Optical Disk Library Service Manual

Models 10C and 20C

Models 20T and 40T

HEWLETT PACKARD

HP Part No. C1700-90031
Printed in USA June 1993

Edition 2
E0693

HP Computer Museum
www.hpmuseum.net

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Printing History

First Edition ..... October, 1992

Second Edition ..... June, 1993

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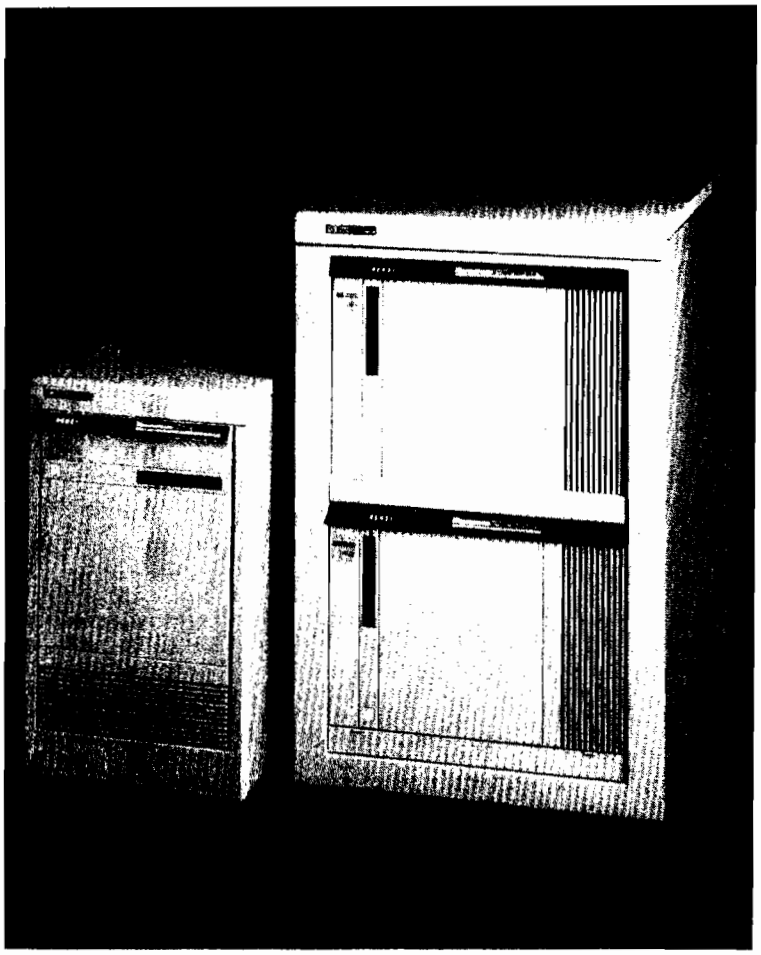

The Optical Disk Library
(Models 10C/20C and 20T/40T)

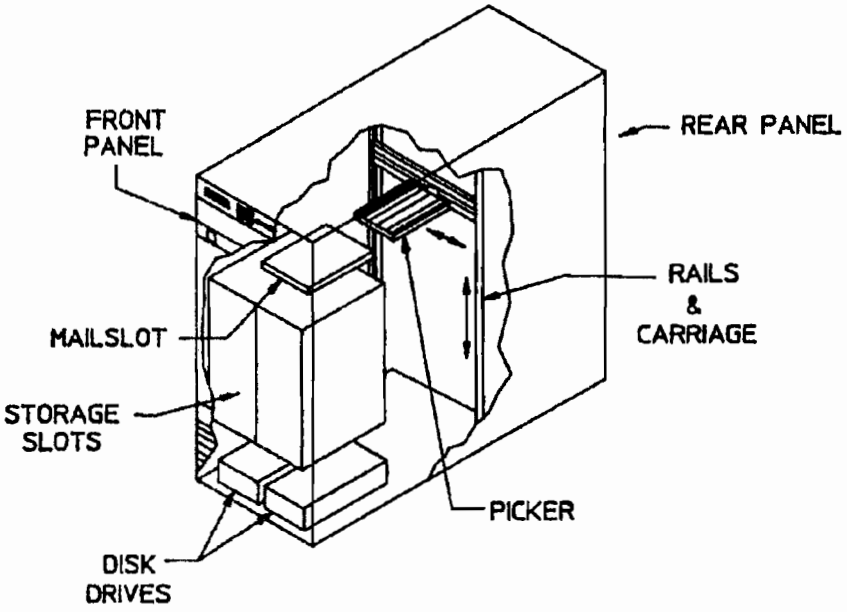

Figure 1-1. Deskside Optical Disk Library Components

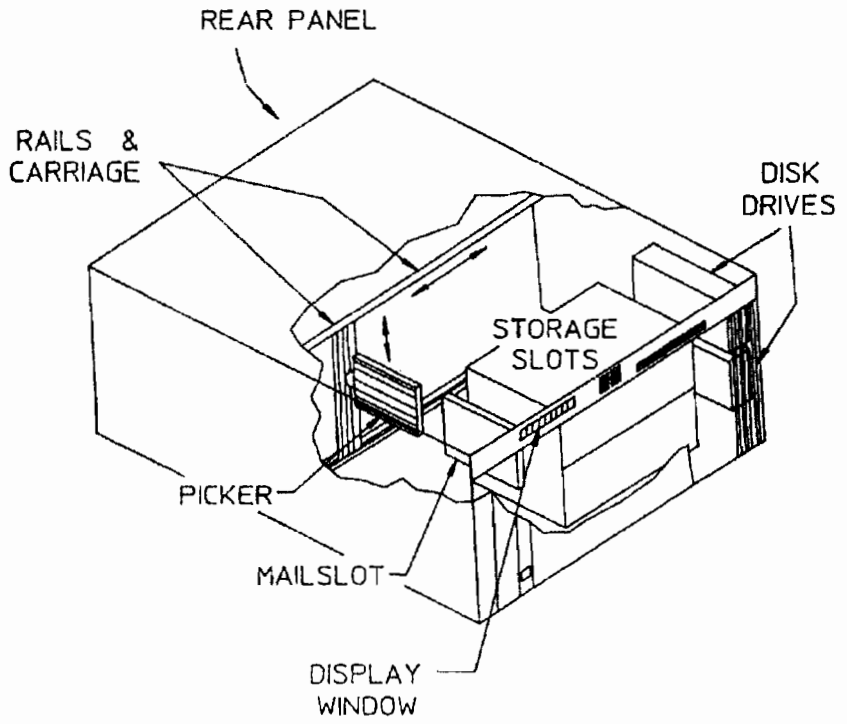

Figure 1-2. Rackmount Optical Disk Library Components

Disk Drives	The disk library contains either one (Models 10C and 20T) or two (Models 20C and 40T) optical disk drives for read/write data transfer. Each drive requires a unique SCSI address. When you face the front panel of the deskside version, drive 1 is located on the right side and drive 2 is on the left. When you face the front panel of the rackmount version, drive 1 is located on the top and drive 2 is on the bottom. (See Figures 1-1 and 1-2.)
Magazines	The disk library contains either two (Models 10C and 20T) or four (Models 20C and 40T) magazines. Each magazine has eight storage slots for a total of either 16 or 32 optical disk storage slots.
Mailslot	The mailslot is used to insert and remove optical disks from the disk library.
Front Panel	The front panel includes a control panel used to manage and display optical disk library functions, and a mailslot to insert and remove disks. Control panel features are described in Chapter 3, in the section "Control Panel Operations."
Rear Panel	The rear panel includes SCSI, UPS, and power cord connections. Instructions for setting the address select switches are given in Chapter 3, in the section "Setting the Disk Library Addresses." Instructions for connecting a deskside or rackmount version of the optical disk library to a host computer are in the *Setup Guide Kit* (C1700-90020).
Rails and Carriage	The rails and carriage support the picker for its movement within the disk library.
Picker	The picker rotates, flips, and transports disks to and from storage slots, drives, and the mailslot.

Product Features - All Models

These optical libraries, regardless of the capacity, have the following features and meet the following specifications:

- direct online access to data
- high reliability and data security when using HP-supplied rewritable and write-once 5.25-inch optical disks
- multifunction capability (write-once and rewritable technologies)
- HP optical disks have a 30-year archival life
- data security through the ability to "lock" the optical disk library (prevent disk removal)
- high through a design that eliminates the motors, cables, and sensors from the delivery mechanism
- either single-ended asynchronous SCSI-2 or differential asynchronous SCSI-2 bus interface to the host
- optical disk library reliability of:
  - 40,000 hours MTBF
  - 1,000,000 MSBF (Mean Swaps Between Failure)
- a seven-second average disk exchange time (excluding the drive load/unload sequence)
- modular replacement of all major assemblies
- full read and write data buffering to optimize system performance

- HP optical disks meet the following standards:

Table 1-1. HP Optical Disk Standards

Disk Type	Capacity/Format	Standard
Rewritable	594 Mbyte 512 bytes/sector 650 Mbyte 1024 bytes/sector	meet ANSI and ISO standards for Continuous-Composite (CC) format—conforms to ISO/IEC DIS 10089A; ANSI X3.212-199x
	1.2 Gbyte 512 bytes/sector 1.3 Gbyte 1024 bytes/sector	meets ECMA 184 standard for Continous-Composite (CC) format.
Write-Once	594 Mbytes 512 bytes/sector 650 Mbyte 1,024 bytes/sector	meets ISO and ANSI standards for Continuous-Composite - Write-Once format (CCW)—conforms to ISO/IEC DIS 11560; ANSI X3.220-199x
	1.2 Gbyte 512 bytes/sector 1.3 Gbyte 1,024 bytes/sector	meets ECMA 184 standard for Continuous-Composite - Write-Once format (CCW)

Product Compatibility

There are two basic optical disk library versions:

- The "C" versions
  - Model 10C (C1713C)
  - Model 20C (C1700C and C1710C)
- The "T" versions
  - Model 20T (C1713T)
  - Model 40T (C1700T and C1710T)

The main difference between these two library versions is storage capacity. The "T" version products have approximately twice the storage capacity of the "C" version products. This added capacity is due to a difference in the optical drives contained in the libraries. The "T" version products contain an enhanced version of the drive (C1716T) that is used in "C" version libraries (C1716C). The C1716T drive supports the use of 1.2- and 1.3-Gbyte disks as well as the 594- and 650-Mbyte disks that are supported for use with C1716C drives. Other than the added support of 1.2- and 1.3-Gbyte disks, the "T" version products are mechanically, electrically, and operationally the same as the "T" version libraries, and both versions support the SCSI-2 command set.

Product Configurations

The Optical Disk Libraries have the following product configurations:

Component	Model 10C[1]	Model 20C[2]	Model 20T[3]	Model 40T[4]
An autochanger mechanism (moves disks within the cabinet)	√	√	√	√
5.25-inch multifunction optical disk drives	1	2	1	2
A mailslot (used to insert and remove disks)	√	√	√	√
Storage slots for optical disks	16	32	16	32
A SCSI interface (may be either single-ended or differential)	√	√[5]	√	√[5]

1 HP C1713C - Distributor Version

2 HP C1700C - HP-connect version and HP C1710C - Distributor version only

3 HP C1713T - Distributor Version only

4 HP C1700T - HP-connect version and HP C1710T - Distributor version

5 The HP-connect version comes only with a single-ended SCSI interface.

Capacity Configurations

Table 1-2. Optical Disk Library Storage Capacities

Product No.	Storage Slots	Maximum Capacity
C1713C	16	10.4 Gbytes
C1700C & C1710C	32	20.8 Gbytes
C1713T	16	20.8 Gbytes
C1700T & C1710T	32	41.6 Gbytes

The C1713C and C1713T are distributor version libraries. These library capacities are achieved through 2 magazines that each have 8 storage slots providing space for 16 optical cartridges. The C1713C library supports the use of 650-Mbyte cartridges (1,024 bytes/sector, 325 Mbytes/side) for a total of 10.4 Gbytes. The C1713T library supports the use of both 650-Mbyte cartridges and 1.3 Gbyte cartridges (1,024 bytes/sector, 650 Mbytes/side) for a maximum capacity of 20.8 Gbytes.

The C1700C, C1710C, C1700T, and C1710T library capacities are achieved through 4 magazines that each have 8 storage slots providing space for 32 optical disk cartridges. (The C1710C and C1710T libraries are distributor versions of the C1700C and C1700T libraries.) The C1700C and C1710C libraries support the use of 650-Mbyte cartridges (1,024 bytes/sector, 325 Mbytes/side) for a total storage capacity of 20.8 Gbytes. The C1700T and C1710T libraries support the use of both 650-Mbyte cartridges and 1.3 Gbyte cartridges (1,024 bytes/sector, 650 Mbytes/side) for a total storage capacity of 41.6 Gbytes.

The C1713C and C1713T have the top two magazines removed and a filler panel installed in their place. The controller PCA works only with these 16-slot libraries.

The C1713C and C1713T may be converted into a C1710C or C1710T through the C1723C or C1723T upgrade products. In the upgrade, the controller PCA is changed to a new controller for a 32-slot version and two magazines (containing 16 slots) replace the filler panel.

Note The firmware is the same for both the C1713C/T and the C1710C/T products. The firmware reads the type of controller it is installed into and configures itself accordingly.

Rackmount and Deskside Configurations

HP Models 10C/20C and 20T/40T are available in either a deskside orientation or a horizontal rackmountable orientation. Explanations of the different product configurations are given below. Refer to Table 1-3 for related option numbers.

Deskside Configuration

The deskside configuration is one optical disk library contained in its own cabinet. This cabinet must be removed when servicing the optical library. The control panel display assembly and the front panel assembly accommodate the width of the deskside optical disk library.

Rackmount Configuration

The rackmount configuration enables up to two optical disk libraries to be mounted horizontally in a standard 1-meter (19-inch) cabinet. Instructions for mounting a library into the rack are shipped with the product and are included in the *16- and 32-Cartridge Optical Disk Library Setup Guide for Rackmount Version in a 1-meter Cabinet* which is found in the supplemental section of this manual. The control panel display assembly and the front panel assembly accomodate the length of the rackmountable optical disk library.

Host Support

Host support for the optical disk library is being expanded as an ongoing effort. Therefore, specific host system support cannot be provided accurately in this manual. However, host system support is documented in the current Product Support Plan, supplied to SSD by Greeley Storage Division as it is updated.

SCSI Interface Options

The optical disk library connects to the host system through a Small Computer Systems Interface (SCSI). This interface conforms to SCSI standards ANSI X3.131-SCSI-2.

Usually each SCSI-connect peripheral requires one SCSI address. With the disk library, however, there are either two or three unique SCSI interface addresses—one SCSI address for the optical disk library controller and one for each drive contained in the disk library. (The disk library has either 1 or 2 optical drives.)

The optical disk library controller and the host operating system manage communication through the SCSI bus to each drive's unique SCSI address.

Even though the disk library can have either a single-ended or a differential SCSI interface, only single-ended signals are used within the library. The library comes standard with a single-ended interface, and a differential interface is orderable as an option by distributors. To determine which option is installed, locate the SCSI connectors on the lower rear panel of the optical disk library. If the SCSI connectors are not labeled, the interface is single-ended SCSI; if the connectors are labeled "Differential," the interface is differential SCSI.

Although both interface types use the same SCSI cables, different terminators are required. (Refer to Table 1-4 for accessory ordering information.) Also, the allowable external cable lengths differ as follows:

Interface Type	Total Length	minus	Internal Cable	equals	Allowed Cable Length
Single-ended	6 m		1.44 m		4.56 m
Differential	25 m		11.44 m[1]		13.56 m

1 The differential SCSI repeater PCA uses the equivalent of 10 meters of SCSI cable internally so the total internal cable length is (10 m plus 1.44 m) = 11.44 m.

Distributor Product Service Information (HP C1713C, C1710C, C1713T, and C1710T)

Because distributor system connections and operating systems are different from site to site, it is recommended that HP service personnel disconnect the disk library from the host system and run internal selftests from the front panel and/or run offline diagnostics.

Internal diagnostics are described in Chapter 4, in the section *Internal Diagnostic Tests* and offline diagnostics are described in *Offline Diagnostics for Hewlett-Packard Optical Storage Products* found in the supplementary section of this manual.

Note

Once the disk library is disconnected from the host, passes all internal selftests and HP-supplied offline diagnostics, the functionality of the unit may be considered verified by the HP Field. *The HP Field is responsible for troubleshooting/repair of the optical library only—not for any host integration or distributor-related problems.*

Refer to the Product Support Plan (supplied to SSD by Greeley Storage Division as it is updated) for further details on support strategy.

If no problems are detected with the library system, the customer should be instructed to contact his distributor for support relating to non-library-unit problems such as integration, configuration, etc.

Product Matrix

The following products are discussed in this manual. To determine which product you have, find the product information labels located on the disk library rear panel and check the corresponding information in the following table.

Table 1-3. Disk Library Products Matrix

√	Product No./Options	Description
	C1700C	Model 20C Optical Library (20.8 GB) with 32 storage slots, 2 multifunction drives, and a single-ended SCSI interface. Includes disks.[1] (HP-connect version)
	Options:	
	1AB	Deskside version with cabinet
	1AC	Rackmount version with 1.0 m cabinet
	133	Rackmount version with rackslides (no cabinet)
	231	Includes only 1 rewritable optical disk (1,024 bytes/sector)
	232	Includes only 1 write-once optical disk (1,024 bytes/sector)
	241	Specify 32 rewritable optical disks (1,024 bytes/sector)
	242	Specify 32 write-once optical disks (1,024 bytes/sector)

1 Select one of the options 1AB, 1AC, 133 and one of the options 231, 232, 241, 242.

Table 1-3. Disk Library Products Matrix (continued)

√	Product No./Options	Description
	C1700T	Model 40T Optical Library (41.6 GB) with 32 storage slots, 2 multifunction drives, and a single-ended SCSI interface. Includes disks.[1] (HP-connect version)
	Options:	
	1AB	Deskside version with cabinet
	1AC	Rackmount version with 1.0 m cabinet
	133	Rackmount version with rackslides (no cabinet)
	231	Includes only 1 rewritable optical disk (1,024 bytes/sector)
	232	Includes 1 only write-once optical disk (1,024 bytes/sector)
	241	Specify 32 rewritable optical disks (1,024 bytes/sector)
	242	Specify 32 write-once optical disks (1,024 bytes/sector)

1 Select one of the options 1AB, 1AC, 133 and one of the options 231, 232, 241, 242.

Table 1-3. Disk Library Products Matrix (continued)

√	Product No./Options	Description
	C1710C	Model 20C (20.8 GB) Optical Library with 32 storage slots and 2 multifunction drives. No disks or cabinet. (Distributor version)
	Options:[1]	
	001	Single-ended SCSI interface
	002	Differential SCSI interface
	100	Deskside version with cabinet
	101	Rackmount version with rackslides
	102	Rackmount version without rackslides
	103	Deskside version without cabinet
	104	Rackmount version with 1.0 m cabinet
	700	HP color and logo for deskside version
	701	HP color and logo for rackmount version
	710	HP color, no logo for deskside version (no manual)
	711	HP color, no logo for rackmount version (no manual)
	W04	Convert standard 90-day parts and labor end-user warranty to 12-month parts only reseller warranty
	W05	Add on-site hardware verification
	AFM	Add serial interface cable for the UPS

1 Select one of the options 001 or 002, one of the options 100, 101, 102, 103, 104 and one of the options 700, 701, 710, 711.

Table 1-3. Disk Library Products Matrix (continued)

√	Product No./Options	Description
	C1710T	Model 40T (41.6 GB) Optical Library with 32 storage slots and 2 multifunction drives. No disks or cabinet. (Distributor version)
	Options:[1]	
	001	Single-ended SCSI interface
	002	Differential SCSI interface
	100	Deskside version with cabinet
	101	Rackmount version with rackslides
	102	Rackmount version without rackslides
	103	Deskside version without cabinet
	104	Rackmount version with 1.0 m cabinet
	700	HP color and logo for deskside version
	701	HP color and logo for rackmount version
	710	HP color, no logo for deskside version (no manual)
	711	HP color, no logo for rackmount version (no manual)
	W04	Convert standard 90-day parts and labor end-user warranty to 12-month parts only reseller warranty
	W05	Add on-site hardware verification
	AFM	Add serial interface cable for the UPS

1 Select one of the options 001 or 002, one of the options 100, 101, 102, 103, 104 and one of the options 700, 701, 710, 711.

Table 1-3. Disk Library Products Matrix (continued)

√	Product No./Options	Description
	C1713C	Model 10C (10.4 GB) Optical Disk Library with 16 storage slots and 1 multifunction drive. (Distributor version)
	Options:[1]	
	001	Single-ended SCSI interface
	002	Differential SCSI interface
	100	Deskside version with cabinet
	101	Rackmount version with rackslides
	102	Rackmount version without rackslides
	103	Deskside version without cabinet
	104	Rackmount version with 1.0 m cabinet
	700	HP color and logo for deskside version
	701	HP color and logo for rackmount version
	710	HP color, no logo for deskside version (no manual)
	711	HP color, no logo for rackmount version (no manual)
	W04	Convert standard 90-day parts and labor end-user warranty to 12-month parts only reseller warranty
	W05	Add on-site hardware verification
	AFM	Add serial interface cable for the UPS
	C1723C	Capacity upgrade for Model 10C to 20C

1 Select one of the options 001 or 002, one of the options 100, 101, 102, 103, 104 and one of the options 700, 701, 710, 711.

Table 1-3. Disk Library Products Matrix (continued)

√	Product No./Options	Description
	C1713T	Model 20T (20.8 GB) Optical Disk Library with 16 storage slots and 1 multifunction drive. (Distributor version)
	Options:[1]	
	001	Single-ended SCSI interface
	002	Differential SCSI interface
	100	Deskside version with cabinet
	101	Rackmount version with rackslides
	102	Rackmount version without rackslides
	103	Deskside version without cabinet
	104	Rackmount version with 1.0 m cabinet
	700	HP color and logo for deskside version
	701	HP color and logo for rackmount version
	710	HP color, no logo for deskside version (no manual)
	711	HP color, no logo for rackmount version (no manual)
	W04	Convert standard 90-day parts and labor end-user warranty to 12-month parts only reseller warranty
	W05	Add hardware verification
	AFM	Add serial interface cable for the UPS
	C1723T	Capacity upgrade for Model 20T to Model 40T

1 Select one of the options 001 or 002, one of the options 100, 101, 102, 103, 104 and one of the options 700, 701, 710, 711.

Accessories

Table 1-4. Accessories

Description	HP Part Number
650-Mbyte Rewritable Optical Disks (1,024 bytes/sector)	
single disk	92280A
pack of 8 disks	92280M
pack of 32 disks	92280Z
594-Mbyte Rewritable Optical Disks (512 bytes/sector)	
single disk	92279A
pack of 8 disks	92279M
pack of 32 disks	92279Z
650-Mbyte Write-Once Optical Disks (1,024 bytes/sector)	
single disk	92290A
pack of 8 disks	92290M
pack of 32 disks	92290Z
594-Mbyte Write-Once Optical Disks (512 bytes/sector)	
single disk	92289A
pack of 8 disks	92289M
pack of 32 disks	92289Z
1.3-Gbyte Rewritable Optical Disks (1,024 bytes/sector)	
single disk	92280T
1.2-Gbyte Rewritable Optical Disks (512 bytes/sector)	
single disk	92279T
1.3-Gbyte Write-Once Optical Disks (1,024 bytes/sector)	
single disk	92290T
1.2-Gbyte Write-Once Optical Disks (512 bytes/sector)	
single disk	92289T

Table 1-4. Accessories (continued)

Description	HP Part Number
0.5m (1.6 ft) SCSI interface cable	92222A
1m (3.3 ft) SCSI interface cable	92222B
2m (6.6 ft) SCSI interface cable	92222C
1m (3.3 ft) SCSI extender cable	92222D
Single-ended SCSI terminator	K2291
Differential SCSI terminator	12016-80003

Information for choosing and ordering an uninterruptible power supply can be found in *Optical Disk Library User's Guide, Models 10C and 20C, Models 20T and 40T*.

