StorageServer 100

Optical Disk Library Service Manual
20 GB System

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Printing History

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FCC Radio Frequency Interference Statement (USA Only)

The Federal Communications Commission has specified that the following notice be brought to the attention of the users of this product:

Warning: This equipment generates and uses radio frequency energy and, if not installed and used properly may cause interference to radio and television reception. The equipment has been type tested and found to comply within the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference in a commercial environment. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: re-orient the receiving antenna, relocate the equipment with respect to the receiver, move the equipment away from the receiver, plug the equipment into a different outlet so that equipment and receiver are on different branch circuits. If necessary, the user should consult the dealer or an experienced radio/ television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: *How to Identify and Resolve Radio - TV Interference Problems*. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-000-00345-4.

Funkentstörung Deutschland

Herstellerbescheinigung

Hiermit wird bescheinigt, daß die Gerät HP C1700A/M, C1703A, C1710M, C1713M, in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört sind. Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Wird das Gerät innerhalb einer Anlage betrieben,

- so muß bei Inanspruchnahme der Allgemeinen Genehmigung FTZ 1046/84 die gesamte Anlage der oben genannten Genehmigung entsprechen.

- die mit einer FTZ-Serienprüfnummer gekennzeichnet ist, und für die eine Betriebsgenehmigung vorliegt oder beantragt wird, so sind in der Regel keine weiteren Schritte notwendig.

Turvallisuusyhteenveto

Laserturvallisuus

Hewlett-Packard C1700A/M, C1703A, C1710M, C1713M, optinen levymuistiasema on käyttäjän kannalta turvallinen luokan 1 laserlaite. Levymuistiaseman on tarkastanut Suomessa Työterveyslaitos ja tyyppihyväksynyt Työsuojeluhallitus, Työsuojeluhallituksen hyväksyntänumero TSH 45/6019/90.

Tarkastuksessa levymuistiaseman turvallisuusluokka on määrätty valtioneuvoston päätöksen N:o 472/1985 ja standardin SFS-IEC 825 mukaisesti. Laite on myös varustettu standardin SFS-IEC 825 mukaisella turvallisuusluokan ilmoittavalla merkinnällä:

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LUOKAN 1 LASERLAITE
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Normaalikäytössä levymuistiaseman kotelo estää lasersäteen pääsyn laitteen ulkopuolelle.

Huolto

Levymuistiaseman sisällä ei ole käyttäjän huollettavissa olevia kohteita. Laitteen saa avata ja huoltaa ainoastaan sen huoltamiseen kuolutettu henkilö.

Levymuistiaseman sisällä asennettujen luku-kirjoitusyksiköiden suojakotelo ei tule avata huoltotoimenpiteiden yhteydessä. Mikäli suojakotelo avataan ja suojalukitus ohitetaan, on mahdollista altistua näkymättömälle luokan 3B lasersäteilylle.

Japanese VCCI Statement

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取扱説明書に従って正しい取り扱いをして下さい。

United Kingdom Telecommunications

The Hewlett-Packard C1700A/M, C1703A, C1710M, C1713M, is approved under Approval Number NS/G/1234/J/100003 for indirect connection to Public Telecommunication Systems within the United Kingdom.

Laser Safety Statement (USA Only)

The Hewlett-Packard C1700A/M, C1703A, C1710M, C1713M, Optical Disk Library is certified as a Class 1 laser product under the U.S. Department of Health and Human Services (DHHS) Radiation Performance Standard according to the Radiation Control for Health and Safety Act of 1968.

Because the HP C1700A/M, C1703A, C1710M, C1713M, comply with this law, no hazardous laser radiation is produced by the product. Since laser light emitted inside the optical drives is completely confined within a protective housing and external covers, the laser beam cannot escape from the machine during any phase of user operation.

CDRH Regulations (USA Only)

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

Complies with 21 CFR Chapter 1
Subchapter J.

MANUFACTURED:
Made in U.S.A.

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

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

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Introduction

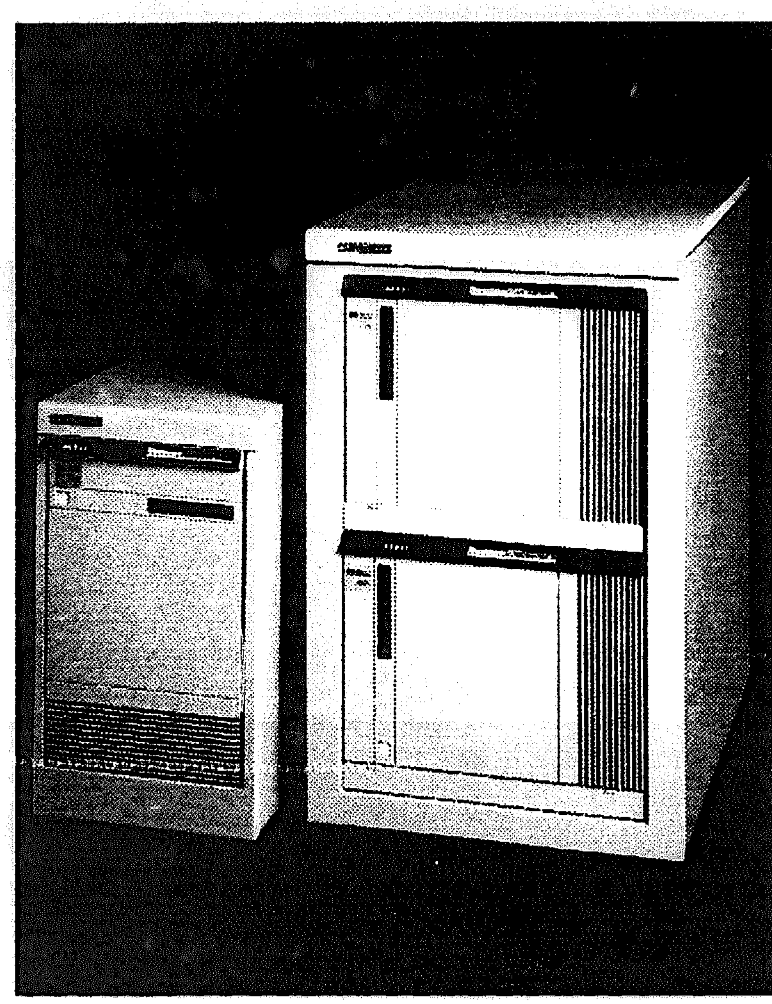


Figure 1-1. The HP Series 6300 Models 10 and 20

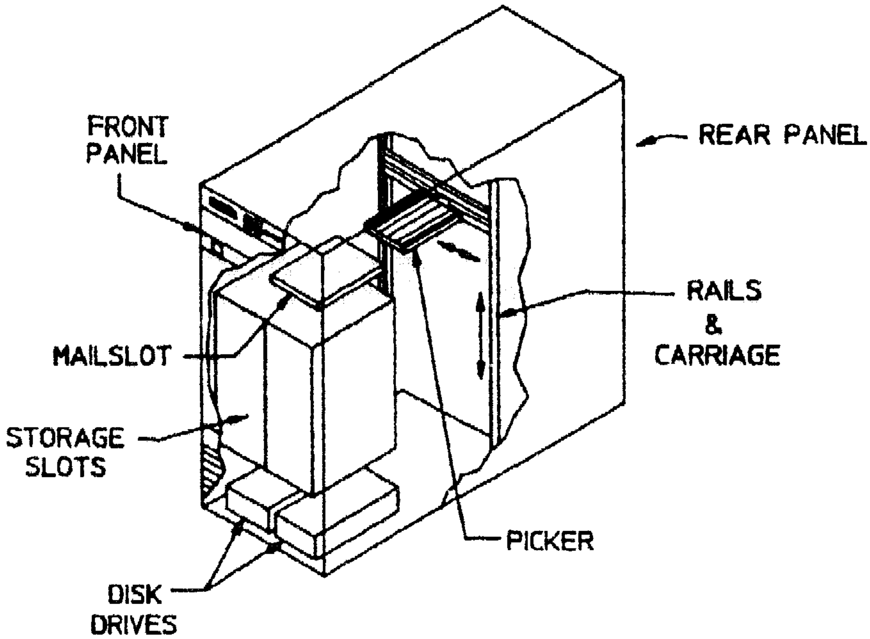


Figure 1-2. Deskside Optical Disk Library Components

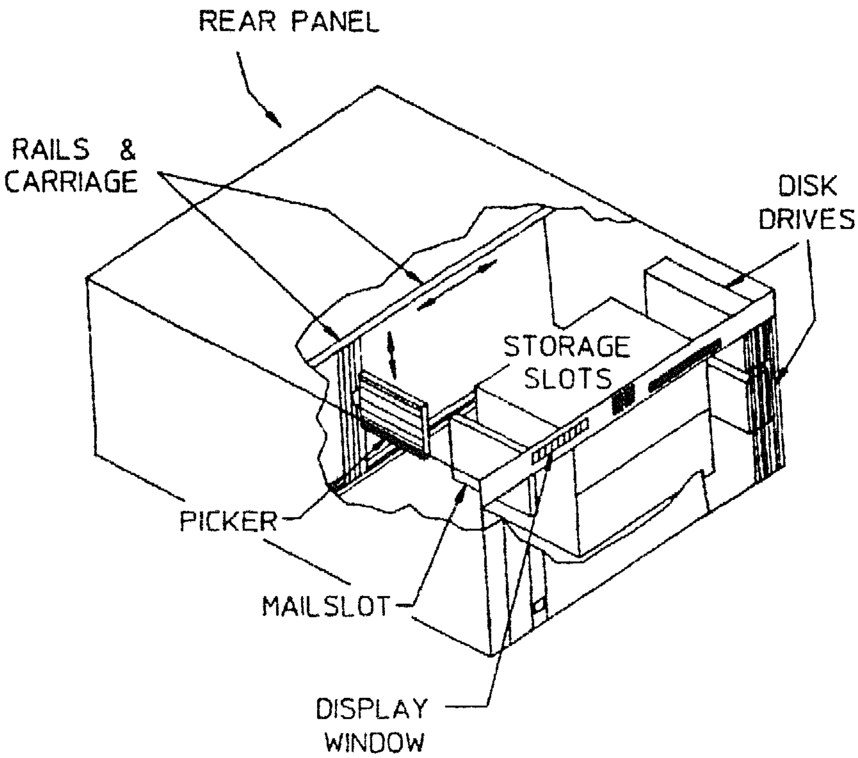


Figure 1-3. Rackmount Optical Disk Library Components

Disk Drives	The Disk Library System contains either one or two 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 Figure 1-2 and 1-3.)
Magazines	The Disk Library System contains either two (Model 10) or four (Model 20) magazines. Each magazine has eight storage slots for a total of either 16 (Model 10) or 32 (Model 20) optical disk storage slots.
Mailslot	The mailslot is used to insert and remove optical disks from the Disk Library System.
Front Panel	The Front Panel includes a control panel used to manage and display Autochanger functions, and a mailslot to insert and remove disks. Front panel and control panel features are described in Chapter 3, Section 3.4 "Control Panel Operations."
Rear Panel	The rear panel includes SCSI and power cord connections, and drive address select switches. Instructions for setting the address select switches are given in Chapter 3, Subsection 3.5 "Setting the Disk Drives' SCSI Address." Instructions for connecting a Deskside or Rackmount version of the Autochanger to a host computer are in the *Setup Guide Kit* (C1700-90050).
Rails and Carriage	The rails and carriage and support the picker for its movement within the Disk Library System.
Picker	Rotates, flips, and transports disks to and from storage slots, drives, and the mailslot.

1.1 The HP C1703A and HP C1700A/M (HP-Connect)

The C1703A (HP6300 Model 10GB/A and the C1700A/M (HP6300 Model 20GB/A [or 20GB/M] are optical storage library systems for the HP-connect market.

The C1703A comes with one 5.25-inch rewritable optical drive mechanism and supports both 1,024 bytes/sector and 512 bytes/sector optical disk cartridges.

The C1700A comes with two 5.25-inch rewritable optical drive mechanisms and supports both 1,024 bytes/sector and 512 bytes/sector optical disk cartridges.

The C1700M library comes with two 5.25-inch multifunctional optical drive mechanisms and supports both rewritable and write-once 1,024 bytes/sector and 512 bytes/sector optical disk cartridges.

These libraries interface to the host though either of two SCSI interface options; Single-Ended asynchronous SCSI or Differential asynchronous SCSI. The Single-Ended SCSI interface is the standard interface.

Storage capacity of these libraries is based on 1,024 bytes/sector disks.

Capacity Configurations

C1703A - 16 cartridge slots, 10.4 Gbytes maximum storage
C1700A/M - 32 cartridge slots, 20.8 Gbytes maximum storage

The C1703A has a maximum storage capacity of 10.4 Gbytes. This capacity is achieved through two magazines that each have eight storage slots providing space for 16 optical cartridges. Each cartridge holds one 650-Mbyte cartridge (1,024 bytes/sector, 325 Mbytes/side).

The top two magazines in the C1703A are removed and a filler panel is installed in their place.

The Controller PCA for the C1703A works only with a 16-slot library.

A C1703A may be converted into a C1700A through the C1722A upgrade product. In the upgrade, the Autochanger Controller PCA is replaced with a controller for a 32-slot version. Two magazines, containing 16 slots, replace the filler panel. The upgrade also includes one rewritable drive and controller to give the library a two-drive capacity.

The C1700A has a maximum storage capacity of 20.8 Gbytes. This capacity is achieved through four magazines that each have eight storage slots providing space for 32 optical cartridges. Each cartridge holds one 650-Mbyte cartridge (1,024 bytes/sector, 325 Mbytes/side).

The Autochanger Controller PCA for the C1700A/M works only with a 32-slot library.

Note	The firmware is the same for both the C1703A and the C1700A/M. The firmware determines the type of controller into which it is installed and configures itself accordingly.

Configurations of the HP C1700A, Serial Number Prefix 3107Axxxxx and below

Two orientations of the Autochanger allow mounting into a deskside cabinet or mounting into a standard 1-meter (19-inch) cabinet.

The two options differ in the following ways:

C1700A #1AB Deskside version of the autochanger

A Constant Force Spring Assembly (C1700-60033) is required to counterbalance gravitational forces that effect the motion of the Carriage and Picker Assembly. As a result, it takes the same amount of energy to move the Carriage and Picker Assembly up or down.

The deskside version requires Autochanger Controller Code, revision 4.5x or higher. Initial release was with AC Controller Code, revision 4.50 (C1700-60137).

The Control Panel Display Assembly (C1700-60022) and the Front Panel Assembly (C1700-60024) accomodate the width of the deskside Autochanger.

C1700A #1AC Rackmount version of the Autochanger

The rackmount version requires Autochanger Controller Code, revision 4.7x or higher. Initial release was with AC Controller Code, revision 4.70 (C1700-60537).

The Control Panel Display Assembly (C1700-60012) and the Front Panel Assembly (C1700-60014) accomodate the length of the rackmountable Autochanger.

The rackmount orientation requires drives that are capable of loading disks with the drives on their sides. These drives (C1700-60010) are used in both orientations of the Autochanger so that the product family will have a single service drive.

New rack slides (C1700-60046) allow mounting the Autochanger into a standard 1-meter (19-inch) cabinet. The slides also allow the unit to swivel when pulled out, resulting in easier servicing.

A special strap (C1700-68282) is required to mount the unit into the 1-meter cabinet.

Configurations of the HP C1700A/M, Serial Number Prefix 3135Axxxxx and above

Two orientations of the Autochanger allow mounting into a deskside cabinet or mounting into a standard 1-meter (19-inch) cabinet. The major differences between these units and the units mentioned in the previous versions (3107Axxxxx and below) are that a common Autochanger Controller firmware set is used and neither configuration requires a constant-force spring.

The two options differ in the following ways:

C1700A/M #1AB Deskside version of the Autochanger

The Control Panel Display Assembly (C1700-60122) and the Front Panel Assembly (C1700-60124) accomodate the width of the deskside Autochanger.

C1700A/M #1AC Rackmountable version of the Autochanger.

The Control Panel Display Assembly (C1700-60112) and the Front Panel Assembly (C1700-60114) accomodate the length of the rackmountable Autochanger.

C1700A:
The code revision at Ship Release is 5.34. The first unit is recognized by the prefix/serial number 3136A00100.

C1700M:
The code revision at Ship Release is 5.34. The first unit is recognized by the prefix/serial number 3145A00100.

Configuration of the C1703A

The C1703A code revision at Ship Release is 5.34. The first unit is recognized by the prefix/serial number 3135A00100.

The C1703A product started with the prefix/serial number 3135A00100. There are no previous versions of this product, so there are no configuration differences.

Interface Options

See Section 1.3 "SCSI Interface Options—All Models."

Operating Environment

Note Detailed support information is in the Product Support Plan for each model.

Table 1-1. C1700A Host Connects

Hardware Platforms	Operating Systems
HP 9000 Series 300	Standard HP-UX 7.0, 8.0
HP 9000 Series 400	Standard HP-UX 7.05, 8.0
HP 9000 Series 400	Domain 10.4
HP 9000 Series 700	Standard HP-UX 8.05, 8.07
HP 9000 Series 800	Standard HP-UX 8.0, 8.02
HP 9000 Series 800 with a 27147A CIO SCSI host adapter card.	*HP-UX 7.0 with AMSO Custom Driver
HP 3000 Series 900	**MPE-XL 3.0

Table 1-2. C1703A Host Connects

Hardware Platforms	Operating Systems
HP 9000 Series 300/400	Standard HP-UX 8.0
HP 9000 Series 700	Standard HP-UX 8.05, 8.07

Table 1-3. C1700M Host Connects

Hardware Platforms	Operating Systems
HP 9000 Series 800 with a 27147A CIO SCSI host adapter card.	***HP-UX 8.0 with AMSO Custom Driver ***HP-UX 8.02 with AMSO Custom Driver
HP 9000 Series 800 with a 28655A NIO SCSI host adapter card.	*** HP-UX 8.02 with AMSO Driver

* The C1700A did not have standard HP 9000 Series 800 HP-UX 7.0 system support. The C1700A is now supported on HP-UX 8.0.

The library was functional on an HP 9000 Series 800 with HP-UX 7.0 by using an HP 27147A CIO SCSI Host Adapter Card and an Advanced Manufacturing Systems Operation Division (AMSO) 93302MX custom CIO Device Driver.

**The C1700A on the HP 3000 Series 900 MPE-XL 3.0 is functional ONLY through TurboStore/XL II.

*** The C1700M Multifunctional Optical Disk Library System is a special; supported on the AMSO special and AIMS application. This configuration connects to an HP 9000 Series 800 HP-UX 8.0 or 8.02 system through a HP 28655A NIO Adapter Card and a Custom SCSI Device Driver developed by HP's Advanced Manufacturing Systems Operation division (AMSO).

AMSO provides the normal HP Factory Online Support to the HP Field CEO, AEO, and RCO for the 93302MX and 93302QW Drivers.

Patches will be distributed via the HP-UX Patch machine, *hpfcse*, in the normal manner. See Chapter 3 of this manual for instructions for downloading patches.

Note The Sherlock Diagnostic supports only the C1700A on the HP 9000 Series 800 running HP-UX 8.0.

1.2 The HP C1713M and HP C1710A/M (Non-HP Connect)

The C1713M (Model 10 - 10.4 GBytes) or the C1710A/M (Model 20 - 20.8 GBytes) are optical disk storage library systems for the OEM/Distributor market.

These libraries interface to the host though either of two SCSI interface options; Single-Ended asynchronous SCSI or Differential asynchronous SCSI. The Single-Ended SCSI interface is the standard interface.

The C1713M library comes with one 5.25-inch multifunctional optical drive mechanism.

The C1710A library comes with two 5.25-inch rewritable optical drive mechanisms. The C1710M library comes with two 5.25-inch multifunctional optical drive mechanisms.

The C1713M and C1710A/M library systems support both 1,024 bytes/sector and 512 bytes/sector rewritable and write-once optical disk cartridges.

Storage capacity of these libraries is based on 1,024bytes/sector disks.

Capacity Configurations

C1713M - 16 cartridge slots, 10.4 Gbytes maximum storage
C1710A/M - 32 cartridge slots, 20.8 Gbytes maximum storage

Storage capacity of these libraries is based on 1,024 bytes/sector disks.

The C1713M has a maximum storage capacity of 10.4 Gbytes. This capacity is achieved through two magazines that each have eight storage slots providing space for 16 optical cartridges. Each cartridge holds one 650-Mbyte cartridge (1,024 bytes/sector, 325 Mbytes/side).

The top two magazines in the C1703A are removed and a filler panel is installed in their place.

The Controller PCA for the C1713M works only with a 16-slot library.

A C1713M may be converted into a C1710M through the C1723M upgrade product. In the upgrade, the Autochanger Controller PCA is replaced with a controller for a 32-slot version. Two magazines, containing 16 slots, replace the filler panel. The upgrade also includes one multifunction drive and controller to give the library a two-drive capacity.

The C1710A/M has a maximum storage capacity of 20.8 Gbytes. This capacity is achieved through 4 magazines that each have 8 storage slots providing space for 32 optical cartridges. Each cartridge holds one 650-Mbyte cartridge (1,024 bytes/sector, 325 Mbytes/side).

Configuration of the C1713M

The code revision will be 5.00 at Ship Release date. The first unit is recognized by the prefix/serial number 3137A00100.

Configurations of the C1710A PRIOR to 3133Axxxxx and Configurations of the C1710M PRIOR to 3134Axxxxx

Two orientations of the Autochanger allow mounting into a deskside cabinet or mounting into a standard 1-meter (19-inch) cabinet. The two options differ in the following ways:

C1710A #100 Deskside version of the Autochanger

A Constant Force Spring Assembly (C1700-60033) is required to counterbalance gravitational forces that effect the motion of the Carriage and Picker Assembly. As a result, it takes the same amount of energy to move the Carriage and Picker Assembly up or down.

The deskside version requires Autochanger Controller Code, revision 4.5x or higher. Initial release was with AC Controller Code, revision 4.50 (C1700-60137).

The Control Panel Display Assembly (C1710-60022) and the Front Panel Assembly (C1710-60024) accomodate the width of the deskside Autochanger.

C1710A #101 Rackmount version of the Autochanger

The rackmount version requires Autochanger Controller Code, revision 4.7x or higher. Initial release was with AC Controller Code, revision 4.70 (C1700-60537). Convergence of the deskside and rackmount versions of the Autochanger controller code is planned for 1991.

The Control Panel Display Assembly (C1710-60012) and the Front Panel Assembly (C1710-60014) accomodate the length of the rackmountable Autochanger.

The rackmount orientation requires drives that are capable of loading disks with the drives on their sides. These drives (C1700-60010) are used in both orientations of the Autochanger so that the product family will have a single service drive.

New rack slides (C1700-60046) allow mounting the Autochanger into a standard 1-meter (19-inch) cabinet. The slides also allow the unit to swivel when pulled out, resulting in easier servicing.

A special strap (C1700-68282) is required to mount the unit into the 1-meter cabinet.

Configurations of the C1710M AFTER 3134Axxxxx

Two orientations of the Autochanger allow mounting into a deskside cabinet or mounting into a standard 1-meter (19-inch) cabinet. The major differences between these units and the units mentioned in the previous versions (below 3133Axxxxx [C1710A] and below 3134Axxxxx [C1710M]) are that a common Autochanger Controller firmware set is used and neither configuration requires a constant-force spring.

The two options differ in the following ways:

C1710M #100 Deskside version of the Autochanger

The Control Panel Display Assembly (C1710-60122) and the Front Panel Assembly (C1710-60124) accomodate the width of the deskside Autochanger.

C1710M #101 Rackmountable version of the Autochanger

The Control Panel Display Assembly (C1710-60112) and the Front Panel Assembly (C1710-60114) accomodate the length of the rackmountable Autochanger.

C1710M:
The code revision at Ship Release is 5.00. The first unit is recognized by the prefix/serial number 3149A00100.

Drive Options

Option 312 - include two multi-function drives
Option 314 - include four multi-function drives

Interface Options

See Section 1.3 "SCSI Interface Options—All Models."

Service Recommendations

Because Distributor system connects and operating systems are different from site to site, it is recommended that HP service personnel disconnect the C1710A/M and C1713M from the host system and run internal selftests from the front panel and/or run offline diagnostics (ACDIAG, ACDIAG+, MODIAG, and SCSIMO).

Internal selftests are described in Chapter 5, *Diagnostics* and the PC-based ACDIAG, ACDIAG+ and MODIAG offline diagnostics are described in Appendix B *Offline Diagnostics*.

