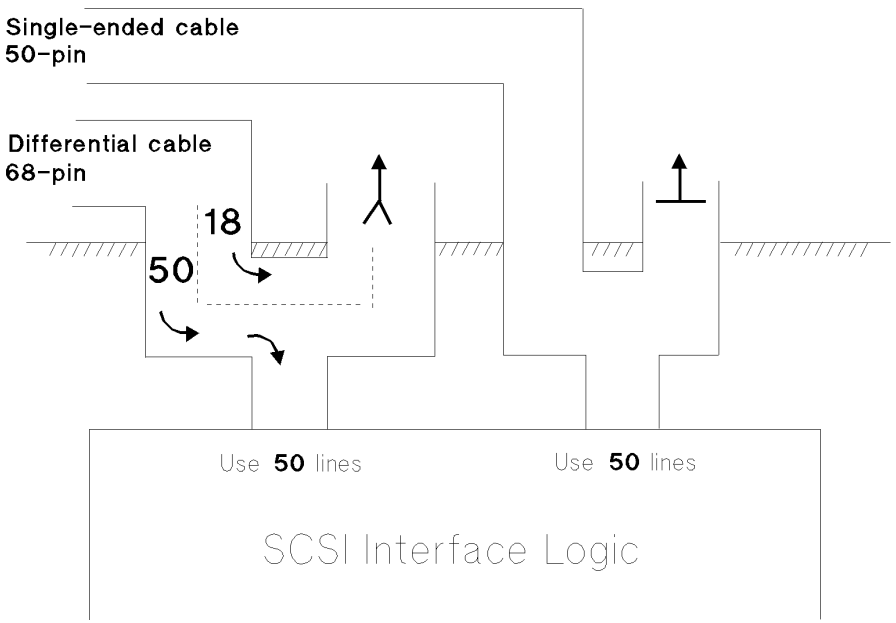
The SCSI Bus and This Jukebox

This jukebox is a “fast and narrow” SCSI device with the capability to connect to either a narrow single-ended bus or a wide differential bus.

In the diagram below, note that the single-ended (50-line) bus is brought directly onto the jukebox internal narrow bus. The differential interface accepts a wide bus in its 68-pin connector, but only *uses the 50 data and control lines* that comprise the “*narrow*” portion of the bus. The other 18 lines that provide the upper IDs and data of the wide bus are ignored. Note that all lines of the wide bus pass through the two 68-pin differential connectors. The wide bus is maintained as a wide bus.

The *single-ended* connectors are 50-pin and can accept only a narrow bus. The *differential* ports use 68-pin connectors and can accept (and pass through) a wide bus.

Figure 6-14 **Single-ended and Differential Interfaces on This Jukebox**



Adding Devices to the Bus

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. Another reason is that this jukebox, when fully utilized, is capable of using up the full bandwidth of the bus. Performance of one or all of the devices on the bus can be affected.

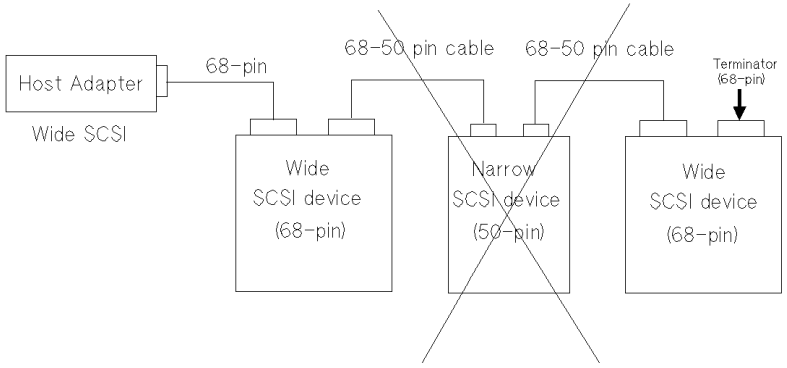
Consider the quantity of data that the bus will have to carry, the frequency of data transfer, and the priority of the data transfer under consideration. If the jukebox is used as a backup or archive device, the demands on the jukebox will be different than if the jukebox is used for near-online storage 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, a drop in performance should be expected.

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.

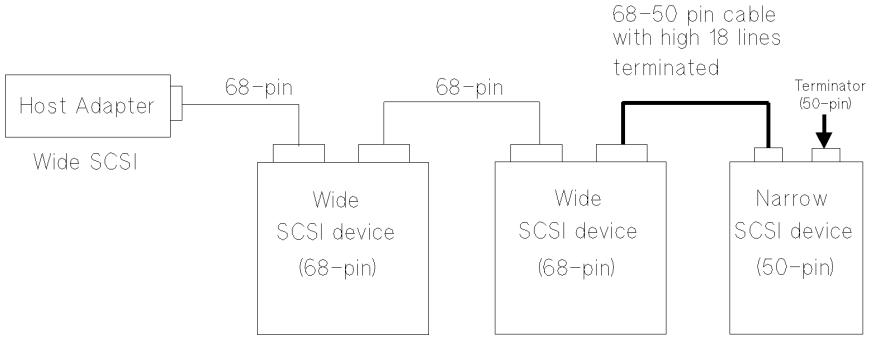
This method should only be implemented by an experienced systems integrator who is highly knowledgeable about SCSI. Since the wide (68-pin) buses need more data lines on the bus for their data transfer, it's necessary that the cables connecting the devices are 68 pin. The data would be lost if the devices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



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. The host adapter is a device, so if 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 on the next page.



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

Observe SCSI cable maximum lengths;

- 3 meters (9.8 feet) for the single-ended bus (remember, this is a fast device)

- 25 meters (82 feet) for the differential bus.

Termination

- Refer to the documentation for the particular adapter being used 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 from the host adapter (on the bus) and the last physical device on the bus external to the computer.

General

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

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