Disk Library/Multifunction Drive Specifications

Performance Specifications

Optical Disk Library

Capacity	
Model 10C	16 disks; 10.4 Gbytes
Model 20C	32 disks; 20.8 Gbytes
Model 20T	16 disks; 20.8 Gbytes
Model 40T	32 disks; 41.6 Gbytes
Drives	1 standard, 5.25-inch multifunction optical for Models 10C and 20T
	2 standard, 5.25-inch multifunction optical for Models 20C and 40T
Average disk exchange time (excluding drive load/unload sequences)	7 seconds
Interface	Single-ended asynchronous SCSI
	Differential SCSI

Optical Drives

	C1716C	C1716T[1]
Seek Times		
Short Stroke (across 2.2 Mbytes)	8 ms	4 ms
Average	27 ms	23.5 ms
Full Stroke	50 ms	45 ms
Average Rotational Delay	8.33 ms	12.5 ms

1 Specifications based on C1716T drive using 2x disks.

	C1716C	C1716T[1]
Media load/unload time		
Load time (including spin up)	2.5 seconds (maximum)	2.3 seconds (average)
Unload time (including spin down)	2.0 seconds	1.4 seconds
Data Transfer Rate*(1024-byte sectors)		
Reads (maximum sustained)	1.0 Mbytes/second	.8 - 1.6 Mbytes/second
Writes (maximum sustained)	.5 Mbytes/second	.4 - .8 Mbytes/second
Burst (synchronous)	5 Mbytes/second	5 Mbytes/second
Burst (asynchronous)	3 Mbytes/second	3 Mbytes/second

*System and application software dependent

Optical Disks

	1X	2X
Formatted capacity		
1024 byte sectors	650 Mbytes	1.3 Gbytes
512 byte sectors	594 Mbytes	1.2 Gbytes
Recording Characteristics (Continuous Composite Format)		
Bytes per sector	512/1024 medium dependent	512/1024 medium dependent
Sectors per track	17/31 medium dependent	17/31 medium dependent
Tracks per surface	18751	37600 (logical)
Tracks per inch	15875	18273
Error Rate	Less than 1 block in error per 10^{14} bytes	Less than 1 block in error per 10^{14} bytes
Archival Life	30 years	30 years

Power Requirements

Line Voltage	100-240 Vac
Line Frequency	50-60 Hz
Power Consumption (per library)	
Maximum	200 Watts
Typical	175 Watts

Environmental Conditions

	Optical Disk Library	Drives	Disks
Temperature			
Operating	10° to 40°C	5° to 50°C	10° to 60°C
Non-operating	-30° to 60°C	-40° to 70°C	-10° to 50°C
Temperature gradient (operating)	10°C per hour	10°C per hour	10°C per hour
Transportation			-10° to 55°C
Humidity (non-condensing)			
Operating	10 to 90%	5 to 90%	10 to 80%
Non-operating	5 to 95%	5 to 95%	10 to 90%
Maximum wet bulb	29°C	29°C	29°C
Relative Humidity gradient (operating)			10% per hour
Transportation			5 to 90%

	Optical Disk Library	Drives	Disks
Shock (non-operating)			
End-use, handling	10.2 cm tilt drop test, 4 edges		760 mm drop (to 2 mm vinyl-covered concrete)
Transportation (30 G trapezoidal)	427 cm/s	742 cm/s	
Operating, no data loss		40 g @3 ms (half-sine)	
Vibration (5-500 Hz)			
Operating	0.21 g rms	0.5 g rms	>0.21 g rms
Non-operating			
Random	2.1 g rms	3 g rms	
Swept Sine	1 g 0-peak	0.75 g 0-peak	
Altitude			
Operating	4,572 m (15,000 ft)	7,620 m (25,000 ft)	
Non-operating	15,240 m (50,000 ft)	15,300 m (50,000 ft)	
Acoustic Emissions (A-weighted sound power)			
Power on, standby	4.4 Bels	4.7 Bels	
Operating	6.7 Bels	6.15 Bels	

Physical Characteristics

	Deskside Option	Rackmount Option	Unit Outside of Cabinet
Dimensions:			
Height	715 mm (28.1 in.)	1000 mm (39.4 in.)	400 mm (15.8 in.)
Width	375 mm (14.6 in.)	600 mm (23.6 in.)	450 mm (17.7 in.)
Depth	790 mm (31.0 in.)	800 mm (31.5 in.)	760 mm (29.9 in.)
Weight:			
Net with disks	96 kg (211 lb)	175 kg (385 lb)	64 kg (144 lb)
Net without disks	88 kg (195 lb)	167 kg (369 lb)	58 kg (128 lb)
Shipping Weight:			
With disks	124 kg (274 lb)	188 kg (415 lb)	93 kg (206 lb)
Without disks	117 kg (258 lb)	181 kg (399 lb)	86 kg (190 lb)

Product Certifications

Safety:

UL 1950 (C1700C listed; C1710C and C1713C recognized component)
CSA-C22.2 No. 950-M89
IEC 950
TUV approved to VDE 0805 (EN 60950)

Electromagnetic Emissions Compatibility:

FCC 47 CFR Part 15 Subpart J - Class A
EN 55022/CISPR 22 Class A
pr EN 55024-2/IEC 801-2, 3kV CD, 8 kV AD
pr EN 55024-3/IEC 801-3, 3 V/m
VCCI Level 1
SABS

Laser:

CDRH 21 CFR Chapter 1, Subpart J, Class 1 Laser
TUV approved to VDE 0837
TSH Approved to Decision 472
BS 4803 Part 2 (complies)
EN60825/IEC 825, Class 1 Laser

United Kingdom

Approved under Approval Number NS/G/1234/J/100003 for indirect connection to Public Telecommunication Systems within the United Kingdom.

Related Documents

Document Name	Part No.	Edition/ Date
HP-UX Host Connect Guide Kit Contains the *Optical Disk Library System Administrator's Guide, HP9000 Series 300, 400, 700, and 800 HP-UX Hosts*, and *Installing the Optical Disk Library HP9000 Series 300, 400, 700 and 800 HP-UX Hosts.*	5960-7624	Ed.1 9/92
900 Series HP 3000 Computer Systems, Installing and Using the Optical Disk Library System (packaged with the service manual (C1700-90031) and shipped with each unit)	C1700-90076	Ed.2 7/92
Setup Guide Kit. Contains the *16- and 32-Cartridge Optical Disk Library Setup Guide for Deskside Models* and the *16- and 32-Cartridge\Optical Disk Library Setup Guide for Rackmount Version in a 1-meter Cabinet* (packaged with the service manual (C1700-90031) and shipped with each unit)	C1700-90020	Ed.3 5/93
Optical Disk Library User's Guide, Models 10C/20C and 20T/40T (shipped with each unit)	C1700-90040	Ed.2 5/93
Offline Diagnostics for Hewlett-Packard Optical Products (packaged with the Service Manual (C1700-90031))	5960-7626	Ed.1 10/92
Offline Firmware Upgrade Utility for Hewlett-Packard Optical Products (shipped with the Service Manual (C1700-90031))	5960-7625	Ed.1 10/92
Unpacking Instructions (all optical disk library systems—shipped with each unit)	C1700-90073	Ed.2 9/91

Document Name	Part No.	Edition/ Date
The Optical Storage Primer	5180-0043 (CDC)	Ed.2 3/90
The Multifunction Optical Storage Primer	5952-0334 (LDC)	Ed.1 3/91
Optical Drives and Libraries Technical Guide	5960-7605	Ed.2 5/93
Multifunction Optical Drive and Library SCSI-2 Command Reference	5960-7606	Ed.4 5/93
16/32-Slot Optical Disk Library Service Training Kit (NTSC formatted tapes)	C1700+49C-60001[1]	Ed. 2 6/93
16/32-Slot Optical Disk Library Service Training Kit (PAL formatted tapes)	C1700+49C-60002[2]	Ed. 2 6/93

1 If you have not had training on other GSD libraries, you must also order the kernel training package, part number C17xx-49B-60001

2 If you have not had training on other GSD libraries, you must also order the kernel training package, part number C17xx-49B-60002

Environmental/Installation/PM

Environmental Requirements

The following environmental requirements should be met at each site before installation. For detailed site environmental information, refer to the publication entitled *CE Site Preparation Handbook* (5958-2370).

Note The environmental specifications listed here apply when the disk library is not connected to a Hewlett-Packard system. When this device is connected to HP systems, the more stringent environmental specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

Operating Temperature Requirements

The optical disk library is designed to operate with an ambient air temperature range of 10° to 40°C (50 to 104°F) with a rate of temperature change not to exceed 10°C (50°F) per hour.

The area does not have to be air-conditioned but maintaining an operating room temperature between 18°C to 24°C (65°F to 75°F) is RECOMMENDED.

A minimum of 2-3 inches (70-80 mm) should be maintained behind the rear cover of the cabinet to allow air circulation.

Location Requirements

Position the drive away from sources of particulate contamination such as frequently-used doors and walkways, stacks of supplies that collect dust, and smoke-filled rooms. If possible, allow enough room behind the drive for access to the rear panel and for service.

Primary Power/External Ground

The power outlet used to supply AC power to the autochanger must be checked to ensure that the proper voltage (listed below) is available.

Table 2-1. Acceptable Voltage/Frequency

Voltage (Nominal Range)	Frequency (Nominal Range)	Voltage (Min/Max Range)	Frequency (Min/Max Range)
100-127	50-60	90-132	47-66
200-240	50-60	180-269	47-66

Also check the earth (safety) ground in the power outlet (which uses NEMA 5-15R).

The electrical load imposed by the autochanger may reduce the available voltage below the non-load value. If the line voltage is not within the correct range, resolve the power problem.

Installation (HP-Connect Versions)

After verifying that the environmental requirements listed earlier in this chapter are met, the product is installed in the following three steps.

1. Unpacking - The **customer** inspects for damage and moves the library to a final site.
2. Hardware installation - The **CE** removes the components from the shipping pallet (according to configuration ordered), installs the mechanism into the rack (if rackmount option), and checks the address and power configurations.
3. Configuration - The **CE** configures the optical disk library for use with a specific host.

Unpacking Tips

Unpacking is described in the *Unpacking Instructions* found on the box for each major component (C1700-90073). If any items are missing, contact the factory Order Processing Center with the following information:

- original order number or unit serial number
- receiving address

If the unit is damaged, it will be repaired in all cases. Billing of the charges depends on whether the damage was caused by the carrier or the factory packaging. The cause of the damage will be determined by the field service representative.

If the carrier refuses payment of damages, replacement/repair costs should be entered into the Field Engineering Support account (F.E.S.).

In order to submit a warranty claim, problems determined to be caused by factory packaging should be reported, in detail, to the factory.

Be sure to include the model number and full serial number in any correspondence with Hewlett-Packard concerning the optical disk library.

Installation and Configuration Information Supplied

The *16- and 32-Cartridge Optical Disk Library Setup Guide for Deskside Models* and the *16- and 32-Cartridge\Optical Disk Library Setup Guide for Rackmount Version in a 1-meter Cabinet* make up the Setup Guide Kit (C1700-90020). This kit is packed in the accessory kit with each optical disk library and is included with this service manual. HP-UX host configuration guides are also shipped in the accessory kits for each optical disk library and are included in this service manual's supplemental information.

Refer to the appropriate setup guide and host configuration guide to complete the installation.

Hardware Verification (Distributor Version Products)

Hardware verification is completed in two steps.

1. Unpacking - The **customer** inspects the library for damage and moves it to final site.
2. The **CE** removes the components from the shipping pallet (according to configuration ordered), installs the mechanism into the rack (rackmount option), and checks the address and power configurations, and completes the hardware verification process.

Unpacking Tips

Unpacking is described in the *Unpacking Instructions* found on the box for each major component (C1700-90073). If any items are missing, contact the factory Order Processing Center with the following information:

- original order number or unit serial number
- receiving address

If the unit is damaged, it will be repaired in all cases. Billing of the charges depends on whether the damage was caused by the carrier or the factory packaging. The cause of the damage will be determined by the field service representative.

If the carrier refuses payment of damages, replacement/repair costs should be entered into the Field Engineering Support account (F.E.S.).

In order to submit a warranty claim, problems determined to be caused by factory packaging should be reported, in detail, to the factory.

Be sure to include the model number and full serial number in any correspondence with Hewlett-Packard concerning the optical disk library.

Hardware Verification

The Customer Engineer needs to verify that the optical disk library is fully functional. To do this, the CE powers up the unit, which will invoke the poweron diagnostic. After completion of the poweron diagnostic, the CE needs to connect an offline diagnostic tool and test the autochanger mechanism and drive(s) to verify that all functions of the optical library unit (moves, flips, reads, writes, etc.) are operating correctly.

The *16- and 32-Cartridge Optical Disk Library Setup Guide for Deskside Models* and the *16- and 32-Cartridge\ Optical Disk Library Setup Guide for Rackmount Version in a 1-meter Cabinet* make up the Setup Guide Kit (C1700-90020). This kit is packed in the accessory kit with each optical disk library and is included with this service manual. HP-UX host configuration guides are also shipped in the accessory kits for each optical disk library and are included in this service manual's supplemental information.

Refer to the appropriate *Setup Guide* and host configuration guide to complete the installation.

Uninterruptible Power Supply Installation

Follow the UPS manufacturer's directions for connecting a UPS. The following information will be helpful.

Caution Improper connection of the UPS with a communication link to the autochanger may not provide full protection against data loss. To insure proper UPS connection, do the following:

- Use interface cable C1708-60080 to connect the UPS to the autochanger.
- Run test 75 after connecting a UPS with a communication link to the autochanger. (See "Diagnostics" in chapter 4 for instructions for running test 75.)

UPS Power Requirements

Table 2-2. UPS Power Requirements

Volt-Amps	Watts
125 Volt-Amps (typical)	75 Watts (typical)
190 Volt-Amps (worst)	110 Watts (worst)

Preventive Maintenance

The only possible preventive maintenance for the optical disk library is cleaning its optical disks.

Cleaning Optical Disks

Cleaning an optical disk is needed more commonly on standalone drives than with autochangers because of the differences in their environments and usage. However, an autochanger may be used in such a way as to make disk cleaning necessary.

To determine whether or not disk cleaning is appropriate for your customer's situation, see "Optical Disk Cleaning" in Chapter 4.

Caution **Do not attempt to clean the optical drive objective lens (unless notified by Hewlett-Packard of an approved cleaning device)!**

Although disk drive cleaning kits are available, they are not approved for use with Models 10C/20C and Models 20T/40T. Using these kits to clean the drive in these libraries will damage the optical drive mechanism.

Moving the Optical Disk Library

Moving the Optical Disk Library a Short Distance

If you simply need to move the optical disk library down the hall, to another floor level, or to another building on site, follow these steps.

1. Unmount (unreserve) any disk surfaces from the host system if necessary.
2. Eject all disks from the autochanger drives.
3. If the disks were not labeled with a storage slot location prior to inserting them into the autochanger, do it now.

Caution Failure to eject the disks from the optical drives prior to transport could result in damage to the drive mechanism.

Caution Do not switch off the optical disk library either from the operation switch or from the power switch (located on the rear panel) until you are sure that the SCSI bus is inactive. Pressing either button when 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.

4. Switch off the optical disk library operation switch (located on the front panel) and the power switch (located on the rear panel).
5. Remove the power cord and SCSI cable connections from the disk library system.
6. Raise the leveler feet (if your optical disk library is in a cabinet) using a 1/2-inch wrench.
7. Carefully roll the optical disk library to its new destination.
8. Connect the optical disk library to the host.

9. Re-connect the power cord.
10. Lower the leveler feet using a 1/2-inch wrench.
11. Configure the optical disk library to the host. (Refer to your host system manual for configuration information.)
12. Re-insert the optical disks into their correct storage slot locations. (See "Loading Disks" in chapter 6 in the *Optical Disk Library User's Guide* for the procedure for loading disks.)

Moving the Optical Disk Library a Long Distance

If you need to move your optical disk library a long distance, do the following:

1. Unmount (unreserve) any disk surfaces from the host system if necessary.
2. Eject all disks from the autochanger and, if the disks were not labeled with a storage slot location prior to inserting them into the autochanger, do it now.

Caution Failure to eject the disks from the optical drives prior to transport could result in damage to the drive mechanism.

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3. Run TEST 23 to position the picker for shipping.
   a. Press (OPTION).
   b. Press (NEXT) until TEST * appears, and then press (ENTER).
   c. Press (NEXT) until TEST 23 appears, and then press (ENTER).

Caution Do not switch off the optical disk library either from the operation switch or from the power switch (located on the rear panel) until you are sure that the SCSI bus is inactive. Pressing either button when 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.

4. Remove the right side rack panel (rack-mounted units only).
5. Attach the orange shipping bracket.
6. Switch off the optical disk library operation switch (located on the front panel) and the power switch (located on the rear panel).
7. Have the unit repackaged and shipped in the same manner in which it was received.

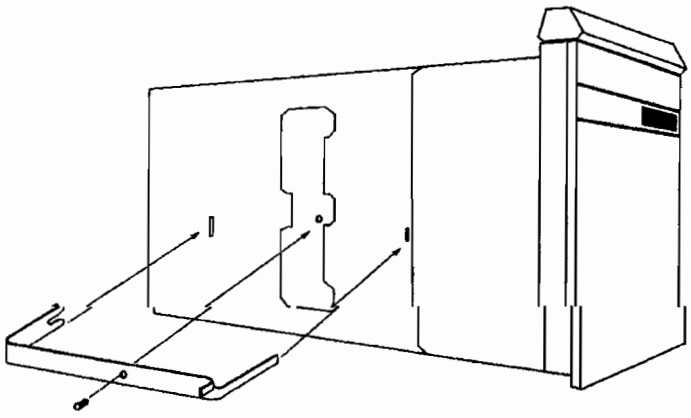


Figure 2-1. Attaching the Shipping Bracket

Note Before powering on the optical disk library once it has reached its destination, the shipping bracket must be removed to allow free movement of the picker.

8. Remove the shipping bracket.
9. Connect the power cable to the disk library.
10. Connect the one end of a SCSI cable to the disk library, and connect the other end to the host system.

3

Operating and Configuring

Control Panel Operations

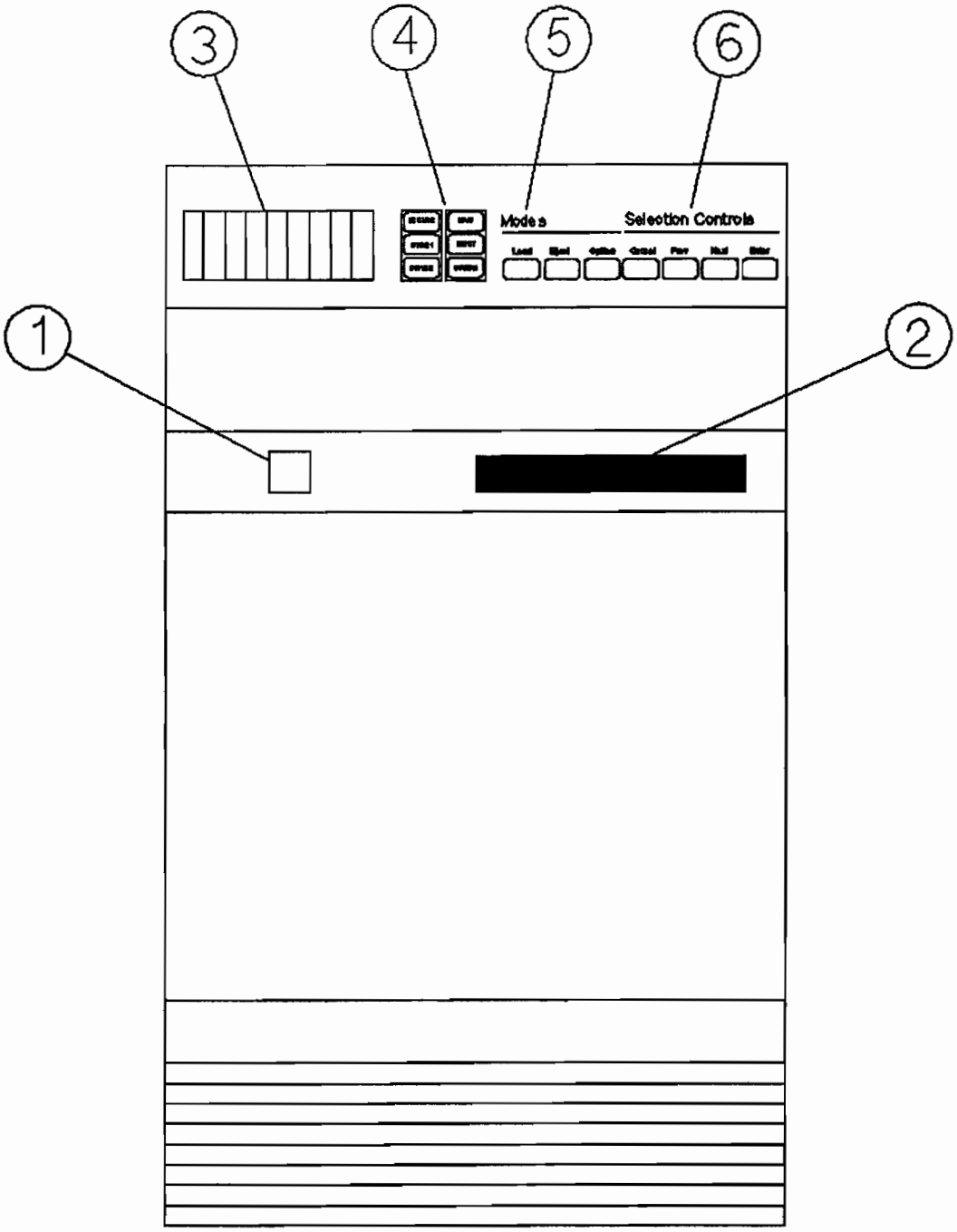


Figure 3-1. Deskside Configuration Front Panel

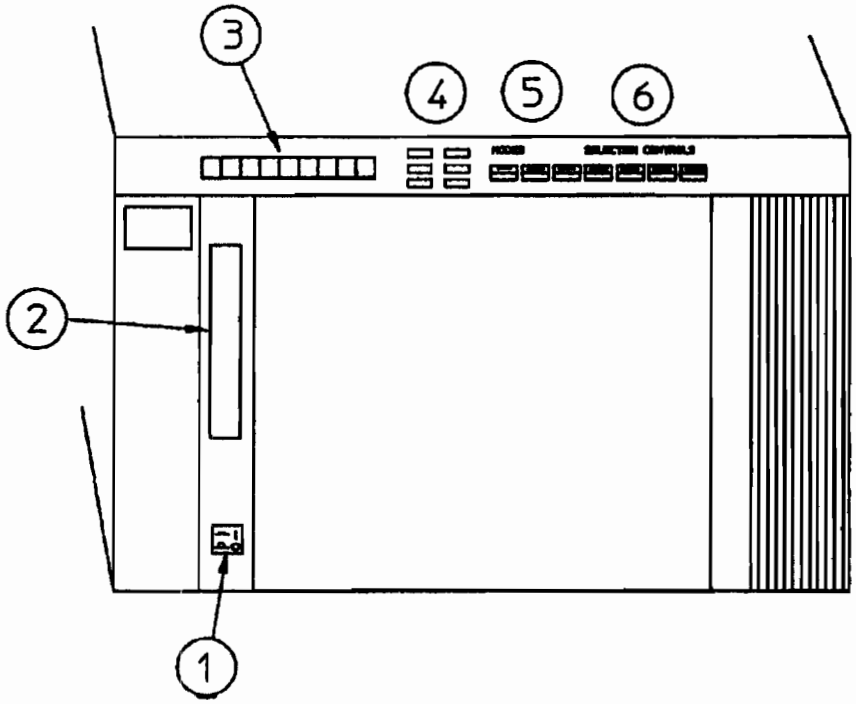


Figure 3-2. Rackmount Configuration Front Panel

1. Operation Switch — Pushed to enable or disable operation of the disk library. (This is NOT the power switch. The power switch is located on the rear panel.)

2. Mailslot — Allows you to insert or remove disks.

3. 9-Character Display — Displays information about the the current operation. Generally you press [NEXT] or [PREV] to control the selections. Once your selection is displayed, you press [ENTER]. You may press [CANCEL] to cancel your selection.

4. Status Indicators — Lit when the indicated activity is taking place.

5. Modes Buttons — Press these buttons to perform the desired operation.

[LOAD] is pressed after you place the disk in the mailslot. Once [LOAD] is pressed, the display prompts you for the desired destination inside the unit. Once you choose the location, press [ENTER]. The disk loads to that location.

[EJECT] is pressed to remove a disk from storage in the library. Once [EJECT] is pressed, the display prompts you for which disk location to eject. Once you choose the location, press [ENTER]. The disk is then brought from that location to the mailslot.

[OPTION] is pressed to display the current operation options available such as TEST, INFOrmation, CONFiguration, and SCSI ID.

6. Selection Control Buttons — Press these buttons to perform the desired operation.

[CANCEL] cancels the current operation or choice.

[PREV] scrolls the display choice backward by one.

[NEXT] scrolls the display choice forward by one.

[ENTER] chooses the displayed selection.

Setting a Configuration (CONF)

A list of the configuration choices for the optical disk library can be found in chapter 8, table 8-1. To set a configuration, complete the following steps.

1. With READY displayed, press (OPTION). TEST * displays.
2. Press (NEXT). CONF * displays.
3. Press (ENTER). CONF 0 displays.
4. Press (NEXT) or (PREV) until CONF ## displays (where ## is the configuration number you want to change).
5. Press (ENTER).

   Some configurations require a security code. If prompted, enter the security code.
6. Press (NEXT) or (PREV) until the value you want appears in the display.
7. Press (ENTER) once your choice displays. SET ## displays followed by CONF *.

Setting a Security Code

Note The default factory-set security code is 0-0-0. When setting a new security code, key in the old one first, and then the new one.

1. With READY displayed, press (OPTION). TEST * displays.
2. Press (NEXT). CONF * displays.
3. Press (ENTER). CONF 0 displays.
4. Press (NEXT) until CONF 17 displays.
5. Press (ENTER). 0 displays.

6. Press (NEXT) or (PREV) until first number of old (or default) security code displays.
7. Press (ENTER). `0` displays.
8. Press (NEXT) or (PREV) until second number of old (or default) security code displays.
9. Press (ENTER). `0` displays.
10. Press (NEXT) or (PREV) until third number of old (or default) security code displays.

Note

If the security code was keyed in successfully, the display prompts you for the new one. If a mistake was made in keying in the security code, `NO CONFIG` briefly displays and the unit returns to the `CONF 17` display.

If you realize you've made a mistake in keying in a security code, press (CANCEL) to return to the `CONF 17` option.

---

11. Press (ENTER). `A` displays.
12. Press (NEXT) or (PREV) until first number of new security code displays.
13. Press (ENTER). `B` displays.
14. Press (NEXT) or (PREV) until second number of new security code displays.
15. Press (ENTER). `C` displays.
16. Press (NEXT) or (PREV) until third number of new security code displays.
17. Press (ENTER). `SET 17` displays.

Restricting Disk Insertion and Removal

Configurations 15 and 20 act together to control disks during normal and powerfail conditions.

- `CONF 15` - when this is set to ON, you cannot insert or remove disks without a security code.
- `CONF 20` - when this is set to ON, the `CONF 15` status is maintained when a power fail occurs. Also, the reserved status on mounted surfaces is maintained if the autochanger power fails.

When setting `CONF 15` or `CONF 20`, the display prompts you for a security code. This security code is `0-0-0` (default) or the one set by the customer using `CONF 17`.

Setting CONF 15 or CONF 20

1. Press (NEXT) or (PREV) until `CONF 15` or `CONF 20` displays.
2. Press (ENTER). `0` displays.
3. Press (NEXT) or (PREV) until the first security code number displays.
4. Press (ENTER). `0` displays.
5. Press (NEXT) or (PREV) until the second security code number displays.
6. Press (ENTER). `0` displays.
7. Press (NEXT) or (PREV) until the third security code number displays.
8. Press (ENTER).
9. Press (NEXT) or (PREV) to select `ON` or `OFF`.
10. Press (ENTER). `SET 15` or `SET 20` displays.

Setting the Disk Library Addresses

Note

Determine what SCSI device addresses are currently in use on the host system. You can then correctly determine what available SCSI address to use for the autochanger controller and disk drives.