Note Once the C1710A/M or C1713M 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 system only—not for any integration or Distributor-related problems.*

Refer to the C1713M/C1710A/M Product Support Plan for further details on support strategy.

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

1.3 SCSI Interface Options—All Models

Option 001 - Add an 88410A Single-Ended interface
Option 002 - Add an 88411A Differential interface

Note The interface type must be specified when ordering the library.

Regardless of the type of external SCSI interface option chosen, the library system internally uses SCSI single-ended signals and termination.

OPTION 002 is for connection to a Differential external SCSI bus.

This option specifies a Differential SCSI Repeater PCA (88411A). This PCA enables the Library System to be connected to an external Differential SCSI bus and also provides two additional functions as follows:

- *converts* the external Differential SCSI to the Single-Ended SCSI used internally by the Library.
- provides *bus buffering*, which makes the Library's 21.65-inch internal SCSI bus length effectively zero and makes the maximum Differential SCSI external bus length of 25 meters available for connection to the host system. (Actual Library-to-host distance depends on whether there are any other SCSI devices on this bus).

1.4 Optical Disk Drives in the System

The disk drives in the Disk Library use 5.25-inch magneto-optical disks that comply with ANSI and ISO standards for Continuous Composite format.

Each optical disk holds 650 or 594 megabytes of data, depending on whether 1,024 or 512 bytes are used per sector.

The drives have a 2,400 rpm rotational speed and achieve a maximum sustained write transfer rate of 340 Kbytes per second and a maximum sustained read transfer rate of 680 Kbytes per second (depending on the host system).

Two types of drives are used in the Disk Library System. One type of drive uses rewritable operation; the other type can operate in both rewritable and write-once modes. The second type of drive is called a "multifunction" drive.

Multifunction drives sense the disk type and select either rewritable or write-once mode automatically. To use both modes of the drives, the host must implement the corresponding rewritable and write-once commands.

1.5 Summary of the Optical Disk Library Systems Features

The Optical Storage Library Systems, 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.
- HP rewritable optical disks meet ANSI and ISO standards for Continuous Composite (CC) format. HP write-once disks meet ANSI standards for Continuous Composite - Write-Once format (CCW).

  Continuous Composite format conforms to ISO/IEC JTC1 DIS 10089A; ANSI X3B11.
- Greater security through the ability to "lock" the Autochanger (prevent disk removal).
- High Autochanger reliability through a design that eliminates the motors, cables, and sensors from the delivery mechanism.
- Either Single-Ended asynchronous SCSI or Differential asynchronous SCSI bus interface to the host.
- Autochanger reliability of:
  - 40,000 hours MTBF
  - 500,000 MSBF (Mean Swaps Between Failure)
- A seven-second average disk exchange time (excluding the drive load/unload sequence).

1.6 Product Matrix

Table 1-4. Models 10/20 Disk Library System Products Matrix

Product No./Options	Description
C1700A	Model 20 Optical Library System with 32 storage slots, 2 rewritable drives, and a single-ended SCSI interface.
1AB	Deskside version with a cabinet
1AC	Rackmount version with a 1-meter cabinet
133	Rackmount version with rackslides
231	Includes 1 rewritable optical disk (1,024 bytes/sector)
241	Includes 32 rewritable optical disks (1,024 bytes/sector)
C1700M	Model 20 Optical Library System with 32 storage slots, 2 multifunction drives, and a single-ended SCSI interface.
1AB	Deskside version with a cabinet
1AC	Rackmount version with a 1-meter cabinet
133	Rackmount version with rackslides
231	Includes 1 rewritable optical disk (1,024 bytes/sector)
232	Includes 1 write-once optical disk (1,024 bytes/sector)
241	Includes 32 rewritable optical disks (1,024 bytes/sector)
242	Includes 32 write-once optical disks (1,024 bytes/sector)

Table 1-4.
Models 10/20 Disk Library System Products Matrix (continued)

Product No./Options	Description
C1703A	Model 10 Optical Library System with 16 storage slots, 1 rewritable drive, and a single-ended SCSI interface.
1AB	Deskside version with a cabinet
1AC	Rackmount version with a 1-meter cabinet
133	Rackmount version with rackslides
C1710M	OEM/Distributor Model 20 Optical Library System with 32 storage slots, 2 multifunction drives.
001	Single-Ended SCSI interface
002	Differential SCSI Interface
100	Deskside version with a cabinet
101	Rackmount version with rackslides
102	Rackmount version without rackslides
103	Deskside version without a cabinet
104	Rackmount version with a 1-meter cabinet

Table 1-4. Models 10/20 Disk Library System Products Matrix (continued)

Product No./Options	Description
C1713M	OEM/Distributor Model 10 Optical Library System with 16 storage slots, 1 multifunction drive, and a single-ended SCSI interface.
002	Differential SCSI Interface
100	Deskside version with a cabinet
101	Rackmount version with rackslides
102	Rackmount version without rackslides
103	Deskside version without a cabinet
104	Rackmount version with a 1-meter cabinet
C1722A	Upgrade kit to convert a C1703A (Model 10 GB/A) to a C1700A (Model 20 GB/A), includes 1 rewritable drive
C1723M	Upgrade kit to convert a C1713M (Model 10) to a C1710M (Model 20), includes 1 multifunction drive
88410A	SCSI Single-Ended interface
88411A	SCSI Differential interface

1.7 Reliability- and Serviceability-Enhanced Models (After Serial Number Prefix 3133Axxxxx)

Starting with serial number prefix 3133A, all libraries in this product family incorporated a number of changes that increased their reliability and make servicing easier. The package of changes was called RSE, for "Reliability and Serviceability Enhanced".

RSE improvements are as follows:

- PCA consolidation
- power supply redesign
- cooling fan consolidation
- constant force spring elimination
- Autochanger Controller firmware consolidation
- cable and connector changes
- miscellaneous.

The advantages gained by these improvements are as follows:

- fewer PCAs
- fewer connections
- simpler cabling
- increased reliability
- enhanced serviceability.

PCA Consolidation

The Autochanger Controller PCA (C1700-60101), Address Switch PCA (C1700-60013), and Mother PCA (C1700-60100) are consolidated into a single, Autochanger Controller PCA. The part number of the new Autochanger Controller PCA is C1703-60001 for Model 20 (full) Autochangers and is C1703-60011 for Model 10 (half) Autochangers.

The new Autochanger Controller PCA mounts to the side of the new power supply (see "Power Supply Redesign" which follows). The MO Drive Controller PCAs mount where the AC Controller PCA used to mount.

This consolidation and relocation of PCAs results in less cable clutter and greater accessibility. Although the power supply must be removed to remove the Autochanger Controller PCA, this removal is much easier than in previous units.

New Power Supply

The new, modular power supply (C1703-60028) was designed by Hewlett-Packard and uses the latest advancements in switching dc-to-dc converters. The power supply was designed for flexibility and improved reliability. All previous regulatory certifications are either maintained or improved.

In units previous to prefix 3133A, 120 Vac is routed to the power switch on the front panel using a double-insulated cable. The RSE design uses an operation switch, on the front panel which is a 20 Vdc switch that controls the secondary module in the power supply only. The primary module, with its high voltages, are controlled by a power switch on the rear panel. The new, 20-volt operation switch is a lighter duty, more easily serviced switch and cable assembly.

The power supply is auto-ranging; the line voltage no longer must be set.

The number of connectors on the power supply has been reduced from five to two, resulting in a serviceability enhancement. Units prior to 3133A have two 14-pin connectors for the drives, one 14-pin connector for the Autochanger Controller PCA, a connector for the power ON/OFF switch, and a connector for 24-volt motor power. The new module has one 14-pin connector for the drives and one 18-pin connector which splits into three ends for the Autochanger Controller PCA, the power ON/OFF switch, and 24-volt motor.

The new module is narrower than the old, resulting in a different rear access panel (C1703-60062). The bulge that is on the rear of older units is gone and the power receptacle is flush with the back panel.

The new supply is fully backward compatible with old units using the adapter kit (C1700-60048).

Fan Consolidation

A larger power supply fan and improved airflow characteristics allow the elimination of the fan in the rear electronics area. Also, mechanical architecture of the new power supply allows the power supply fan to be a separate Field Replaceable Unit (FRU). The fan that currently exists as a FRU (C1700-60038) is eliminated in RSE units and replaced by a fan that is externally mounted to the new power supply (C1703-60028) will be a new service FRU (C1703-60068) for RSE units.

These changes cause no degradation in acoustics or airflow over the drives.

Elimination of the Constant Force Spring

RSE units use a integral servo control system rather than the proportional servo control system used in older units.

This change eliminates the constant force spring (C1700-60033).

With the removal of the spring, the acceleration due to gravity affects the speed with which the motors can move the carriage. As a result, velocities, accelerations, and force limits will change slightly. Some performance improvements were added to offset the small losses in vertical motion speed associated with the removal of the constant force spring.

A relay was added to allow the firmware to disconnect the motors from the driver circuitry and shunt a resistor across them. This significantly slows the descent of the carriage assembly (in Deskside units) during error or power-off conditions.

The 10 ms settling time inserted at the completion of every micro motion has been removed. This time is not required on all moves and will only be done when necessary.

Autochanger Controller Firmware Changes

The calibration code now determines the orientation of the unit. This allows the maintenance of only one set of firmware for both vertical and horizontal orientations of the Autochanger. For RSE units, C1700-60437 and C1700-60737 is replaced by a single Autochanger Controller code kit, C1703-60037. The new code set is used for both Model 10 and Model 20 Autochangers.

Note The previous paragraph is valid only for RSE units. Pre-RSE units must use unique code sets.

The Control Panel processor has been replaced by a Programmable Array Logic (PAL) and the associated code was migrated into the 68000 code set. This change increases reliability by reducing the number of programmed parts on the Autochanger Controller PCA to two.

Drives in the Autochanger will not accept a disk if the disk's shutter is open because the drive shutter opening arm blocks insertion of the disk. Previously, when a picker tried to insert a disk that had an open shutter, the Autochanger motors would exceed their shutdown limit when meeting this resistance from the drive. The disk cartridge then had to be manually removed from the picker. The new firmware relaxes the motors when resistance is met and then enters an error recovery procedure that includes the Find Home sequence. At the end of the sequence, another attempt is made to insert the disk. If, after repeating this procedure three times, the resistance is still there, the Autochanger enters a "Restore" sequence and puts the disk cartridge back into the slot it came from.

With firmware of rev 4.78 or less, the Wellness diagnostic (Test 2) would fail if access was attempted to any reserved slot or drive. The new firmware (C1703-60037) allows the picker to bypass any reserved slot/drive while the Wellness test runs.

Also, with firmware of rev 4.78 or less, the (NEXT) and (PREV) buttons would occasionally seem to "bounce." This was caused by a timing problem in the Control Panel State Machine (FPSM). This has been fixed in the new firmware.

CONFig 33 has been added to enable the user to lock the Autochanger SCSI ID. If CONFig 33 is ON, the SCSI ID cannot be modified.

CONFig 50 has been added such that a full Autochanger (32 storage slots and two drives) can emulate a half Autochanger (16 storage slots and one drive).

In the new firmware, the FRU Isolation Test order is changed slightly. The sensor test will now come before the picker test.

With previous firmware, the "SValid" and "Invert" bits in the Data Transfer Element Descriptor Block of the SCSI Read Element Status command were updated only when the Autochanger inserted a disk into a drive. If a disk was manually inserted, the Autochanger used the previously-stored element status information even though this information was not correct. The new firmware eliminates this problem by clearing the "SValid" bit when the disk is removed from the drive.

The new calibration code takes advantage of the integral servo to more precisely find the vertical location of the height sensors. This increases the reliability of the unit by more exactly placing cartridges in magazines and drives.

Cable and Connector Changes

A number of connectors were eliminated. Reliability is improved in addition to simplifying the cabling. Cables are routed directly to the new Autochanger Controller PCA rather than routing them first to the Mother PCA.

The RS-232 connector was eliminated. This connector was used only for development. An RS-232 interface was never supported or released for this product.

The Control Panel and interconnect cables are shorter.

The motor power and encoder cables are combined into a single cable assembly.

The new, operation switch cable and the mailslot cable have been combined into a single cable. This reduces the number of cable clamps needed and eliminates the need to remove the Carriage/Picker assembly and the Left Way to replace the power cable. Also, the operation switch may be changed without changing the cable.

The external SCSI connectors are attached directly to the chassis and cabled to the Autochanger Controller. This is a sturdier configuration, simplifies cable routing, and improves electrical noise immunity.

The location of the SCSI connectors has also changed and the internal SCSI ribbon cables are different. In the Deskside Autochanger configuration, the connectors are at the bottom of the back panel. In the Rackmount configuration, the connectors are on the left side of the back panel when viewing the Autochanger from the rear.

Miscellaneous

- To provide a smooth strategy for upgrading a 16-cartridge library system to a 32-cartridge library system, the physical mapping of cartridges within the unit has been changed starting with RSE units. This strategy is consistent with that used in the Models 60 and 100 Disk Library Systems.

  Magazine numbering is shown in the diagram below. The view is from the rear of the Autochanger.

Old numbering		New numbering	
26	42	41	42
25	41	39	40
24	40	37	38
23	39	35	36
*	*	*	*
*	*	*	*
*	*	*	*
14	30	17	18
13	29	15	16
12	28	13	14
11	27	11	12
Drive 1	Drive 2	Drive 1	Drive 2

Figure 1-4. Physical Mapping of Cartridges in the Autochanger

- The non-volatile RAM backup battery is now soldered onto the Autochanger Controller PCA, rather than socketed. This eliminates the potential for poor pressure contact in the socket. The battery is the same battery used in previous units, and has a minimum expected life of five years in a unit that is powered off. Because the battery will no longer be socketed, spare boards will not be shipped with a protect tab.

- Multiple ICs and FETs are now surface-mount devices. These include the motor driver FETs, the motor controller IC, the SCSI IC, and the microprocessor.
- The translate bar is welded to the chassis, rather than permanently installed with e-rings. This improves airflow to the drives by allowing the removal of an assembly hole.

1.8 Accessories

Table 1-5. Accessories

Description	HP Part Number
Rewritable Optical Disks (1,024 bytes/sector)	
Single Disk	92280A
Pack of 8 Disks	92280M
Pack of 32 Disks	92280Z
Rewritable Optical Disk (512 bytes/sector)	
Single Disk	92279A
Pack of 8 Disks	92289M
Pack of 32 Disks	92290Z
Write-Once Optical Disks (1,024 bytes/sector)	
Single Disk	92290A
Pack of 8 Disks	92290M
Pack of 32 Disks	92290Z
Write-Once Optical Disk Cartridge (512 bytes/sector)	
Single Disk	92289A
Pack of 8 Disks	92289M
Pack of 32 Disks	92289Z
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
1m (3.3 ft) High-density SCSI cable for HP Model 425x (Use with models manufactured before 11/1/90)	K2286
1m (3.3 ft) High-density SCSI cable for HP Model 425x (Use with models manufactured after 11/1/90)	K2296
1.5m (4.9 ft) High-density SCSI cable for HP Model 425x (Use with models manufactured before 11/1/90)	K2285

Table 1-5. Accessories (continued)

Description	HP Part Number
1.5m (4.9 ft) High-density SCSI cable for HP Model 425x (Use with models manufactured after 11/1/90)	K2296
Single-ended SCSI terminator	K2291
Differential SCSI terminator	A1658-62024

1.9 Disk Library/Magneto-Optical Drive Specifications

Performance Specifications

Optical Disk Library System

Capacity	32 disks
	20.8 Gbytes
Drives	1 standard, 5.25-inch multifunction optical for C1713M
	2 standard, 5.25-inch rewritable optical for C17x0A
	2 standard, 5.25-inch multifunction optical for C17x0M
Average disk exchange time (excluding drive load/unload sequences)	7 seconds
Interface	Single-ended asynchronous SCSI

Optical Drives, Rewritable and Multifunction

Formatted capacity	
(1024/512 byte sectors)	650/594 Mbytes (medium dependent)
Seek Times	
Short Stroke (across 2.2 Mbytes)	22 ms
Average	95 ms
Full Stroke	185 ms
Average Rotational Delay	12.5 ms

Optical Drives, Rewritable and Multifunction (continued)

Average load/unload sequence	5.3/3.8 seconds
Spin-up/Spin-down	4.0/0.8 seconds

Data Transfer Rate*(1024-byte sectors)

Reads (maximum sustained)	680 Kbytes/second
Writes (maximum sustained)	340 Kbytes/second
Burst (SCSI interface)	1.2 Mbytes/second

*System and application software dependent

Recording Characteristics (Continuous Composite Format)

Bytes per Sector	512/1024 medium dependent
Sectors per Track	31/17 medium dependent
Tracks per surface	18751
Tracks per inch	15875
Error Rate	Less than 1 block in error per 10^{14} bytes

Power Requirements

Line Voltage	100-127 Vac
	200-240 Vac
Line Frequency	50-60 Hz
Power Consumption (per library)	
Maximum	200 Watts
Typical	120 Watts

Environmental Conditions

	Autochanger	Drives	Medium
Temperature			
Operating	10° to 40°C	5° to 40°C	10° to 60°C
Non-operating	-30° to 60°C	-30° to 60°C	-10° to 50°C
Temperature gradient	10°C per hour	10°C per hour	10°C per hour
Transportation (<14 consecutive days)			-40° to 60°C
Humidity (non-condensing)			
Operating	10 to 90%	10 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

	Autochanger	Drives	Medium
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	0.25 G rms	>0.21 G rms
Non-operating			
Random	2.1 G rms	2.4 G rms	
Swept Sine	0.5 G 0-peak	0.75 G 0-peak	
Altitude			
Operating	4,572 m (15,000 ft)		
Non-operating	15,240 m (50,000 ft)		
Acoustic Emissions (A-weighted sound power)			
Poweron, standby	6.0 bels		
Operating	6.5 bels		

Physical Characteristics

	Deskside Option	Rackmount Option	2nd Library (for 1.0 m 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)
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 478 5th Edition (C1700A listed, C1710A recognized component)
CSA C22.2 No. 220-M1986
IEC 950
TUV approved to VDE 0805 (EN 60950)

Electromagnetic Emissions:

FCC 47 CFR Part 15 Subpart J - Level "A"
FTZ 1046/84 - Level "B"
EN 55022/CISPR 22 Level A
SABS

Laser:

CDRH 21 CFR Chapter 1, Subpart J, Registered
TUV approved to VBG 93, VDE 0837
TSH Approved to Decision 472 (C1700A only)
BS 4803 Part 2 (complies)
IEC 825

United Kingdom

The HP C1700A/C1710A are approved under Approval Number NS/G/1234/J/100003 for indirect connection to Public Telecommunication Systems within the United Kingdom.

2

Environmental/Installation/PM

2.1 Environmental Requirements

For detailed site environmental information, refer to the publication entitled *CE Site Preparation Handbook* (5958-2370).

The Disk Library System is designed to operate with an ambient air temperature range of 10° to 40°C (60 to 90°F) with a rate of temperature change not to exceed 10°C (50°F) per hour. See "2.3 Cooling Requirements" for the recommended operating range.

Note The environmental specifications listed here apply when the Disk Library System 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.

2.2 Primary Power/External Ground

The power outlet used to supply AC power to the Autochanger must be checked to ensure that the proper voltage is available.

Table 2-1. Acceptable Voltage/Frequency

(Voltage (Nominal)	Frequency (Nominal)	Voltage Range	Frequency Range
100±10%	50±10%	90-110	47-53
230±10%	50±10%	207-253	47-53
120±10%	60±10%	108-132	57-63
220±10%	60±5%	198-242	57-63

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

Be aware that 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.

2.3 Cooling Requirements

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

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.

2.4 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.

2.5 Installation

Installation is done in three steps.

1. Unpacking—inspection for damage and moving to final site.
2. CE Hardware Installation—Removing components from the shipping pallet (according to configuration ordered), installing the mechanism into the rack (if Rackmount Option), and checking address and power configuration.
3. Configuring the Disk Library System for use with a specific host.

Unpacking is described in the generic Unpacking Instructions found on the box for each major component (C1700-90073). The *Setup Guide* (C1700-90050) is packed in the accessory kit with each Disk Library mechanism and is included with this Service Manual. Host configuration guides are also shipped in the accessory kits for each Disk Library mechanism and will be included in this Service Manual as these different configurations become supported.

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

2.6 Preventive Maintenance

There is no preventive maintenance for the Disk Library System.

3

Configuration

3.1 Unpacking, Assembling, and Checking

Instructions for final unpacking, assembling, and hardware configuration for the different options of the Disk Library System are in the *Setup Guide Kit* (C1700-90050). Software configurations are in the appropriate *Configuring and Using ...* manual (C1700-90076,-77, -78, and -79). These manuals are shipped with the unit and are included with this service manual.

3.2 Configuring the Disk Library System to a Host

Instructions for configuring the Disk Library System to a specific host are in the appropriate host configuration guide shipped with the Disk Library System and supplied with this manual.

Before You Start

Before starting the configuration of the Disk Library System you should—

- Have completed the "CES2-9000UXA/B System Administration for CEs" class.
- Have experience installing HP-UX peripherals.
- Have experience with an HP-UX text editor such as vi and be able to access this editor on the host for the Autochanger.
- Have superuser access to the host Series 300.
- Verify that the host Series 300 HP-UX kernel is at least version 6.5.

Note A "patch" is also required for installation. This patch is located in the Fort Collins Service Engineering system "hpfcse" in both the HP-UX 6.5 and 7.0 directories for Series 300s. Depending on the version of your operating system, access as follows:

```
cd /usr/spool/uucppublic/300-6.5/autochanger
   or
cd /usr/spool/uucppublic/300-7.0/autochanger
```

Download the contents of the directory and use the instructions in the "README" file to apply the patch.

Automatic Installation

An unsupported utility for automatically configuring the C1700A/M Disk Library System to an HP 9000 Series 300 host is available.

To obtain a copy of this utility send your request through HPDESK to GSD HDWSUPP. At the "Subject:" prompt enter OPINST. No entry is needed at the "Text:" prompt. You will receive the utility in an AUTOANSWER.

Over HP-UX mail, use gsd_hdwsupp.gr.hp.com as the address and specify "OPINST" as the subject. No other text is required. If your HP-UX address is on the HP Global Database, you will receive the utility in an AUTOANSWER.

3.3 Autochanger Configuration Choices

The following table lists the available configurations choices. An explanation of how to access and set these configurations is in Section 3.4.

Autochanger Configuration Choices

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

Autochanger Configuration Choices (continued)

No.	Function	Default	Options
17	Set New Password (password required)	0-0-0	
18	Clear/Save Logs (password 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.
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 (password 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.

Autochanger Configuration Choices (continued)

No.	Function	Default	Options
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.
31	Secured Mailslot Rotation (password 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.

Autochanger Configuration Choices (continued)

No.	Function	Default	Options
32	Mailslot Rotation Command (password 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.
50	Emulate Model 10 (Must be a Model 20. Password required)	Off	Off - Normal Model 20 mode.
			On - Emulates a Model 10. (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 (password required)	Save	RAM remains unchanged.
		Clear	Zeros all RAM locations and reboots the library system.

3.4 Control Panel Operations

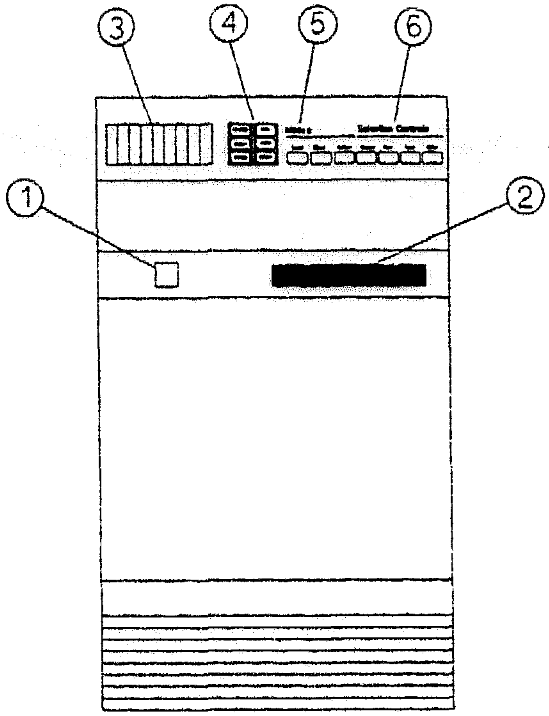


Figure 3-1. Deskside Configuration Front Panel

1	RSE versions—Operation Switch	Pushed to enable or disable operation of the Disk Library System. (This is **NOT** the power switch. The power switch is located on the rear panel on RSE models.)
1	Pre-RSE versions—Power Switch	Power ON/OFF Switch.
2	Mailslot	Allows you to insert or remove disks.
3	Status Indicators	Lit when the indicated activity is taking place.

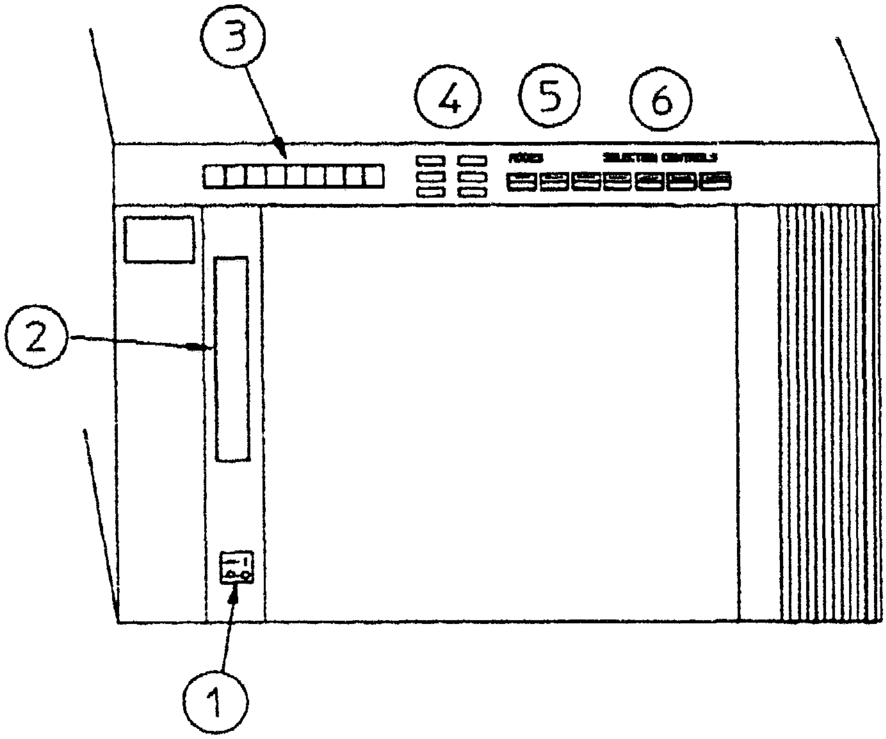


Figure 3-2. Rackmount Configuration Front Panel

4 Selection Control Buttons	Press these buttons to perform the desired operation.
	CANCEL is pressed to cancel the current operation or choice.
	PREV is pressed to scroll the display choice backward by one.
	NEXT is pressed to scroll the display choice forward by one.
	ENTER is pressed to choose the displayed selection.

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 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.

Setting a Configuration (CONF)

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.)

   See the previous table for a complete listing of configurations.
5. Press [ENTER].

   Some configurations require a password. If prompted, enter the password.
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 *.

Displaying Information Logs (INFO)

Information logs are in Chapter 4.

1. With READY displayed, press [OPTION]. TEST * displays.
2. Press [NEXT] until INFO * displays.
3. Press [ENTER].
4. Press [NEXT] or [PREV] until the desired log number displays.

   See Chapter 4 for a complete listing of information logs.
5. Press [ENTER]. The log information displays.

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.

Choosing Tests and Displaying Results (TEST)

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.

   See Chapter 5 for a complete listing of diagnostic tests.
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, RUN ## displays (where ## is the test number).
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.

Setting a Password

Note The default factory-set password is 0-0-0. When setting a new password, 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) password displays.
7. Press [ENTER]. 0 displays.
8. Press [NEXT] or [PREV] until second number of old (or default) password displays.
9. Press [ENTER]. 0 displays.
10. Press [NEXT] or [PREV] until third number of old (or default) password displays.

Note If the password was keyed in successfully, the display prompts you for the new one. If a mistake was made in keying in the password, 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 password, press [CANCEL] to return to the CONF 17 option.

11. Press [ENTER]. A displays.
12. Press [NEXT] or [PREV] until first number of new password displays.
13. Press [ENTER]. B displays.
14. Press [NEXT] or [PREV] until second number of new password displays.

15. Press [ENTER]. C displays.
16. Press [NEXT] or [PREV] until third number of new password 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 password.
- 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 password. This password 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 password number displays.
4. Press [ENTER]. 0 displays.
5. Press [NEXT] or [PREV] until the second password number displays.
6. Press [ENTER]. 0 displays.
7. Press [NEXT] or [PREV] until the third password number displays.
8. Press [ENTER].
9. Press [NEXT] or [PREV] to select ON or OFF.
10. Press [ENTER]. SET 15 or SET 20 displays.

3.5 Setting the Autochanger SCSI Address

Note Determine what SCSI device addresses are currently in use on the host system. You can then correctly determine what available SCSI addresse to use for the Autochanger controller and disk drives (setting drive addresses are in Section 3.6 "Setting the Disk Drives' SCSI Address."

Note The Autochanger controller default SCSI address is 3. If you are configuring more than one Disk Library System to the same host, you must change the SCSI addresses on one of the Disk Library Systems to avoid an address conflict.

To set the Autochanger controller address do the following:

1. With `READY` displayed, press [OPTION]. `TEST *` displays.
2. Press [NEXT]. `CONF *` displays.
3. Press [NEXT]. `INFO *` displays.
4. Press [NEXT]. `SCSI ID` displays.
5. Press [ENTER]. `SCSI ID 3` displays.
6. Press [NEXT] or [PREV] until the address you want is displayed.
7. Press [ENTER]. The address you chose is now set.

Note Pressing [OPTION] at any time returns you to the `READY` state. Pressing [CANCEL] takes you back one step each time it is pressed.

3.6 Setting the Disk Drives' SCSI Addresses

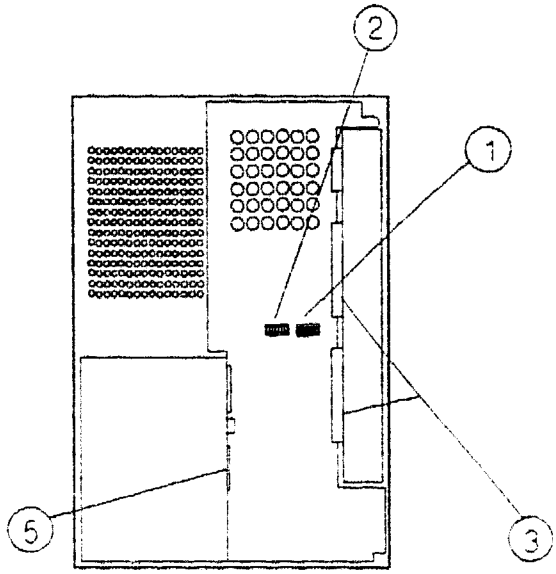


Figure 3-3. Disk Library Rear Panel (Deskside pre-RSE version shown)

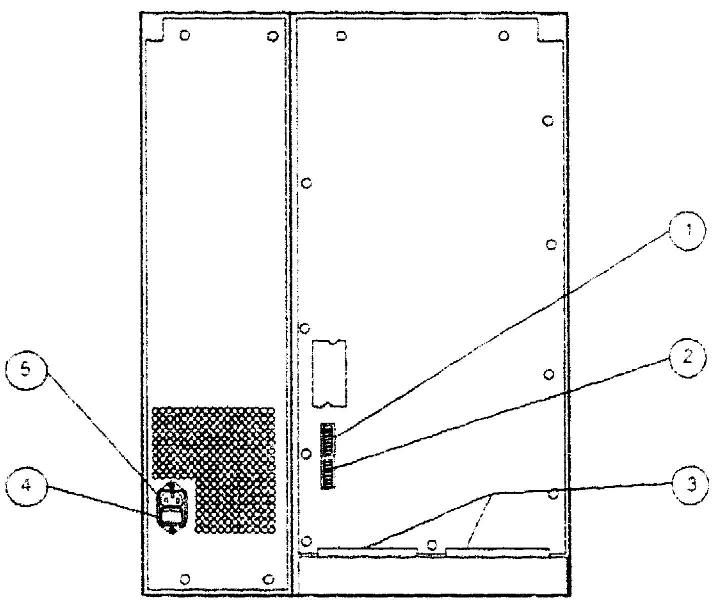


Figure 3-4. Disk Library Rear Panel (Deskside RSE version shown)

1	Drive 1 Address Select Switch	Used to set the SCSI ID for Disk Drive 1. Default address is 4.
2	Drive 2 Address Select Switch	Used to set the SCSI ID for Disk Drive 2. Default address is 5.
3	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.
4	Power Switch (RSE version)	Switches power on or off. Pre-RSE versions switch power on and off from the front panel.
5	Power Connector	Connection for the power cord.

Setting the SCSI Address Switches on the Rear Panel

The default address settings are:

Model 10

Optical Disk Drive #1	Address 4

Model 20

Optical Disk Drive #1	Address 4
Optical Disk Drive #2	Address 5

Caution

Make sure the Disk Library System is switched off (using the power switch located on the Disk Library System rear panel) and the power cord is unplugged before changing the disk drive addresses.

Do not press the Disk Library System operation switch (located on the front panel) or 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 sytem reference manuals for information on checking the status of the SCSI bus.

To change the Optical Drive addresses, do the following steps.

1. Locate the address switches on the rear panel of the Disk Library System.
2. Verify that switches 2, 4, and 5 are in the "OFF" position and switch 3 is in the "ON" position.

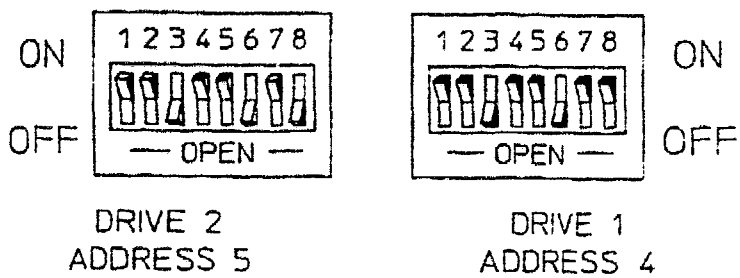


Figure 3-5. Default Switch Settings

Table 3-1. Switch Explanations

Switch	Selection	Description
1 - * Write-with-Verify	On	After each write operation, the data that was just written is verified on the next disk rotation (see the note that follows this table).
	Off	(Default) Write-with-Verify is disabled.
2 - Eject Mode	Off	(Default) The eject button on the front of the MO drive is enabled. Disks may be ejected either by SCSI command from the host or done manually. This switch should be left in the OFF position.
	On	The eject button on the disk drive is disabled—a disk may only be ejected using host commands. possible by host commands only.

Table 3-1. Switch Explanations (continued)

Switch	Selection	Description
3 - Eject Through SCSI Command	On	(Default) When the SCSI Eject Command is received, the drive spins down but the disk is not ejected. Leave this switch ON.
	Off	When SCSI Eject Command is received, the drive spins down and the disk is ejected.
4 - Diagnostic Switch	On	Run disk drive diagnostics.
	Off	(Default) No disk drive diagnostics - normal operating mode.
5 - SCSI Parity Check Mode Selection	On	Parity check disable.
	Off	(Default) Parity Check enable.
6, 7, and 8 - SCSI Address		These switches combine to set the SCSI address. Refer to the next step.

Note

It is recommended that a library be configured to Write-with-Verify to assure data integrity. If the host system does not initiate a Write-with-Verify, this function may be enabled by setting switch 1 to ON.

This verification process may cause a 0-40% overall system performance degradation, depending on the host system and the application.

3. Set the appropriate address switches on both disk drives.

   Switches 6 through 8 are used to set the address. The address can be set from 0 to 7. However, you should **avoid address 7** as it is used by the host HP-UX system or other hosts for the SCSI controller address.

Table 3-2. SCSI Address Settings

SCSI ID	SWITCH 6	SWITCH 7	SWITCH 8
0	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4 (default)	ON	OFF	OFF
5 (default)	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

4. Record the address settings in the system information for future reference.

4

Troubleshooting

4.1 The Autochanger

General Sequence

Intermittent Errors—Check the Logs Immediately After Failure

Hard Errors—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.

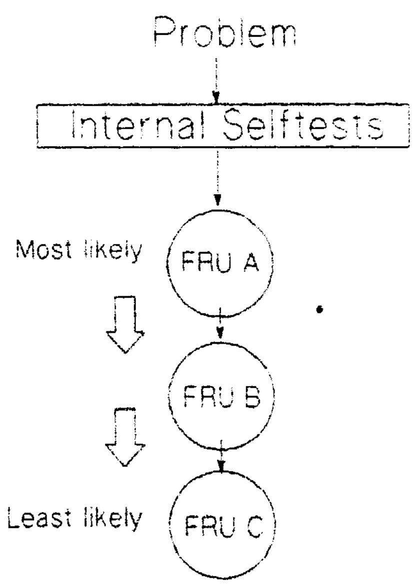


Figure 4-1. The Autochanger Returns Suspect FRUs

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. Similarly 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 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 the 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. Cartridges are not intentionally rearranged, but if the Picker starts this test with a cartridge in it, the position and orientation of that cartridge 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 can not 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.

Service Uses the Results of the Internal Tests

Similar to treating symptoms rather than the real problem, the suspect FRUs given by the automatic 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.

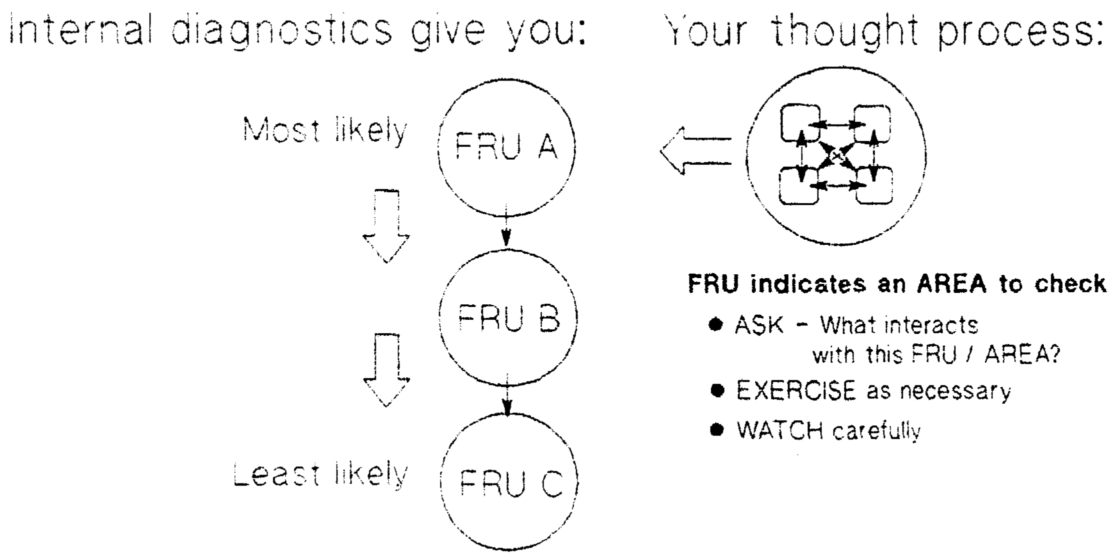


Figure 4-2. How Service Views the Suspect FRUs

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 drives, you will be able to more easily detect the real problem pointed to by a suspect FRU.

An example:
Say the Autochanger fails with an error code of 4D (hexadecimal), "MOTION

ERROR CHECKING FOR CARTRIDGE IN THE PICKER," and lists the Picker (FRU 27) as the most likely failure. However, when you observe the unit while running the Wellness Test (Test 2), you see that the Picker is having trouble flipping. As you manually move the Carriage/Picker assembly around and touch the components that are involved, you notice that the Picker belt is abnormally tight. The belt is tight because the Carriage 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.

In Chapter 5, Table 5-14, "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 traces the execution of the FRU Isolation Test. A failure requires additional tests at that point to determine the actual cause. 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 supplies, 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. It should come to a hard stop.
   (Eliminates all Picker belts, Picker belt tensioner.)
5. Move Carriage/Picker assembly toward the drives. It should come to a hard stop.
   (Eliminates Carriage belt.)
6. Move Carriage/Picker assembly away from the drives. 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 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.

Specific Steps of the FIND HOME Sequence

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.

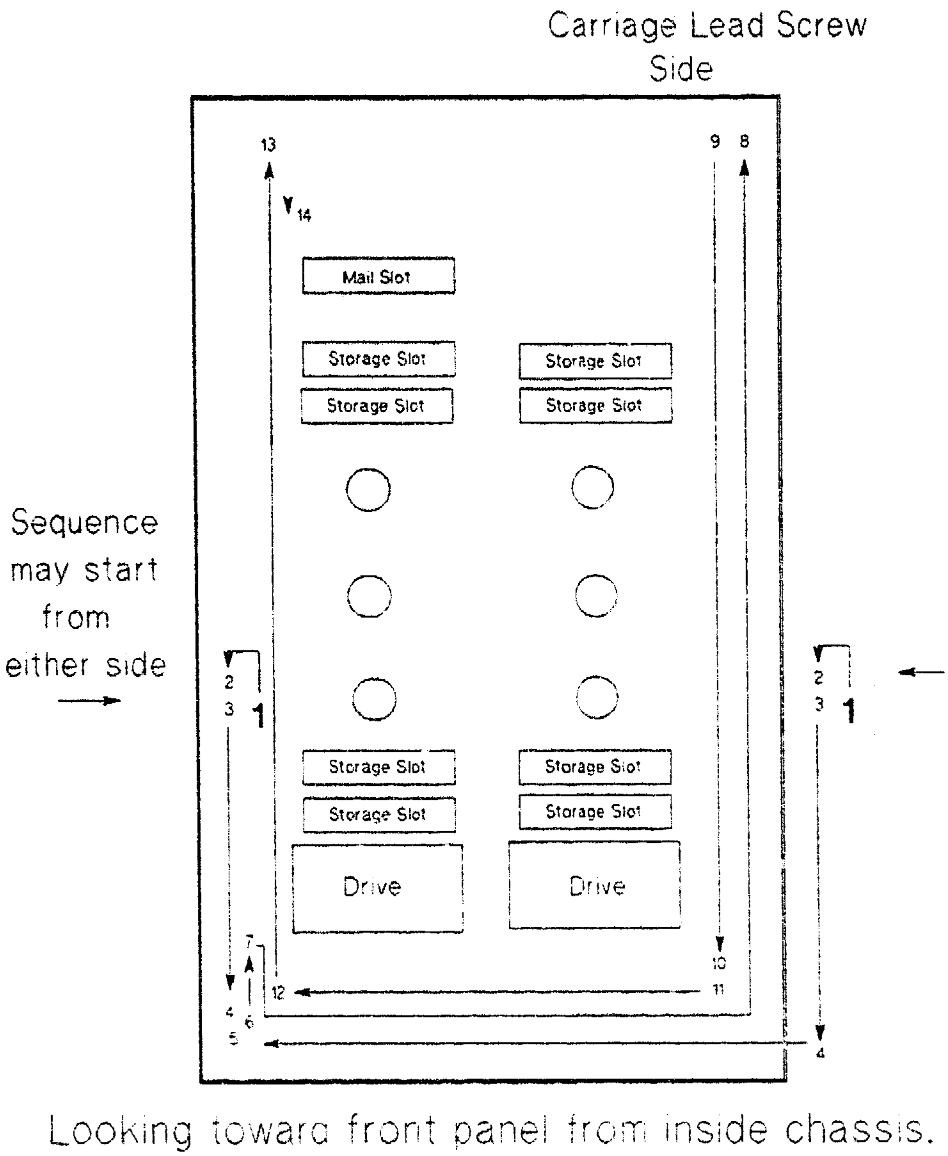


Figure 4-3.
The "FIND HOME" Sequence
(deskside orientation shown)

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.

Error and Performance Logs

The optical Autochanger Control Panel diagnostic tests have two major purposes. The first is to provide predictive diagnostic information that can lead to early detection of an Autochanger problem. The second is to provide fault isolation tests.

The predictive diagnostics make extensive use of runtime logs and runtime error monitoring. All the logs are maintained within non-volatile RAM, and so are not affected by cycling the operation switch. These logs are accessible from the Control Panel by using the **INFO** option.

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 [OPTION]. **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 the table on the following page.

Table 4-1. Error and Performance 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.
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

Table 4-1. Error and Performance Logs (INFO Logs) (continued)

No.	Log Name	Description
3	Software Clock	Displays the current "count" in seconds of the software clock. (hexadecimal)
4	Drive Load Count	Displays the number of cartridge loads 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.	
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.

Table 4-1. Error and Performance Logs (INFO Logs) (continued)

No.	Log Name	Description
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
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.

Table 4-1. Error and Performance Logs (INFO Logs) (continued)

No.	Log Name	Description
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.
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

4.2 The Magneto-Optical Drives

Poweron Selftest

Caution

During this poweron test, the SCSI interface and the terminator must BOTH be either connected OR disconnected.

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

Caution

Do not remove a drive from the SCSI bus until you are sure the system SCSI bus is INACTIVE and will REMAIN INACTIVE. Check the host system reference manuals for information on checking the status of the SCSI bus.

Removing any peripheral from an active SCSI bus can cause data loss and/or indeterminate bus states.

To perform the poweron selftest :

1. Remove power from the Autochanger electronics. In pre-RSE units, press the power switch on the front panel to OFF. In RSE units, press the operation switch on the front panel to standby.
2. On RSE units, remove the rear access panel to view the Drive Controller PCAs. On pre-RSE units, the glow of any LEDs left on after the poweron test can be seen through the ventilation holes on the top right of the rear chassis covers—it is not necessary to remove the panel to see a failed condition.

Note

A failure will occur if an unformatted disk is used in the next step.

3. Insert a known-good FORMATTED disk in the drive to be tested. Placing a disk in the drive may be done either manually or by using the mailslot/Control Panel.
4. Press the front panel power switch to ON (pre-RSE units) or press the front panel operation switch to OPERATE (RSE units).

   Wait for the poweron selftest to complete.

If both the drive mechanism and the Drive Controller PCA tests pass, the Busy Indicator and the red test LEDs on the Drive Controller PCAs turn off. Test failures are indicated as described below.

Symptom	Solution
Busy Indicator remains lit	Drive Mechanism failed poweron test. Replace Drive Mechanism.
All or some Controller PCA LEDs remain lit	Defective Controller PCA. Replace PCA.
Controller LEDs and Busy Indicator don't light	Check AC fuse first, then the voltage levels on the checkpoints on the front of the Controller PCA.

4.3 Disk/Disk Drive Cleaning in Libraries

Note

Standalone optical disks and drives are used, many times, in "dirtier" environments and with a disk loaded in the drive (open shutter) longer than with libraries.

But while the following cleaning information is more applicable to standalone drives, any specific library may be used in such a way as to make the following cleaning information apply.

However, because of the probable environment and disk usage in a library, disk cleaning, as explained below, should be done selectively.

Disk cleaning, for libraries, is NOT RECOMMENDED as a normal user task.

When Should Disk/Disk Drive Cleaning Be Done for Libraries?

A failure to read a disk may result from:

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

Disk and/or disk drive cleaning should only be done after a read/write failure or when the customer notices a loss of performance. You must determine that the read/write failure was not caused by a definite hardware failure.

In the case of a read failure, contamination may be the cause and cleaning might be the only way to get the customer's data back. Contamination might also be causing the loss of performance. In this second case, a few minutes spent cleaning may prevent an unncecessary service parts replacement 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 the disks/disk drives:

- place the Autochanger away from high-traffic areas
- do not leave the disk in the drive for extended periods unless required by the application
- do not place the Autochanger in a "dirty" environment (examples [real]: coal mine, railroad maintenance yard)

On an otherwise working drive, check to see that the library is at the current firmware code level and that all applicable service notes have been done. If these are in order, contamination *could* be a cause and there is more of a reason to try cleaning.

Note

If the problem appeared as loss of performance and cleaning a disk cleared 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 the disk should be stored, the disk reformatted, and the data restored back on the disk.

Cleaning Tools Available

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

Extra swabs and alcohol are in the Optical Disk Cleaner Accessory Kit (C1700-88801). This kit be ordered at the same time as the Optical Disk Cleaning Kit.

The objective lens in an optical drive may be cleaned with the Optical Disk Lens Cleaning Cartridge (C1700-88802). A lens may be cleaned in five quick insertions with this cleaning cartridge. Instructions are included.