If you are configuring more than one disk library to the same host, you must change the SCSI addresses on one of the disk libraries to avoid an address conflict.

The disk library uses either 2 or 3 SCSI addresses—one for each optical drive and one for the autochanger controller. These addresses are set using the front panel.

The default address settings are:

Models 10C and 20T

Autochanger Controller	Address 3
Optical Disk Drive #1	Address 4

Models 20C and 40T

Autochanger Controller	Address 3
Optical Disk Drive #1	Address 4
Optical Disk Drive #2	Address 5

If you want to change one of the addresses, follow these steps.

1. Switch on the disk library if it is not already on.
2. With READY displayed, press (OPTION). TEST * displays.
3. Press (NEXT) until SCSI IDs * displays.
4. Press (ENTER). AC ID ## displays (where ## is the current AC ID address).

   This is the autochanger controller address.
5. Press (NEXT) until the drive or controller selection you want displays.
6. Press (ENTER). The current drive or controller address displays.
7. Press (NEXT) or (PREV) until the address you want displays.
8. Press (ENTER). The chosen address will display.

   Repeat steps 5-8 until all of the desired addresses have been changed.
9. Press (NEXT) until UPDATE or CONFLICT displays.

   If CONFLICT displays, two or more drives and/or the controller have been set to the same address and must be reset.

   If UPDATE displays and you are satisfied with the addresses you have selected, press (ENTER). UPDATED will display.
10. Record the new address setting(s) for future reference.

Caution Do not remove power to the disk library system until you are sure that the SCSI bus is inactive. Removing power from a SCSI peripheral when the bus is active can cause data loss and/or indeterminate bus states. (Check the host sytsem reference manuals for information on checking the status of the SCSI bus.)

11. Push the operation switch (located on the disk library front panel) off and then back on so the new address setting(s) will be recognized by the host system.

Note Some host systems must be power cycled to recognize the new disk library address settings.

Note The drive's parity is enabled at the factory.

Rear Panel Connections

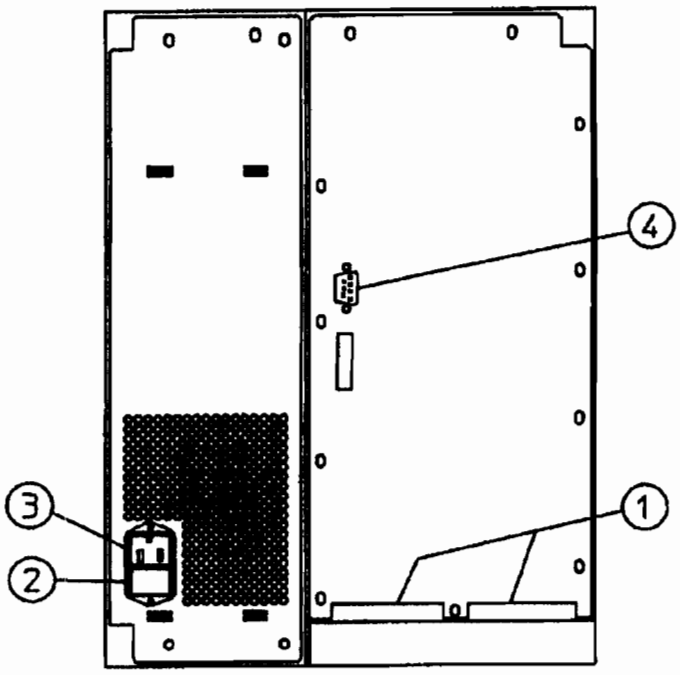


Figure 3-3. Deskside Optical Disk Library Rear Panel

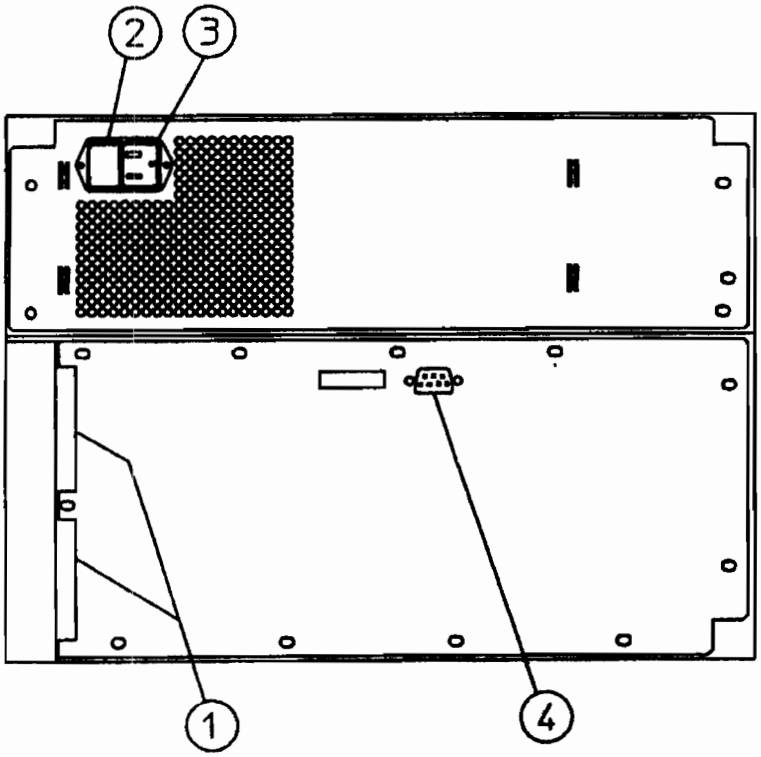


Figure 3-4. Rackmount Optical Disk Library Rear Panel

1. SCSI Connectors	Two SCSI bus connectors that allow SCSI devices to be daisy-chained. If no other SCSI device exists after the current device on the chain, a terminator must be connected to the unused connector.
2. Power Switch	Used for switching power on or off.
3. Power Connector	Connection for the power cord.
4. UPS 9-pin D-Connector	Connection for an uninterruptible power supply (UPS).

Host Configuration

Once the disk library is connected to the host system and the device address is set, you are ready to prepare the host system to access the library.

To determine if the host you are connecting to supports the optical disk library and for further installation information, check the following documents:

- product support plan (available from Systems Support Division)
- the product matrix sheet shipped as part of the HP-UX Host Connect Guide Kit (shipped with the library and included in the "Supplemental Information" section of this manual)
- host system documentation

4

Troubleshooting and Diagnostics

This chapter is divided into the following sections:

- Operation/Installation Error Information

  Common problems encountered during operation and installation of the optical disk library are listed in this section, and suggestions for solving these problems are given. This troubleshooting is considered top-level troubleshooting.

- Control Panel Error Information

  Error messages and log information which are available through the control panel display are provided in this section. This intermediate level of troubleshooting is used when "hard" (repeatable) errors are encountered.

- Error Information through SCSI Commands

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

- Diagnostics

  Internal and external diagnostics used to aid in the troubleshooting process are discussed in this section.

Operation/Installation Error Information

The following table lists problems that may occur during operation of the optical disk library. If you cannot find a solution to a problem in this section, go to the next section for more in-depth troubleshooting.

Caution DO NOT CYCLE POWER during any troubleshooting until you are sure the system SCSI bus is INACTIVE and will REMAIN INACTIVE.

Removing power while the bus is active can cause data loss and/or indeterminate bus states. Check the host system reference manuals for information on checking the status of the SCSI bus.

Task	Problem/Symptom	What to do
Communicating host <—> library	Can't get the host to recognize the optical disk library.	■ Make sure the disk library is supported on the host operating system. ■ Make sure the autochanger was installed and configured as described in the appropriate disk library setup guide and the appropriate host system manuals. ■ Check the SCSI connections. ■ Check the SCSI interface address as it relates to the device files.

Task	Problem/Symptom	What to do
Changing the drive address	Changed drive address but new address is not recognized.	After changing an address, the autochanger power and/or the host system power may need to be cycled for the new address to be recognized. (Refer to the host system documentation for information on setting peripheral addresses and shutting down the host system.)
Inputting Security Code	Security code forgotten or misplaced for the autochanger.	First, try the default security code (0-0-0). If the security code is not set to the default, locate the 8-switch dip switch on the controller PCA, and set switch 1 to the "closed" position. Switch on the autochanger. This sets the security code to the default code. NOTE: Once the default security code is set, the switch must be reset to its original setting. The customer may now use configuration 17 to set a new security code. (See "Setting a Security Code" in chapter 3.)
Loading Disks	Disk inserted in mailslot, but the display reads `ERROR`, `EMPTY`, or `MISLOAD`.	Remove the disk from the mailslot and try inserting it again. Push the disk in, shutter-end first, so that the disk is flush with the optical disk library front panel.

Task	Problem/Symptom	What to do
Powering on	The optical disk library won't poweron.	■ Make sure the power cord connections are tight. ■ Check to see that both the back power switch and the front operation switch are in the ON position. ■ Make sure the power outlet is operating. ■ Check the voltage select switch setting. ■ Replace the fuse with a new one. ■ Replace the power cord with a known good one. ■ Replace the power supply module.
	Poweron selftest fails.	Turn the unit off, then turn it on again. Observe the poweron test result. If the unit continues to fail, use the error code to begin troubleshooting. (See the "Poweron Selftest" section following this table.)
	Does not boot correctly.	Make sure the boot disk is ON, spun up, and ready before applying power to the host computer. The autochanger and the host may then be powered on in any order.

Task	Problem/Symptom	What to do
Power fail	Just the autochanger power fails.	When power returns, unmount and remount all disk surfaces. Do not eject any disks until the surfaces are unmounted/ unreserved.
	Autochanger power fails while a disk is in the drive.	If you need to remove the disk before power can be resupplied to the drive, the eject tool can be used to recover the disk. See "Using the Eject Tool to Remove a Disk From the Drive" in this chapter for instructions for using the eject tool.
	Host computer power fails and the autochanger stays on.	After the host reboots, file system check (**fsck**) any write-mounted surfaces.

Caution Do not eject disks from the autochanger until all mounted surfaces are unmounted.

To prevent disks from being removed after a power failure, set configuration 20 (Poweron Cartridge Security) to "ON." See the sections, "Autochanger Configuration Choices" in chapter 8 and "Control Panel Operations" in chapter 3 for an explanation of configuration 20 and how it is set.

Task	Problem/Symptom	What to do
Power Fail (cont.)	Both the host system and autochanger power fail.	After the host reboots, file system check (**fsck**) any write-mounted surfaces. See the previous CAUTION note.
Reading the Front Panel Display Window	No display messages appear.	■ Make sure both the power switch (on the rear panel) and the operation switch (on the front panel) are switched on. ■ Check that the power cord is connected. ■ Check AC input. ■ Check the fuse. ■ Check the control panel cable connections. ■ Replace the control panel PCA. ■ Replace the autochanger controller PCA. ■ Replace the power supply.
Reading/writing magneto-optical disks	Can't write to the disk.	■ Check the file system access permissions. ■ Check the write-protect tab on each disk side to assure write-enabled status. ■ Check to make sure the disk was initialized with the **mediainit** and **newfs** commands. ■ Check that the disk file system was mounted correctly. ■ Refer to the "Optical Disk Cleaning" section in this chapter.

Task	Problem/Symptom	What to do
Removing disks	Disk removal attempted, but the storage slot or drive location won't display the option.	Make sure the optical disk surface's file systems have been unmounted.
	Disk removal attempted, but a `FULL` or `MISLOAD` message displays.	Remove the disk from the mailslot and try to remove the desired disk again.
	The unit's power failed while a disk was in the drive.	■ Try powering on the unit. If successful, use the file system check (**fsck**) command. ■ If poweron is unsuccessful, power the unit off. *Do not move the unit.* Moving the unit with a disk in the drive risks damaging the magneto-optical mechanism in the MO drive. Refer to the "Powering On" and "Power Fail" sections earlier in this table. ■ If it is critical that the disk be removed from the drive before power can be restored to the drive, see "Using the Eject Tool to Remove a Disk from the Drive" in this chapter.

Poweron Selftest

Caution When the optical disk library is powered on and selftest is run, the SCSI interface and the terminator must both be either connected or disconnected.

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

Caution Do not switch off any peripheral on the SCSI bus without first checking that the bus is not active.

Switching off can cause data loss and/or indeterminate bus states.

To run the poweron selftest, do the following steps:

1. Insert a formatted disk into the drive either from a storage slot location or through the mailslot/control panel.
2. Remove power from the optical disk library. Press both the power switch on the back panel and the operation switch on the front panel.
3. Remove the disk library top cover and side panels so that you can observe the LEDs on the front of the optical drive mechanism.

   Follow the steps in the "Service Access" section in chapter 5.
4. Switch on both the rear panel power switch and the front panel operation switch, and wait for the poweron selftest to complete.

Note A failure will occur under the following circumstances:

- if an unformatted disk is used during the test
- if the host is not powered up and properly terminated
- if the host is not connected and the drive is not correctly terminated

The poweron selftest will have one of the following results:

Indication	Description	Further Diagnosis
The busy and the fault LEDs turn off.	No failure has occurred.	
The fault LED remains lit.	A failure had occurred.	Connect the offline diagnostic tool to determine failure.
The LEDs do not light at all, and the disk does not load	There are possible loose power connections.	Check all power connections for the drives.

Optical Disk Cleaning

Note Cleaning an optical disk is needed more commonly on standalone drives than with autochangers because of the differences in their environments and usage. While the following information is therefore more applicable to standalone drives, an autochanger may be used in such a way as to make the following cleaning information apply. Disk cleaning for libraries in general, however, is NOT RECOMMENDED as a normal user task.

Disk cleaning should only be done after a read/write failure or if a customer notices a loss of autochanger performance. In addition, it must be determined that the failure or loss of performance was not caused by a definite hardware failure.

A failure to read a disk may result from:

- hardware failure
- contamination of the disk surface
- contamination of the drive objective lens

On an otherwise working drive, check to see that the most current firmware code level is being used and/or that all applicable service notes have been done. If so, contamination could be a cause and cleaning may be necessary.

In the case of a read failure, cleaning might be the only way to get the customer's data back. In the case of performance loss, a few minutes spent cleaning may prevent unnecessary replacement of service parts and present an opportunity to "fix the site" and help the customer prevent contamination in the future.

The following are recommendations for preventing contamination of disks and the disk drive:

- Place the library away from high traffic areas.
- Do not leave a disk in the drive for extended periods of time if possible.
- Do not use the library in "dirty" environments such as coal mines, railroad maintenance yards, etc.

Cleaning Tools Available

Disks may be cleaned with the Optical Disk Cleaning Kit (C1700-88800). This kit contains swabs and alcohol, cleaning instructions, and a special cartridge holder that keeps the sliding sleeve open.

Note If the problem appeared as loss of performance and cleaning a disk solved the problem, another couple of steps must be done to regain performance using that disk.

As performance was declining because of read/write problems, the disk was probably becoming fragmented through excessive "sparing." To regain performance, the data on each side of the disk should be stored, each side of the disk reformatted, and the data restored back on the disk.

Caution **Do not attempt to clean the optical drive objective lens (unless notified by Hewlett-Packard of an approved cleaning device)!**

Although disk drive cleaning kits are available, they are not approved for use with Models 10/20C and Models 20/40T. Using these kits to clean the drive in these libraries will damage the optical drive mechanism.

Using the Eject Tool to Remove a Disk From the Drive

The optical drive mechanism does not automatically eject a disk from the drive if a power failure occurs. If you need to manually remove a disk from a drive with no power, you must use the eject tool.

If you do not have an eject tool for the HP C1716C or the HP C1716T optical drive, you may order one of these:

- Hewlett-Packard part number - C1701-88803
- Marshall Industries part number - R3322

You may also use a small flat-head screwdriver with the following dimensions:

Length	50 mm
Width	2.45 mm
Thickness	.5 mm

A disk can be removed from the drive while the drive is still secured in the autochanger. Follow the service access procedures in Chapter 5 to access the front of the drive mechanism, and then do the following steps to remove a disk from the drive:

1. Disconnect all power to the drive if you have not done so already.
2. Insert the eject tool into the small round hole in the front panel of the drive.
3. Turn the eject tool in a **clockwise** direction (approximately 20 complete rotations) until the disk is ejected through the front of the drive.

Caution Do not reach into the drive to get the disk. Wait until the disk is ejected through the front of the drive before removing it. Premature removal of the disk could damage the drive.

Troubleshooting Using the Control Panel and Observation

When there are errors in autochanger movements, two main approaches are available to get information and to run execiser tests. The approach usually depends on whether the error encountered was a **hard** error or whether it was a **soft** (intermittent) error.

- Troubleshooting Using the Control Panel and Observation - This method (described in this section) is usually used in situations where you have a hard error.
- Troubleshooting Through the SCSI Bus - This method (described in the next section) is used in situations where you have a soft (intermittent) error.

Error information and logs accessed through the control panel are summarized. By knowing how the autochanger operates and using the summarized information from the control panel display, there is enough information to troubleshoot many problems that result in a **hard** error.

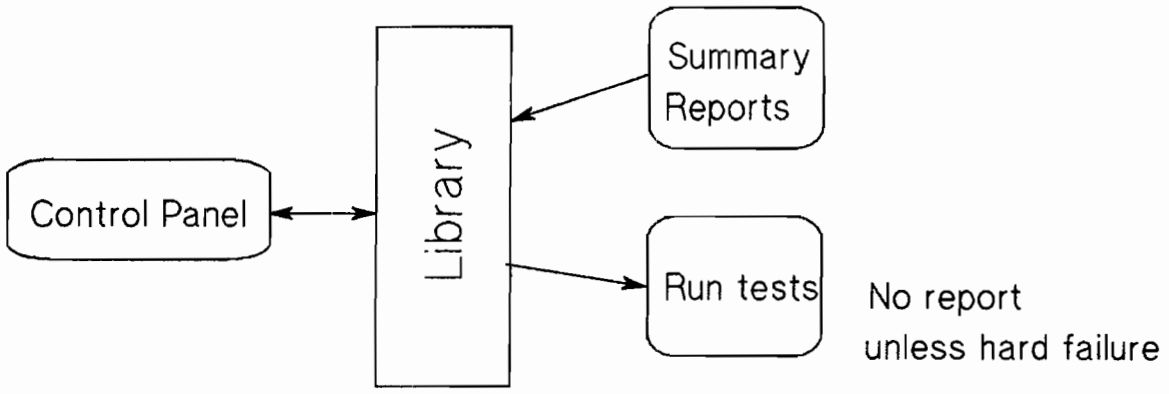


Figure 4-1. Information and Tests Through the Control Panel

The Autochanger Lists the First "Possibles"

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

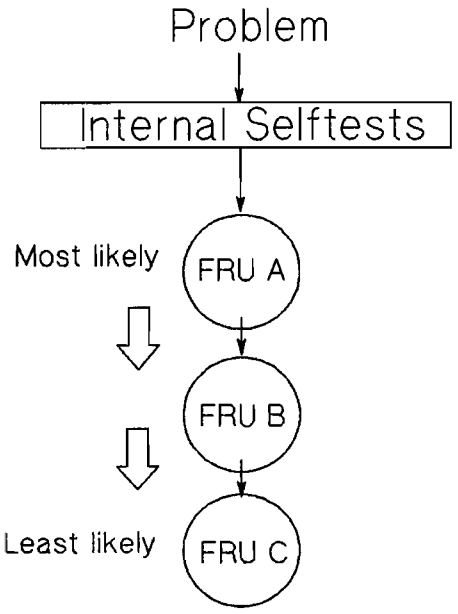


Figure 4-2. The Autochanger Returns Suspect FRUs

Note This test sequence returns possible failed FRUs only if there has been a **HARD FAILURE**. The test sequence will NOT find an intermittent failure. This test sequence, called the "FRU Isolation Test" (test 60), can also be run from the control panel. Similar to its automatic operation, this test sequence only points out ("isolates") FRUs if there has been a hard failure.

What the Autochanger Assumes—

The FRU Isolation Test assumes the following:

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

  The test takes advantage of this and does whatever is necessary to determine the cause of the failure. Disks are not intentionally rearranged, but if the picker starts this test with a disk in it, the position and orientation of that disk is unknown.

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

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

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

How to Use the Results of the Internal Tests

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

The hard move error that caused the autochanger to run the FRU isolation test may have only been a PRODUCT of the actual problem. Blindly and repeatedly replacing the suspect FRU(s) will not solve the problem.

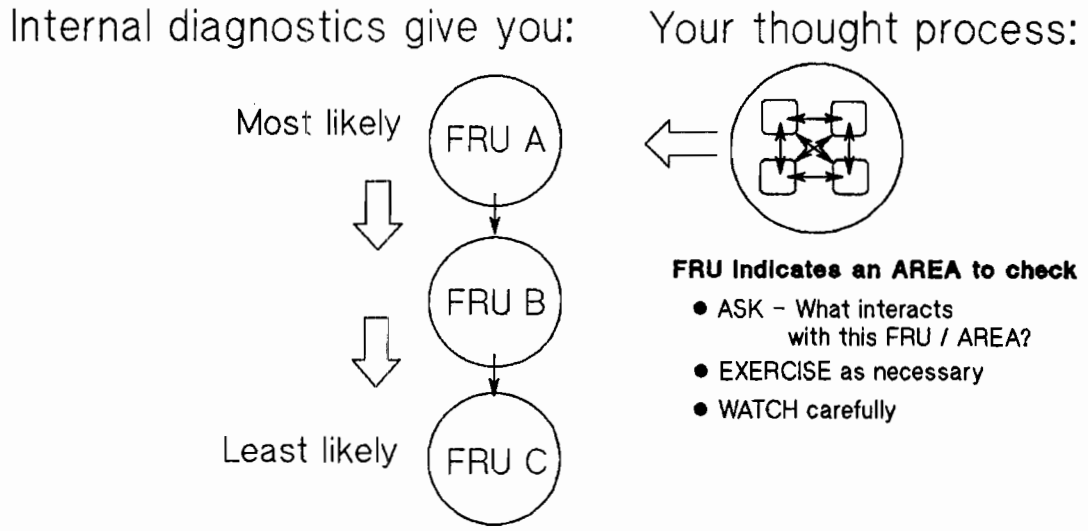


Figure 4-3. How Service Views the Suspect FRUs

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

A good visual inspection requires an understanding of how the autochanger acts under normal operation. This understanding can be achieved by completing the self-paced training for the autochanger and getting as much hands-on experience as possible. If you are familiar with the moves of the carriage/picker assembly during the FIND HOME sequence and you are familiar with the behavior of the drive, you will be able to more easily detect the real problem pointed to by a suspect FRU.

Note The specific steps of the FIND HOME sequence and the possible errors which may result are listed in chapter 8, "Reference."

An example:

Suppose the autochanger fails with an error code of 4D (hexadecimal), "MOTION ERROR CHECKING FOR CARTRIDGE IN THE PICKER," and lists the picker (FRU 27) as the most likely failure. However, when you observe the unit while running the `Wellness Test` (test 2), you see that the picker is having trouble flipping. As you manually move the carriage/picker assembly around and touch the components that are involved, you notice that the picker belt is abnormally tight. The belt is tight because the picker motor is skewed.

The error (4D) and suspect FRU gave an AREA to look at when troubleshooting. Visual inspection (concurrent with physical checks) helps to link the suspect FRU with the root cause by providing an area to examine. In the preceding example, the components that INTERACT with, and DRIVE the picker are examined.

The section in this chapter entitled, "Recovery Procedures for Specific Hardware Errors," lists each error code and procedure for finding the cause of the error, using the autochanger's suspect FRUs as a guide. Error codes and recovery procedures are grouped by functional area in the autochanger.

At the BEGINNING of the list of errors for each functional group, you will find general HINTS about what areas should be checked when errors appear in that group. Be sure to check out those hints.

The FRU Isolation Test Sequence

The following list traces the execution of the FRU isolation test. A failure requires additional tests at that point to determine the actuaakause. The original sequence is not continued if a test fails.

1. Look at the error code generated by the FIND HOME sequence, some codes may have obvious, implied FRUs.
   (eliminates optical sensors and their cables)
2. Run autochanger controller PCA tests that do not cause host communication loss.
   (eliminates power supply, power supply cables, ROMs, RAM, motor control IC, and microprocessor)
3. Check that the motors are capable of moving by attempting to move them very small distances in both directions.
   (eliminates motor assemblies (except belts), motor cables, PCA drivers)
4. Pull picker fingers back. They should come to a hard stop with the leadscrew nut completely at the end of the leadscrew.
   (eliminates the picker belt)
5. Move carriage/picker assembly toward the drive. It should come to a hard stop.
   (eliminates the carriage belt)
6. Move carriage/picker assembly away from the drive. The move has to be far enough to be certain that the leadscrew can move, but not so far that a jammed cartridge will cause the test to fail.
   (eliminates the carriage leadscrew assembly)
   a. **If the FRU isolation test has been run from the front panel,** the FIND HOME sequence will automatically be executed at this point.
7. At this point, there is some level of confidence that the system is capable of moving the carriage/picker assembly. Using the new information learned by running these tests, look at the error codes, the move ID that failed, and how the recovery system failed.

Information Logs

The optical autochanger control panel diagnostic tests have two major purposes. The first is to provide diagnostic information that can lead to early detection of an autochanger problem. The second is to provide fault isolation tests.

All the logs are maintained within non-volatile RAM, and so are not affected by cycling autochanger power. These logs are accessible from the control panel by using the INFO option. (If more in-depth troubleshooting is needed, an external diagnostic (such as DOSDASS2) may be used to access the error and information logs. See the next section, "Error Information through SCSI Commands.")

Procedure

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

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

Note Some logs will display more information when [NEXT] or [PREV] is pressed.

Press [CANCEL] to stop the INFO display. Press [ENTER] to choose another log.

You have several information selections that are outlined in chapter 8 in the "Information Logs" section.

Recovery from Hardware Errors

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

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

The autochanger firmware can detect broken components such as a dead motor, a missing belt, etc., but if failures are due to marginal or random problems, the failing component may induce errors in other components. For example, if any portion of the electronics becomes intermittent or if friction increases on a part, different components of the autochanger may appear to fail at varied points as the autochanger runs its code. This results in many different error codes.