5

Diagnostics

5.1 Running Diagnostic Tests

An extensive set of diagnostic tests are available for the optical 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 mechanism moves to check out elementary functions.

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

Mechanism Core Tests (50 - 69) run basic tests of the Autochanger mechanism. These tests make combinations of moves that can help to detect the source of failures.

Procedure

To display test information and to choose tests to execute, access the **TEST** option using the following steps.

1. With the Autochanger power on and in the **READY** state, press [OPTION]. **TEST** * displays.
2. Press [ENTER]. **TEST 0** displays.
3. Press [NEXT] or [PREV] until the test number you want shows in the display.
4. Press [ENTER] to choose the test. **ONCE** displays. You may accept **ONCE** by pressing [ENTER] or press [NEXT] or [PREV] to choose **10**, **100**, **1000**, or **LOOP** times. **LOOP** runs the test continuously until [CANCEL] is pressed or the operation switch is placed to standby.

Note Any test may be stopped, at any time, by pressing [CANCEL]. The unit will stop the test after it completes its current activity.

---

5. Once you have pressed [ENTER] for the number of times the test will repeat, **RUN nn** displays.
6. At this point the test runs. If no problems are encountered, the message **PASS nn** displays. You may press [OPTION] to get back to the **READY** state; or, you may press [ENTER] or [CANCEL] to run another test.

   If a problem occurs during the test, the message **FAIL nn** displays. Press [ENTER] to gain information about the failure. An **ERROR nn** displays. The Error Log stores the FRU information, TEST nn information, and a time stamp.

5.2 Diagnostic Test Command Descriptions

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

Sequence Tests

Table 5-1. 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 —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 5-1. 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 and motor 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

Exerciser Tests

Table 5-2. 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. Needs one loaded cartridge, drives and mailslot empty.
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.
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

Table 5-2. Exerciser Tests (continued)

No.	Test Name	Description
		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.
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 0s.

Table 5-2. Exerciser Tests (continued)

No.	Test Name	Description
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.
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 5-3. 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 Find Home sequence is run when this test finishes.
31	ROM Checksum Test	Does a checksum verification of the ROM.
32	RAM Checksum Test	A checksum of the "Controlled" area of RAM is kept on a continuous basis. This test verifies that the checksum is still valid.
33	Non-Destructive RAM Test	Tests all the Controller's RAM, checking for data acceptance and retention. The test is non-destructive unless interrupted by power failure. To run correctly, this test must shut down the servo system; as a result, a Find Home sequence runs when this test finishes.
34	SCSI Interface Controller Chip Test	Checks out operations of the SCSI interface controller chip. This test will not be run if initiated via SCSI, 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; on pre-RSE models,a Find Home sequence runs when this test finishes.

Table 5-3. 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 then 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 FEH `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 5-3. 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.
65	Calibrate Magazines	Calculates the offset for each storage slot magazine. This test should be run on an empty Autochanger. The Autochanger requires a disk in the Mailslot.
66	Clear Magazine Offset	Clears the value calculated in Test 65.

Table 5-3. Electronic Core Tests (continued)

No.	Test Name	Description
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 to 80	Reserved	For design/production use only.

Diagnostics Quick Reference Table

The following table summarizes the diagnostic tests.

Table 5-4. Diagnostics Quick Reference Table

(Test #) Description	*Type	Number of Para-meters	Used in Sequence	FRUs tested
(1) Poweron Test	S	0	2	many
(2) Wellness Test	S	0	-	many
(3) Controller Test	S	0	1	1
(5) Initialize Mechanism	S	0	1	many
(10) Initialize Element Status	E	0	-	-
(11) Mechanism Exerciser	S,E	0	2	-
(12) Carriage/Picker Move Test	E	0	11	-
(13) Translate Exerciser	E	0	11	-
(14) Flip Exerciser	E	0	11	-
(15) Slot Exerciser	E	0	11	-
(16) Drive Exerciser	E	0	11	-
(17) Mailslot Exerciser	E	0	11	-
(18) Set Speed Factor	M	1	-	-
(19) Zero Maximum Force Log	M	0	-	-
(20) Set Speed Factor to Full Speed	M,P	0	-	-

Table 5-4. Diagnostics Quick Reference Table (continued)

(Test #) Description	*Type	Number of Parameters	Used in Sequence	FRUs tested
(21) Set Speed Factor to Half Speed	M	0	-	-
(22) Set Speed Factor to Quarter Speed	M	0	-	-
(23) Shipping	E	0	-	-
(24) Fill Picker Exerciser	E	0	-	-
(25) Empty Picker Exerciser	E	0	-	-
(26) Zero Runtime Log	M	0	-	-
(27) Set Minimum Retries	M	0	-	-
(28) Set Default Retries	M,P	0	-	-
(29) Zero Error Log	M	0	-	-
(30) Microprocessor Test	T,P	0	3,60	1
(31) ROM Checksum	T,P	0	3,60	37
(32) RAM Checksum	T,P	0	3	1
(33) Non-destructive RAM	T,P	0	3,60	1
(34) SCSI Interface IC Test	C,P	0	3	1
(35) Timer IC Test	T,P	0	3,60	1
(36) Motor IC Test	T,P	0	3,60	1
(37) Drive Connect	T,P	0	3	1,63
(38) Control Panel Light	C,P	0	1	22,56
(39) Control Panel Button	C	0	-	22,56

Table 5-4. Diagnostics Quick Reference Table (continued)

(Test #) Description	*Type	Number of Para- meters	Used in Sequence	FRUs tested
(40) Power Supply Test	T,P	0	1,60	28
(41) SCSI Loopback	C	0	-	1
(42) Optical Sensor Test	C	0	-	-
(43) Mailslot Sensor Test	C	0	-	-
(50) Find Home Sequence	T,P	0	5,60	Many
(51) Carriage/Picker Assy Calibration	T,P	0	50	30,31
(60) FRU Isolation Test	S	0	-	Many
(65) Calibrate Magazines	E	0	-	-
(66) Clear Magazine Offset	M	0	-	-
(67) Calibrate Mailslot	E	0	-	-
(68) Clear Mailslot Offset	M	0	-	-
(70) Reserved for design	-	-	-	-
(71) Reserved for design	-	-	-	-
(72) Reserved for design	-	-	-	-
(80) Reserved for design	-	-	-	-

*** Type**

Test
- C - Check (no SCSI access)
- E - Exerciser (no FRUs or error codes)
- M - Modify parameter
- S - Sequence of other tests
- T - Test

Poweron
- P - used at poweron

5.3 Error Identification

Information Returned by the Request Sense Command

When the Request Sense Command is issued through the SCSI interface after an error condition has occurred, the following information can be used to select the appropriate type of recovery procedure.

Table 5-5. Request Sense Data Parameter Block Format

Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code (70H or 71H)						
1	Reserved (0)							
2	Reserved (0)				Sense Key			
3-6	Reserved (0)							
7	Additional Sense Length (n - 7)							
8-11	Reserved (0)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Reserved (0)							
15	SKSV	Sense Key Specific						
16-17	Sense Key Specific							
18-77	Additional Sense Bytes							

Valid	Always 0.
Error Code	Either 70H (current error) or 71H (deferred error).
Sense Key	Valid Sense Key field values are: 0H - No Sense 1H - Recovered Error 2H - Not Ready 4H - Hardware Error 5H - Illegal Request 6H - Unit Attention BH - Aborted Command
Additional Sense Length	Will be 10 for all errors except when Sense Key = 1, or Sense Key = 4, where the Additional Sense Length will be 70.
Additional Sense Code	The Additional Sense Code specifies detailed information related to the error reported in the Sense Key field.
Additional Sense Code Qualifier	The Additional Sense Code Qualifier specifies detailed information related to the Additional Sense Code.
SKSV	If set to 1, this bit indicates that the Sense Key Specific field (bytes 15, 16 and 17) contains valid data.
Sense Key Specific	The definition of this field is determined by the value of the Sense Key field. If the sense key field is set to Illegal Request and the SKSV bit is set to 1, then the Sense Key Specific fields are defined as shown in the next table.
Additional Sense Bytes	This field may contain information when the Additional Sense Length field contains a value greater than 10.

Table 5-6. Sense Key Field = Illegal Request, and SKSV Bit = 1

Byte	7	6	5	4	3	2	1	0
15	SKSV (1)	C/D	Reserved (0)		BPV	Bit Pointer		
16	Field Pointer (MSB)							
17	Field Pointer (LSB)							

C/D — 1 = Illegal Parameter in Command Descriptor Block.
0 = Illegal Parameter in Data Out Phase.

BPV — 1 = Bit pointer field is valid.
0 = Bit pointer field is invalid.

Bit Pointer — Specifies which bit is in error.

Field Pointer — Specifies which byte is in error.

Request Sense Error Code Explanations and Responses

This section identifies each of the error responses for the Request Sense command. The information is grouped according to the Sense Key returned. Within each group, the errors are in Additional Sense Code order.

The following table provides the following information for each error response.

Field Pointer

Only given when applicable. Otherwise the field pointer is 0.

Explanation

An explanation of what the error means and its cause.

Internal state

The state of the Autochanger after the command completes.

Recommended Action

The recommended action to correct the problem.

Table 5-7. Request Sense Data [hexadecimal]

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
00	00	00	10	No Sense (Zero Sense) *Explanation* No Sense information describing an error is pertinent. A Request Sense command was sent when no error was outstanding. *Internal State* This has no effect on the Autochanger. *Recommended Action* No action necessary.
01	00	00	70	Recovered Error (Recovered Move) *Additional Sense Bytes* Nature of move recovery. *Explanation* The previous movement command encountered a mechanical error that was corrected by invoking the error recovery procedures. *Internal State* The movement command has completed successfully. *Recommended Action* Evaluate the Additional Sense Bytes for error log purposes.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
02	04	01	10	Not Ready (Becoming Ready) *Explanation* The Autochanger is in the process of powering on, or recovering from a SCSI reset. *Internal State* The poweron process will be completed. The receipt of a command will have no effect on the Autochanger. *Recommended Action* Continue to send the comma. 1 until this condition is no longer reported.
02	04	02	10	Not Ready (Need to Initialize Element Status) *Explanation* The Element status information must be determined before movement operations can be done. *Internal State* The Autochanger is not capable of any movement. *Recommended Action* Perform the Initialize Element Status command.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
02	04	03	10	Not Ready (Fatal Error) *Explanation* A mechanical problem is impeding the ability for unhindered movement within the Autochanger. It requires human intervention to correct. For example: A cartridge is not completely in the storage element, and therefore in the path of the Medium Transport Element. *Internal State* The Autochanger is not capable of any movement. *Recommended Action* Correct the cause of the problem manually and restart the Autochanger.
02	81	00	10	Not Ready (NVRAM Checksum) *Explanation* Non-volatile RAM checksum failed. *Internal State* The Autochanger is not capable of movement. *Recommended Action* Cycle the operation switch to standby, then ON with the switches set to Initialize Default configuration.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
03				Medium Error This Sense Key will never be returned.
04	15	01	70	Hardware Error (Move Error) *Explanation* The Mechanical system failed during the last movement operation. The Additional Sense Bytes will describe the nature of the failure. *Internal State* Check the Mechanism State Bit Map to determine movement capability. *Recommended Action* Evaluate the Additional Sense Bytes to determine the nature of the failure.
04	40	80	70	Hardware Error (Diagnostic Failure) *Explanation* The test specified in the previous Send Diagnostic command failed. *Internal State* Check the Mechanism State Bit Map to determine movement capability. *Recommended Action* Evaluate the Additional Sense Bytes to determine the nature of the failure.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
04	42	00	70	Hardware Error (Poweron Selftest Failure) *Explanation* An error was detected during the Poweron selftest. The Additional Sense Bytes will describe the nature of the error. This error will be reported for each subsequent SCSI command received. *Internal State* Check the Mechanism State Bit Map to determine movement capability. *Recommended Action* Evaluate the Additional Sense Bytes to determine the nature of the failure.
05	1A	00	10	Illegal Request (Invalid Parameter List Length) *Explanation* A command with Data Out as a parameter list has been received with invalid parameter list length. Reserve Command - Parameter List Length is not divisible by 6. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	20	00	10	Illegal Request (Unsupported Command) *Explanation* A SCSI command that is not supported by the Autochanger has been received. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending unsupported commands.
05	21	01	10	Illegal Request (Invalid Element Address) *Explanation* A Read Element Status command has been received that specifies the use of an element that does not exist or is of the wrong type. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	21	01	10	Illegal Request (Invalid Transport Element) *Field Pointer* 02 *Explanation* The Transport Element Address specified does not exist. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.
05	21	01	10	Illegal Request (Invalid Source Element) *Field Pointer* 04 *Explanation* The Source Element Address specified does not exist. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	21	01	10	Illegal Request (Invalid Destination Element) *Field Pointer* 06 *Explanation* The Destination Element Address specified does not exist. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.
05	21	01	10	Illegal Request (Invalid Second Destination Element) *Field Pointer* 08 *Explanation* The Second Destination Element Address specified for the Exchange Command does not exist. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	22	00	10	Illegal Request (Illegal Function) *Explanation* The Command with the parameters requested can not be done by the Autochanger. For example: A move from the Medium Transport Element to the Import/Export Element. *Internal State* No action has been taken within the Autochanger. *Recommended Action* Refer to Mode Sense Page 1FH for a description of the Move and Exchange capabilities of the Autochanger. Determine why the host has sent a command beyond these capabilities.
05	24	00	10	Illegal Request (Illegal Field In CDB) *Explanation* A SCSI command was received with one or more invalid bits in the Command Descriptor Block. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	25	00	10	Illegal Request (Invalid LUN) *Explanation* A SCSI command was received indicating an unsupported Logical Unit Number. If the Identify Message Out was sent after selection, the LUN was contained within it. If the Identify Message Out was not received, the LUN was in the second byte of the CDB. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.
05	26	00	10	Illegal Request (Invalid Parameter List) *Explanation* A command with Data Out as a parameter list has been received with invalid data. Send Diagnostic Command - Parameter List Length is not between 2 and 10. Write Buffer Command - Parameter List Length is not 10.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
				Internal State This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending incorrect commands.
05	3B	0D	10	Illegal Request (Transport Full) *Field Pointer* 02 *Explanation* The Transport specified to be used for this operation already contains a cartridge. *Internal State* This has no effect on the Autochanger. *Recommended Action* Place the cartridge in the transport into a Storage Element and repeat the command.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	3B	0D	10	Illegal Request (Destination Full) *Field Pointer* 06 *Explanation* The Destination Storage Element specified to be used for this operation already contains a cartridge. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is trying to place a cartridge into a full slot, and correct the situation.
05	3B	0D	10	Illegal Request (Exchange Second Destination Full) *Field Pointer* 08 *Explanation* The Second Destination Storage Element specified to be used for this operation already contains a cartridge. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is trying to put a cartridge into a full slot, and correct the situation.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	3B	0E	10	Illegal Request (Source Empty) *Field Pointer* 04 *Explanation* The Source Storage Element specified to be used for this operation does not contain a cartridge. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is trying to remove a cartridge from an empty slot, and correct the situation.
05	3B	0E	10	Illegal Request (Exchange First Destination Empty) *Field Pointer* 06 *Explanation* The First Destination Storage Element specified to be used for this operation does not contain a cartridge. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is trying to remove a cartridge from an empty slot, and correct the situation.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
05	3D	00	10	Illegal Request (Invalid Identify Message In) *Explanation* A Reserve bit is set in the Identify Message In. *Internal State* This has no effect on the Autochanger. *Recommended Action* Determine why the host is sending an invalid Identify message.
06	29	00	10	Unit Attention (Power on sense) *Explanation* Either the Autochanger has just powered up, or it has received a SCSI reset or SCSI Bus Device Reset Message. *Internal State* The Autochanger has calibrated the mechanism and is in a known power up state. *Recommended Action* Re-try the command.
07				Data Protect This Sense Key will never be returned.
08				Blank Check This Sense Key will never be returned.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
09				Vendor Unique This Sense Key will never be returned.
0A				Copy Aborted This Sense Key will never be returned.
0B	43	00	10	Aborted Command (Message Parity Error) *Explanation* The Autochanger received the Message Parity Error message from the initiator. *Internal State* If the message was received before the completion of the operation (during Disconnect Message In), the operation will be cancelled. If the message was received after completion of the operation (during Identify Message In or Command Complete Message In) the operation will be successful. *Recommended Action* Diagnose why the initiator is sending an Message Parity Error Message Out.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
0B	45	00	10	Aborted Command (Reselection Timeout Error) *Explanation* The Autochanger attempted to reselect the initiator unsuccessfully. *Internal State* The command completed although SCSI status was not sent. *Recommended Action* Diagnose why the initiator is not responding to re-selection.
0B	47	00	10	Aborted Command (Parity Error) *Explanation* A parity error on the SCSI bus has been detected by the Autochanger during an Information Transfer Out. *Internal State* The command is aborted. The Autochanger is returned to the state it was in prior to the command. *Recommended Action* Diagnose the cause of the SCSI bus parity error.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
0B	48	00	10	Aborted Command (Initiator Detected Error) *Explanation* The Autochanger received the Initiator Detected Error message from the initiator. *Internal State* If the message was received before the completion of the operation (during Data In), the operation will be cancelled. If the message was received after completion of the operation (during Status), the operation will be successful. *Recommended Action* Diagnose why the initiator is sending an Initiator Detected Error Message Out.
0B	4B	00	10	Aborted Command (Data Phase Error) *Explanation* A data phase error was detected. *Internal State* The command will be aborted. *Recommended Action* Retry command.

Table 5-7. Request Sense Data [hexadecimal] (continued)

Sense Key	Addit. Sense Code	Addit. Sense Code Qu'l'fier	Addit. Sense Length	Description
0B	4E	00	10	Aborted Command (Bus Protocol Error) *Explanation* A second command has been received from an initiator while the Autochanger was disconnected and operating on a first command from the same initiator. *Internal State* Both commands will be aborted. *Recommended Action* Determine why the host is sending a second command before receiving status from the first.
0C				Equal This Sense Key will never be returned.
0D				Volume Overflow This Sense Key will never be returned.
0E				Miscompare This Sense Key will never be returned.

Additional Sense Data Format for Error Recovery. The following is a description of the 60 Additional Sense Bytes returned during the Data In phase of the Request Sense Command from the Autochanger. The overall layout of the data is presented first, followed by a description of each byte.

Table 5-8. Additional Sense Data

Byte	7	6	5	4	3	2	1	0
18	Move Error Code							
19	Hardware Error Code							
20	First FRU							
21	Second FRU							
22	Third FRU							
23	Mechanism State Bit Map							
24-25	Reserved (0)							
26	Retry Algorithm Bit Map							
27	Retry Count							
28-29	Reserved (0)							
30	Recovery Algorithm Bit Map							
31	Recovery Count							
32-34	Reserved (0)							
35	Source Element Bit Map							
36-37	Source Element Number							
38	Destination Element Bit Map							
39-40	Destination Element Number							

Table 5-8. Additional Sense Data (continued)

Byte	7	6	5	4	3	2	1	0
41	Secondary Source Element Bit Map							
42-43	Secondary Source Element Number							
44	Second Destination Element Bit Map							
45-46	Second Destination Element Number							
47	Reserved (0)							
48	Reserved (0)							
49	Reserved (0)							
50-55	Original Failure Micro-Move ID History							
56	Micro-Move Error Code							
57-60	Y Input Position (not decoded for service use)							
61-64	Y Output Position (not decoded for service use)							
65-68	Z Input Position (not decoded for service use)							
69-72	Z Output Position (not decoded for service use)							
73-77	Reserved (0)							

Explanation of Additional Sense Data Fields

Move Error Code The movement in progress when the error occurred.

Hardware Error Code The error code determined by fault isolation to indicate the cause of the failure.

An FRU list is located under "Replaceable Parts" in Chapter 8.

First FRU The most likely Field Replaceable Unit to be the cause of the failure.

Second FRU The second most likely Field Replaceable Unit to be the cause of the failure.

Third FRU The third most likely Field Replaceable Unit to be the cause of the failure.

Mechanism State Bit Map The state of the Autochanger after the termination of the retry or recovery algorithms. This byte is bit mapped as shown below from Most Significant Bit (7) to Least Significant Bit (0):

(7)Move Capability	A "1" in this bit indicates the Autochanger is capable of performing movement commands.
(6)Last SCSI State	A "1" in this bit indicates the Autochanger has successfully returned the cartridges to the state that they were in before the command which failed was executed.
(5)Reduced Performance	A "1" in this bit indicates the Autochanger is operational, but the performance of the system has been reduced out of necessity in an effort to maintain functionality. This capability is currently not implemented.
(4)Position Lost	A "1" in this bit indicates the Autochanger is not capable of calibrating the mechanism and has therefore lost the position of the Transport Element.
(3)Cartridge In Transport	A "1" in this bit indicates a cartridge is in the Transport Element. The transport was either unexpectedly full, or a cartridge remained in it after an attempt to recover from a failure. If the latter is true, the Source Element Bit Map bytes will indicate which cartridge is in the transport.

(2)Reserved	Not currently used.
(1)Reserved	Not currently used.
(0)Reserved	Not currently used.

Reserved This space is not usable by the host. Reserved bytes may not be 0. This space may contain diagnostic information useful to the Autochanger designers.

Retry Algorithm Bit Map This byte will be bit mapped to indicate which of the retry algorithms were invoked in the attempt to complete the operation as shown below from Most Significant Bit (7) to Least Significant Bit (0):

(7)Drive Insertion Retry	More than one attempt was needed to insert the cartridge into the drive.
(6)Drive Eject Retry	More than one attempt was needed to eject the cartridge from the drive.
(5)Picker Recovery	The Picker fingers were fully retracted after a failure.
(4)Carriage Assembly/Picker Recovery	The Picker fingers were fully retracted after a failure and the translate pin is engaged.
(3)Reserved	Not currently used.
(2)Reserved	Not currently used.

(1)Blind Find Home	The Find Home algorithm was invoked while the optical sensors were inoperable. An attempt is made to clear the paths.
(0)Find Home Recovery	The Find Home algorithm was invoked to locate the mechanical home position and recalibrate the mechanism.

Retry Count The total number of retry attempts done.

Recovery Algorithm Bit Map This byte will be bit mapped to indicate which of the recovery algorithms were run in the attempt to recover the state of the Autochanger after the exhaustion of the retries. This bit map is the same as for "Retry Algorithm Bit Map" on the preceding page.

Recovery Count The total number of recovery attempts that were performed.

Source Element Bit Map This byte indicates the status of the element that was the specified Source Element of the Move or Exchange command after the failure or retry, as well as the status of the Element itself. This byte is bit mapped as shown below from Most Significant Bit (7) to Least Significant Bit (0):

(7)Valid	A "1" in this bit indicates the values in this byte and the Element Number byte are valid. A zero indicates the remainder of this byte and the Element Number are invalid.
(6)Error Enroute	An error occurred while the transport mechanism was enroute to this element.
(5)Cartridge in Transport	After the exhaustion of all recovery algorithms, a "1" in this bit indicates the cartridge that was originally in this element has remained in the Transport.

(4)Cartridge in Element	After the exhaustion of all recovery algorithms, a "1" in this bit indicates the cartridge associated with this move is in this element.
(3)Unexpectedly Empty	A "1" in this bit indicates the absence of a cartridge from this element when the Autochanger expected one should be there.
(2)Unexpectedly Full	A "1" in this bit indicates the presence of a cartridge in this element when the Autochanger expected it to be empty.
(1)Media Inverted	The cartridge is inverted from its state before the operation began.
(0)Element Required Retry	A "1" in this bit indicates an operation into or out of this element required one or more retry algorithms to be run.

Source Element Number The Element Number the Source Element Bit Map data is referring to.

Destination Element Bit Map This byte indicates the status of the element that was the Destination Element of a Move or First Destination Element of the Exchange Command after the failure/retry of the command. This byte is bit mapped as described in the 'Source Element Bit Map'.

Destination Element Number The Element Number the Destination Element Bit Map data refers to.

Secondary Source Element Bit Map This byte indicates the status of the element that was the source (First Destination Element) of the first move of exchange after the failure/retry of an Exchange Medium command. The 'Valid' bit in this byte will only be set during the Exchange Medium command. This byte is bit mapped as described in the 'Source Element Bit Map'.

Secondary Source Element Number The Element Number that the Secondary Source Element Bit Map data refers to.

Second Destination Element Bit Map This byte indicates the status of the element that was the destination of the first move of an exchange after the failure/retry. The 'Valid' bit in this byte will only be set during the Exhange Medium command. This byte is bit mapped as described in the 'Source Element Bit Map'.

Second Destination Element Number The Element Number the Second Destination Element Bit Map data refers to.

Original Micro-Move ID History The last 6 Autochanger Micro-Move IDs for the original movement command prior to the failure. The sixth byte (49) will be the Micro-Move ID that encountered the failure.

Micro-Move Error Code The error code associated with the Micro-Move ID that failed.

***** The following are not decoded for field use*

Y Input Position The intended Carriage motion axis encoder position.

Y Output Position The actual Carriage motion axis encoder position.

Z Input Position The intended z-axis encoder position.

Z Output Position The actual z-axis encoder position.

Micro-Move ID and Macro-Move ID Tables

Table 5-9. 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 5-9. 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 using short steps; look for drive to accept the 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.
23	Move fingers toward mailslot; with intent to grab cartridge.
24	Detect cartridge in mailslot before grab.

Table 5-9. Micro-Move IDs (continued)

ID (hex)	Description
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.
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.

Table 5-9. Micro-Move IDs (continued)

ID (hex)	Description
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).
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.

Table 5-9. Micro-Move IDs (continued)

ID (hex)	Description
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.
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.

Table 5-9. Micro-Move IDs (continued)

ID (hex)	Description
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.
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.

Table 5-10. Macro-Move IDs

ID (hex)	Description
0	Move Medium or Exchange Medium commands. Non-leadscrew side of Picker facing mailslot end.
1	Initialize element status command. Non-leadscrew side of Picker facing mailslot end.
2	Position to element command (Seek). Non-leadscrew side of Picker facing mailslot end.
3	Mailslot rotation function. Non-leadscrew side of Picker facing mailslot end.
80	Move Medium or Exchange Medium commands. Leadscrew side of Picker facing mailslot end.
81	Initialize element status command. Leadscrew side of Picker facing mailslot end.
82	Position to element command (Seek). Leadscrew side of Picker facing mailslot end.
83	Mailslot rotation function. Leadscrew side of Picker facing mailslot end.

Hardware Error Codes

If an error is unrecoverable (i.e., something is broken or jammed beyond recovery without manual intervention), the Autochanger will take an additional step of attempting to identify the FRU that is causing the failure. A routine that performs a process of elimination for various FRUs is invoked automatically. It attempts to isolate the error to three or less FRUs. If no error can be found (or if error recovery was made), the unit will return a "no error" status. If an error is found, a Hardware Error Code is returned when the command completes. Up to three FRUs will be returned to guide service in replacement priority. The Hardware Error Codes are listed in the following table.

An **asterisk** is placed after every test that is explained further in "Additional Description of Some Hardware Error Codes", following the table.

Table 5-11. Hardware Error Codes

Error Code (hex.)	Failure Description
AUTOCHANGER CONTROLLER PCA ERROR CODES	
00	No error
01	ROM checksum error
03	RAM test error
04	Microprocessor test error
05	Controlled area of RAM checksum error*
09	Firmware error*
0A	Controller PCA error*
SCSI INTERFACE-SPECIFIC ERROR CODES	
0B	SCSI controller register error
0C	SCSI controller IC's RAM failed
0D	SCSI controller message error
0E	SCSI controller command error
0F	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
LOOPBACK ERROR CODES	
18	SCSI connector loopback error in DBO or I/O
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 5-11. Hardware Error Codes (continued)

Error Code (hex.)	Failure Description
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
MULTI-FUNCTION PERIPHERAL IC ERROR CODES	
29	RS-232 loopback data did not match what was sent
2A	Timed out waiting for RS-232 loopback data
2B	Timer A did not count down as expected
MOTOR CONTROL IC ERROR CODES	
2C	Failed read\write test to Motor control IC
2D	Motor control IC loopback test failed
2E	Motor control IC RAM test failed
POWER SUPPLY ERROR CODES	
33	Low voltage power supply failed
34	High voltage power supply failed
DRIVE CONNECT ERROR CODES	
38	Drive 1 not connected
39	Drive 2 not connected
MECHANISM ERROR CODES	
3C	Unspecified mechanical failure
3E	Unspecified servo failure
40	Unable to free the Picker fingers in preparation for Carriage motion
41	Unable to verify that the Picker is at the Home position during Find Home sequence (non-leadscrew side)

Table 5-11. Hardware Error Codes (continued)

Error Code (hex.)	Failure Description
43	Picker fingers met resistance during retraction*
44	Carriage motion failure during Find Home sequence*
45	Unable to free the Picker fingers in preparation for translate motion*
46	Carriage motion failed while initializing Home position during Find Home sequence*
47	Translate failed while moving towards non-leadscrew side during Find Home sequence*
48	Carriage motion failed during Carriage/Picker assembly calibration (leadscrew side)*
49	Carriage motion failed during Carriage/Picker assembly calibration (non-leadscrew side)*
4A	Motion error while determining orientation of the Picker
4B	No sensor found* (V4.2 code only)
4C	Failed flip motion during the Find Home sequence* (V4.5 code)
4D	Motion error while checking for cartridge in the Picker
4E	Unable to measure height of sensor on left side
4F	Unable to measure height of sensor on right side
50	Excessive tilt of the Carriage/Picker assembly (away from the drives)*
51	Excessive tilt of the Carriage/Picker assembly (toward the drives)*
52	Excessive cone angle on Picker*
53	Excessive stack tilt*
54	Unable to complete an interrupted move at power up*
EXERCISER TEST ERROR CODES	
55	Unable to find top of unit
56	Need to issue Initialize Element Status Command

Table 5-11. Hardware Error Codes (continued)

Error Code (hex.)	Failure Description
57	Invalid test configuration
59	Exerciser unrecovered error
5A	Invalid test configuration (elements reserved)
5B	Initialize Element Status command failed
5C	Shipping Diagnostic run with cartridges in the mechanism
CALIBRATION SENSOR SYSTEM ERRORS	
60	Optical sensor failed (leadscrew side)
61	Optical sensor failed (non-leadscrew side)
MAILSLOT/STORAGE SLOT ERROR CODES	
B0	Mailslot will not rotate
B1	Inside Mailslot sensor failed
B2	Mailslot will not accept or release cartridge
B3	Storage slot will not accept or release cartridge
B4	Outside Mailslot sensor failed
DRIVE ERROR CODES	
B8	Drive 1 access error*
B9	Drive 2 access error*
BC	Drive 1 access error*
BD	Drive 2 access error*
FRU DETECTION TEST ERROR CODES	
C8	Unable to gain proper servo control of the motors*
C9	Unable to move the Picker motor
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*

Table 5-11. Hardware Error Codes (continued)

Error Code (hex.)	Failure Description
CD	Unable to find a hard stop while turning the Carriage motor*
CE	Excessive force required to move the Carriage leadscrew
MISCELLANEOUS ERROR CODES	
FA	Invalid switch configuration*
FC	The test can only be run from the Front Panel
FD	The test can only be run from the SCSI interface
FE	The test did not run, probably a configuration error
FF	Invalid test number

Additional Description of Some Hardware Error Codes

Most of the single line descriptions of the Hardware Error Code table are self-explanatory. The following Hardware Error Codes require further clarification:

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. If this error occurs, 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.

0A	Controller PCA error The Autochanger Controller PCA has a critical failure. Reorder the PCA.
43-4C	See Chapter 4 "Troubleshooting" 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 If the drive will not eject a cartridge and the Element Status claims that the cartridge exists, then the failure will be "Source Unexpectedly Empty". It is not possible to differentiate between a dead drive and an "Unexpectedly Empty" drive. If the Autochanger cannot get a drive to accept a cartridge, then the above errors are to be expected.
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.
FA	Invalid switch configuration The switches on the Controller PCA are set incorrectly for this configuration.

Move Errors

Table 5-12. Move Error Codes

Error Code (hex)	Failure Description
00H	Failure occurred before any servo-controlled motions were attempted during Poweron Selftest.
02H	Failure while Picker is not moving.
04	Failure while moving the Carriage/Picker assembly away from drives.
06	Failure while moving the Carriage/Picker assembly toward drives.
08	Failure while flipping the Picker.
0A	Failure while translating the Picker assembly.
0E	Failure while moving the Picker fingers back in preparation to translate.
10	Failure while moving the Picker fingers to engage the cartridge from the source storage element.
12	Failure while moving the Picker fingers back to remove the cartridge from the source storage element.
18	Failure while moving the Picker fingers forwards to insert a cartridge in the destination storage element.
1A	Failure while moving the Picker fingers back after inserting a cartridge in the destination storage slot.
20	Failure while moving the Picker fingers forwards to engage the cartridge ejected from the drive (source).
22	Failure while moving the Picker fingers back to remove the cartridge from the drive (source).

Table 5-12. Move Error Codes (continued)

Error Code (hex)	Failure Description
28	Failure while moving the Picker fingers forwards to insert the cartridge into the drive (destination).
2A	Failure while moving the Picker fingers back after inserting a cartridge into the drive (destination).
30	Failure while moving the Picker fingers forward to engage the cartridge in the mailslot (source).
32	Failure while moving the Picker fingers back to remove the cartridge from the mailslot (source).
38	Failure while moving the Picker fingers forward to insert the cartridge in the mailslot (destination).
3A	Failure while moving the Picker fingers back after inserting the cartridge in the mailslot (destination).
40	Failure while rotating the mailslot actuator inward.
42	Failure to ensure that the mailslot rotated inward.
48	Failure while rotating the mailslot actuator outward.
4A	Failure to ensure that the mailslot rotated outward.
50	Failure while the finding the home position.
52	Failure while calibrating the Carriage/Picker assembly.
60	Initializing element status failed while testing an element with a cartridge in the Picker assembly.
80	Failure to remove a cartridge from a source element.

Table 5-12. Move Error Codes (continued)

Error Code (hex)	Failure Description
84	Failure to leave a cartridge properly in a destination element.
88	An obstruction was encountered before the cartridge had been inserted the proper distance.
90	Source element unexpectedly empty.
94	Destination element unexpectedly full.
A0	Front mailslot sensor failed.
A2	Inside mailslot sensor failed.
A4	Drive light stuck on.
B0	Door interlock open.

Micro-Move Error Codes

Table 5-13. Micro-Move Error Codes

Error Code (hex)	Description
0	No error.
1	Carriage motor drive voltage exceeded limit set by firmware.
2	Carriage motor overcurrent detected by hardware.
3	Carriage motor force exceeded limit set by firmware.
4	Picker motor drive voltage exceeded limit set by firmware.
5	Picker motor overcurrent detected by hardware.
6	Picker motor force exceeded limit set by firmware.
11	Calibrate failed.
12	Diagnose FRU failed.
13	Initial recovery failed.
14	Find home failed.
20	Failed to find hard stop at end of flip.
30	Test drive eject failed (currently unused).
31	Failed while checking for cartridge in a drive.
32	Failed to find a hard stop returning cartridge to storage after testing for presence of cartridge.
33	Failed while checking for cartridge in a storage slot.
34	Failed while checking for cartridge in the Picker.
35	Failed while checking for cartridge in the mailslot.
36	Could not free fingers after testing for a cartridge in a drive.
38	Failed to verify that cartridge exists after insert.

Table 5-13. Micro-Move Error Codes (continued)

Error Code (hex)	Description
40	Failed finding the back of storage slot during retraction.
42	Not able to measure the depth of the storage slot.
43	Failed to free fingers from the storage slot.
48	Could not find the back of the storage slot after insert.
49	Failed to verify that a cartridge exists in the storage slot after insert.
4A	Could not free fingers from storage slot after insert.
50	Could not find the back of the mailslot after get.
52	Not able to measure the depth of the mailslot.
58	Could not find the back of the mailslot after insert.
59	Failed to verify that a cartridge exists in the mailslot after insert.
60	Failed to rotate the mailslot in.
61	Failed to rotate the mailslot out.
70	Exhausted retries while attempting to get the drive to eject the cartridge.
71	Could not verify that the drive ejected the cartridge.
72	Could not free fingers from the drive.
78	Exhausted retries attempting to get drive to accept the cartridge.
79	Could not verify that the drive accepted the cartridge.
7E	Inline recovery attempts exhausted.
7F	Errors below here are counted in the runtime log as retries.
80	Errors above here are counted in the runtime log as in-line.

Table 5-13. Micro-Move Error Codes (continued)

Error Code (hex)	Description
90	Drive access was disallowed because drive busy signal was active.
91	Drive light stuck off.
94	Outside mailslot sensor failed.
95	Inside mailslot sensor failed.
96	Mailslot rotation failure; possibly caused by operator.
FA	Test drive insert retry.
FB	Timed out waiting for drive to eject when testing for the presence of a cartridge; retry being attempted.
FC	Retry being attempted on drive insert.
FD	Retry being attempted on drive eject.
FE	Mechanism error.
FF	Unknown Move ID Error.

5.4 Error Recovery

Difficulties During Operation

The following table lists problems that may occur during operation of the Disk Library System.

Task	Problem/Symptom	What to do
Communicating HP-UX <—> Model 20GB/A	Can't get HP-UX Host to recognize the Disk Library System	■ Check to make sure the host kernel is 6.5 or greater. ■ Check to make sure the Disk Library System was installed and configured as described in the "CE Hardware Installation Guide" and the appropriate host configuration guide. ■ Check the SCSI connections. ■ Check the SCSI interface address as it relates to the device files.
Changing drive addresses	Changed drive addresses but new address is not recognized.	After changing an address, the Disk Library System operation switch must be cycled for the address to be recognized.

Task	Problem/Symptom	What to do
Inputting Password	Password forgotten or misplaced for the Disk Library System	First, try the default password (0-0-0). If the default does not give results, remove the battery from the AC Controller PCA, wait about 10 minutes, and re-install the battery. During that time, hold the terminal clips of the battery together for one minute (see chapter and section 8.12, "Removing the Autochanger Controller PCA Battery." The customer may then use Config 16 to set a password.
Loading Disks	Disk inserted in mailslot, but the display reads `EMPTY` or `MISLOAD`.	Press CANCEL and try inserting the disk in the mailslot again. Push the disk all the way in.
Powering On	Disk Library System won't poweron.	■ Check to make sure the power cord connections are tight. ■ Check to make sure the power outlet is operating. ■ Replace the fuse with a new one. ■ Replace the power cord with a known good one. ■ Replace the Power Supply Module.

Task	Problem/Symptom	What to do
	Poweron selftest fails.	Cycle the operation switch to standby, then ON. Observe the poweron test result. If the unit continues to fail, use the error code to begin troubleshooting.
	Does not boot correctly.	Make sure the boot disk is ON, spun up, and ready before applying power to the host computer. After doing this, the operation switch on the Autochanger may be placed to ON and the host may be powered on (in any order).
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.
	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 Chapter 3, "3.3 Autochanger Configuration Choices" and "3.4 Operation of the Control Panel" 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	No display messages appear.	■ Check power cord connected. ■ Check AC input. ■ Check the fuse. ■ Check Control Panel cable connections. ■ Replace Control Panel PCA. ■ Replace AC Controller PCA. ■ Replace Power Supply Module.
Reading/Writing Magneto-Optical Disks	Can't write to the disk.	■ Check the HP-UX 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.

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 cycling the operation switch. If successful, use the file system check (**fsck**) command. ■ If poweron is unsuccessful, place the operation switch to standby, the power switch on the rear panel to OFF, and pull the power plug on the unit. *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 "Powering On" earlier in this table.

Recovery from Use of the Emergency Eject Tool (Rackmount Option)

Note

Use of the Emergency Eject Tool on drives mounted on their side can cause a false "failure" indication.

The following procedure will prevent lost time troubleshooting a good drive.

Some additional steps are necessary if recovery from a failed disk eject is done on a rackmount version of the Disk Library System.

If you ejected the disk because the drive actually failed, there is no problem, you will be replacing the drive with a new one. But if you eject a disk from a good drive, perhaps during other service procedures, the drive will appear to be defective when you attempt normal disk unload operation.

RECOVERY:

1. Use the OPUTIL or ACDIAG+ diagnostic to determine which slot the cartridge came from. Also determine if the cartridge was flipped during its transport.
2. Move the Picker away from in front of the drive by pressing LOAD and then ENTER (do not specify a slot number). The Picker will move to the mailslot and stay there.
3. Place the operation switch to standby and the power switch on the rear panel to OFF. Remove the power plug.
4. a) If a Deskside unit, remove the top cabinet cover and then the top access cover on the chassis to gain access to the chassis interior.

   b) If a Rackmount unit, slide the Autochanger out to the service position in front of the rack. Remove one of the chassis access panels.

Caution

Note which side the "A" side of the disk faces when it comes out of the drive.

The disk must be correctly replaced into the drive after this procedure to prevent corruption to the file system.

5. Use the Emergency Eject Tool to eject the cartridge. Note which way Side A faces as you take the disk from the drive.
6. Replace the cartridge in its correct slot with the correct orientation.

IF THE DRIVE IS NOT DEFECTIVE—NO REPLACEMENT—GO TO STEP 10.

7. Replace the drive using procedures in Chapter 8, subsection 8.4 "Removing the MO Drives." RETURN TO THIS POINT WHEN THE NEW DRIVE IS INSTALLED.
8. Apply power.
9. Using a scratch cartridge, load the cartridge into the mailslot and select drive (x), (the replaced drive). Cycle the loading and unloading of the cartridge to the mailslot a couple of times. Remove the scratch cartridge from the mailslot when through.
10. Replace the chassis access panel and the top cover. Stop here.

IF THE DRIVE WAS GOOD—NOT REPLACED—

11. Apply power to the Autochanger.
12. After the Autochanger powers up and displays READY, insert a scratch cartridge into the drive.

    The drive should accept and then immediately eject the cartridge. This action resets the internal ejection mechanisms.
13. Insert the cartridge once again into the drive.

    The drive should accept and retain the cartridge.
14. Push the Drive Eject Button. The drive should eject the cartridge normally.

    If the drive does NOT eject the cartridge, the loader motor has probably failed. Replace the drive (procedures for replacing the drive are in Chapter 8, subsection 8.4, "Removing the MO Drives." Then complete steps 15 to 17.

    If the drive ejects the cartridge, do Steps 15 to 17.

15. Using a scratch cartridge, load the cartridge into the mailslot and select drive (x), (the replaced drive). Cycle the loading and unloading of the cartridge to the mailslot a couple of times. Remove the scratch cartridge from the mailslot when through.
16. Replace the access cover.
17. Slide the Autochanger back into the rack.

Recovery from Hardware Errors

When a hardware failure occurs you will see a message displayed on the Control Panel. If the failure occurred during the poweron sequence, you will see `FAIL 1`. If the failure occurs at some other time, you may see `MISLOAD` or `FAIL 0`. If a failure occurs while you are running a test, you will see `FAIL #`, 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.

The following table shows the hardware error codes possible.

Note Refer to Chapter 4, "Troubleshooting," for an explanation of how these error codes aid troubleshooting.

Table 5-14. Recovery Procedures for Specific Hardware Errors

Error Code (hexadecimal)	Recovery Procedures:
00 No error	No action. Error could not be isolated.
AUTOCHANGER CONTROLLER PCA ERROR CODES	
	The first step is to make sure the Autochanger Controller PCA is firmly seated.
01 ROM Checksum Error	Run Test 31—ROM Checksum Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
03 RAM Test Error	Run Test 33—RAM Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
04 Microprocessor Test Error	Run Test 30—Microprocessor Operation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
05 Controlled Area of RAM Checksum Error	Recycle Power—verify failure. If no error, monitor for re-occurrence. If error repeats— Run Configuration 16—resets default values. Recycle power. If error repeats— Remove battery on the AC Controller PCA for 10 minutes and short battery terminals for one minute. 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). If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
0A Firmware Error	Recycle power—verify failure. If no error, monitor for re-occurrence. If error repeats— Replace Autochanger Controller PCA (FRU 01) Poweron—check fix

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
SCSI INTERFACE-SPECIFIC ERROR CODES	
	Visual inspection is not possible for errors 0B to 13.
0B SCSI Controller Register Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
0C SCSI Controller IC's RAM Failed	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
0D SCSI Controller Message Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
0E SCSI Controller Command Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14. Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
0F SCSI Controller Kill Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
10 SCSI Controller FIFO Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
11 SCSI Controller Target Sequence Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
12 SCSI Controller Com'nd Sequence Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
13 SCSI Controller Status Sequence Error	Run Test 34—SCSI Interface Controller Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
18 SCSI Connector Loopback Error in DBO or I/O	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
19 SCSI Connector Loopback Error in DB1 or C/D	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
1A SCSI Connector Loopback Error in DB2 or MSG	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
1B SCSI Connector Loopback Error in DB3 or REQ	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
1C SCSI Connector Loopback Error in DB4 or ACK	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
1D SCSI Connector Loopback Error in DB5 or ATN	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
1E SCSI Connector Loopback Error in DB6 or SEL	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
1F SCSI Connector Loopback Error in DB7 or BSY	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14. Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
20 SCSI Connector Loopback Error in DBP or RST	Run Test 41—(with loopback connector)—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
MULTI-FUNCTION PERIPHERAL IC ERROR CODES	
	Visual inspection is not possible for errors 29 to 2B.
29 RS-232 Loopback data did not match what was sent	Run Test 35—Multi-Function Peripheral Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
2A Timed out waiting for RS-232 loopback data	Run Test 35—Multi-Function Peripheral Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
2B Timer A did not count down as expected	Run Test 35—Multi-Function Peripheral Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
MOTOR CONTROL IC ERROR CODES	
	Visual inspection is not possible for errors 2C to 2E.
2C Failed read\ write test to motor control IC	Run Test 36—Motor Control Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
2D Motor Control Loopback Test failed	Run Test 36—Motor Control Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
2E Motor Control IC RAM Test failed	Run Test 36—Motor Control Chip Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14. Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
POWER SUPPLY ERROR CODES	
	Visually check the power cables and connections.
33 Low voltage Power Supply failed	Run Test 40—Power Supply Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Measure 12V (see Chapter 8, Figures 8-15,(2) and 8-52) -measure at 4-prong Molex® that connects to J81 on Mother PCA. Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
34 High voltage Power Supply failed	Run Test 40—Power Supply Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Measure 24V (see Chapter 8, Figure 8-15,(4) -measure at 4-prong Molex that connects to J81 on Mother PCA). Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
DRIVE CONNECT ERROR CODES	
	On error codes 38 and 39 be sure to check: **—drive cabling** **-good contacts** **-no cut or exposed wires** **—drive tray not skewed**
38 Drive 1 not connected	Run Test 37—Drive Connector Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
39 Drive 2 not connected	Run Test 37—Drive Connector Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14. Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
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.
3C Unspecified failure	Run Test 11—Mechanism Exercise Test. If no error, monitor for re-occurrence. On error— Go to error code in this table
3E Unspecified servo failure	Run Test 11—Mechanism Exercise Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
40 Unable to free Picker fingers for Carriage motion	**Check the Picker, Mailslot, and Magazine for loose labels or other obstructions.** Run Test 50—Find Home Sequence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
41 Unable to verify Picker is at Home position (non-leadscrew side)	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
43 Picker fingers met resistance during retraction	Check drive and magazine for loose labels or other obstructions. Run Test 50, Find Home sequence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
44 Carriage motion failure during Find Home sequence	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
45 Unable to free Picker fingers for translate motion	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
46 Carriage motion failed while initializing Home position (during Find Home)	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
47 Translate failed while moving toward non-leadscrew side during Find Home sequence	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
48 Carriage motion failed during Carriage/Picker assembly calibration (leadscrew side)	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
49 Carriage motion failed during Carriage/Picker assembly calibration (non-leadscrew side)	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
4A Motion error while determining orientation of the Picker	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
4B No sensor found	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
4C Failed flip motion during Find Home sequence	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
4D Motion error checking for cartridge in the Picker	Run Test 50—Find Home Sequence—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
4E Unable to measure height of sensor on the leadscrew side	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
4F Unable to measure height of sensor on non-leadscrew side	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
	On errors 50 and 51, also check the optical sensors.
50 Excessive tilt of the Carriage/ Picker assembly (away from the drives)	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
51 Excessive tilt of the Carriage/ Picker assembly (toward drives)	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
52 Excessive cone angle on Picker	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
	On error 53, also check the optical sensors.
53 Excessive stack tilt	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
54 Unable to complete an interrupted move (at powerup)	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If Test 60 shows an error code— Look up the hardware error code in this table and follow the recovery procedures for that error.
55 Unable to find top of unit	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
EXERCISER TEST ERROR CODES	
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 test you are running is proper for the configuration. Run (or rerun) the proper test.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
59 Exerciser unrecovered error	No FRUs failed. Exerciser had an unrecovered error. Rerun exerciser. If exerciser fails again— Access the Recovery Log. *Recovery Log is available only through the SCSI interface. Use OPUTIL or ACDIAG+*
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.
5C Shipping diagnostic run with cartridges in mechanism	No FRUs failed. Shipping warning. Take all disks out of the MO Drives.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
CALIBRATION SENSOR SYSTEM ERRORS	
60 Optical sensor failed (leadscrew side)	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
61 Optical sensor failed (non-leadscrew side)	Run Test 51—Carriage/Picker Assy Calibration—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
MAILSLOT ERROR CODES	
	Check for loose labels or other obstructions in errors that involve the Mailslot (B0-B2).
B0 Mailslot will not rotate	Run Test 17—Mailslot I/O Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
B1 Inside Mailslot sensor failed	Run Test 17—Mailslot I/O Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14.
Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
B2 Mailslot will not accept or release cartridge	Run Test 17—Mailslot I/O Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
STORAGE SLOT ERRORS	
	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. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14. Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
B4 Outside Mailslot sensor failed	Run Test 17—Mailslot I/O—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
DRIVE ERROR CODES	
	On drive error codes check all cabling to and from the drives **—no broken wires** **—no worn cables** **—no loose connections** **Check the drive tray.**
B8, BC Drive 1 access error	Run Test 16—Drive I/O Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary. Error Code BC is seen only on units with Ver. 4.2 code. It is identical to error B8.