Note Instructions for running internal diagnostic tests are given in the "Diagnostics" section at the end of this chapter. A list of the available test choices and their descriptions are given in chapter 8, "Reference."

Hardware Error Codes and Recovery Procedures

The following table shows the hardware error codes possible and recovery procedures for specific hardware errors. In all cases, if you run a test, and no error occurs, monitor for reoccurrence. If the error repeats, use the list of suspect FRUs logged by the FRU isolation test as a guide to determine the problem. Replace the FRU(s) as necessary.

Some error codes require further explanation; see the section immediately following Table 4-1.

Table 4-1. Hardware Error Codes and Recovery Procedures

Hardware Error Code (hex.)	Error Description	Recovery Procedures
00	No error	No action.
AUTOCHANGER CONTROLLER PCA ERRORS		
		The first step is to make sure the autochanger controller PCA cables are seated in their connectors.
01	ROM checksum error	Run test 31—ROM Checksum test—verify failure.
03	RAM test error	Run test 33—RAM test—verify failure.
04	Microprocessor test error	Run test 30—Microprocessor Operation test—verify failure.

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
05	Controlled area of RAM checksum error	Recycle Power—verify failure. **If error repeats—** Run configuration 16—resets default values. Recycle power. **If error repeats—** run configuration 66— Zeros all RAM locations and reboots. **CAUTION**—When this configuration is set to `Clear`, the product ID and the vendor ID must be downloaded using the firmware upgrade procedure outlined in the "Supplemental Information" section at the back of this manual. **If error repeats—** replace AC Controller PCA (FRU 01). Poweron—check fix.
09	Firmware error	Run test 3—Controller test—(may not be able to duplicate).
0A	Improper Board Configuration	The fuses on the board were not properly blown for this configuration.

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
SCSI INTERFACE-SPECIFIC ERRORS		
		Visual inspection is not possible for errors 0B to 13. **All recovery procedures for errors 0B - 13 are handled in the same manner:**
0B	SCSI controller register error	Run test 34—SCSI Interface Controller Chip test—verify failure.
0C	SCSI controller IC's RAM failed	
OD	SCSI controller message error	
OE	SCSI ccontroller command error	
OF	SCSI controller kill error	
10	SCSI controller FIFO error	
11	SCSI controller target sequence error	
12	SCSI controller command sequence error	
13	SCSI controller status sequence error	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
LOOPBACK ERRORS		
		All recovery procedures for errors 18 - 20 are handled in the same manner:
18	SCSI connector loopback error in DBO or I/O	Run test 41—(with loopback connector 88780-60095)—verify failure.
19	SCSI connector loopback error in DB1 or C/D	
1A	SCSI connector loopback error in DB2 or MSG	
1B	SCSI connector loopback error in DB3 or REQ	
1C	SCSI connector loopback error in DB4 or ACK	
1D	SCSI connector loopback error in DB5 or ATN	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
1E	SCSI connector loopback error in DB6 or SEL	
1F	SCSI connector loopback error in DB7 or BSY	
20	SCSI connector loopback error in DBP or RST	
MULTIFUNCTION PERIPHERAL IC ERROR CODES		
		Visual inspection is not possible for errors 29 to 2B **All recovery procedures for errors 29 - 2B are handled in the same manner:**
29	RS-232 loopback data did not match what was sent	Run test 35 - Multifunction Peripheral Chip test - verify failure.
2A	Timed out waiting for RS-232 loopback data	
2B	Timer A did not count down as expected	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
MOTOR CONTROL IC ERRORS		
		Visual inspection is not possible for errors 2C to 2E. **All recovery procedures for errors 2C - 2E are handled in the same manner:**
2C	Failed read/write test to motor control IC	Run test 36—Motor Control Chip test—verify failure.
2D	Motor control loopback test failed	
2E	Motor control IC RAM test failed	
POWER SUPPLY ERRORS		
		Visually check the power cables and connections. **All recovery procedures for errors 33 - 34 are handled in the same manner:**
33	Low voltage power supply failed	Run test 40—Power Supply test—verify failure.
34	High voltage power supply failed	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
DRIVE CONNECT ERRORS		
		On error codes 38 and 39 be sure to check: **—drive cabling** **—good contacts** **—no cut or exposed wires** **—drive tray not skewed** **All recovery procedures for errors 38 - 39 are handled in the same manner:**
38	Drive 1 not connected	Run test 37—Drive Connector test—verify failure.
39	Drive 2 not connected	
MECHANISM ERROR CODES		
		Check carriage/picker for free motion. The carriage should travel easily along the rails; you should be able to smoothly translate the picker across the carriage. The picker should also flip easily by pulling the picker belt. **All recovery procedures for errors 3C - 3E are handled in the same manner:**
3C	Unspecified mechanical failure	Run test 11—autochanger Mechanism Exercise test. On error—go to error code in this table.
3E	Unspecified servo failure	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
		Check the appropriate area for loose labels or other obstructions (drive(s), picker, mailslot, magazine(s)).
40	Unable to free picker fingers for carriage motion	Run test 50—Find Home Sequence.
		All recovery procedures for 41 - 47 are handled in the same manner
41	Unable to verify picker is at home position during Find Home sequence (non-leadscrew side)	Run test 50—Find Home Sequence—verify failure.
43	Picker fingers met resistance during retraction	
44	Carriage motion failure during Find Home sequence	
45	Unable to free picker fingers for translate motion	
46	Carriage motion failed while initializing home position during Find Home sequence	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
47	Translate failed while moving toward non-leadscrew side during Find Home sequence	
		All recovery procedures for 48 - 49 are handled in the same manner
48	Carriage motion failed during carriage/picker assembly calibration (leadscrew side)	Run test 51—Carriage/Picker Assy Calibration—verify failure.
49	Carriage motion failed during carriage/picker assembly calibration (non- leadscrew side)	
		All recovery procedures for 4A-4D are handled in the same manner
4A	Motion error while determining orientation of the picker	Run test 50—Find Home Sequence—verify failure.
4B	No sensor found	
4C	Failed flip motion during Find Home sequence	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
4D	Motion error checking for cartridge in the picker	**Check the optical sensors, if necessary. All recovery procedures for 4E-53 are handled in the same manner**
4E	Unable to measure height of sensor on the leadscrew side	Run test 51—Carriage/Picker Assy Calibration—verify failure.
4F	Unable to measure height of sensor on non-leadscrew side	
50	Excessive tilt of the carriage/picker assembly (away from the drives)	
51	Excessive tilt of the carriage/picker assembly (toward drives)	
52	Excessive cone angle on picker	
53	Excessive stack tilt	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
54	Unable to complete an interrupted move (at powerup)	Run test 60—FRU isolation test—verify failure. If test 60 shows an error code—look up the hardware error code in this table and follow the recovery procedures for that error.
55	Unable to find top of unit	Run test 51—Carriage/Picker Assy Calibration—verify failure.
EXERCISER TEST ERRORS		
56	Need to issue Initialize Status command	No FRUs failed. Run test 10 to initialize the element status.
57	Invalid test configuration	No FRUs failed. Check cartridge configuration. Check that the cartridge configuration (number and location) are correct for the test you are doing.
59	Exerciser unrecovered error	No FRUs failed. Exerciser had an unrecovered error. Rerun exerciser. **If exerciser fails again**—access the Recovery Log. *The Recovery Log is available only through the SCSI interface. Use the DOSDASS2 utility. See the Supplementary Information section in this manual for more information.*

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
5A	Invalid test configuration (elements reserved)	No FRUs failed. Can't do the selected test on a reserved cartridge. Check cartridge reservations. Rerun the test.
5B	Initialize Element Status command failed	No FRUs failed. The initialization of an element status failed. Rerun initialization. **If initialization fails again**— access the Recovery Log. *The Recovery Log is available only through the SCSI interface. Use the DOSDASS2 utility. See the Supplementary Information section in this manual.*
5C	Shipping diagnostic run with cartridges in autochanger mechanism.	No FRUs failed. Shipping warning. Take all disks out of the optical drives.
CALIBRATION SENSOR SYSTEM ERRORS		**All recovery procedures for errors 60-61 are handled in the same manner:**
60	Optical sensor failed (leadscrew side)	Run test 51—Carriage/Picker Assy Calibration—verify failure.
61	Optical sensor failed (non-leadscrew side)	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
MAILSLOT/STORAGE SLOT ERRORS		
		Check for loose labels or other obstructions in errors that involve the Mailslot (B0-B2). All recovery procedures for B0-B2 are handled in the same manner
B0	Mailslot will not rotate	Run test 17—Mailslot I/O test—verify failure.
B1	Inside mailslot sensor failed	
B2	Mailslot will not accept or release cartridge	
		Check for loose labels or other obstructions in errors B3 and B4. Also, make sure that the magazines are not skewed.
B3	Storage slot will not accept or release cartridge	Run test 15—Storage Slot test—verify failure.
B4	Outside mailslot sensor failed	Run test 17—Mailslot I/O—verify failure.

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
DRIVE ERRORS		
		The autochanger only checks for the PRESENCE of a drive. **To run complete drive tests requires an external diagnostic.** **On drive error codes, check all cabling to/from the drives** **—no broken wires** **—no worn cables** **—no loose connections** **Check the drive tray.** **All recovery procedures for errors B8 - B9 are handled in the same manner:**
B8	Drive 1 access error	Run test 16—Drive I/O test—verify failure.
B9	Drive 2 access error	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
DRIVE EJECT ERRORS		
BC	Drive 1 access failure	
BD	Drive 2 access failure	
FRU DETECTION TEST ERRORS		
		Check carriage/picker for free motion. The carriage should travel easily along the rails; you should be able to smoothly translate the picker across the carriage. **You should be able to easily flip the picker using the picker belt.** **All recovery procedures for C8-CE are handled in the same manner**
C8	Unable to gain proper servo control of motors	Run test 60—FRU isolation test—verify failure. Replace the FRU(s) if necessary.
C9	Unable to move picker motor	

Table 4-1.
Hardware Error Codes and Recovery Procedures (continued)

Hardware Error Code (hex.)	Error Description	Recovery Procedures
CA	Unable to move the carriage motor	
CB	Unable to move either motor	
CC	Unable to find a hard stop while turning the picker motor	
CD	Unable to find a hard stop while turning the carriage motor	
CE	Excessive force needed to move the carriage leadscrew	

Table 4-2. Miscellaneous Error Codes

Error Code (hex.)	Meaning
MISCELLANEOUS ERROR CODES	
FA	Invalid switch configuration for this firmware. Switch 2 of S2 switch should be open.
FB	Door interlock open
FC	The test can not be run through the SCSI interface.
FD	The test can only be run from the SCSI interface.
FE	The test did not run; probably a configuration error.
FF	Invalid test number.

Additional Explanation of Some Hardware Error Codes

Error Code	Explanation
05	Controlled area of RAM checksum error. All of the RAM on the autochanger controller board has battery back-up, but not all of it needs to be retained upon power loss. The portion of the RAM which needs to be valid at poweron is referred to as "Controlled RAM". The stored checksum is re-calculated on this area every time the "Controlled RAM" is modified. The checksum is verified by test #32. Error 05H is returned any time the calculated checksum does not match the stored checksum. To reset the checksum, clear configuration 16 using the control panel and switch the autochanger off and on again. This error is deemed to be so unacceptable that all autochanger function is halted. The motors are turned off and the SCSI bus is not accessed.
09	Firmware error There are three conditions where this code is used: 1. case statement which falls through 2. stack overflow 3. divide by zero In case 1, the error code is returned over SCSI to the host. In cases 2 and 3, the motors shut down, the processor halts.
43-4C	Refer to "Specific Steps of the FIND HOME Sequence" in chapter 8 for a thorough explanation of the Find Home test.
50	Excess upward droop on picker.

51	Excess downward droop on picker. "Droop" is the distance between where the end of a perfectly perpendicular picker (in relationship to the carriage) would be, and where the end of this picker is MEASURED to be. If the picker droops down too far, it will not be able to engage the mailslot correctly. It will first engage the translate pin and move across, rather than out.
52	Excessive cone angle on picker. If the sum of the upward droop on one side of the picker plus the downward droop on the other side of the picker is too great for proper operation, this error is returned.
53	Excessive stack tilt. The height of each side of the autochanger, or "stack", is the height of each of the two sensors. Tilt is the measure of the difference of the heights of the sides. If the tilt is too great for proper operation, this error is returned.
54	At power up, unable to complete an interrupted move. If a move was interrupted by a power failure, at the next poweron the autochanger will attempt to return the library to the state it was in before that command was issued. This error is returned if all the poweron tests pass, but the autochanger is unable to put the cartridge(s) back.
B8-BD	Drive Errors. Errors B8 and B9 appear when a drive cannot come to a READY state. Errors BC and BD appear if there is a problem either inserting or ejecting a cartridge. These errors also occur when either the drive eject mechanism has failed or the drive eject-control solenoid will not allow the cartridge to come out and be grabbed by the picker.

C8	Unable to close the loops on the motors. When this error occurs, the FRU Isolation code has already confirmed that the motors and encoders appear functional. But, for some reason, the servo system is unable to initiate proper control. This condition is rare.
CC	Unable to find a hard stop while turning the picker motor.
CD	Unable to find a hard stop while turning the carriage leadscrew motor. The FRU Isolation code checks for the presence of the belts by turning the motors until the mechanical system hits something. These errors are returned if the motors continue to spin longer than the maximum expected distances.

Error Information through SCSI Commands

When there are errors in autochanger movements, two main approaches are available to get information and to run execiser tests. The approach usually depends on whether the error encountered was a **hard** error or whether it was a **soft** or intermittent error.

- Troubleshooting Using the Control Panel and Observation - The method described in the previous section is usually used in situations where you have a hard error.
- Troubleshooting Through the SCSI Bus - The method discussed in this section is used in situations where you have a soft or intermittent error.

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

Also, through the Log Sense and Request Sense commands, you can gather information on the optical drives; which cannot be done through the control panel.

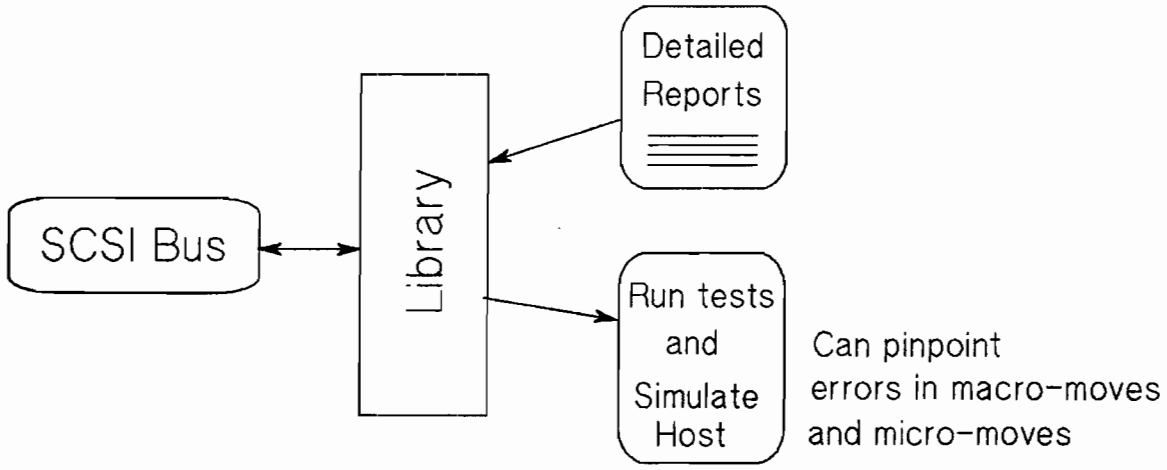


Figure 4-4. Information and Tests Through the SCSI Bus

An external utility is needed to read the data on the SCSI bus. Hewlett-Packard offers a diagnostic utility called *DOSDASS2* that provides this capability.

Refer to the following information when troubleshooting through the SCSI bus:

- *Offline Diagnostics for Hewlett-Packard Optical Storage Products* - located in the "Supplemental Information" section of this manual.

  This guide contains information about Hewlett-Packard's offline diagnostic, *DOSDASS2*, which can be used to access the above information through the SCSI bus.

  In addition, refer to the following tables, also contained in this guide:

  - Request Sense Command Tables

    These tables show error information and information about the state of the autochanger after an error has occurred, which is returned when a Request Sense command is issued through the SCSI bus.

  - Log Sense Command Tables

    These tables show the error and move information which is stored in various logs during autochanger operation and when running internal diagnostics.

Diagnostics

Several diagnostic programs and tests are available for the disk library. This chapter gives information on how to run these tests/programs or where to find this information.

The two types of diagnostics available for the disk library are:

- Offline Diagnostics - Hewlett-Packard offers a diagnostic program called *DOSDASS2* for use with the optical disk library. This PC-based diagnostic program allows you to fully test the autochanger mechanism or the optical drive mechanism.
- Internal Diagnostics - These tests are run from the control panel and are divided into four groups: sequence tests, exerciser tests, electronic core tests, and mechanism core tests. These tests are fully explained in chapter 8, "Reference." Instruction for running these tests are provided in this chapter.

Offline Diagnostics

A diagnostic utility called *DOSDASS2* is available from Hewlett-Packard for accessing the optical disk library through the SCSI bus.

DOSDASS2 fully exercises either standalone multifunction optical drives or autochangers that contain multifunction optical drives. Information for getting and using *DOSDASS2* is found in the "Supplemental Information" section of this manual in the booklet entitled, *Offline Diagnostics for Hewlett-Packard Optical Storage Products*.

Internal Diagnostic Tests

An extensive set of internal diagnostic tests is available for the autochanger. Except for the poweron sequence test, the running of tests is not automatic. The operator may initiate each test from the control panel.

A test is actually a sequence of separate tests that are called and run in series. Each test exercises a specific portion of the autochanger. Each test is identified by a test number that is requested when the test is to be run. Tests return either `PASS` or `FAIL`.

All the tests are combined into groups of similar functions.

Sequence Tests (1 - 9) execute sequences of individual tests within the range of test 10 through test 69. Sequences may be used to either test many portions of the autochanger or as an autochanger exerciser. When a sequence test is selected, the autochanger executes the tests in sequence until an error occurs or until the sequence successfully completes.

Exerciser Tests (10 - 29) do simple autochanger mechanism moves to check out elementary functions.

Electronics Core Tests (30 - 49) run basic tests of the autochanger controller PCA.

Autochanger Mechanism Core Tests (50 - 75) run basic tests of the autochanger mechanism. These tests make combinations of moves that can help to detect the source of failures.

Note Chapter 8, "Reference," contains a complete listing and description of these diagnostic tests. Instructions for running these tests are given in the next section of this chapter.

Procedure

A complete listing of diagnostic tests can be found in table 8-2.

1. With READY displayed, press (OPTION). TEST * displays.
2. Press (ENTER). TEST 0 displays.
3. Press (NEXT) or (PREV) until the needed test number displays.
4. When you press (ENTER) for the chosen test, ONCE displays.

   You may accept ONCE by pressing (ENTER) or press (NEXT) or (PREV) to choose 10, 100, 1000, or LOOP test repetition times.

   LOOP indicates that the test runs continuously until (CANCEL) is pressed or the unit is switched off.

Note All tests except test 39 may be stopped by pressing (CANCEL). The current test iteration completes. To stop test 39, press (CANCEL) twice.

---

5. Once you press (ENTER) for the number of test iterations, TESTING displays.
6. The test runs. If no problems are encountered, the message PASS ## displays.

   You may press (OPTION) to get back to the READY state; or, you may press (ENTER) or (CANCEL) to perform another test.

   If a problem occurs during the test, the message FAIL ## displays. Press (ENTER) to gain information about the failure. An ERROR ## displays. Relevant information is stored in the autochanger Error Log (Log 0).

   Press (CANCEL) or (OPTION) to exit this display.

5

Removal and Replacement

This chapter explains the procedures to remove damaged or nonfunctional components of the disk library system, and then to replace these components with new ones. Removal and replacement procedures are organized as follows.

- Service Access
  - Deskside option—Removing the cabinet, rear cover, and front panel
  - Rackmount option—Accessing the autochanger chassis
  - Rackmount option—Removing the front panel
  - Deskside/rackmount electronics and mechanism access
- Removing the power supply module
- Removing the autochanger controller PCA
- Removing the SCSI repeater PCA
- Changing the autochanger controller PCA code
- Changing the MO drive code
- Removing the MO drives
- Removing the carriage/picker assembly
- Removing the carriage motor
- Removing the carriage leadscrew
- Removing the picker motor
- Removing the leadscrew-side carriage way (rail)
- Removing the mailslot
- Removing the power supply fan
- Removing the interconnect PCA
- Re-initializing autochanger controller PCA RAM after service
- Replaceable parts

Keep the following information in mind when servicing an optical disk library system.

Warning **The magneto-optical drive mechanisms in the autochanger become Class 3B laser mechanisms when disassembled. If a drive is disassembled, exposure to the invisible laser beam and hazardous invisible laser radiation could result in blindness.**

DO NOT disassemble the drive mechanisms. A drive that has been disassembled will **not** be accepted as an exchange assembly.

Caution If you will be working on or around the disk magazines, record the slot location and orientation of each cartridge to make sure that the disks can be restored to their original positions if moved.

Always return disks to their original slot and orientation before returning control back to the customer. Serious loss of system integrity will result if this practice is not followed.

TOOLS NEEDED:

- #7, #10, #15, Torx®
- #2 Pozidriv with at least a 10-inch shank (picker removal)
- Medium slot-blade screwdriver
- 3/16- and 7/64-inch Allen wrenches
- 7/16-inch socket or box-end wrench (or crescent wrench)

Note **The deskside option orientation is used in most explanations of disassembly and re-assembly. If access or parts are different between the deskside and rackmount options, these differences are noted.**

Deskside option—Removing the Cabinet, Rear Cover, and Front Panel

CABINET

1. The *top cover* is removed by lifting it from the rear, pushing it slightly towards the front, and lifting it off.
2. Each *side panel* is held at the top by two captive, slotted-head screws. Loosen the screws and pull the panel up and away.

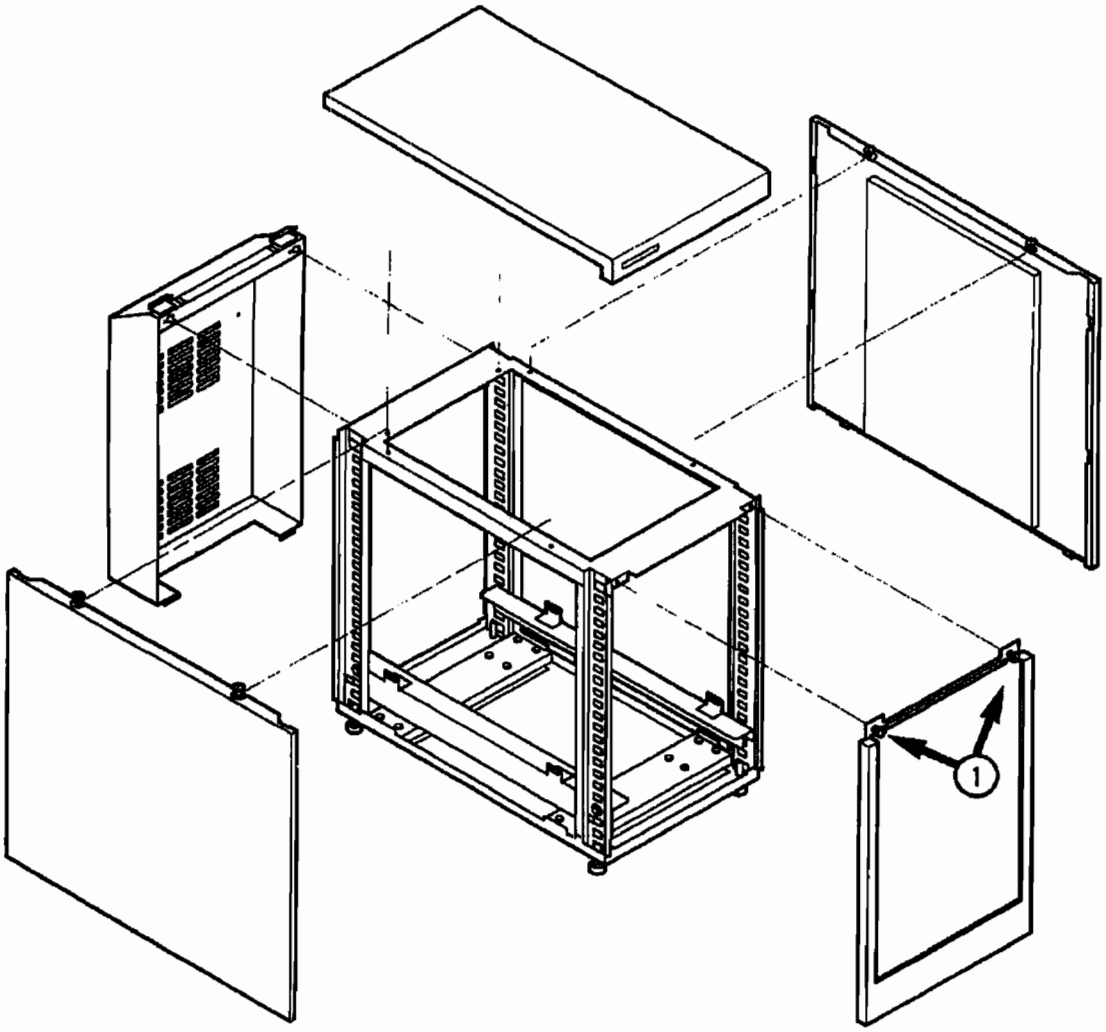


Figure 5-1. Service Access

REAR PANEL

1. The *rear cover* is held by two snaps at the top. Pull the top of the panel back to release the snaps.

FRONT PANEL

1. The *front panel bezel* is held by two captive screws as shown in figure 5-1 (1).
2. The *front panel* is held by two Torx screws accessed from the rear of the front panel display (see figure 5-2). Remove these screws and then push a screwdriver through the center, top slot to separate the front panel from the chassis.

   The front panel plastic is attached to a metal backing plate. These two pieces should be handled as a single unit. *Do not attempt to separate the pieces.*

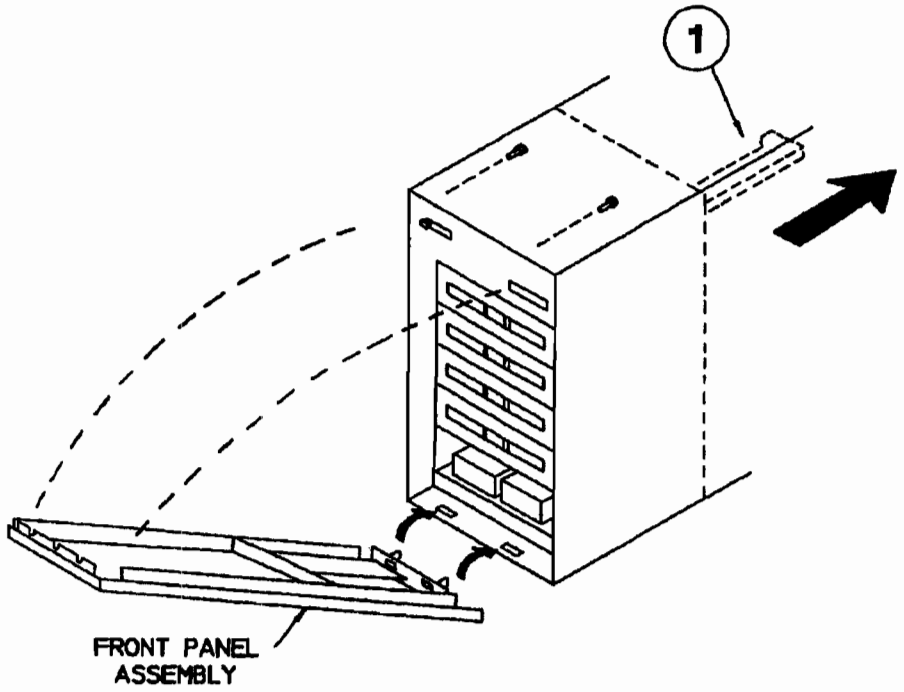


Figure 5-2. Removing the Front Panel

When re-assembling:

The mailslot door must be lowered to re-install the front panel. Manually pull the mailslot actuator arm all the way back before placing the front panel into position. See figure 5-2 (1) for the location and movement of the actuator arm.

Rackmount option—Accessing the Autochanger Chassis

1. Remove the rackslide handle cover by inserting a flat-blade screwdriver between the cover and the handle (near the middle of the cover) and GENTLY pry the cover away from the handle (figure 5-3).

   The cover is held by plastic clips near each end and in the middle. If the cover bends but does not release, try moving the screwdriver toward an end while continuing to pry the cover off.

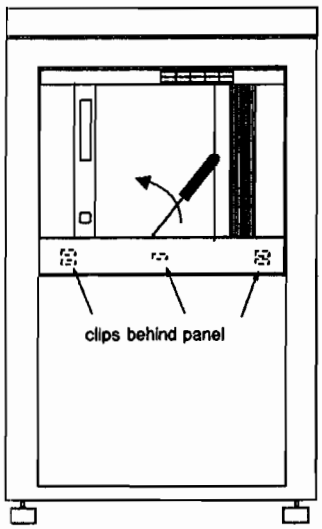


Figure 5-3. Removing the Slide Handle Cover

2. Unlock the slide from the rack by rotating the slotted screws on each side of the handle AWAY from the rack vertical members (rotate the left screw clockwise; rotate the right screw counterclockwise). Figure 5-4 shows the right-side screw and how it is rotated to release the latch.

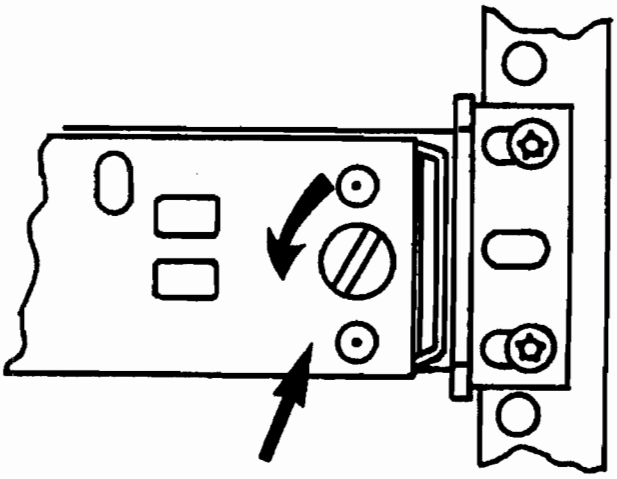


Figure 5-4. Unlocking the Slide Assembly (Right Side)

3. Pull the slide out until you hear it lock into place.

Rackmount option—Removing the Front Panel

1. The *front panel* is held by two Torx screws as shown in figure 5-5.

   Loosen the two screws.

Warning **The front panel is held in place by two tabs in slots on the drive-end of the chassis (right side as you face a rackmount unit). Be careful when rotating the panel out. When the tabs rotate free from the right side, the panel may drop.**

2. Rotate the left side of the front panel outward. SUPPORT the right side of the front panel and pull slightly to the left to free the front panel from its tab supports.

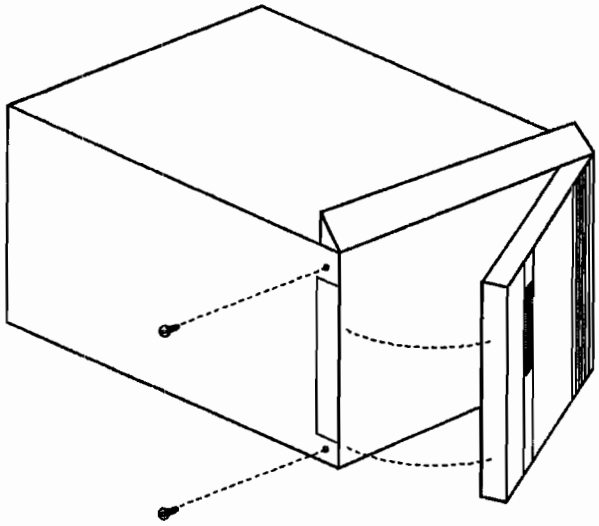


Figure 5-5.
Front Panel Mounting Screws
(Rackmount Option)

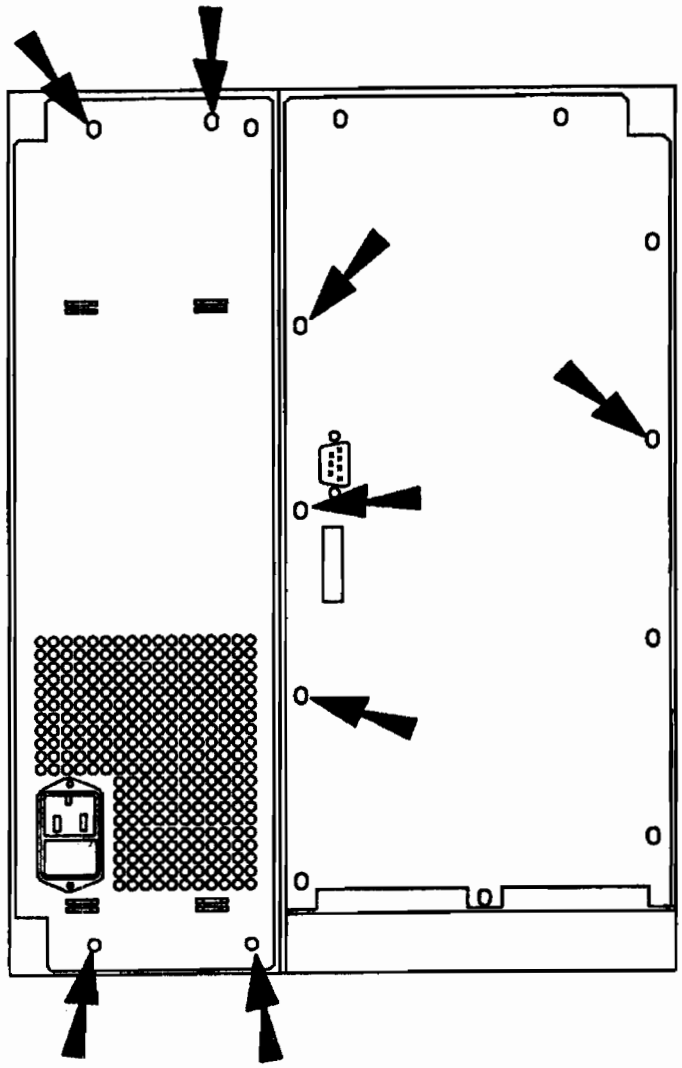


Figure 5-6. The Rear Access Panel and Power Supply

Deskside and Rackmount Electronics and Mechanism Access

- The *rear electronics access panel* is the panel to the right in Figure 5-6. This panel is held by 11 Torx (T-15) screws. The left panel shown in Figure 5-6 is the power supply and is held by 4 Torx (T-15) screws.
- Four Torx (T-10) screws hold the panel covering the large chassis access panel. See Figure 5-7.
- Two Torx (T-15) screws hold each panel over the two small, rectangular access panels. On rackmount models only one of these smaller access panels is available while the chassis is mounted on the rackslide. See Figure 5-7.

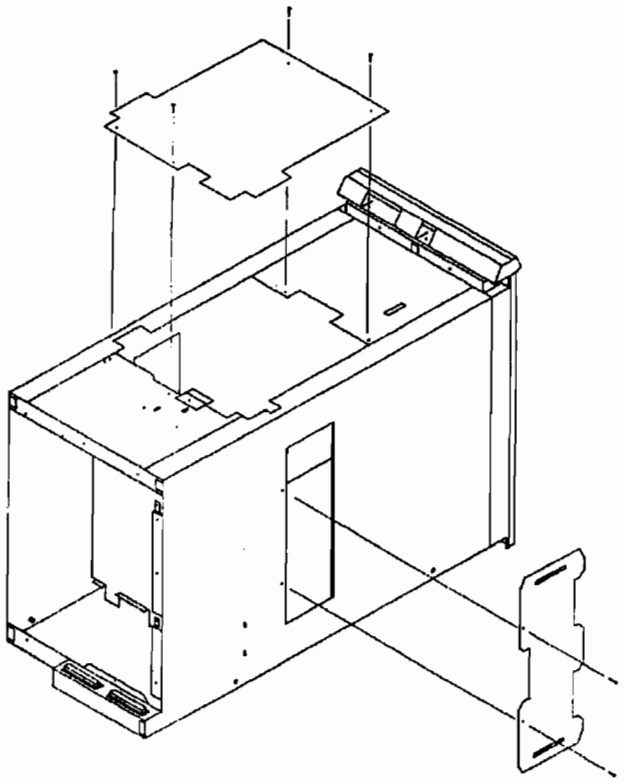


Figure 5-7.
The Large and Small Chassis Access Panels
(oriented differently, depending on whether deskside or rackmount)

Removing the Power Supply Module

Caution The electronics in the autochanger are very susceptible to damage from Electrostatic Discharge. Use ESD straps and mats to prevent damage.

1. Place the power switch on the rear panel to OFF.
2. Unplug the power cord.

Refer to figure 5-6.

3. Remove the 11 T-15 screws that secure the rear access panel.
4. Remove all the cables to the autochanger controller PCA mounted on the side of the power supply.

5. Remove the four T-15 screws that hold the power supply to the chassis (Figure 5-6).
6. Rotate the power supply out from the chassis far enough to disconnect the power cables from the power-receptacle end of the supply (Figure 5-8).

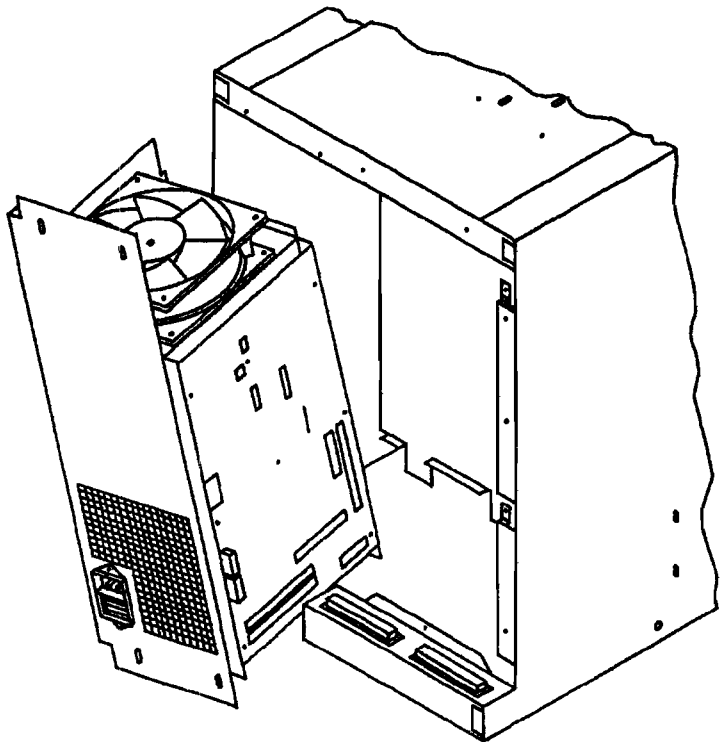


Figure 5-8. Rotating the Power Supply Module Out of the Chassis

Removing the Autochanger Controller PCA

1. Do the first six steps of "Removing the Power Supply Module."

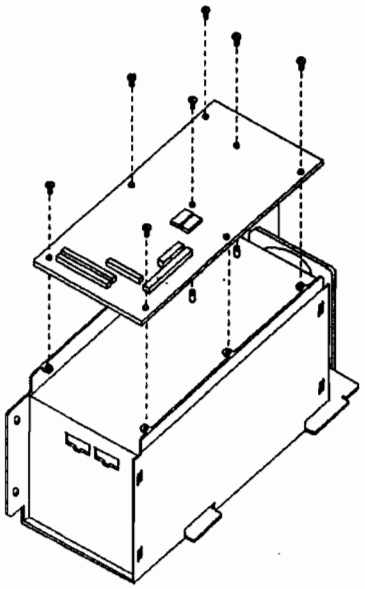


Figure 5-9. Removing the Autochanger Controller PCA

2. Remove the eight mounting screws that secure the autochanger controller PCA to the power supply assembly (Figure 5-9). Remove the PCA.
3. On the replacement PCA, verify that the 8-switch rocker switch (SW2) is set to the positions called out in Tables 5-1 and 5-2. Refer to Figure 5-10 for the location of the dip switch.

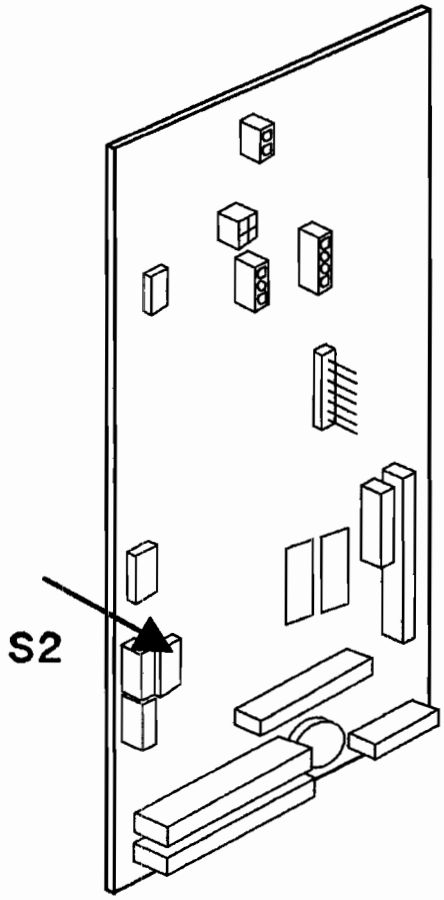


Figure 5-10. Dip Switch Locations on the Autochanger Controller PCA

Table 5-1.
S2 Switch Settings
Autochanger Controller PCA

Position	Description	Default
1	Clears NVRAM and Passwords	open
2	Factory setting, do not change	open
3	Factory setting, do not change	open/closed[1]
4	Factory setting, do not change	open/closed[2]
5	Termpower (see next table, "Termpower Settings")	
6	Termpower (see next table, "Termpower Settings")	
7	Termpower (see next table, "Termpower Settings")	
8	Factory setting, do not change	open

1 The default configuration setting for Models 10C and 20T is opened and for Models 20C and 40T is closed.

2 The default setting for Models 10C and 20T is closed, and for Models 20C and 40T is opened.

Table 5-2. Termpower Settings (S2 Switch, positions 5,6,7)

Supply	Position 5	Position 6	Position 7
Autochanger supply to bus	closed	closed	closed
Autochanger supply to bus	closed	closed	open
Autochanger supply to bus	open	closed	closed
Autochanger supply to Autochanger bus	open	open	closed
Host supply to bus (Default)	closed	open	open

4. Position the new controller PCA on the power supply in the same manner that the old controller PCA was positioned.

5. Secure the PCA using the eight screws and washers that were previously removed. Loosely start each screw and then tighten them.
6. With the power off, disconnect the drive I/O cables from the drives. Refer to Figure 5-13.
7. Power on the autochanger.
8. Perform the Firmware Upgrade and Product ID/Vendor ID Procedures. (These procedures are in the supplemental section of this manual.)
9. Power down the autochanger.
10. Reconnect the drive I/O cables.
11. Power on the autochanger and set configurations 16 and 18.

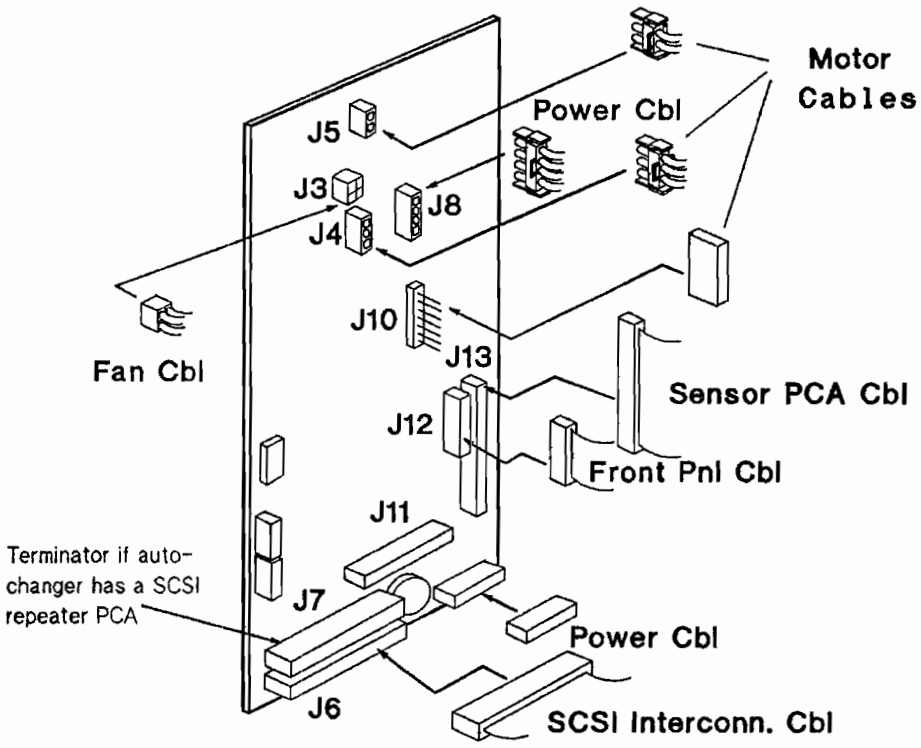


Figure 5-11. Autochanger Controller PCA Cable Connections

Removing the SCSI Repeater PCA

1. Do the first three steps of "Removing the Power Supply Module."
2. Remove the two screws that hold the SCSI repeater PCA mounting plate to the disk library chassis (Figure 5-12).

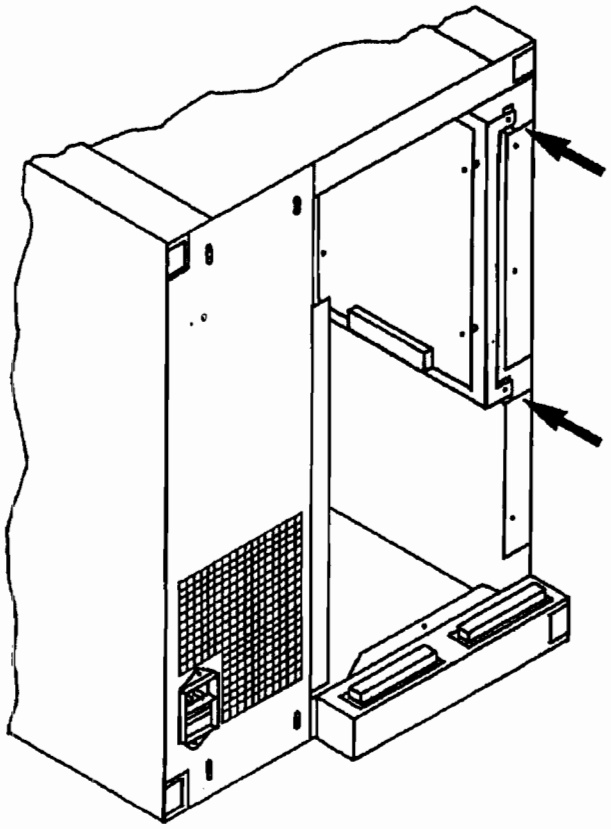


Figure 5-12. Removing the SCSI Repeater PCA Mounting Plate

3. Pull the SCSI repeater PCA mounting plate (which still holds the SCSI repeater PCA) out of the chassis far enough to make cable removal easy.
4. Disconnect the cables attached to the SCSI repeater PCA.
5. Remove the four T-15 Torx screws that hold the SCSI repeater PCA to the mounting plate.

Note The 90 ° top connector is the I/O from external connectors and the (flat) bottom connector is I/O to AC controller PCA.

Autochanger Controller PCA Code Changes

Autochanger controller PCA code is downloaded to the controller PCA using an external firmware upgrade utility (available from Greeley Storage Division).

Refer to the Firmware Upgrade Procedures in the supplemental section of the manual for more information regarding firmware updates.

MO Drive Code Changes

MO drive code is upgraded using an offline firmware upgrade utility available from Greeley Storage Division. Refer to the Firmware Upgrade Procedures in the supplemental section of this manual for specific information regarding MO drive code upgrades.

Removing/Replacing the MO Drives

1. Remove the front panel as described in "Service Access," earlier in this chapter. Refer to the deskside option or rackmount option as applicable.
2. Remove one of the access panels (your choice) that will let you remove cables on the inside of the chassis next to the drives.
3. Disconnect the drive power, SCSI, and interface cables from the rear of the drives. Refer to Figure 5-13.

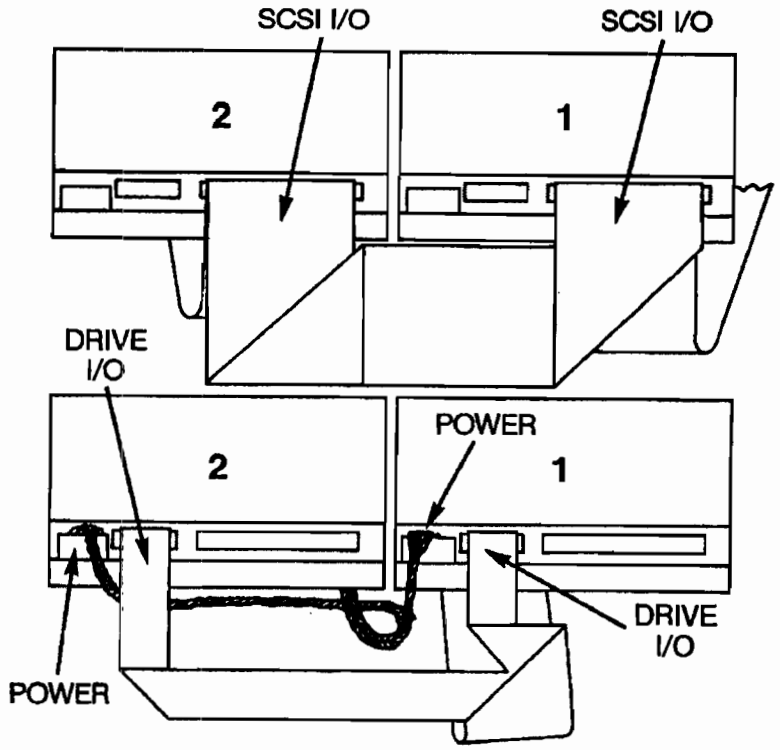


Figure 5-13.
Removing the Drive Power, SCSI and Interface Cables from the MO Drives

Refer to Figure 5-14.

4. Remove the T-15 Torx screws that hold the optical sensors in place.

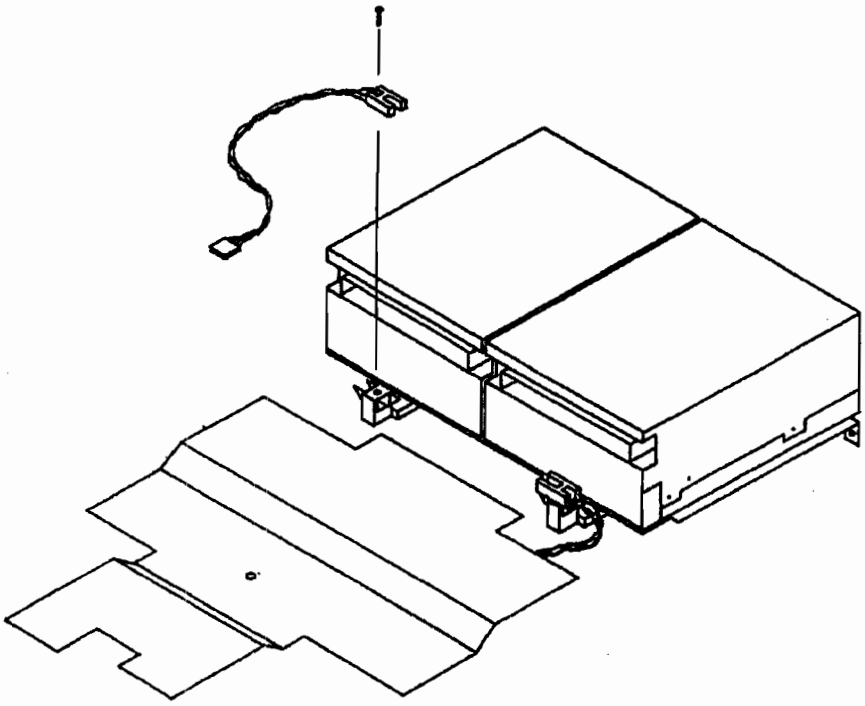


Figure 5-14. Optical Sensor Positions

5. Loosen the two T-15 screws at each end of the rear of the drive tray (Figure 5-15).
6. Slide the drive assembly out.

   IF THE TRAY BINDS, check to see if the tray is hitting the heads of the chassis mounting screws.