Table 5-14. Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
B9, BD Drive 2 access error	Run Test 16—Drive I/O Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary. Error Code BD is seen only on units with Ver. 4.2 code. It is identical to error B9.
FRU DETECTION TEST 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. **You should be able to easily flip the Picker using the Picker Belt.**
C8 Unable to gain proper servo control of motors	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
C9 Unable to move Picker motor	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-14. Recovery Procedures for Specific Hardware Errors (continued)

Error Code (hexadecimal)	Recovery Procedures:
CA Unable to move Carriage motor	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
CB Unable to move either motor	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
CC Unable to find a hard stop while turning the Picker motor	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
CD Unable to find a hard stop while turning the Carriage motor	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.
CE Excessive force needed to move the Carriage leadscrew	Run Test 60—FRU Isolation Test—verify failure. If no error, monitor for re-occurrence. If error repeats— Use list of suspect FRUs logged by the FRU Isolation Test as a guide to determine the problem. Replace the FRU(s) if necessary.

Table 5-15. Miscellaneous Error Codes

Error Code (hexadecimal)	Meaning
FA	Check DIP switch settigs on the Autochanger Controller PCA.
FC	The test can only be run from the Control Panel or from the RS-232 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.

5.5 Online Diagnostics Available

OPUTIL—HP 9000/300 Series

OPUTIL is a diagnostic utility that uses the I/O controls on the HP9000/300 system (ioctl) to execute SCSI commands to the optical disk drives and the Autochanger. The utility may be used on HP 9000/300 systems with Release 6.5 or later.

Presently, OPUTIL is resident on the HP-UX Release 7.0 of the HP C2455 Optical Storage Server/Manager. OPUTIL will be resident on HP-UX Release 8.0.

You may obtain this utility from Greeley Storage Division through HPDESK or through Greeley's Bulletin Board System.

This utility, its commands, and how it may be obtained, are described in Appendix A.

A brief summary of OPUTIL commands are are as follows:

Table 5-16. OPUTIL Commands

For MO Disk Drives	For the Autochanger
TEST UNIT READY	TEST UNIT READY
DIAGNOSTIC TESTS	UNLOCK (Autochanger)
REASSIGN BLOCK	LOCK (Autochanger)
WRITE ERASED BLOCK	REQUEST SENSE
UNLOCK (media)	INQUIRY
LOCK (media)	RESERVE
REQUEST SENSE	RELEASE
INQUIRY	REZERO UNIT
RESERVE	INIT ELEMENT STATUS
RELEASE	POSITION TO ELEMENT
REZERO UNIT	READ ELEMENT STATUS
START UNIT	MOVE MEDIUM
STOP UNIT	EXCHANGE MEDIUM
EJECT MEDIA	LOG SENSE
READ CAPACITY	AUTOCHANGER MODE SENSE
MODE SENSE	AC DIAGNOSTICS
SEEK	FIRMWARE REV
ERASE	WORKOUT AC
VERIFY	CHANGE DEVICE
MODE SELECT	COMMAND EXPLANATIONS
MEDIA FORMAT	HELP
FIRMWARE REV	EXIT
COMMAND EXPLANATIONS	
HELP	
DEFECT DATA	
WORKOUT MO	
READ BLOCK	
CHANGE DEVICE	
EXIT	

DASSDIAG—HP 9000/800 and HP 3000/900 Series

This is a SHERLOCK diagnostic for the Autochanger and MO Drives. It will be resident on MPE/XL Release 3.0 and HP-UX Release 8.0.

Instructions for running diagnostics using the Sherlock Diagnostic are in the *Online Diagnostic Subsystem Manual, Volume 5*, (09740-90042).

5.6 Offline Diagnostics Available

ACDIAG and ACDIAG+—Uses the Vectra PC/Portable Plus

ACDIAG is an offline diagnostic that can be operated from an HP Vectra PC or an AT-compatible with an Adaptec 1540/42B Interface PCA.

ACDIAG+ is the version of the ACDIAG diagnostic that runs from the HP Portable PLUS using an HP-IL to SCSI converter.

The ACDIAG/ACDIAG+ diagnostic provides the user a means of retrieving and decoding various internal logs, running internal selftests, and testing manual movements of the Autochanger mechanism.

The ACDIAG/ACDIAG+ diagnostic does the following:

- Tests and confirms the SCSI communication path.
- Tests product type identification and displays vital product data.
- Calls internal selftests, displays selftest failure information and decodes this failure information to aid in FRU isolation.
- Enables the display and decoding of internal logs.
- Enables testing the manual movements of the Autochanger mechanism while replacing Field Replacement Units (FRUs) and during the verification process.

This diagnostic and its commands are described in Appendix B.

MODIAG—Uses the HP Vectra or AT-compatible computer

The MODIAG diagnostic fully exercises the rewritable and write-once modes of a library. This diagnostic has the same "look and feel" as ACDIAG/ACDIAG+.

MODIAG supports the following magneto-optical disk products:

- HP 6000 products.
- The C2212A Option 5 or C2213A Option 5 drives.
- Series 6300 650/A (C1701A) and the C1711A standalone magneto-optical drives.
- Drives in the C17xx optical library series.

This diagnostic and its commands are described in Appendix B.

SCSIMO—Uses the Portable Plus

SCSIMO is a standalone diagnostic test that supports the following magneto-optical disk products:

- HP 6000 products.
- The C2212A Option 5 or C2213A Option 5 drives.
- Series 6300 650/A (C1701A) and the C1711A standalone magneto-optical drives.
- Drives in the C17xx optical library series.

Information on using the diagnostic is in the "Using Mass Storage Diagnostics with the HP-IL Interface," (5960-0163).

6

Adjustments

There are no field adjustments to this product.

7

Peripherals

There are no peripherals to this product.

8

Removal and Replacement

Note This chapter is divided between removal and assembly for units manufactured before September, 1991 and those manufactured after that date.

Sections 8.1 through 8.12 apply to earlier versions, Sections 8.13 through 8.20 are procedures for Reliability and Serviceability-Enhanced units manufactured after September, 1991.

Rather than repeat identical (or nearly identical) procedures for the two major versions of the product, the second group of sections in this chapter only contain Removal and Replacement procedures for RSE versions that are so different that confusion could result if they were merged into procedures for the older versions.

Section 8.22 gives the replaceable parts for ALL versions.

Versions before September, 1991 (w/some merged RSE notes)

Page

Versions after September, 1991 (RSE unique)

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:

- #10, #15, #20 Torx®
- #2 magnetized #1 Phillips screwdriver (drive bezel removal)
- #2 Pozidriv with at least a 10-inch shank (Picker removal)
- Medium slot-blade screwdriver
- #1 and #2 Pozidriv magnetized screwdrivers
- 3/16- and 7/64-inch Allen wrenches
- 7/16-inch socket or box-end wrench (or crescent wrench)

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.

Switching bezels between the replacement drive and the defective drive to prepare the defective drive for shipment back to Support Materials Division is not considered disassembly.

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.**

8.1 Service Access

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.

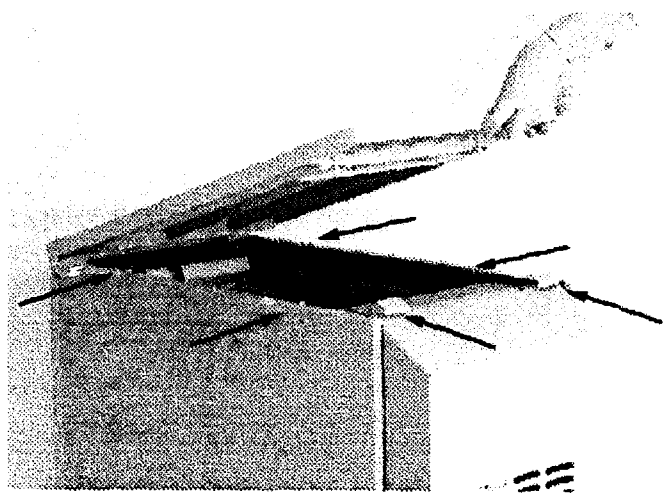


Figure 8-1. Removing Top Cover, Side Panels, and Rear Cover

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 the next figure.

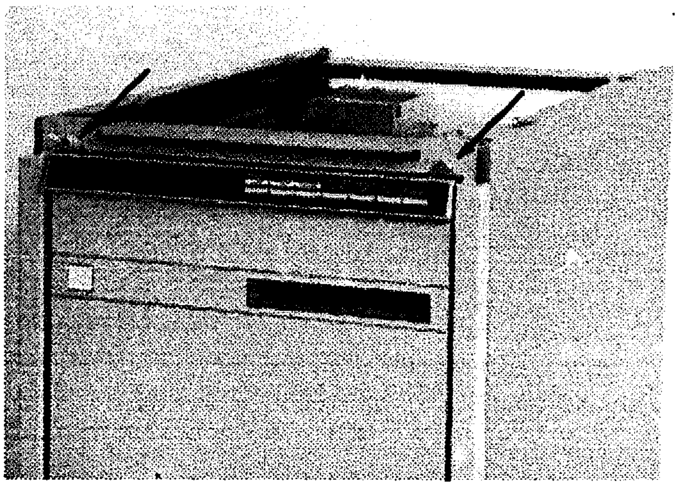


Figure 8-2. Removing the Front Panel Bezel

2. The *front panel* is held by two Pozidriv screws accessed from the rear of the front panel display (see Figure 8-3). Remove these screws and then push a screwdriver through the center, top slot to separate the front panel from the chassis (Figure 8-4).

   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.*

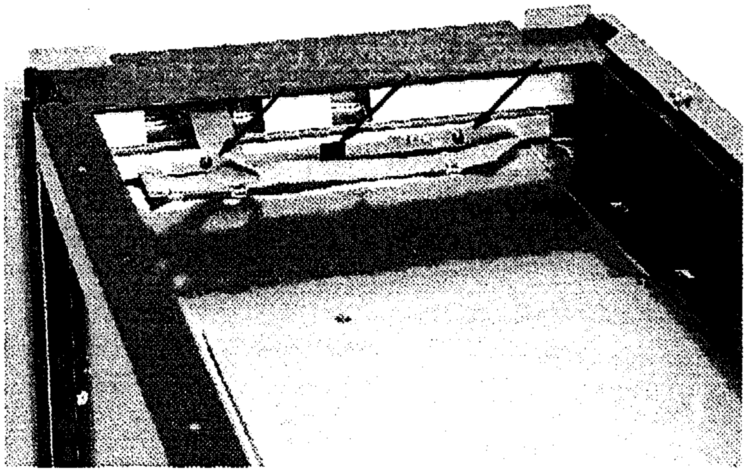


Figure 8-3. Front Panel Mounting Screws and Push Hole

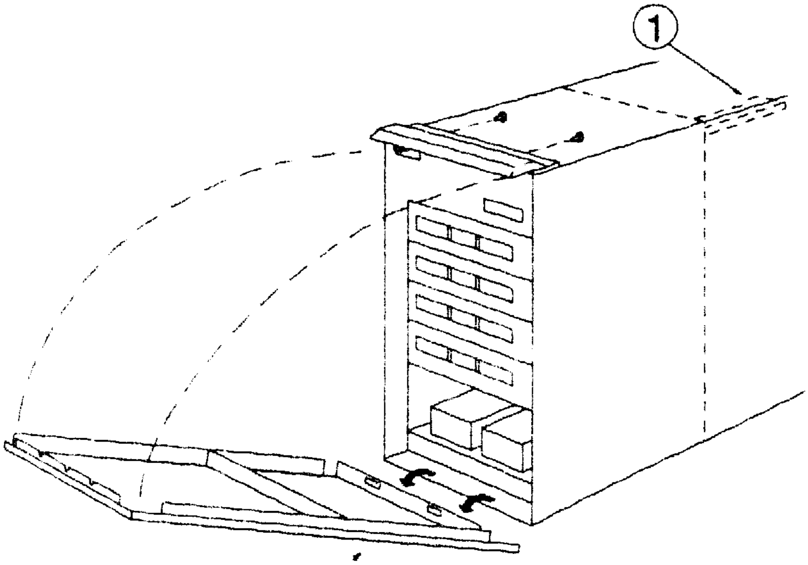


Figure 8-4. Removing the Front Panel

When re-assembling:

The aluminum door opener 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 8-4 (1) and Figure 8-5 for the location and movement of the actuator arm.

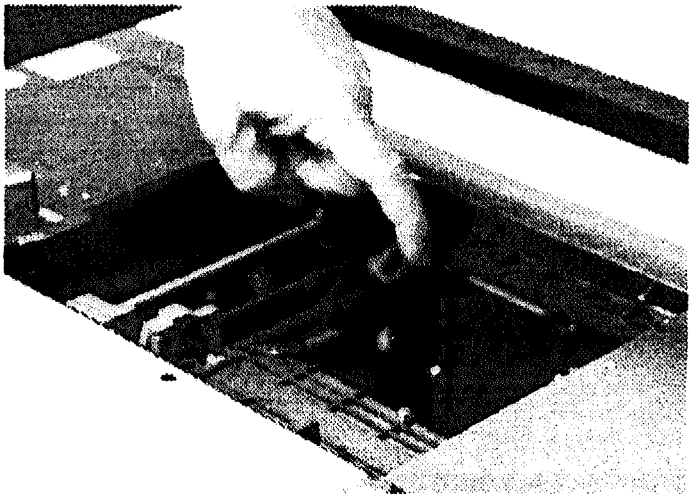


Figure 8-5. Mailslot Actuator Arm

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.

   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.

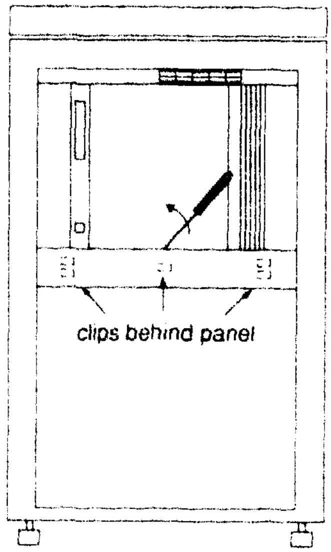


Figure 8-6. Removing the Slide Handle Cover

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 8-7 shows the right-side screw and how it is rotated to release the latch.

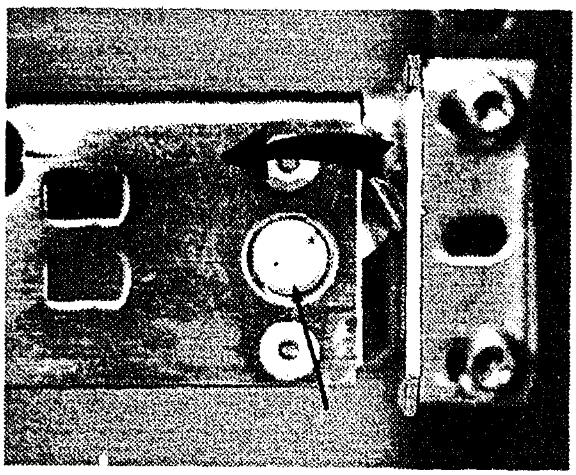


Figure 8-7. Unlocking the Slide Assembly (Right Side)

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 Pozidriv screws as shown in Figure 8-8 or 8-9.

   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.**

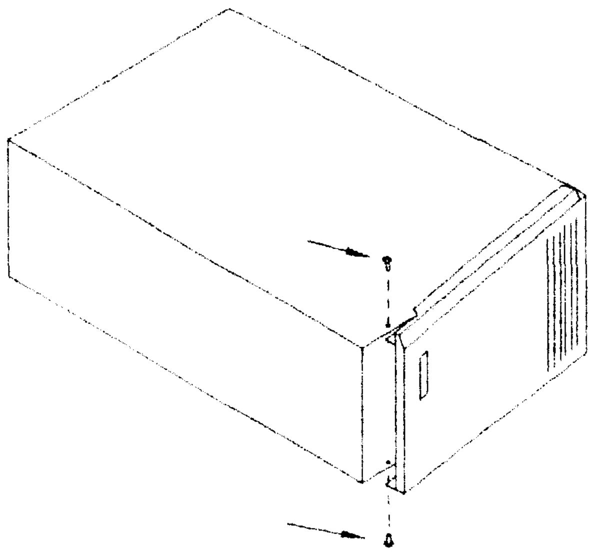


Figure 8-8.
Front Panel Mounting Screws
(Rackmount Option—earlier units)

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.

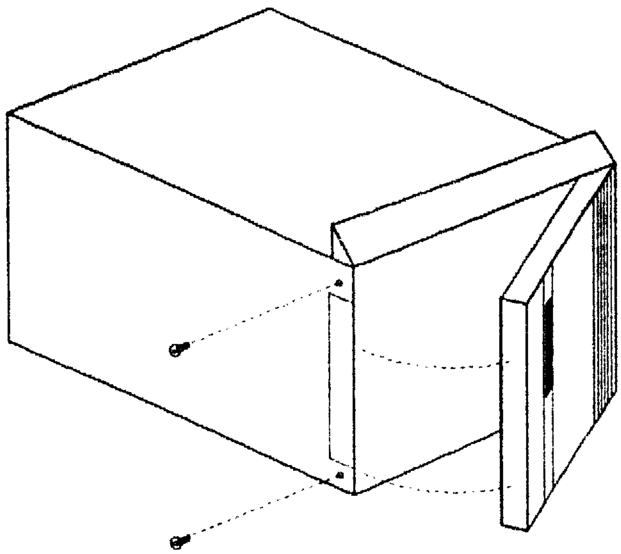


Figure 8-9.
Front Panel Mounting Screws
(Rackmount Option—later units)

Deskside and Rackmount Electronics and Mechanism Access

- The *rear electronics access panels* are held by Pozidriv screws. On earlier units, there are three panels and on later units there is only one.

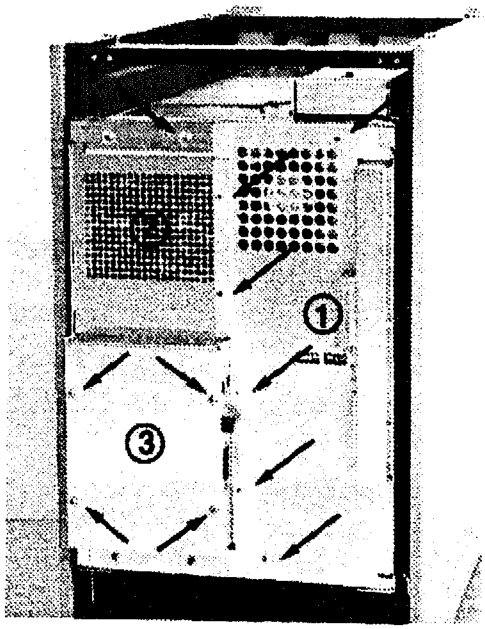


Figure 8-10. Rear Electronics Access Panels (earlier units)

- Four Pozidriv screws hold the panel covering the large chassis access panel.
- Two Pozidriv 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.

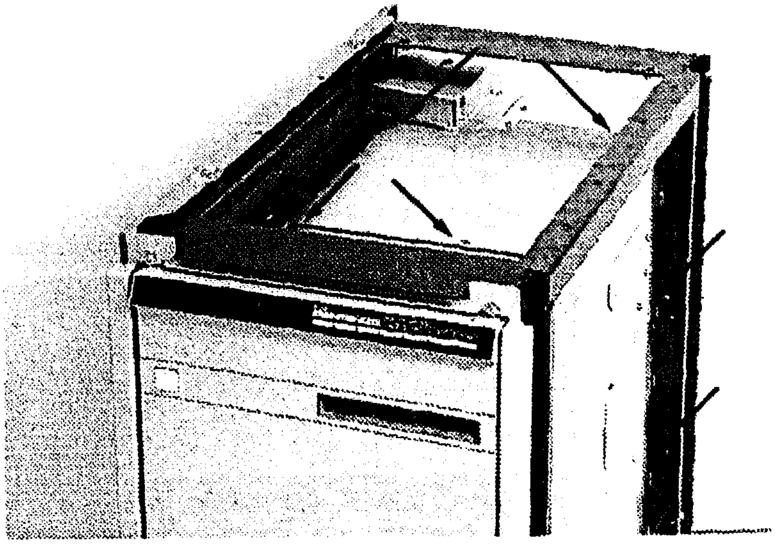


Figure 8-11.
The Large and Small Chassis Access Panels
(oriented differently, depending on whether Deskside or Rackmount)

8.2 Removing PCAs

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

Autochanger Controller PCA (includes NVRAM Battery removal)

1. Press the power switch on the front panel to OFF.
2. Remove the power cord from the Power Module.

Refer to Figure 8-10.

3. Remove the long electronics access panel next to the Autochanger Controller PCA (Figure 8-10 (1)). On later units, the three electronic access panels are one piece.

Refer to Figure 8-12.

4. Remove the three Pozidriv mounting screws and washers that hold the Autochanger PCA extension (1). Note (for re-assembly) that the lip of the Controller PCA end plate assembly (2) is on the OUTSIDE of the chassis extension.

Refer to Figure 8-13.

5. Disconnect the two SCSI Interconnect ribbon cables (1) on the PCA.
6. Pull the PCA out of the chassis.

NVRAM BATTERY REMOVAL

Refer to Figure 8-14.

7. Use a thin screwdriver to pry the battery out of its holder (Figure 8-13 (1)).
8. If discharging circuit, press the battery contacts together after removing the battery.

   If you press the battery contacts together for one minute, and then wait 10 more minutes before replacing the battery, the NVRAM should be at its default settings.

When re-assembling:

Check the settings of S2 on the replacement PCA.

Table 8-1.
S2 Switch Settings
(Pre-RSE-version Autochanger Controller PCA)

Position	Description	Default
1	Clear RAM	open
2	W_DR_IDfor non-Sony drives (returns "Invalid Configuration" if Open)	closed
3	not used	-
4	not used	-
5	Termpower (see next table, "Termpower Settings")	-
6	Termpower (see next table, "Termpower Settings")	-
7	Termpower (see next table, "Termpower Settings")	-
8	Password (used with "1" to clear RAM)	open

Table 8-2.
Termpower Settings
(Pre-RSE-version Autochanger Controller PCA)
(SW 2, 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

When the AC Controller PCA is re-inserted into the chassis, be sure that the PCA edge connectors couple with all three receptacles on the Mother PCA (Figure 8-12 (3)).

Make sure the lip of the PCA end plate assembly goes on the OUTSIDE of the chassis extension.

Clear and re-initialize the NVRAM:

—*Select* CONF 16—*Clear (reset critical values)*
—*Select* CONF 18—*Clear (reset Autochanger odometers)*
—*Select* TEST 10—*Initialize Element Status (requires the password).*

See Section 8.21 for an explanation of variables that are being set.