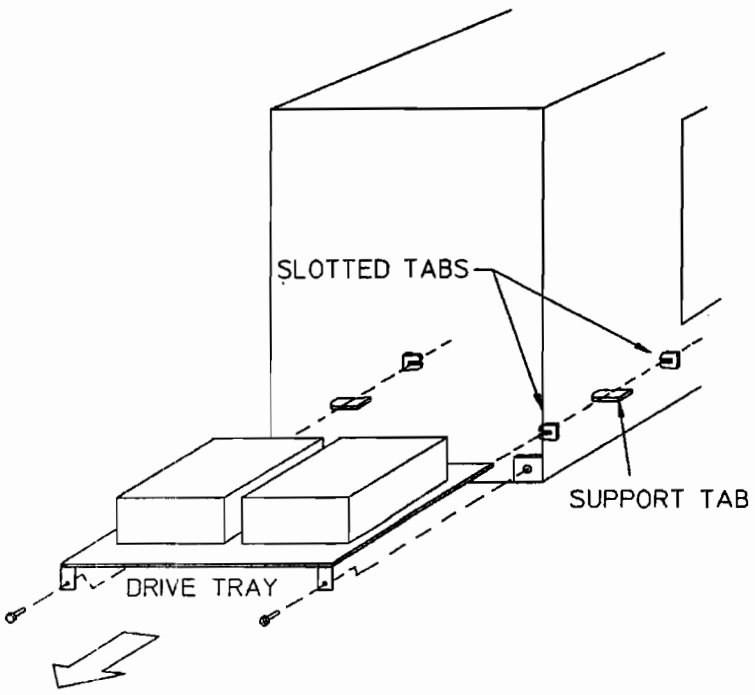


Figure 5-15. Removing the MO Drives

7. Each drive is attached to the tray with four T-10 Torx screws. Remove screws as necessary to replace drive(s).

When re-assembling:

Use the mounting holes closest to the sensor brackets to install the drive(s). (See Figure 5-16.)

After reversing the disassembly steps and remounting the drives, refer to the re-assembly notes in the section, "Service Access," in this chapter to correctly remount the front panel.

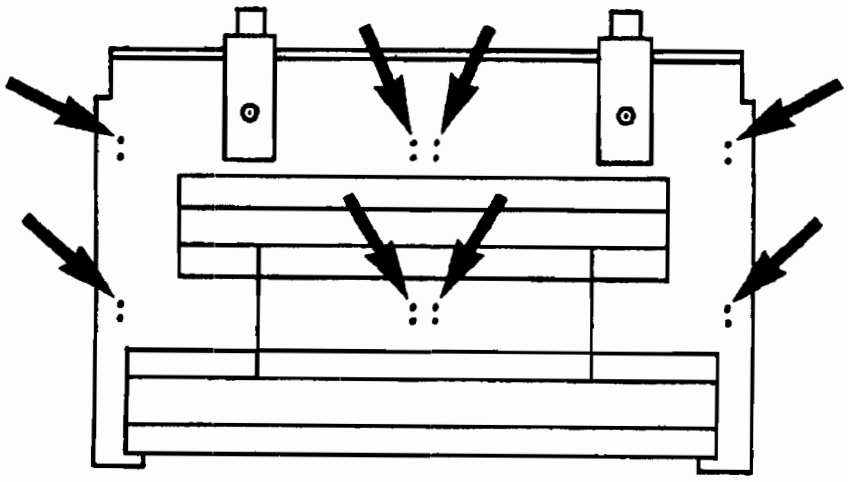


Figure 5-16. Drive Mounting Holes

Removing the Carriage/Picker Assembly

1. Remove the large chassis access panel.

Refer to Figure 5-17.

2. Remove the Torx screw holding the carriage bracket to the bottom of the picker carriage (Figure 5-17 (1)). This screw is sealed by Loctite®.

Note DO NOT REMOVE the screw that holds the carriage BRACKET to the leadscrew.

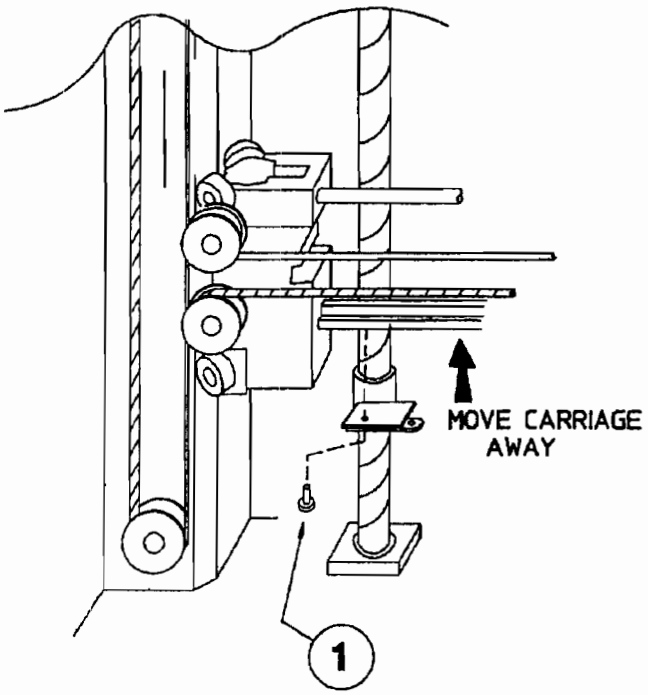


Figure 5-17. Separating the Carriage from the Carriage Bracket

Refer to Figure 5-18.

3. Release the tension on the picker belt by pushing the tensioner spring toward the drives. To push the spring *toward* the drives, pry with the tool you are using as shown in Figure 5-18.

   While holding the tensioner spring down, slip the picker belt off the pulley at the end of the carriage rail (way) on the leadscrew side.

   Then remove the belt from one of the pulleys on the leadscrew-side carriage rail.

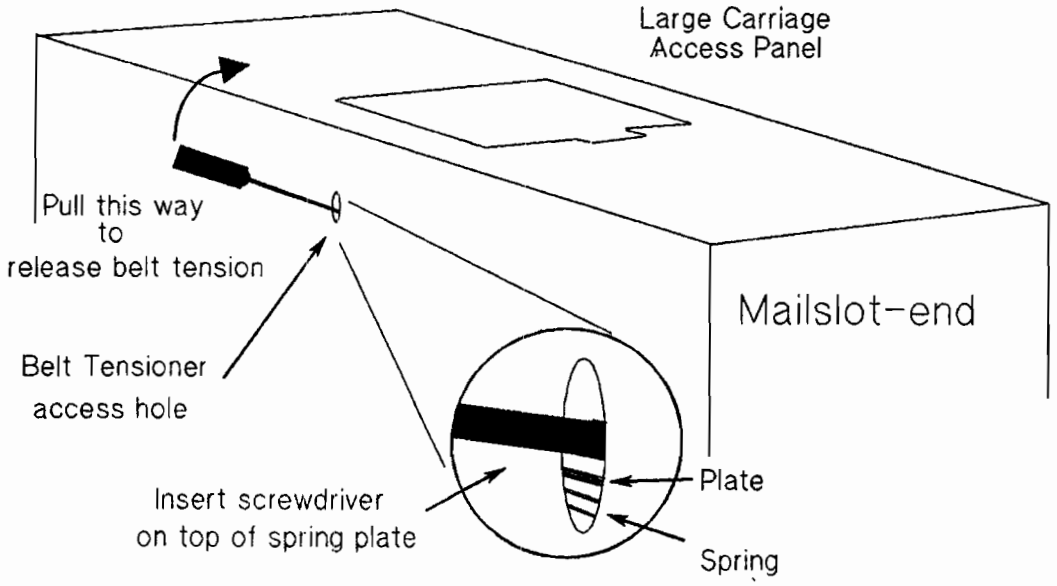


Figure 5-18. Releasing the Picker Belt Tension

4. Position the picker in the center of the carriage so that it can pass through the cutout in the chassis.

   Refer to Figure 5-19. (Note that view is of the side of the picker that faces the drive end of the chassis).

   a. Push the translate latch toward the picker to unlock the picker.

      A slot in the bottom of the picker shaft belt pulley must be positioned over the translate latch to allow the translate latch to fully retract.

You may have to rotate the picker shaft belt pulley a little to line up this slot. To do this, jiggle the belt back and forth just a little until you feel the picker release from the rail.

b. When you feel the picker slide freely, move the picker to the center of the carriage.

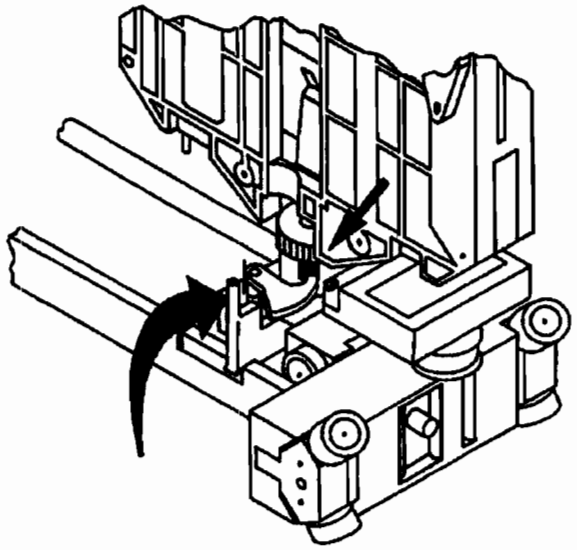


Figure 5-19. Releasing the translate latch (seen from drive side of picker)

Refer to Figure 5-20.

c. Release the picker for rotation by pushing on the release lever. Rotate the picker to a position parallel to the carriage rails as shown in Figure 5-21.

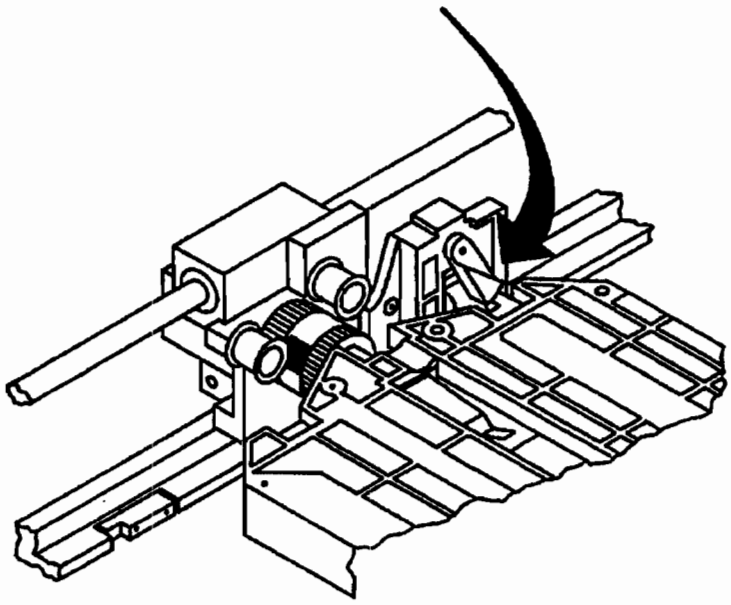


Figure 5-20. Releasing the Picker for Rotation

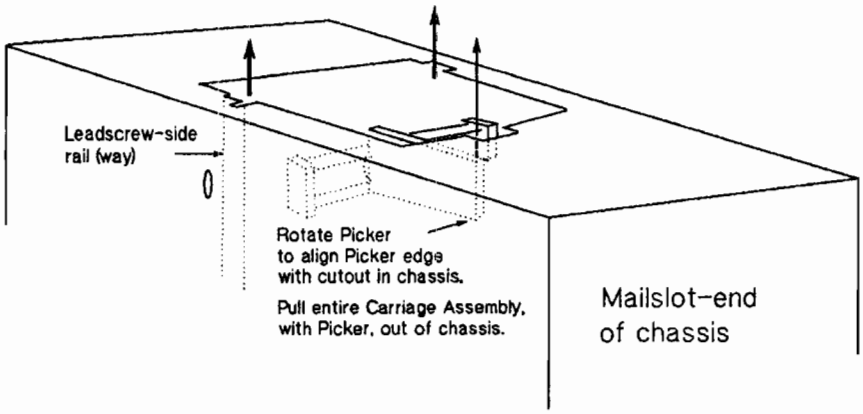


Figure 5-21. Removing the Carriage Assembly and Picker as a Unit

Warning **As the carriage is pulled off the ends of its rails during the next step, the spring-loaded bearing block assembly on the non-leadscrew side of the carriage assembly can separate from the assembly with considerable force and could cause injury.**

Hold the bearing block assembly against the carriage assembly as you pull the carriage assembly off the end of the rails.

Refer to Figure 5-21.

d. Pull the picker carriage out of the chassis.

When re-assembling:

Be sure to press in the static pin on the outside of the carriage support (leadscrew-side) as you slide the carriage onto the rails (ways). This pin can be broken off.

Hold the tensioner spring down as explained in Step 3 while replacing the picker belt. Make sure that the picker belt is centered between the two ridges on the pulley. (Refer to Figure 5-22 to correctly thread the picker belt.) After the picker belt is in place, verify that the tensioner spring returns to its upmost position by inserting the tool underneath the tensioner plate and gently prying it up.

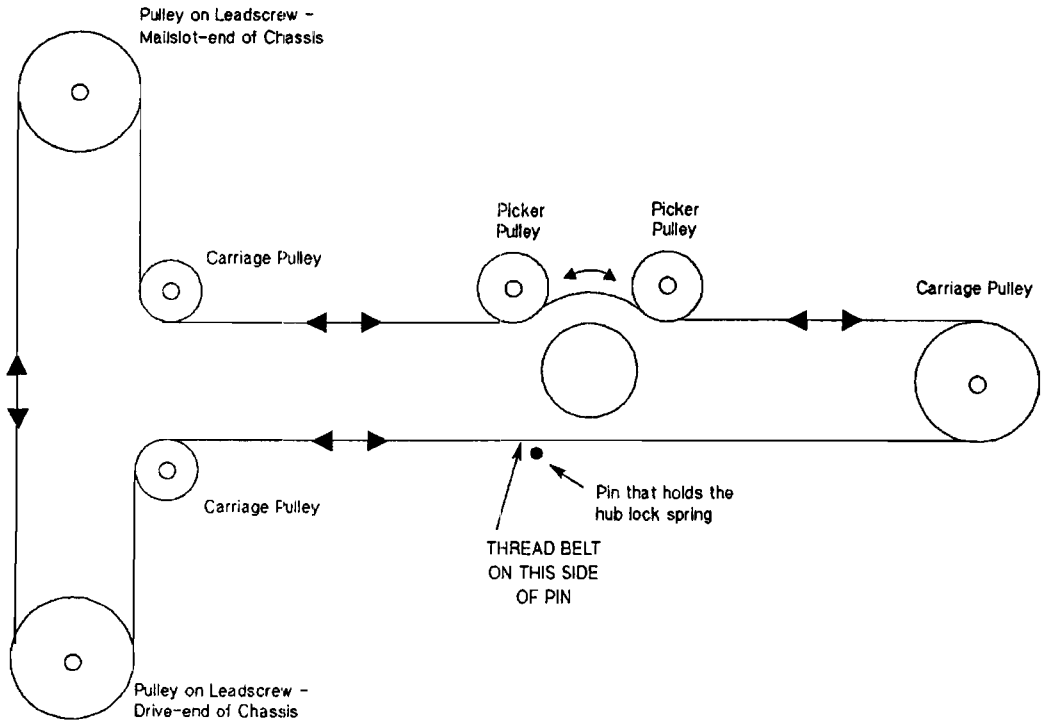


Figure 5-22. Picker Belt Threading Diagram

Removing the Carriage Motor

Refer to Figure 5-23.

1. Loosen the screws holding the carriage motor (Figure 5-23 (1)).
2. Remove the belt between the carriage motor and the leadscrew.
3. Disconnect the wires on the motor.
4. Remove the carriage motor.

Note The motor encoder plug goes both ways.

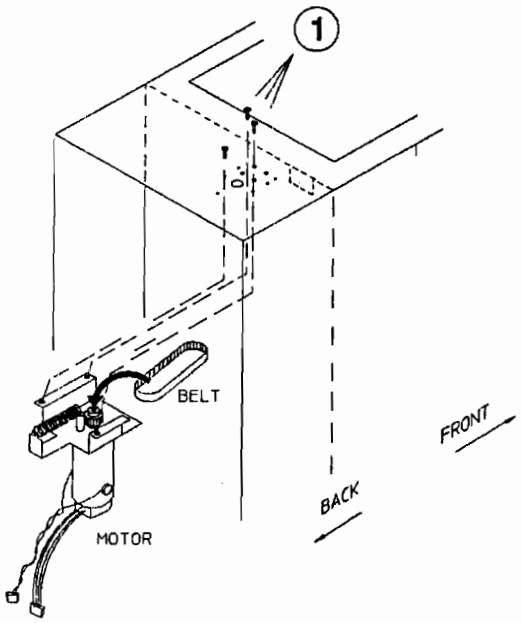


Figure 5-23. Removing the Carriage Motor

Removing the Carriage Leadscrew

1. Remove the belt to the carriage motor.

   The belt may be removed by pulling the belt over the end of the leadscrew gear as the gear is rotated. Move the carriage assembly up or down to rotate the gear.

2. Remove the screws holding the leadscrew top bracket to the back wall of the chassis (Figure 5-24 (1)).

3. Lift out the leadscrew.

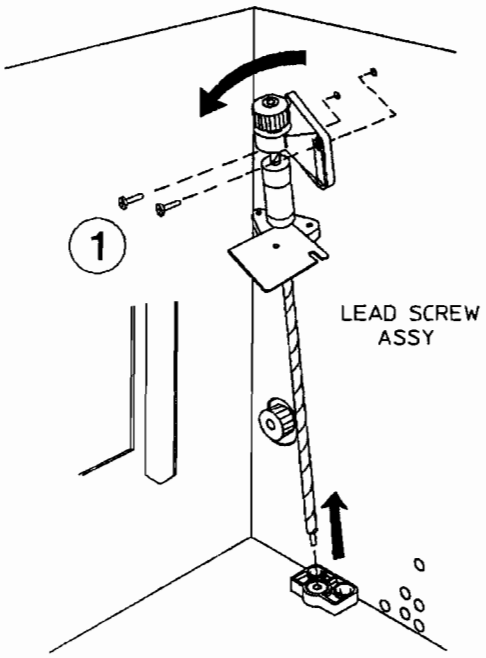


Figure 5-24. Removing the Carriage Leadscrew Assembly

Removing the Picker Motor

Refer to Figure 5-25 and Figure 5-26.

1. Do the first three steps of "Removing the Power Supply Module."
2. Remove the two cables connecting the picker motor to the autochanger controller PCA.
3. Loosen the tensioner spring (see Figure 5-25).

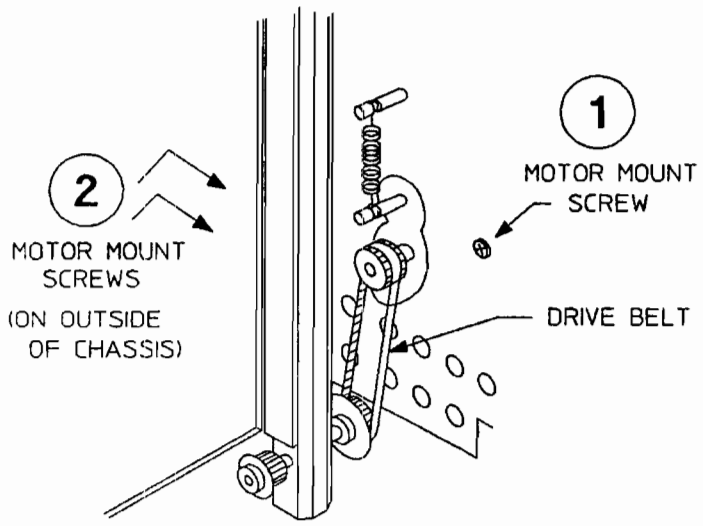


Figure 5-25. Picker Motor Mounting Screws and Drive Belt

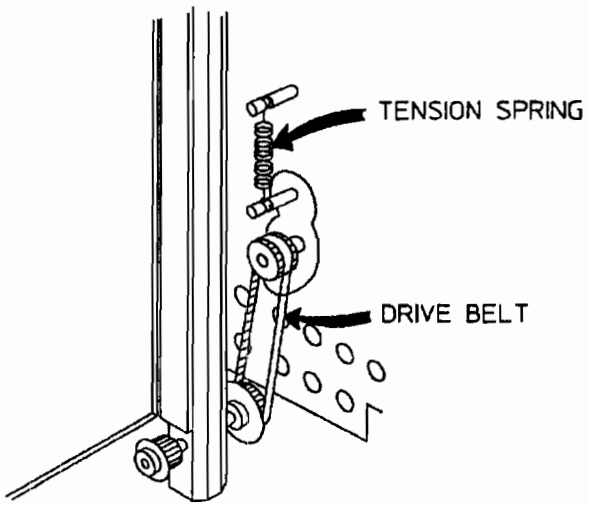


Figure 5-26. Picker Motor Mounting Screws

4. LOOSEN the motor mounting screw on the inside of the electronics area (Figure 5-26 (1)) and the two mounting screws on the outside of the chassis (Figure 5-26 (2)). Do not remove the screws.
5. Remove the picker belt.
6. REMOVE the three picker motor mounting screws.
7. Remove the picker motor.

When re-assembling:

1. *Put the replacement picker motor into the unit, attach the tensioning spring, and begin tightening all three mounting screws. Do not fully tighten the screws yet.*

Note Failure to tighten the screws in the following order will result in premature failure of the belt.

---

2. *Replace the picker belt. Tighten the screw located behind the carriage leadscrew (Figure 5-26 (1)).*
3. *Tighten the two remaining screws (Figure 5-26 (2)).*
4. *Check that the picker assembly can move and flip freely.*
5. *Replace the two picker motor cable connections on the autochanger controller PCA.*

Removing the Leadscrew-side Carriage Way (rail)

1. Remove the carriage/picker assembly.

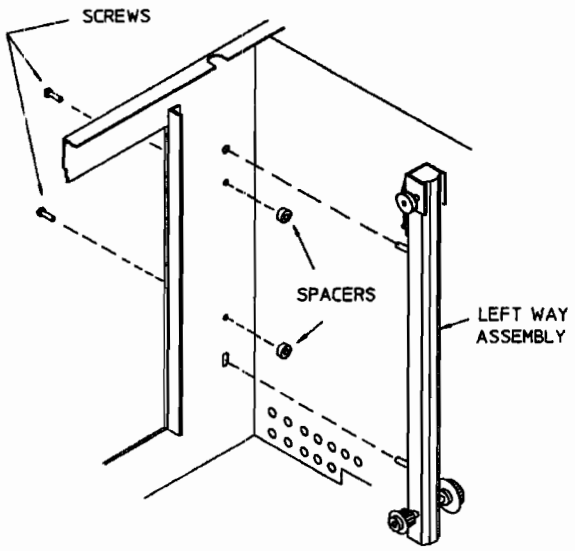


Figure 5-27. Removing the Leadscrew-side Carriage Way (rail)

Refer to Figure 5-25.

2. Loosen the tensioner spring.
3. LOOSEN the motor mount screw on the inside of the electronics area (Figure 5-26 (1)) and the two mounting screws on the outside of the chassis (Figure 5-26 (2)). Do not remove the screws.
4. Remove the picker motor belt.
5. Remove the two mounting screws holding the way. These screws are located on the outside of the chassis. Note that there are two spacers between the way and the side of the chassis. Refer to Figure 5-27.
6. Remove the way from the chassis.

When re-assembling:

1. Replace the way assembly to the chassis. Do not forget the spacers that go between the way and the side of the chassis.

2. Attach the tensioning spring.

Note Failure to tighten the screws in the following order will result in premature failure of the belt.

---

3. Replace the picker belt. Tighten the screw located behind the carriage leadscrew (Figure 5-26 (1)).

4. Tighten the two remaining screws (Figure 5-26 (2)).

5. Check that the picker assembly can move and flip freely.

Removing the Mailslot

Refer to Figures 5-28 and 5-29.

1. Remove the front panel.

Refer to the section, "Service Access" for instructions on how to remove the front panel for either a deskside option unit or a rackmount option unit.

2. Remove the two self-tapping screws on each side of the front of the mailslot (Figure 5-28 (1)).
3. Disconnect the mailslot sensor cable.
4. Pull the mailslot out.

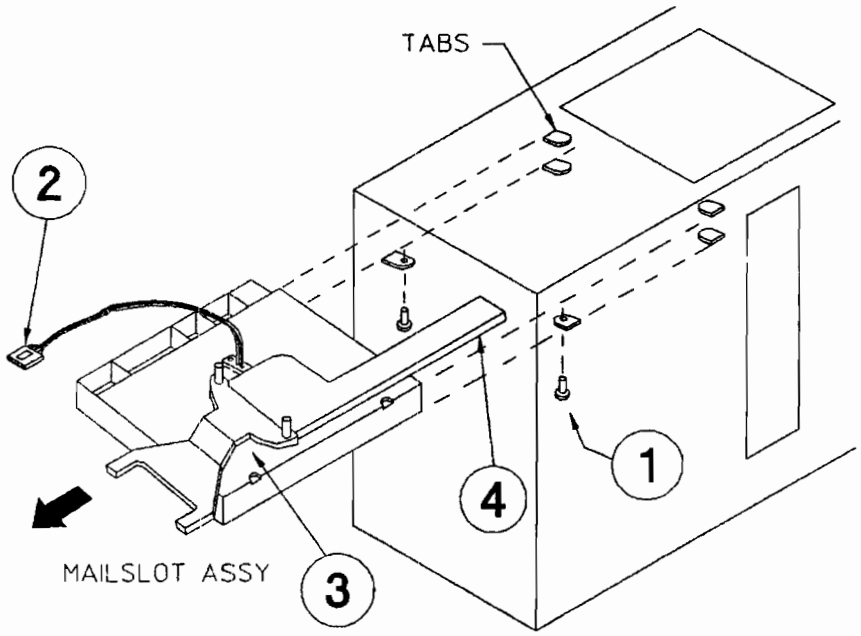


Figure 5-28. Removing the Mailslot Assembly

When re-assembling:

Pull the actuator arm on the mailslot (Figure 5-28 (4)) all the way back (towards the rear of the unit) before placing the front panel into position.

Pulling the arm back lowers the mailslot door and makes it possible for the front panel to be placed into position.

Removing the Power Supply Fan

1. Do the first five steps of "Removing the Power Supply Module."

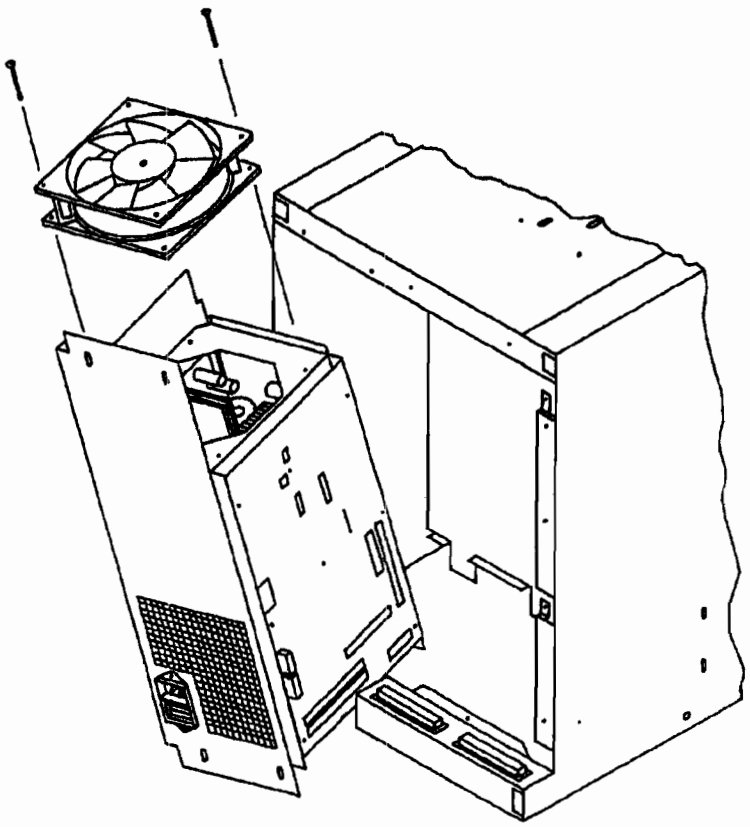


Figure 5-29. Rotating the Power Supply Out to Access the Fan

2. Rotate the power supply outward enough to access the cooling fan on the top of the power supply.
3. Remove the two screws that hold the cooling fan to the top of the power supply.

Removing the Interconnect PCA

Note When removing the interconnect board, move the picker out of the way by sliding it to the top of the carriage and inserting a cartridge to hold it there.

- Remove the top access panel. Refer to the "Service Access" section at the beginning of this chapter for further instructions.

  Refer to Figure 5-30.

- Remove the T-15 screw from the top of the clear plastic shield that covers the interconnect PCA.
- Pull the clear plastic shield towards the back of the unit. Then pull the front part of the shield up, and out of the unit's large access panel.
- Remove all of the connectors from the interconnect PCA.
- Remove the eight T-15 screws from the interconnect PCA. Refer to Figure 5-30.
- Pull the interconnect board up and out of the unit's large access panel.

Note There is a plastic shield under the interconnect board that can remain in the unit until the interconnect PCA is replaced. Align the holes on the clear plastic under-shield with the holes on the interconnect board while re-inserting the eight T-15 screws.

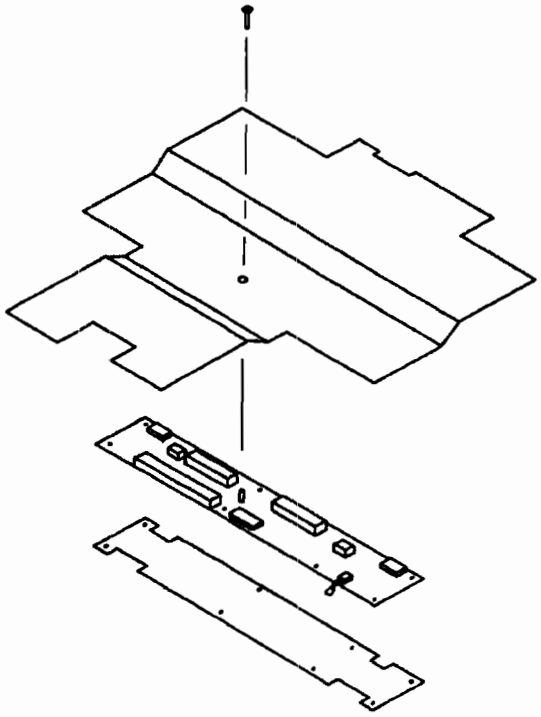


Figure 5-30. The Interconnect PCA

Re-initializing Autochanger Controller PCA RAM After Service

All the RAM on the autochanger controller PCA is battery backed and is, therefore, non-volatile. Most of the RAM is initialized to known values at powerup. Variables that are not changed are customer configurations, autochanger logs, autochanger odometers, element status variables, and variables that help the autochanger recover from power failures. These variables are set by configurations 16 and 18.

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

Variables set by Configuration 16

> SCSI address of the autochanger
> Configurable options set to system defaults (ROM-dependent)
- whether the autochanger should report recovered errors (CONF 27)
- whether the autochanger should rotate the mailslot inwards when in secure mode (CONF 31)
- whether the autochanger should automatically initialize element status when cartridges are found in unexpected places (ROM-dependent)

> Drive status variables
- reported SCSI address of the drive set to system defaults
- clear the source of the disk in the drive

> RS-232 configuration set to system defaults
- baud rate = 19,200
- word length = 8
- start/stop bits = 1
- parity = none

>Power fail variables
- whether the last move was started is set to FALSE
- clear the state of the last move

> Recovery restore variables set to to system defaults
- maximum number of Find Home retries = 3
- maximum number of error recovery retries = 3
- maximum number of restore retries = 1

> Security variables

- clear Unit Reserved
- clear Prevent Media Removal for each SCSI ID

> Element Status variables
- clear exception bits
- clear element reservations

> Clear autochanger logs
- clear Error Log (INFO 0)
- clear Move Success Log (INFO 10)
- clear Recovery Log
- clear Runtime Log (INFO 11)
- clear number of major retries
- clear number of inline retries

> Clear magazine and mailslot offsets
- (unused in most units/invalid in RSE units)

> Reset the password to 0,0,0

Variables set by Configuration 18

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

Configuration 66 - Clear all RAM

Configuration 66 first initializes all of RAM to zeros and then reboots the autochanger. This sequence may be used as a last resort to free an autochanger from uncommon errors.

Replaceable Parts

Exchange Assemblies

Refer to Figures 5-31, 5-32, and 5-33 for exploded views of the optical disk library, labeled with FRU numbers.

Table 5-3. Exchange Assemblies

FRU Number	Part Number	Description
7	C1700-60007	Interconnect PCA
22	C1700-60012	Horizontal Display Panel
22	C1700-60022	Display Panel
23	C1700-60023	Vertical Motor
26	C1700-60026	Magazine Assembly
30	C1700-60030	Optical Sensor
32	C1700-60032	Leadscrew
34	C1700-60034	Horizontal Belt
35	C1700-60035	Vertical Belt
41	C1700-60042	Bearing Block-Long
45	C1700-60045	Side Access Panel
68	C1700-60068	I/O Power Cable
69	C1700-60069	SCSI I/O Cable
70	C1700-60070	Dual Mailslot Cable
73	C1700-60073	Internal SCSI Cable

Table 5-3. Exchange Assemblies (continued)

FRU Number	Part Number	Description
83	C1700-60083	UPS Cable
21	C1700-60121	Left Way
25	C1700-60125	Horizontal Motor
27	C1700-60127	Picker
39	C1700-60139	Bearing Block Assembly
47	C1700-60147	Drive Tray
40	C1700-60240	Carriage Assembly
29	C1700-60529	Mailslot
28	C1703-60228	Power Supply
44	C1703-60044	Top Access Panel
50	C1703-60050	5/12/24V Power Cable
56	C1703-60056	Front Panel Cable
59	C1703-60059	Sensor Cable
66	C1700-60066	Line Switch Cable
38	C1703-60068	Power Supply Fan
	C1703-60079	Switch Cable
80	C1703-60080	Motor Power Cable
8	C1708-60008	Single-Ended Repeater PCA
9	C1708-60009	Differential Converter PCA

Table 5-4. FRU 24 - Front Panel Assemblies

Part Number	Description
C1700-60088	Horizontal Front Panel (Model 20C)
C1700-60089	Vertical Front Panel (Model 20C)
C1700-60090	Horizontal Front Panel (Model 10C)
C1700-60091	Vertical Front Panel (Model 10C)
C1713-60090	Horizontal Front Panel (Model 20T)
C1713-60091	Vertical Front Panel (Model 20T)
C1700-60093	Horizontal Front Panel (Model 40T)
C1700-60094	Vertical Front Panel (Model 40T)

Table 5-5. Exchange Parts - Models 10C/20C

FRU Number	Part Number	Description
1	C1703-69108	Autochanger Controller PCA - Model 10C
1	C1700-69108	Autochanger Controller PCA - Model 20C
20	C1716-69201	MO/MF Single-Ended Optical Drive

Table 5-6. Exchange Assemblies - Models 20T/40T

FRU Number	Part Number	Description
1	C1703-69108	Autochanger Controller PCA - Model 20T
1	C1700-69108	Autochanger Controller PCA - Model 40T
20	C1716-69002	MO/MF 2X Single-Ended Optical Drive

Table 5-7. Common Exchange Parts

FRU Number	Part Number	Description
28	C1703-69228	Power Supply

Table 5-8. Miscellaneous

FRU Number	Part Number	Description
	C1700-60046	Horizontal Slide Kit

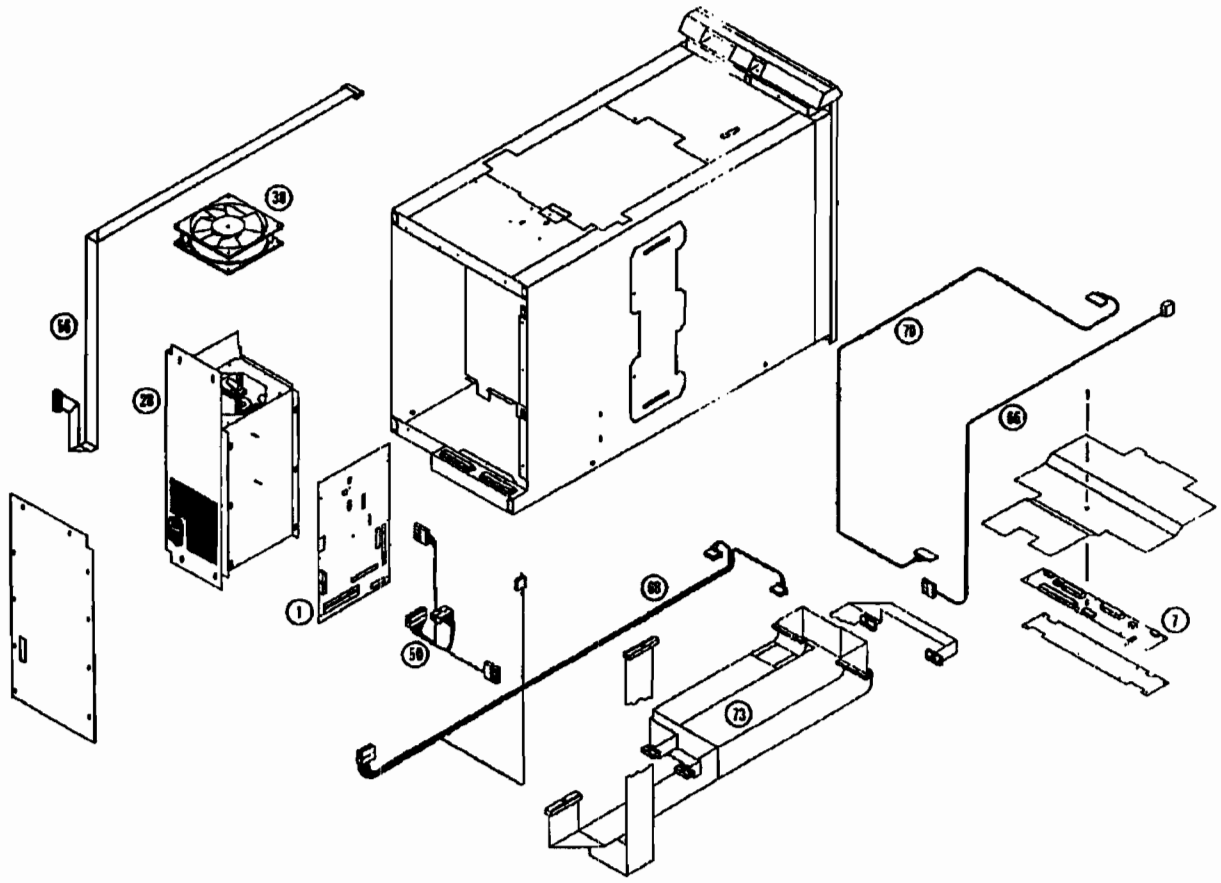


Figure 5-31. Replacement Parts - View 1

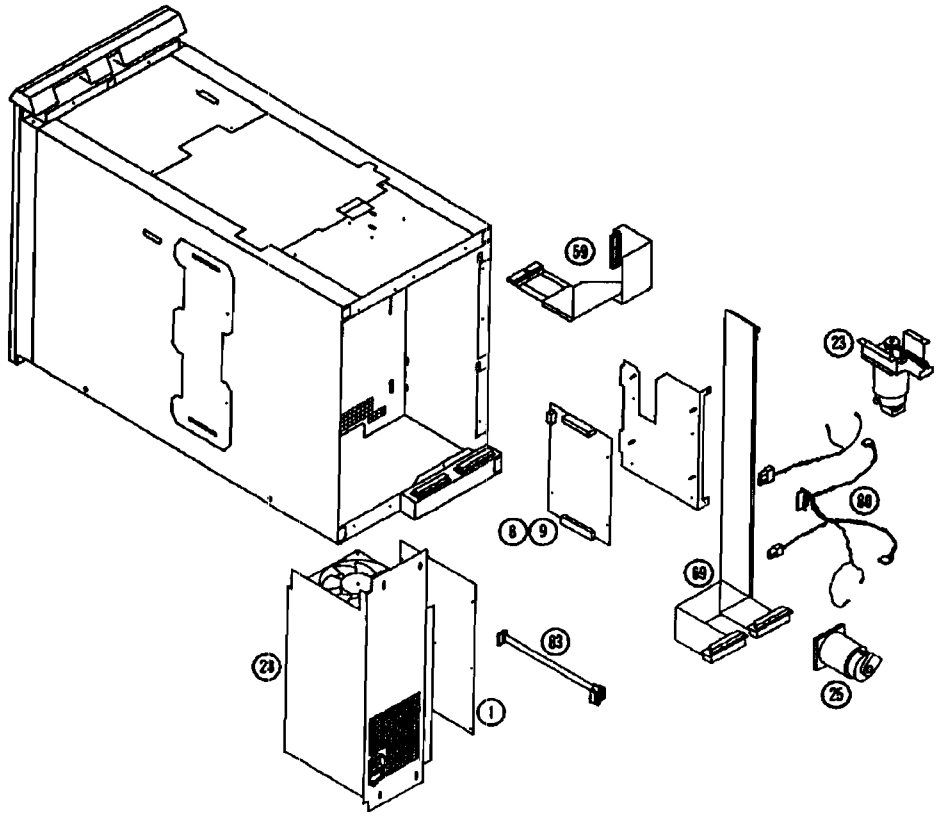


Figure 5-32. Replacement Parts - View 2

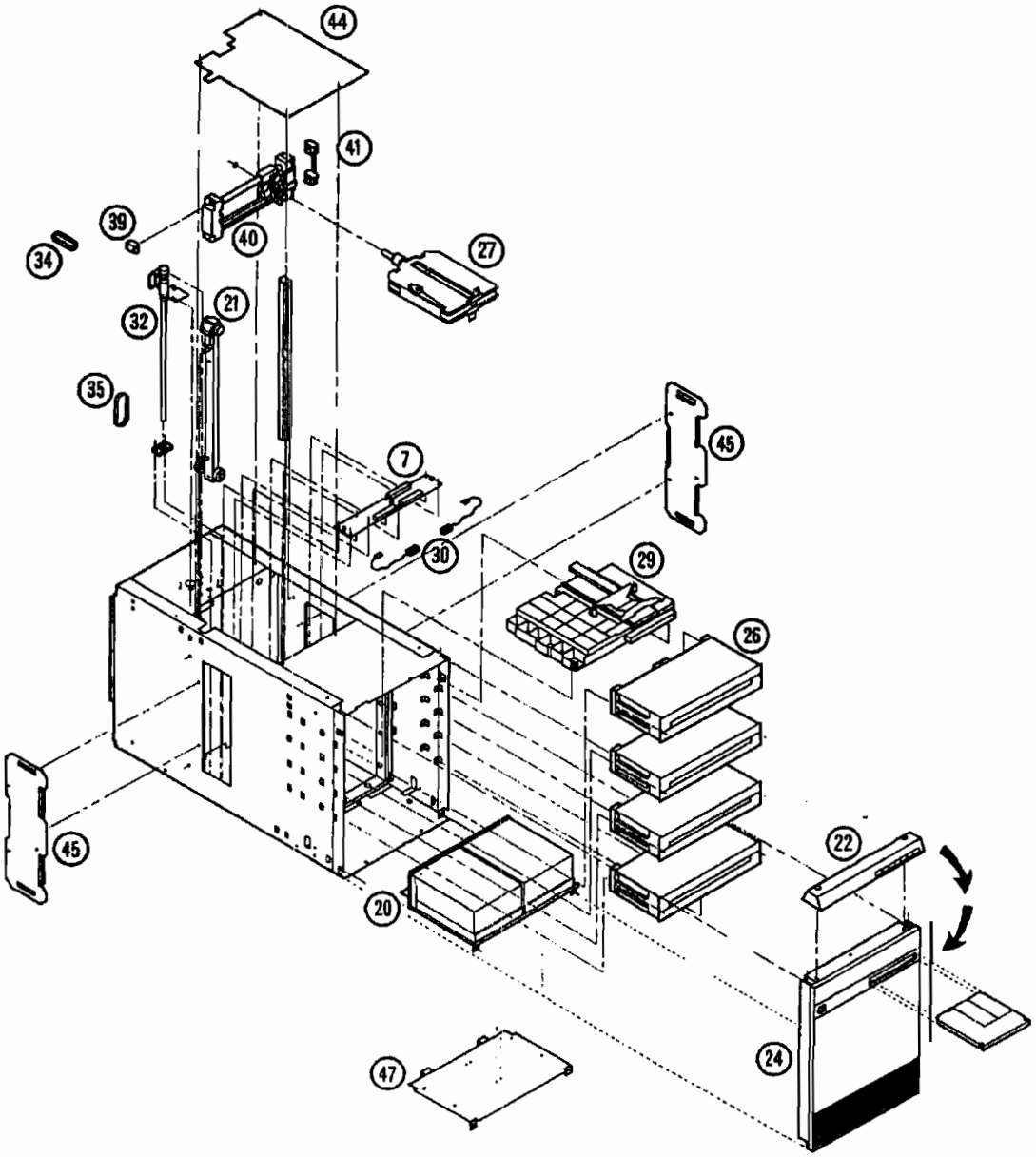


Figure 5-33. Replacement Parts - View 3

Miscellaneous

While no specials tools are required to service the optical library, there are some commonly used items that may be stocked and available as an area resource.

Table 5-9. Basic Supplies

Item	HP Part Number
Rewritable optical disk (594 Mbytes, 512 bytes/sector)	92279A
Rewritable optical disk (650 Mbytes, 1,024 bytes/sector)	92280A
Write-Once optical disk (594 Mbytes, 512 bytes/sector)	92289A
Write-Once optical disk (650 Mbytes, 1,024 bytes/sector)	92290A
Rewritable Optical Disk (1.3 Gbytes, 1,024 bytes/sector)	92280T
Rewritable Optical Disk (1.2 Gbytes, 512 bytes/sector)	92279T
Write-Once Optical Disk (1.3 Gbytes,1,024 bytes/sector)	92290T
Write-Once Optical Disk (1.2 Gbytes, 512 bytes/sector)	92289T
0.5m (1.6 ft) SCSI interface cable	92222A
1m (3.3 ft) SCSI interface cable	92222B
2m (6.6 ft) SCSI interface cable	92222C
1m (3.3 ft) SCSI extender cable	92222D
External UPS cable	C1708-60080
Single-ended SCSI terminator	K2291
Differential SCSI terminator	12016-80003
Eject tool	C1708-88803
Optical disk cleaning kit	C1700-88800
Optical disk cleaner accessory kit (extra swabs and alcohol)	C1700-88801
Optical Disk Library User's Guide, Models 10C/20C, Models 20T/40T	C1700-90040

6

Theory of Operation

This chapter discusses the following aspects of the optical disk library:

- the autochanger
  - movements
  - mechanics
- autochanger controller PCA
- power supply
- optical disk drive

In addition, autochanger error detection, diagnostic strategy, and the SCSI interface and command set are discussed.

7

Service Notes/IOSMs

At the time of this printing there are no service notes for the optical disk libraries.

8

Reference

Autochanger Configuration Choices

The following table lists the available configurations choices. An explanation of how to access and set these configurations is found in "Setting a Configuration" in chapter 3.

Table 8-1. Autochanger Configuration Choices

No.	Function	Default	Options
0	Clear/Save Error Log (Information Log 0)	Save	Clear - clears the error log immediately. Save - saves the error log until Clear is configured.
8	No Break on Failure	Off	Off - if a test encounters a failure, the test stops. On - if a test encounters a failure, the test continues.
10	Clear/Save Move Log (Information Log 10)	Save	Clear - clears the move log immediately. Save - saves the move log until Clear is configured.
11	Clear/Save Runtime Log (Information Log 11)	Save	Clear - clears the runtime log immediately. Save - saves the runtime log until clear is configured.

Table 8-1. Autochanger Configuration Choices (continued)

No.	Function	Default	Options
	Configurations 15 - 20 require a security code.		
15	Prevent Media Removal (security code required)	Off	On = No mailslot I/O Off = Normal mailslot I/O
16	Set Default Configurations (security code required)	Save	Clear - restores default configurations immediately. Save - maintains all set configurations.
17	Set New Security Code (security code required)	0-0-0	
18	Clear/Save Logs (security code required) Clears/zeros these logs: #4 - Drive Load Count #5 - Poweron Hours #9 - Move #12 - Flip #13 - Translate #14 - Mailslot Rotation	Save	Clear - clears/zeros the specified logs. Save - maintains the specified logs until clear is configured.

Table 8-1. Autochanger Configuration Choices (continued)

No.	Function	Default	Options
19	Set Autochanger Retries A - Max. attempts to find home B - Max. attempts to do move C - Max. attempts to restore move after failure.	 4 2 1	Sets the number of attempts to retry moves before giving up.
20	Poweron Cartridge Security (security code required)	Off	On - maintains the status of configuration 15 upon power cycle or power failure. Off - Configuration 15 is not maintained through a power cycle or power failure.
21	Enable Autochanger Retries	On	On - Autochanger attempts to correct itself when it encounters difficulty. Off - Autochanger does not attempt to correct itself when it encounters difficulty.
22	Clear Drive 1 Load Count Log (Information Log 4)	Save	Clear - clears the drive 1 Load Count Log immediately. Save - saves the drive 1 Load Count Log until clear is configured.
23	Same as config. 22 for Drive 2.		
27	Report Recovered Error	Off	On - reports the SCSI-level error to the host. Off - no reports of SCSI-level errors to the host.

Table 8-1. Autochanger Configuration Choices (continued)

No.	Function	Default	Options
31	Secured Mailslot Rotation (security code required)	Off	Off - Normal mailslot operation. On - The mailslot rotates in when configuration 15 is set to ON or a Prevent Media Removal command is received. The mailslot remains closed until configuration 15 is set to OFF or an Allow Media Removal command is received. If the autochanger is full, the mailslot will open only for an EJECT command.
32	Mailslot Rotation Command (security code required)	Off	Off - Normal mailslot operation. If the host sends a Rotate mailslot command and config. 32 is set to off, the host will receive a Check Condition followed by a Sense Key of Illegal Request. On - When a Rotate Mailslot command is received (either from the host or via the control panel), the mailslot is toggled open or closed.

Table 8-1. Autochanger Configuration Choices (continued)

No.	Function	Default	Options
50	Emulate a Model 10C or 20T (Must be a Model 20C or 40T. Security code required)	Off	Off - Normal Modes for Models 20C and 40T. (All 32 storage slots are available.) On - Emulates a Model 10C or 20T. (Reduces the number of available storage slots from 32 to 16.) This is only used for system integration, and should not normally be used.
66	Zero all RAM	Save	Save - RAM remains unchanged. Clear - Zeros all RAM locations and reboots. **CAUTION** When this configuration is set to "Clear," the product ID and the vendor ID must be downloaded using the firmware upgrade procedure outlined in the Supplemental Information Section at the back of this manual.

Diagnostic Test Command Descriptions

The following is a description of the diagnostic test commands. Sequences may combine both exercisers and tests.