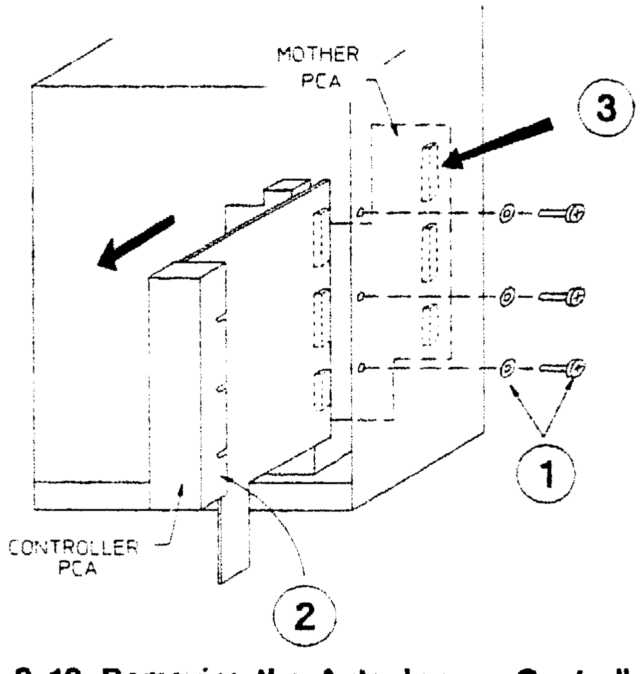


Figure 8-12. Removing the Autochanger Controller PCA

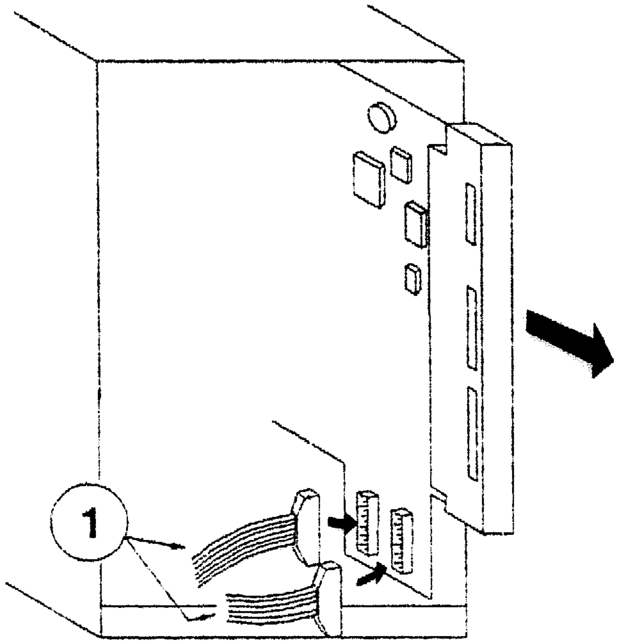


Figure 8-13.
Removing the SCSI Interconnect Cables from the Autochanger Controller PCA

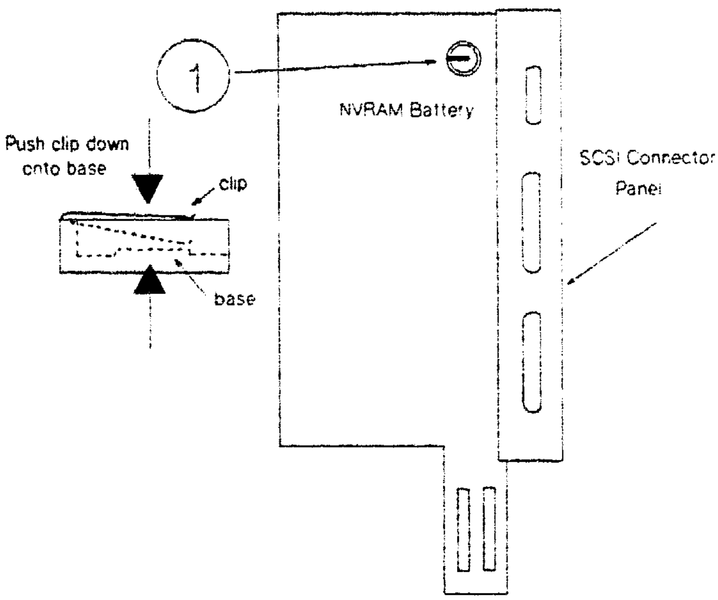


Figure 8-14. NVRAM Battery on the Autochanger Controller PCA

MO Drive Controller PCAs

1. Unplug the power cord from the Power Module.

Caution It is a tight fit in the electronics cabinet. To prevent damage, remove the Autochanger Controller PCA first.

---

2. Remove the Autochanger PCA.

   Use the set of instructions that are just prior to these instructions.

3. Remove the long electronics access panel next to the Autochanger Controller PCA. See Figure 8-10 (1). On later models, the three electronic access panels are one piece.

Refer to Figure 8-15.

4. Remove the MO Drive Address ribbon cable from the Address PCA (1).
5. Loosen the captive screw at the end of the MO Drive Controller PCA mounting frame (2).
6. Rotate the assembly outward far enough to reach the ribbon and power cables that are attached to the two MO Drive Controller PCAs.

Caution Remove the power cables to the MO Drive PCAs from the chassis end (color-coded end). It is difficult to remove these cables from the MO PCA end without stressing other components.

---

7. Remove the ribbon cable and power cables that go to the two MO Drive Controller PCAs.

   The ribbon cable may be disconnected from the edge of the MO Controller PCA Assembly, but the power cables should be disconnected from the chassis end.

8. Rotate the assembly away from the chassis, sliding the large ribbon cables out of their clip (Figure 8-15 (3)) as the assembly is pulled out.

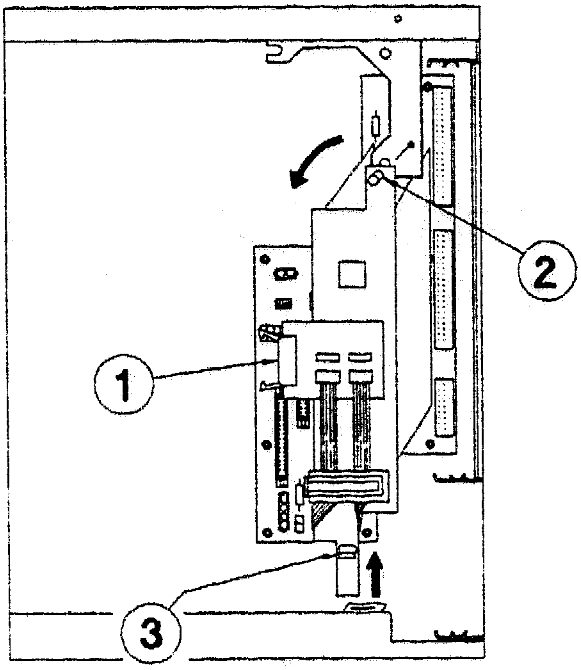


Figure 8-15. Removing the MO Drive Controller PCA Assembly

When re-assembling:

Be careful to place the aluminum brace that is between the two MO Controller PCAs into the card guide on the Mother PCA when the assembly is inserted into the chassis.

8.3 Removing the Power Supply Module

1. Unplug the power cord from the Power Module.
2. Remove the long, vertical electronics access panel along the left side of the Autochanger Controller PCA. See Figure 8-10 (1).
3. Remove the square access panel on the rear of the unit. See Figure 8-9 (2). On later models, a single panel allows access into all areas on the back panel except the power module.

Refer to Figure 8-16.

4. Unplug the AC Power Input connector (1) on the Power Distribution PCA.
5. Unplug the connectors (2) on the PCA at the rear of the Power Supply Module. *These connections are keyed the same; the connectors are interchangeable.*
6. Unfasten the cable fasteners (3) along the side of the module.
7. Unplug the connectors on the Mother PCA (4).
8. Remove the four large mounting screws (5) that hold each end of the Power Supply Module box to the chassis.
9. Pull the Power Module out from the chassis.

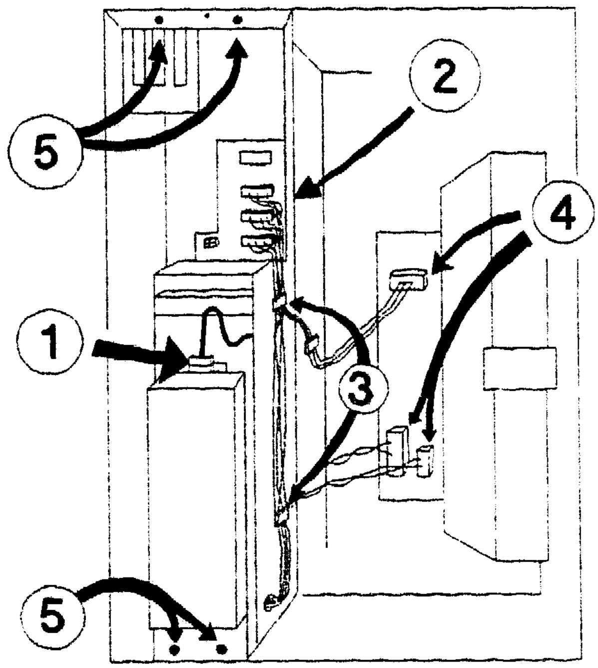


Figure 8-16. Removing Connections to the Power Supply Module

8.4 Removing the MO Drives

To access the drives, you must first remove the front panel as described in Section 8.1, "Service Access." Refer to the Deskside Option or Rackmount Option as applicable.

1. Remove an access panel (of your choice) that will let you remove cables on the inside of the chassis next to the drives.

Refer to Figure 8-17.

2. Disconnect the drive power cables and ribbon interface cables from the rear of the drives.

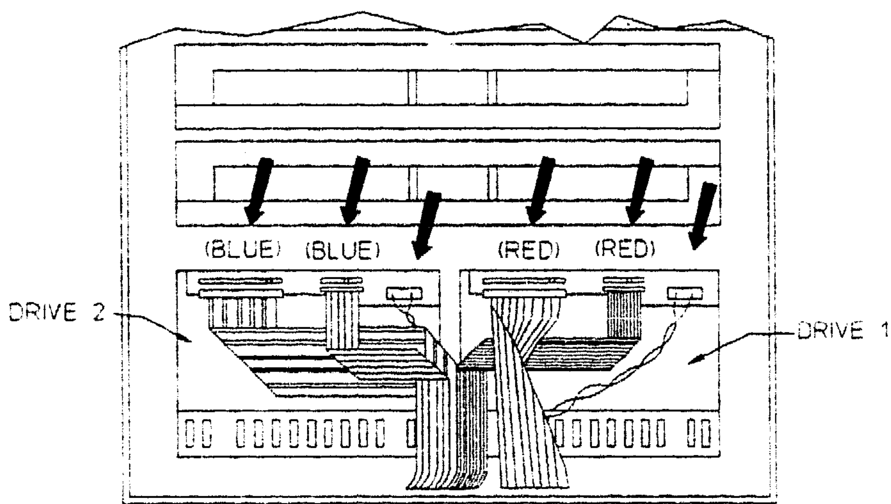


Figure 8-17. Removing the Control, Data, and Power Cables from the MO Drives

Refer to Figure 8-18.

3. Remove the plastic cover from the Interconnect PCA (not shown).
4. Disconnect the two Optical Sensor connectors from the Interconnect PCA.

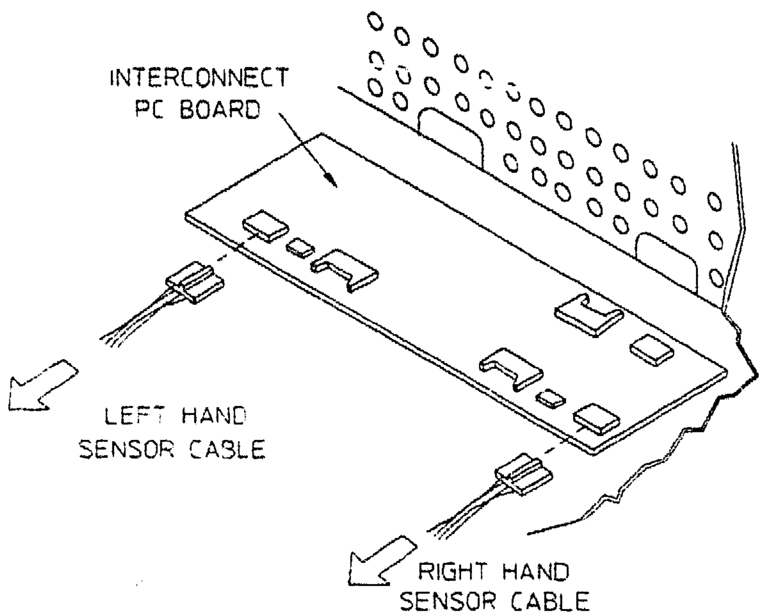


Figure 8-18. Removing the Sensor Cables from the Interconnect PCA

5. Loosen the two captive screws at each end of the front of the drive tray.

Caution Make sure the Picker is clear of the Optical Sensors at the front of the drives. A sensor tab on the end of the Picker can be damaged if it is between the prongs of an Optical Sensor when the drive tray is pulled out.

---

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.

7. Remove the ground wires. The ground wires are white/black wires that go from the rear of each drive to the drive tray. The connector on the rear of each drive is a bayonet connector.

8. Each drive is attached to the tray with four screws. Remove screws as necessary to replace drive(s).

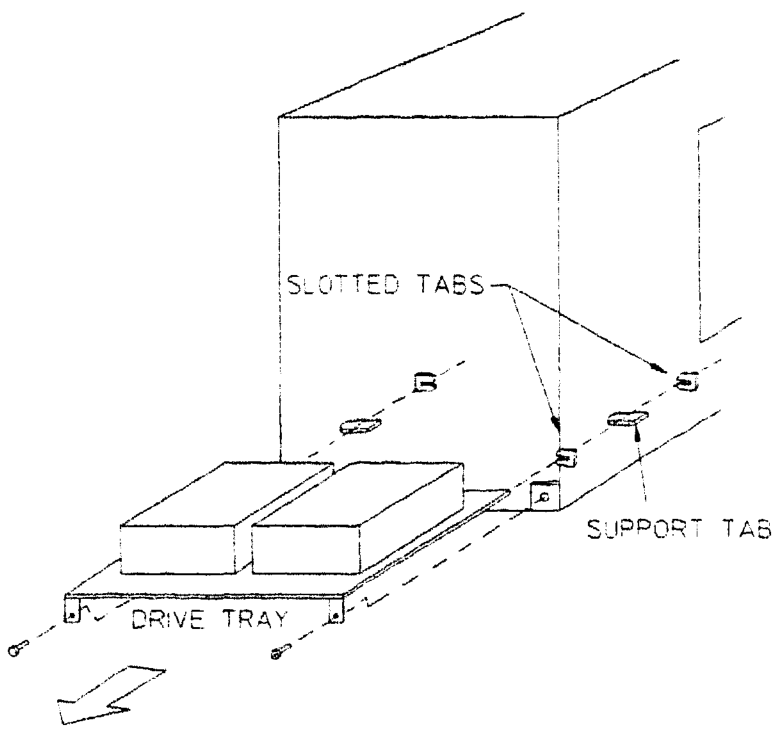


Figure 8-19. Removing the MO Drives

When re-assembling:

Some OEM units have a different colored bezel than the one that comes on the replacement drive. Change bezels as described in the next procedure "Changing the Optical Drive Front Bezel."

After reversing the disassembly steps and remounting the drives, refer to the re-assembly notes in Section 8.1, "Service Access," to correctly remount the front panel.

Changing the MO Drive Front Bezel (some OEM versions)

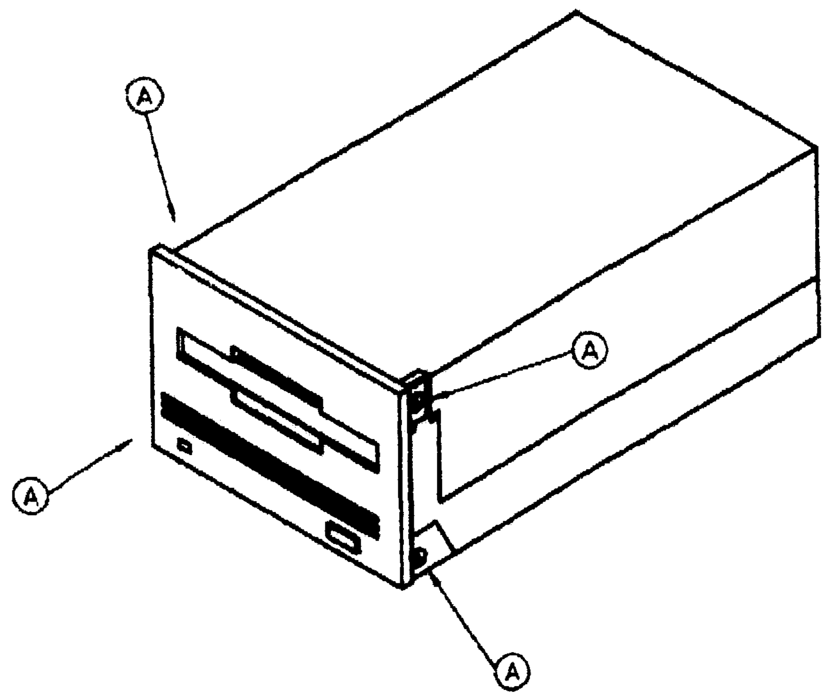


Figure 8-20. MO Drive Front Bezel Screws

Caution To prevent damage to the drive (and bezel), DO NOT place the drive face down on the bezel when removing the bezel.

Refer to Figure 8-21

1. Remove the four screws (A) holding the front bezel. Use a #1 magnetized Phillips screwdriver.

2. Remove the green bezel from the replacement drive in the same manner as in Step 1.
3. Swap the bezels.

Note The screw holes in the bottom of the bezel are ROUND; those at the top of the bezel are SLOTTED. Begin seating the screws starting from the BOTTOM, ROUND holes.

Just START all the screws (A) into the sides of the drive with three complete turns. The bezel may be skewed if any screw is tightened before all screws are started.

4. Use three turns to just START the screws—starting with the two BOTTOM screws. Do not fully tighten.
5. Check that the bezel is properly placed over the disk entry opening of the drive.
6. Tighten all four screws into the sides of the drive.
7. Refer to "Removing the MO Drives" (just before this set of instructions) and re-install the drives into the chassis.

Note After the drive is installed, hand-load a disk into the drive a number of times to verify that the bezel is on correctly.

Caution Re-attach the standard (green) bezel to the drive that you replaced before returning the drive to Support Materials Organization (SMO). The bezel is not just cosmetic; it is part of the drive structure. It is important that the bezel is mounted on the drive when the drive is shipped.

8.5 Removing the Picker and Picker Carriage Assembly

Note

A chassis modification, started with Serial Number 2931A00031 allows the Carriage/Picker Assembly to be removed as one assembly.

If the large access opening on the Disk Library System has cutouts at the ends of the Carriage rails (ways) as shown in Figure 8-21, USE THE PROCEDURES FOLLOWING THIS NOTE. If the unit does NOT have these cutouts, use the procedures in the next subsection, "Autochangers Prior to Serial Number 2931A00031," to remove the Picker or the Carriage/Picker Assembly.

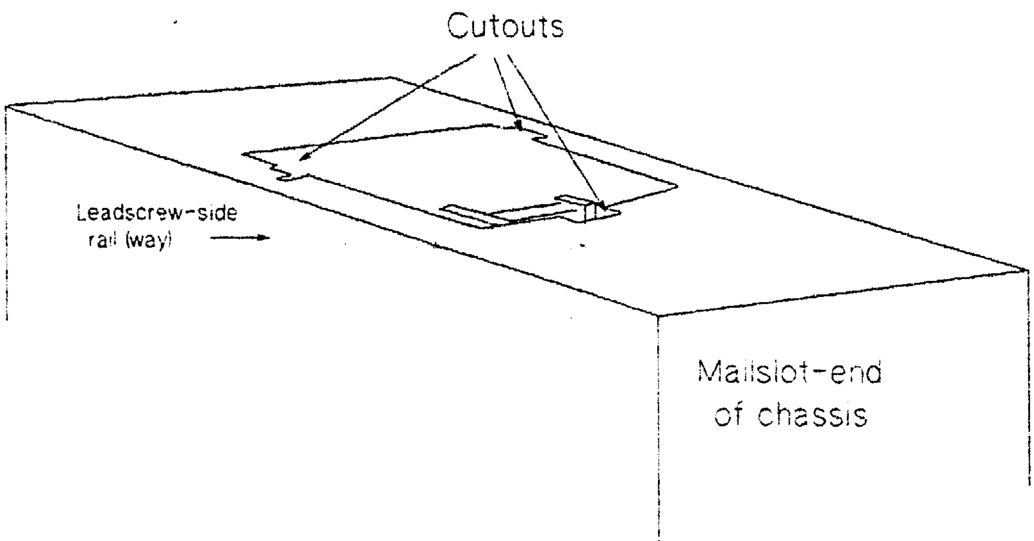


Figure 8-21. Cutouts on Units After Serial Number 2931A00031

Autochangers After Serial Number 2931A00031 (Deskside and Rackmount Options)

Refer to Figure 8-11.

1. Remove the four Pozidriv screws holding the large chassis access panel and remove the panel (in Figure 8-11, this panel is shown on a Deskside unit and is the large panel on the top).

Refer to Figure 8-22.

2. Remove the Pozidriv screw holding the Carriage Bracket to the bottom of the Picker Carriage (Figure 8-22 (1)). This screw is sealed by Loctite®.

Note DO NOT REMOVE the screw that holds the Carriage BRACKET to the Leadscrew (shown in Figure 8-30).

(On Deskside units) DO NOT REMOVE the constant force T-BAR and CABLE (shown in Figure 8-31).

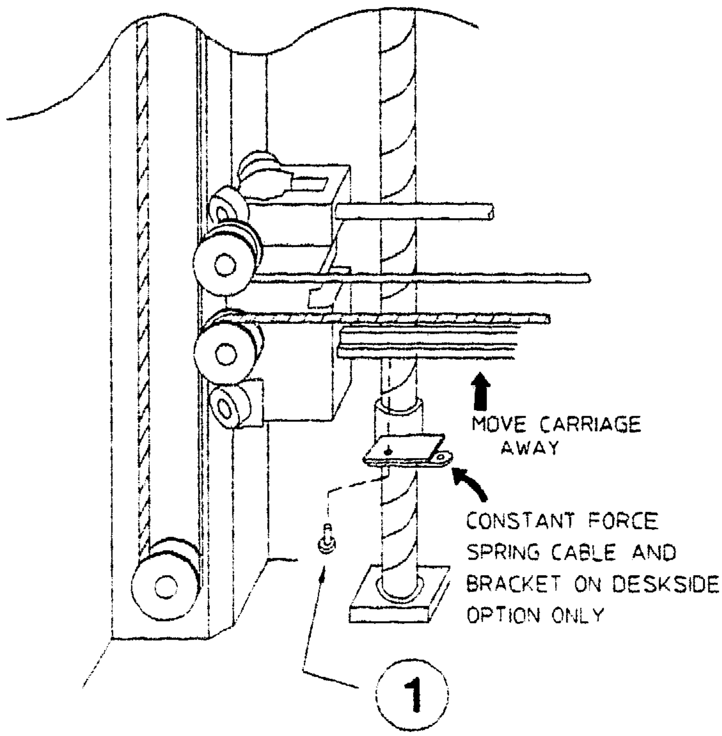


Figure 8-22. Separating the Carriage from the Carriage Bracket

Refer to Figure 8-23.

3. Release the tension on the Picker Belt by pushing the tensioner spring toward the drives. To push the spring *toward* the drives, pry the tool you are using as shown in Figure 8-23.

   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.

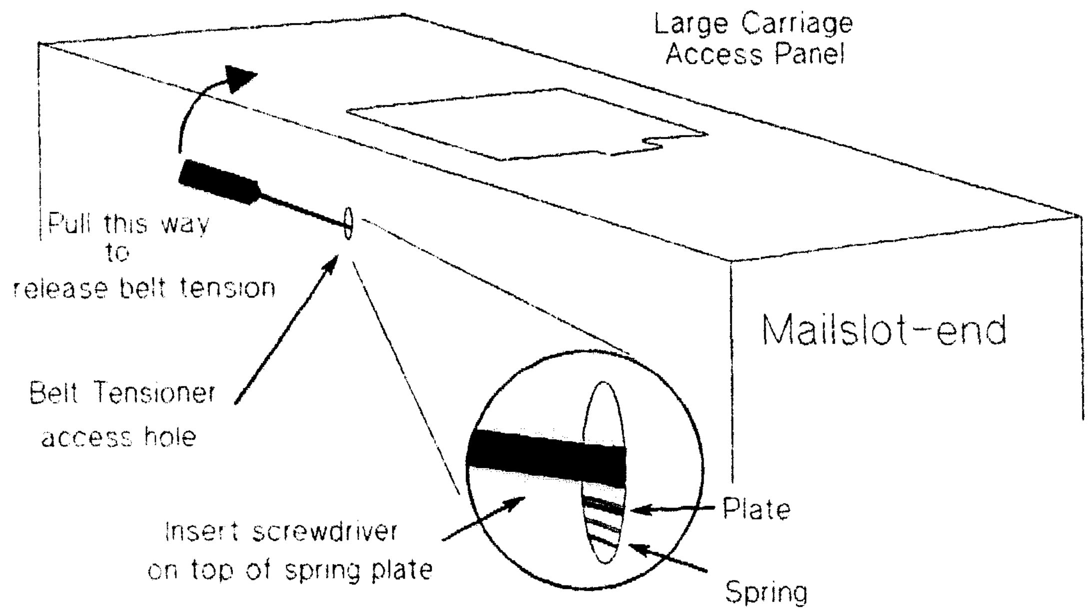


Figure 8-23. Releasing Picker Belt Tension

4. Position the Picker in the center of the Carriage so that it can pass through the cutout in the chassis.

   Refer to Figure 8-24 (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, joggle 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.