Sequence Tests

Table 8-2. Sequence Tests

No.	Test Name	Description
1	Poweron	Checks all digital data paths and normal machine operation. This test runs the same sequence of TESTS as when initiated by an actual power on, but does NOT do all operations (see below). Sequence Order: 3 - Controller Test 40 - Power Supply Test —Motor Connection Test (no number) 5 - Initialize Mechanism 46 - Board Configuration —Restore (if needed). If power failed in the middle of a move, the autochanger tries a "restore" of the last move. The autochanger tries to put the cartridge back to where it came from. This attempt could fail (poweron sequence would fail). POWERON ONLY. 10 - Initialize Element Status (if needed). 38 - "Light Show" in the indicators of the control panel. —Mailslot rotation (if not secured). This rotation could fail (poweron sequence would fail). POWERON ONLY.

Table 8-2. Sequence Tests (continued)

No.	Test Name	Description
2	Wellness Test	Checks out the general capability of the autochanger. Needs one loaded cartridge; drives and mailslot empty. Sequence Order: 1 - Poweron Test 11 - Mechanical Exerciser Test
3	Controller Test	This sequence is run by the autochanger controller at poweron to check out all paths, and operation of the servo motor and autochanger circuitry. Sequence Order: 30 - Processor Test 31 - ROM Checksum Test 33 - Non-Destructive RAM Test 32 - RAM Checksum Test 34 - SCSI Interface Controller IC Test 36 - Motor Control IC Test 35 - Multi-Function Peripheral IC Test 37 - Drive Connect Test
5	Initialize Mechanism	Prepares the unit for movement. Sequence Order: Initialize RAM variables to defaults 50 - Find Home

Table 8-3. Exerciser Tests

No.	Test Name	Description
10	Initialize Element Status	Does the same function as the SCSI Initialize Element Status command. It physically scans the entire unit to determine which storage slots and drives have disks.
11	Mechanism Exercise Test	Makes a combination of moves with a PASS/FAIL result. This exerciser is a sequence of other exerciser tests—12, 13, 14, 15, 16, and 17. This exerciser returns an error code `#57H Invalid Configuration` if there are no cartridges loaded into the unit, or if any drive is full. Needs one loaded cartridge.
12	Carriage/Picker Move Test	Moves the carriage/picker assembly the full length of the rails with the picker on first one side, then the other. Returns PASS/FAIL. No cartridges are required.
13	Translate Test	Makes a combination of moves with a PASS/FAIL result. It does several translations from from various starting positions. No cartridges are required.
14	Flip Test	Makes a combination of moves with a PASS/FAIL result. It does several flips at various locations. No cartridges are required.

Table 8-3. Exerciser Tests (continued)

No.	Test Name	Description
15	Storage Slot Test	Makes a combination of moves with a PASS/FAIL result. It moves a cartridge from a randomly-chosen full to a randomly-chosen empty slot, with a random flip. It then moves the cartridge back to its original storage slot with its original orientation. This exerciser returns an error code 57H, **`Invalid Configuration`**, if there are no cartridges loaded into the unit or if all storage slots are full. Needs one loaded cartridge.
16	Drive I/O Test	Makes a combination of moves with a PASS/FAIL result. It moves a cartridge from a randomly-chosen full slot to a drive, with a random flip. It then moves the cartridge back to its original slot with its original orientation. It does this once for each optical drive. Returns an error code 57H, **`Invalid Configuration`**, if there are no cartridges loaded into the unit or if any drive is loaded. Needs one loaded cartridge; drives must be empty.
17	Mailslot I/O	Makes a combination of moves with a PASS/FAIL result. It moves a cartridge from the lowest-numbered full slot to the mailslot with a random flip. It then moves the cartridge back to its original slot with its original orientation. Returns error code 57H **`Invalid Configuration`** if there are no cartridges loaded into the unit or if the mailslot is full. Needs one loaded cartridge; mailslot must be empty.

Table 8-3. Exerciser Tests (continued)

No.	Test Name	Description
18	Speed Factor Setting Utility	Allows the setting of the speed factor as the first parameter given. The speed factor determines how fast the system moves the mechanics. The number provides 1/Parameter speed (e.g., Parameter=3 runs the motors at 1/3 of full speed). **This test can only be run from the SCSI Interface.**
19	Zero Maximum Force Log	The maximum force log is initialized to all zeros.
20	Set Speed Factor to Full Speed	Allows the mechanics to be run at full speed.
21	Set Speed Factor to Half Speed	Allows the mechanics to be run at half speed.
22	Set Speed Factor to Quarter Speed	Allows the mechanics to be run at quarter speed.
23	Shipping	Moves the picker to the appropriate position for preparation for shipping.
24	Fill Picker	Moves a cartridge into the picker from the first storage slot.

Table 8-3. Exerciser Tests (continued)

No.	Test Name	Description
25	Empty Picker	Moves a cartridge from the picker to the first empty storage slot.
26	Zero Runtime Log	The entire runtime log is initialized to all zeros.
27	Set Minimum Retries	This sets the number of retries to 1. This may be set to see if the chosen test is doing what you want it to do. After you are satisfied that the test is what you want, run test 28 which resets the number of retries to default values.
28	Set to Default Number of Retries	Resets the number of retries to powerup default values. Used after setting retries to 1 by test 27.
29	Zero Error Log	Zeroes the Error Log.

Electronic Core Tests

Table 8-4. Electronic Core Tests

No.	Test Name	Description
30	Microprocessor Operation Test	Does a functional check of the microprocessor. This test must shut down the servo system; a Initialize Mechanism Test is run when this test finishes.
31	ROM Checksum Test	Does a checksum verification of the ROM.
32	RAM Checksum Test	A checksum of the "controlled" area of RAM is kept on a continuous basis. This test verifies that the checksum is still valid.
33	Non-Destructive RAM Test	Tests all the controller's RAM, checking for data acceptance and retention. The test is non-destructive to RAM unless interrupted by power failure. To run correctly, this test must shut down the servo system; as a result, a Initialize Mechanism Test runs when this test finishes.
34	SCSI Interface Controller Chip Test	Checks out operations of the SCSI interface controller chip. This test will not be run if initiated via SCSI, it reports PASS.
35	Multi-Function Peripheral Chip Test	Tests the functionality of the Multi-Function Peripheral chip. It verifies the timer by comparing it to the CPU clock and tests RS-232 capabilities with an on-chip loopback.
36	Motor Control Chip Test	Exercises the registers of the motor control IC. To run correctly, this test shuts down the servo system.

Table 8-4. Electronic Core Tests (continued)

No.	Test Name	Description
37	Drive Connect Test	Checks for expected drive configuration. This is done by polling the drive connect signal on each of the possible drives. This line is grounded at the drive end if a drive is connected. If the drives physically connected do not match the expected configuration, an error is reported.
38	Control Panel Light Show	Lights each portion of the display individually and then together. No feedback; always passes.
39	Control Panel Button Check	Displays the name of the button pressed. Press (CANCEL) twice to exit.
40	Power Supply Test	Looks at both the 12-Volt and the 24-Volt power supplies to verify that they are within limits. The limits for the 12V supply are 11V and 13V and the 24V supply limits are 23.5V and 25.5V.
41	SCSI Connector Loopback Test (interactive)	Runs a loopback through SCSI connectors, checking proper operation of the SCSI drivers, receivers, and cables. Requires an external loopback hood with terminator power. Will not run if initiated via SCSI; if so, it reports error FCH `Test Did Not Run`.
42	Optical Sensor Test (and Mailslot) (interactive)	Checks the status of the two optical sensors. Also checks the status of the mailslot sensor (see test 43). Three "0"s are placed on the control panel display; one at the left position in the display, one in the middle of the display, and one at the right position in the display. The mark is an open zero if the sensor is not blocked, and a zero filled in with lit segments if a sensor is blocked. No FRU is returned.

Table 8-4. Electronic Core Tests (continued)

No.	Test Name	Description
43	Mailslot Sensor Test (and Optical Sensor) (interactive)	See description for test 42.
50	Find Home Sequence	Moves the picker to a known "home" spot. This test assumes nothing about the state of the mechanics. The "home" location is at the lower left position of the box. The servo system is initialized to the "home" location. It then automatically runs test 51.
51	Carriage/Picker Assembly Calibration Test	Runs the portion of the mechanism recalibration related to the optical sensors. It measures sensor offsets and calculates picker tilt and droop. This test assumes that the mechanics and servo system are functional.
60	FRU Isolation Test	Assumes that something has physically failed, either electronic or mechanical. A series of special low level tests are run to select the three (or fewer) FRUs that are most likely to be at fault. Tests 30, 31, 33, 35, 36, 40, and 50 are executed as a part of the isolation process. Returns an error code, three suspect FRUs in decreasing order of fault probability, and a time stamp.

Table 8-4. Electronic Core Tests (continued)

No.	Test Name	Description
65	Calibrate Magazines	Calculates a min/max clearance for a magazine. (The selected magazine should be empty.) The autochanger requires a disk in the mailslot. The test passes if clearance is 85 encoder counts (1 mm) up and down. (See info 23 for actual values.) If this test is run by SCSI command, set byte 1 to the magazine number. (Models 10C and 20T contain 2 magazines; Models 20C and 40T contain 4 magazines.) The test returns: `PASS` or `FAIL`.
66	Clear Magazine Offset	Clears the value calculated in test 65.
67	Calibrate Mailslot	Calculates an offset for the mailslot. The Autochanger requires a disk in the mailslot.
68	Clear Mailslot Offset	Clears the value calculated in test 67.
70 - 74	Reserved	For design/production use only.
75	UPS Test	Tests whether or not the UPS is connected properly. The test returns **PASS** if connected properly, **FAIL** if the UPS is not connected properly or if there is no UPS connected.
76 - 80	Reserved	For design/production use only.

Specific Steps of the FIND HOME Sequence

The following FIND HOME sequence executes all the motions used in normal autochanger operation. Understanding the motions explained here, and the likely errors during these motions, should help you diagnose problems that may be occurring in the unit you are working on.

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

Hardware error numbers and recovery procedures are listed in Chapter 4.

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

Possible errors are not accessible or displayed through the control panel. Errors returned are micro-move errors. Micro-move errors are explained in Chapter 6, "Theory of Operation." A complete listing of micro-move errors is included in *Offline Diagnostics for Hewlett-Packard Optical Products*, located in the "Supplemental Information" section of this manaul.

These steps are repeated, in order, until all pass or until any four failures accumulate. If four failures occur, the errors are diagnosed to three FRUs and a hardware error code is reported.

Note Errors are expressed in hexadecimal format.

1. Clear the Picker of any obstructions that would prevent Carriage/Picker movement.

a. Possible error:
   40–Unable to free the Picker fingers in preparation for Carriage motion.

2. Clear an area large enough to enable a flip to take place.

   a. Possible error:
      44–Carriage motion failed during the Find Home sequence.

3. Initialize the Picker fingers by pulling the fingers back to a hard stop.

   a. Possible error:
      45–Unable to free the Picker fingers in preparation for translate motion.

4. Initialize the Carriage/Picker position by moving it towards the drives until it hits a hard stop.

   a. Possible error:
      46–Carriage motion failed while initializing Home position during Find Home sequence.

5. Translate to the non-leadscrew side.

   a. Possible error:
      47–Translate failed while moving to the non-leadscrew side during the Find Home Sequence.

6. Verify Home position by looking at the sensor.

   a. Possible error #1:
      41–Unable to verify that the Picker is at the Home position during Find Home sequence (non-leadscrew side). (Could be a bad sensor.)

   b. Possible error #2:
      61–Optical sensor failed (non-leadscrew side).

7. Re-initialize the Picker fingers by pulling them back to a hard stop (this position may have been lost in the preceding step). (A slow flip occurs.)

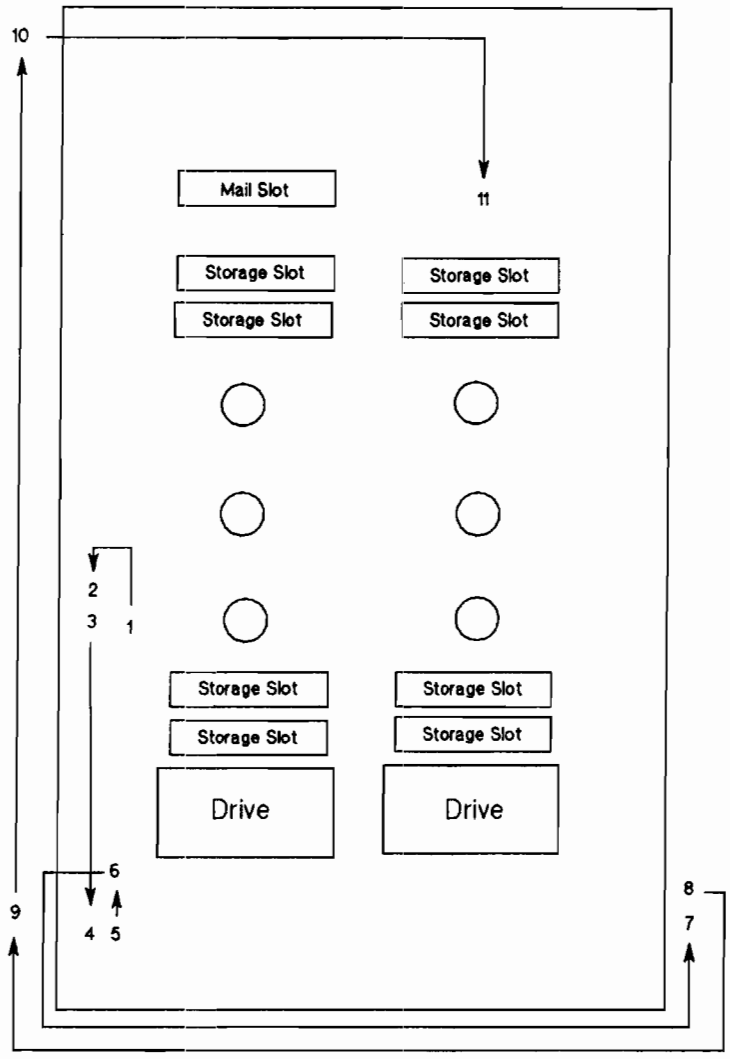
   a. Possible error:
      45–Unable to free the Picker fingers in preparation for translate motion.

8. Translate the Picker to the leadscrew side. Then move the Carriage/Picker assembly to the maximum distance away from the drives.

a. Possible error:
   48–Carriage motion failed during Carriage/Picker assembly calibration (leadscrew side).

9. Determine if there is a cartridge in the Picker by plunging the fingers against a hard stop.

   a. Possible error:
      4D–Motion error while checking for cartridge in Picker.



Looking toward front panel from inside chassis.

Figure 8-1.
The "FIND HOME" Sequence
(deskside orientation shown)

10. Find orientation of the Picker using the sensor on the leadscrew side.

    a. Possible error #1:
    4A–Motion error while determining the orientation of the Picker.

    b. Possible error #2:
    4C–Failed flip motion during the Find Home sequence.

    c. Possible error #3:
    60–Optical Sensor failed (leadscrew side).

11. Calibrate the end of the Picker with respect to the sensor on the leadscrew side. (Do twice, on each side of the Picker, to make sure.)

    a. Possible error #1:
    48–Carriage motion failed during Carriage/Picker assembly calibration (non-leadscrew side).

    b. Possible error #2:
    4C–Failed flip motion during the Find Home sequence.

    c. Possible error #3:
    60–Optical sensor failed (leadscrew side).

12. Calibrate the end of the Picker with respect to the sensor (non-leadscrew side). (Do twice, on each side of the Picker, to make sure.)

    a. Possible error #1:
    49–Carriage motion failed during Carriage/Picker assembly (non-leadscrew side).

    b. Possible error #2:
    4C–Failed flip motion during the Find Home sequence.

    c. Possible error #3:
    61–Optical sensor failed (non-leadscrew side).

13. Translate Picker to non-leadscrew side. Then, move the Carriage/Picker to the maximum distance away from the drives.

    a. Possible error:
    49–Carriage motion failed during Carriage/Picker assembly calibration (non-leadscrew side).

14. If the Picker leadscrew is NOT facing toward the mailslot actuator arm, the Carriage/Picker moves toward the drives a short distance and flips once.

    a. Possible error:
       4C–Failed flip motion during the Find Home sequence.

These steps are repeated, in order, until all pass or until any four failures accumulate. If four failures occur, the errors are diagnosed to three FRUs and a hardware error code is reported.

Micro-Move ID Table

Table 8-5. Micro-Move IDs

ID (hex)	Description
0	No motion; no commands pending.
1	Carriage motion; full speed; away from the drives.
2	Carriage motion; full speed; toward the drives.
3	Carriage motion; move fingers forward during full speed; away from the drives.
4	Carriage motion; move fingers forward during full speed; toward the drives.
5	Full speed finger motion.
7	Pull fingers back to depress flip button.
8	Flip.
9	Verify flip complete.
A	Push fingers out to release flip button.
B	Translate picker from non-leadscrew to leadscrew side.
C	Translate picker from leadscrew to non-leadscrew side.
D	Verify picker translated from non-leadscrew to leadscrew side.
E	Verify picker translated from leadscrew to non-leadscrew side.
F	Release forces after translating picker from non-leadscrew to leadscrew side.
10	Release forces after translating picker from leadscrew to non-leadscrew side.
11	Move fingers toward storage slot; with intent to grab cartridge.

Table 8-5. Micro-Move IDs (continued)

ID (hex)	Description
12	Detect cartridge in storage slot before grab, and during Initialize Element Status.
13	Take up the slack in the fingers before retracting all of the way back with cartridge.
14	Pull fingers back from storage slot with cartridge.
15	Move fingers forward to insert cartridge into storage slot.
16	Detect cartridge in storage slot after insert.
17	Pull fingers back from storage slot after releasing cartridge.
18	Move fingers toward drive; prepare to grab cartridge.
19	No motion; waiting for drive to eject the cartridge.
1A	Carriage shake; to assist the cartridge ejected from the drive to slide into the picker.
1B	Move fingers toward drive; with intent to grab cartridge.
1C	Pull fingers back from drive with cartridge.
1D	Insert cartridge into drive, until slider engages.
1E	Insert cartridge into drive, after slider has engaged.
1F	Move fingers with cartridge toward drive, determining distance of cartridge in drive. Look for drive to accept cartridge.
20	Drive failed to accept cartridge, pull fingers back with cartridge.
21	Drive accepted cartridge, release cartridge and pull fingers back.
22	Carriage motion during mailslot access.

Table 8-5. Micro-Move IDs (continued)

ID (hex)	Description
23	Move fingers toward mailslot; with intent to grab cartridge.
24	Detect cartridge in mailslot before grab.
25	Take up the slack in the fingers before retracting all the way back with cartridge.
26	Pull fingers back from mailslot with cartridge.
27	Carriage motion during mailslot access.
28	Move fingers forward to insert cartridge into mailslot.
29	Detect cartridge in mailslot after insert.
2A	Pull fingers back from mailslot after releasing cartridge.
2B	Move leadscrew tab toward mailslot actuator arm before pulling mailslot in.
2C	Carriage motion toward actuator arm where mailslot is engaged before pulling mailslot in.
2D	Move leadscrew tab to mailslot actuator arm before pushing mailslot out.
2E	Carriage motion toward actuator arm where mailslot is engaged before pushing mailslot out.
2F	Rotate the mailslot when rotational position unknown.
30	Release tension on the rotate arm.
31	Release tension on the rotate arm.
32	Rotate the mailslot.

Table 8-5. Micro-Move IDs (continued)

ID (hex)	Description
33	Rotate the mailslot.
34	Verify the rotation of the mailslot is complete.
35	Rotate the mailslot when rotational position unknown.
36	Check for a cartridge in the picker, same motion is used to check for a cartridge in mailslot or storage slot when picker contains a cartridge.
37	Pull fingers back during test for a cartridge.
38	Move fingers at full speed during test for a cartridge.
39	Positioning before and after test for a cartridge in drive.
3A	Check for a cartridge in the drive.
3D	Move carriage to drive bang position.
3E	Verify the presence of a cartridge by pressing cartridge against drive face.
3F	Short carriage motion to check for cartridge sticking out of a storage slot after insertion (toward drives).
40	Short carriage motion to check for cartridge sticking out of a storage slot after insertion (away from drives).
41	Short carriage motion to check for cartridge sticking out of a drive after insertion (toward drives).
42	Short carriage motion to check for cartridge sticking out of a drive after insertion (away from drives).

Table 8-5. Micro-Move IDs (continued)

ID (hex)	Description
43	Short carriage motion to check for cartridge sticking out of a drive during error recovery (toward, then away from drives).
44	Translate slowly to leadscrew side in FIND HOME sequence.
45	Short translate after finding leadscrew side (toward non-leadscrew side).
46	Short carriage motion after finding leadscrew side of machine (away from drives).
47	Carriage motion toward drives; looking for hard stop in FIND HOME sequence.
48	Release forces after finding hard stop.
49	Carriage motion away from drives; finding room to flip in FIND HOME sequence.
4A	Fast carriage motion toward drives to flip position.
4B	Carriage motion toward drives finding room to flip in FIND HOME sequence.
4C	Fast carriage motion when flip area found in needed direction.
4D	Slow flips during FIND HOME sequence.
4E	Push fingers slowly out of picker after flips in FIND HOME sequence.
4F	Check for picker belts in FRU isolation tests, or slow finger motions during error recovery.

Table 8-5. Micro-Move IDs (continued)

ID (hex)	Description
50	Carriage motion toward drives; looking for hardstop before measuring carriage travel.
51	Verify the maximum required carriage travel from drives.
52	Test for presence of cartridge by pushing against hard stop.
53	Long carriage motion during carriage/picker assembly calibration.
54	Short carriage motion during carriage/picker assembly calibration. (Fine measure)
57	Error occurred while inserting cartridge, push cartridge farther into storage slot.
59	Move fingers toward storage slot; during storage slot recovery.
5A	Pull fingers back from storage slot; during storage slot recovery.
5B	Carriage motion; during drive recovery.
5C	Carriage motion; during storage slot recovery.
5D	Carriage motion; during drive insert recovery.
5E	Slowly push fingers out then in during drive recovery.
5F	Drive recovery.
60	Drive recovery.
61	Short carriage motions during drive recovery (wiggle motion).
62	Long carriage motion in drive recovery (toward, then away from drives).
63	Drive recovery, restore Z-axis in case of unexpected translate.
64	Pull fingers back into picker during recovery.
65	Pull fingers back from storage slot during storage slot recovery.

Table 8-5. Micro-Move IDs (continued)

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

Error and Performance Logs

The logs listed below are accessible from the control panel by using the INFO option. See Chapter 4, "Troubleshooting and Diagnostics" for instructions for using these information logs.

Table 8-6. Information Logs (INFO Logs)

No.	Log Name	Description
0	Autochanger Error Log	The autochanger maintains a time-stamped history of past diagnostic test errors that have occurred within the autochanger. The error message maintained for each error indicates the failure and the possible Field Replaceable Units (FRUs) that may have caused the failure. Displays as follows: Err *n y* - *n*th error; actual error code FRU *A* - suspect FRU #1 FRU *B* - suspect FRU #2 FRU *C* - suspect FRU #3 Test *n* - test that failed *abcdefgh* - time stamp
1	Firmware Version Number	Displays the current autochanger firmware version number.

Table 8-6. Information Logs (INFO Logs) (continued)

No.	Log Name	Description
2	Element Status	Displays the status (`empty` or `full`) of the selected autochanger element. Displays three numbers: First Number = Element number 0 = picker 1 = drive 1 2 = drive 2 10 = mailslot 11 - 42 = storage slots Second Number = Element type 1 = picker 2 = storage slot 3 = mailslot 4 = drive Third Number = Data mask 00 = empty 01 = full
3	Software Clock	Displays the current "count" in seconds of the software clock. (hexadecimal)
4	Drive Load Count	Displays the number of cartridge loads for either drive 1 or drive 2.
5	Poweron Hours	Displays the number of hours the unit has been powered on.
	The term **Move** used in Logs 6 - 10 means SCSI-level moves by the picker mechanism.	

Table 8-6. Information Logs (INFO Logs) (continued)

No.	Log Name	Description
6	Current Move Success Count	Displays the number of successful moves since the most recent autochanger failure.
7	Move Success Average	Displays the average of the values in Log 10 - Move Success Log.
8	Current Move Retry Count	Displays the number of move retries done since the most recent autochanger failure.
9	Total Move Count	Displays the total number of moves and move attempts.
10	Move Success Log	Contains the number of successful moves that have occurred without a failure. Each time a failure occurs, the number of good moves is entered into the log and a new count is started. This `INFO` display shows the most recent 10 (or less) entries in the log. This log also shows the retry counts corresponding to each log entry. Example (2 displays for each entity): 1 33482 3 First display: 1 = entry number and 33482 = number of moves Second display: 3 = number of retries

Table 8-6. Information Logs (INFO Logs) (continued)

No.	Log Name	Description
11	Display Runtime Log	Flashes to each display until CANCEL is pressed. A - Moves done B - Retries C - Automatic recoveries D - Hard errors
12	Display Flip Count	Displays total number of picker flips.
13	Display Translate Count	Displays total number of picker translates.
14	Display Mailslot Rotation Count	Displays total number of mailslot rotations.
15	Number of Drives	Displays the number of disk drives in the unit.
16	Drive #1 SCSI Address	Displays drive #1's SCSI address.
17	Drive #2 SCSI Address	Displays drive #2's SCSI address.
20	Sensor Height	Displays the measured height of the picker sensor. (hexadecimal)
21	Picker Cone Angle	Displays the measured picker cone angle from the nominal position. (hexadecimal) The cone angle is the sum of the upward droop on one side of the picker plus the downward droop on the other side of the picker.

Table 8-6. Information Logs (INFO Logs) (continued)

No.	Log Name	Description
22	Stack Tilt	Displays the measured stack tilt of the box. (hexadecimal) The height of each side of the autochanger, or "stack", is the height of each of the two sensors. Tilt is the measure of the difference of the heights of the sides.
	Right & Left Stack Offset	Displays left/right stack offset.
23	Magazine 1	
24	Magazine 2	LEFToffsetRIGHToffset (hexadecimal)
25	Magazine 3	Example:
26	Magazine 4	00DC0028 = 220, 40 FFEC0014 = -20, 20

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