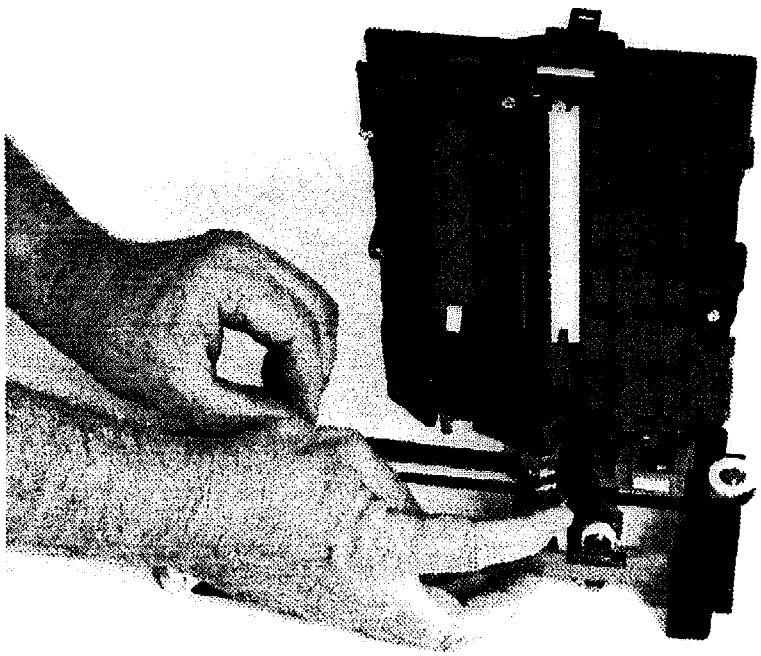


Figure 8-24. Releasing the Translate Latch (seen from drive side of Picker)

Refer to Figure 8-25.

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 8-26.

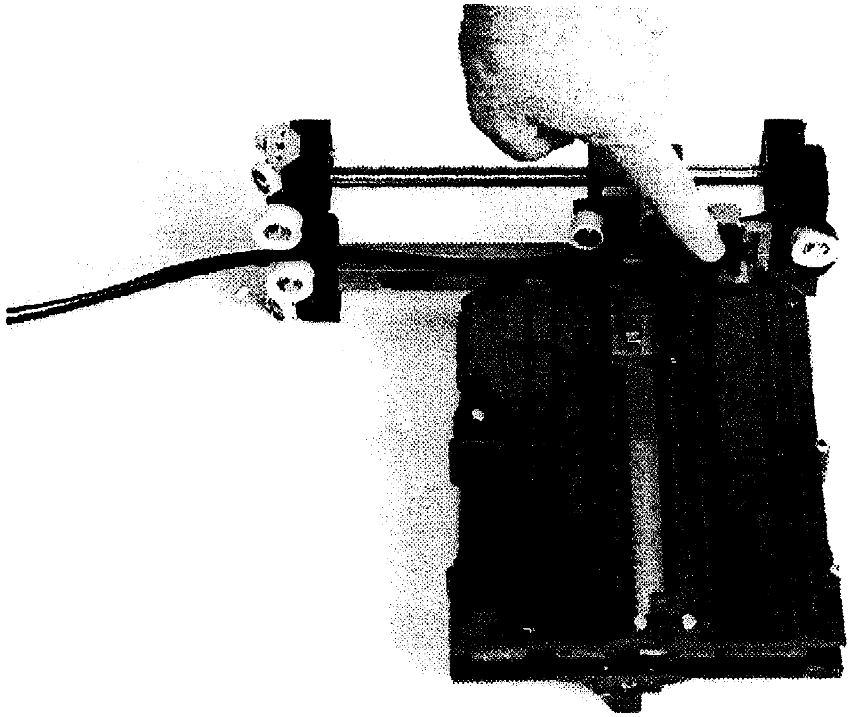


Figure 8-25. Releasing the Picker for Rotation

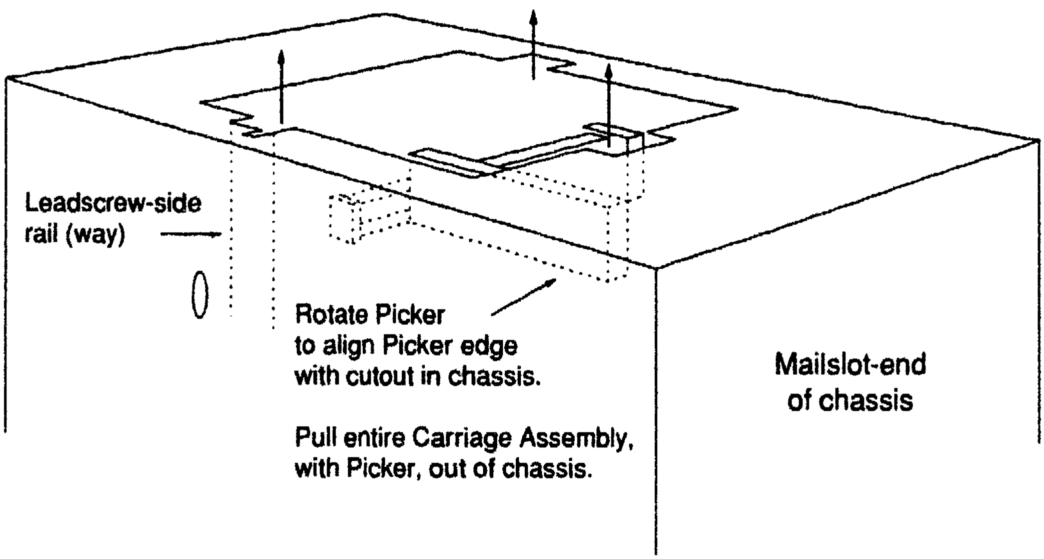


Figure 8-26. Removing the Carriage Assembly and Picker as a Unit

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 8-26.

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.

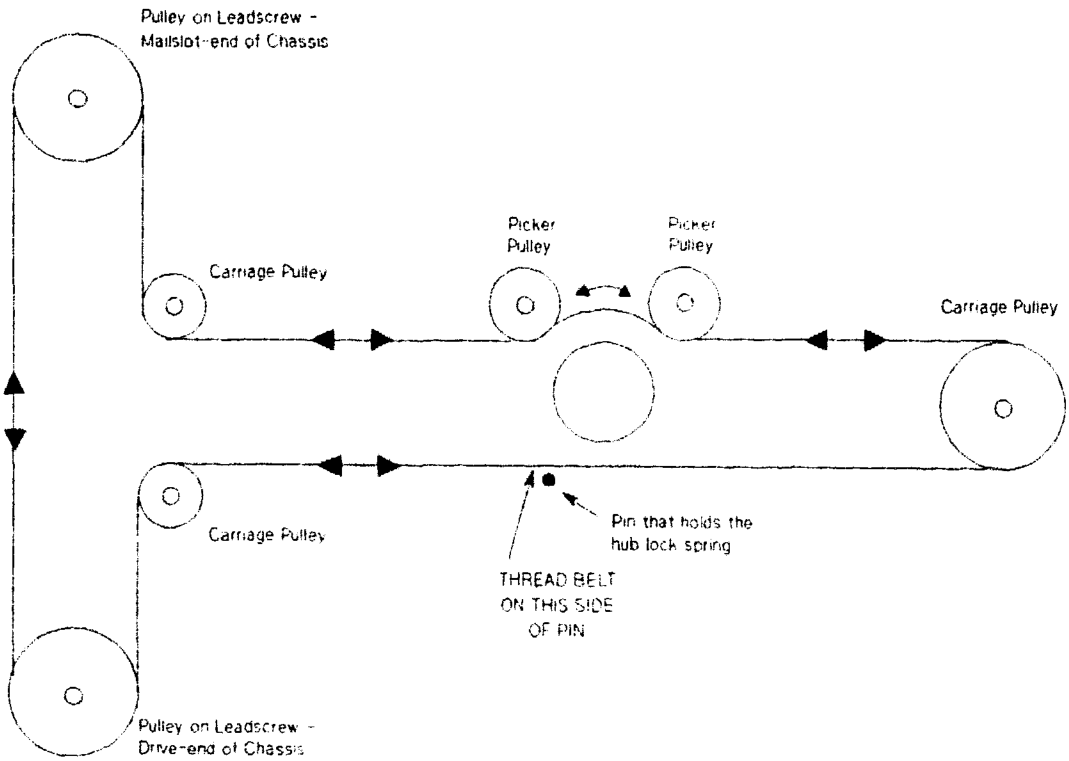


Figure 8-27. Picker Belt Threading Diagram

Autochangers Before Serial Number 2931A00031 (Deskside Units Only)

Removing the Picker Assembly

Refer to Figure 8-28.

1. Remove the two screws holding one of the magazines (preferably one of the two magazines at the mailslot end of the chassis).
2. Slide the magazine forward (toward the front of the chassis) two or three inches. This creates enough room to pull the Picker out of the Picker Carriage.

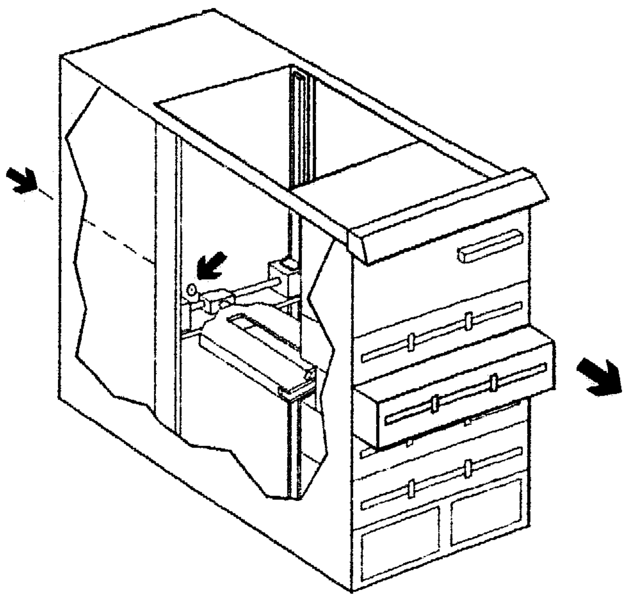


Figure 8-28. Picker Removal

3. Position the rear of the Picker in front of the Picker access hole (the hole is next to the Mother PCA on the electronics housing).

   Refer to Figure 8-24. (View is from the drive side of the Picker)

   a. Manually raise the translate latch.

      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 rotate the Picker shaft belt pulley, pull on the Picker Belt. You can't see the slot on the Picker shaft from above, so you may have to 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 a position in front of the access hole.

4. Remove the single Pozidriv screw in the center of the shaft of the Picker (Figure 8-29 (1)). **Be sure to save the spring washer** (Figure 8-29 (2)).

   The screw in the shaft can be easily removed if the shank on the #2 Pozidriv you use is at least 10 inches long.

5. Slide the Picker to either the right or left end of the Carriage until the translate latch drops into the slot in the Carriage rail.

   This lets the translate latch drop out of the slot in the bottom of the Picker shaft belt pulley and allows the Picker Assembly to be pulled out of the Carriage Assembly.

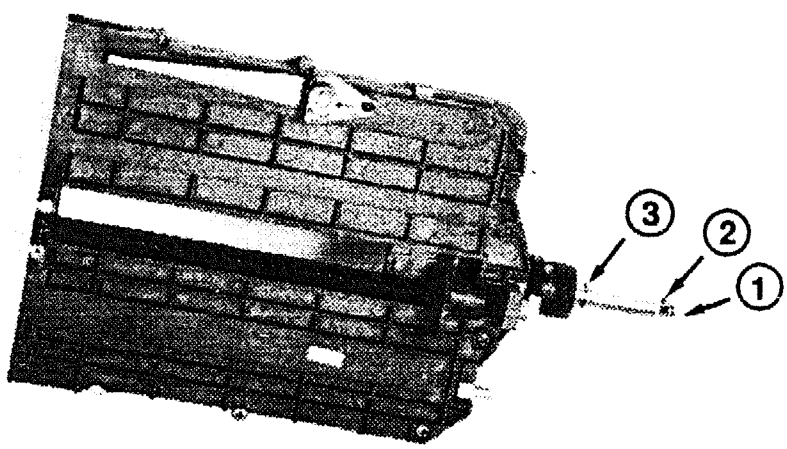


Figure 8-29.
Picker Assembly Shaft Screw, Curved Washer, and Spacing Washer

6. Loosen the Picker Belt on the Picker mechanism by moving the belt tensioner down (pull up on the screwdriver or whatever lever you are using) and at the same time slide the Picker cartridge forward out of its Carriage mount.

   Keep the thick spacing washer on the Picker shaft. (See Figure 8-29 (3)).

   (On some early-production units there is a flange at the base of the Picker shaft belt pulley. This flange prevents the Picker from being pulled away from the Carriage until the smaller belt pulleys on the Carriage, near the Picker, are removed.

   On these units remove the pulley screws and slide the pulleys off their shafts. The pulleys have two ball bearings; one inserted on each side.)

Removing the Picker Carriage Assembly

Refer to Figure 8-28.

1. Release the tension on the Picker Belt and slip the belt off one of the large routing pulleys.

Refer to Figures 8-30 and 8-31.

2. Remove the Pozidriv screw holding the Carriage Bracket to the bottom of the Picker Carriage. This screw is sealed by Loctite.

   Do not remove the screw holding the Carriage Bracket to the Leadscrew.

3. Swing the Vertical Tensioner Cable T-bar out from under the Carriage Bracket and let it gently come to rest on the plastic edge protector/cable guide on the Tensioner Assembly box.

   Refer to Figure 8-32.

4. On the right side of the Picker Carriage (looking towards the rear of the unit), remove the 7/64-inch Allen screw on the back of the *lower* Bearing Block Assembly.

5. Remove the 7/64-inch Allen screw on the back of the *upper* Bearing Block Assembly.

6. Remove the bearing block assemblies.

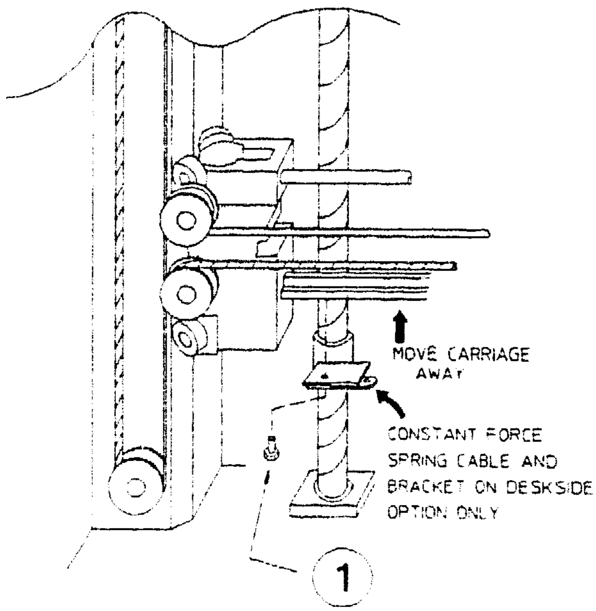


Figure 8-30. Separating the Carriage from the Carriage Bracket

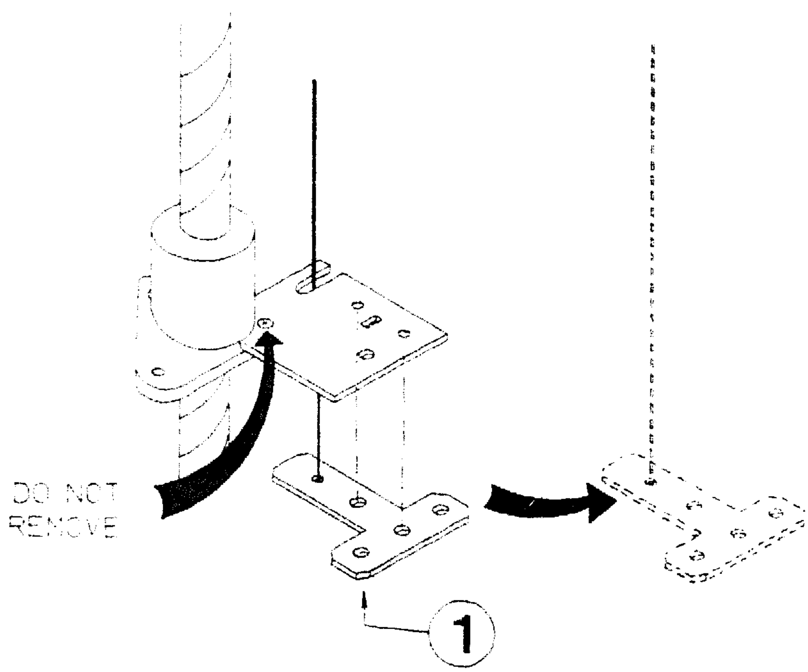


Figure 8-31. Removing the Vertical Tensioner Cable T-bar (Deskside Option)

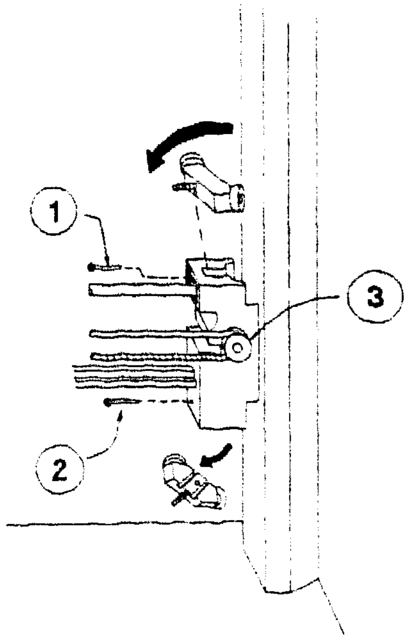


Figure 8-32. Removing the Top and Bottom Bearing Block Assemblies

Warning

If the Carriage Assembly or the Bearing Block assemblies were previously replaced on this unit, you will probably have a single Bearing Block Assembly instead of two separate Bearing Block assemblies on the non-leadscrew side of the Carriage Assembly.

In this case, you will be pulling the Carriage Assembly off as a unit, without removing the two Bearing Blocks as explained in Steps 4-6.

As the Carriage is pulled off the ends of its rails during the next step, the single, spring-loaded Bearing Block Assembly can separate from the Carriage 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.

7. Remove the entire Carriage Assembly.

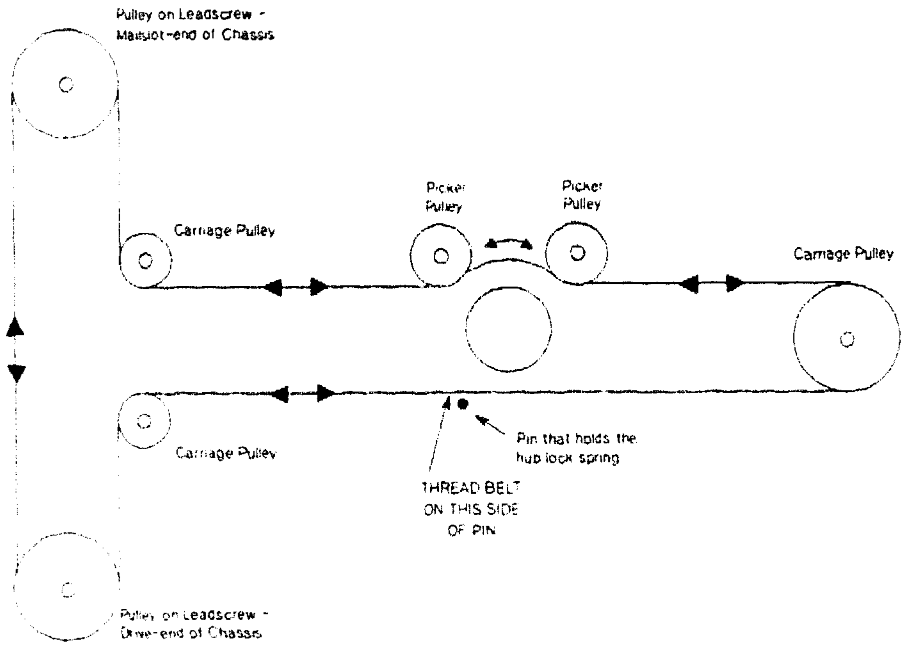


Figure 8-33. Picker Belt Threading Diagram

When re-assembling:

The Picker may be removed and replaced alone or, if Carriage Assembly was removed, may be replaced as an assembled unit with the Carriage Assembly.

The Carriage goes in easier if the upper Bearing Block Assembly is installed first and the lower Bearing Block Assembly is installed last.

It is easier to install the belt on the Picker mechanism before the Carriage Assembly is installed (if the Picker and the Carriage Assembly are being installed as a unit).

Before attaching the Carriage Assembly to the leadscrew bracket, move the Carriage Assembly to the mailslot end of the rails.

After installing the Vertical Tensioner Cable T-bar under the Carriage Bracket, re-apply Loctite to seal the screw.

When installing the Picker Belt on the Picker Assembly, take the tension off the belt by pushing the belt Tensioning Assembly spring down. (See Figure 8-23.)

After re-assembly and with power off, move the Carriage manually to check for smooth horizontal and vertical movement.

8.6 Removing the Vertical Tensioner Assembly (Deskside Option)

1. Remove the two rack mounting screws and slide the chassis forward far enough to gain access to the Carriage Leadscrew Tensioner Cable Assembly. (The rack mounting screws are on the lower left side of the chassis, as viewed from the front of the Autochanger.)

   Refer to Figure 8-34.

2. Remove the screw holding the Vertical Tensioner Cable T-Bar under the Carriage Bracket. Do not remove the screw holding the Carriage Bracket to the Carriage Leadscrew.

Warning **The Vertical Tensioner Cable retracts very quickly when released and could cause injury. Letting the cable abruptly retract can also destroy the adjustment of the Vertical Tensioner Assembly.**

Use caution when separating the T-bar from its mount on the leadscrew.

---

3. Remove the Vertical Tensioner Cable from the Carriage Bracket.

   GENTLY let the T-bar be drawn up to the Vertical Cable Tensioner Assembly. Let the bar rest against the Tensioner Assembly box.

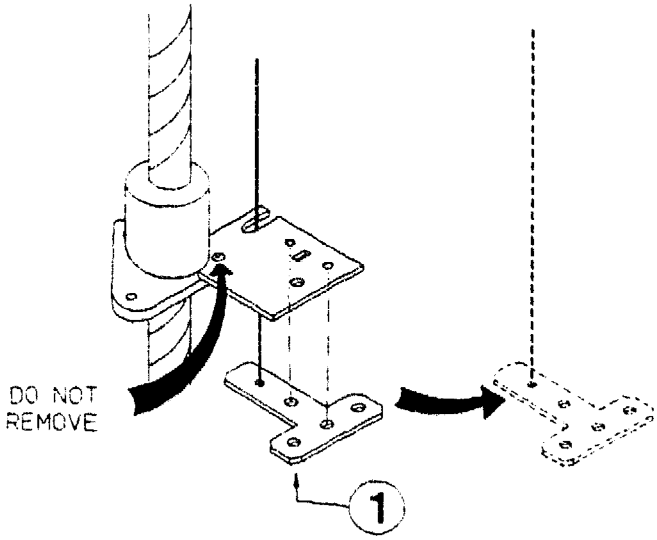


Figure 8-34. Removing the Vertical Tensioner Cable T-bar (Deskside Option)

Refer to Figure 8-35.

4. Remove the Vertical Cable Tensioner Assembly box from the top of the chassis by removing the screws shown in Figure 8-35.

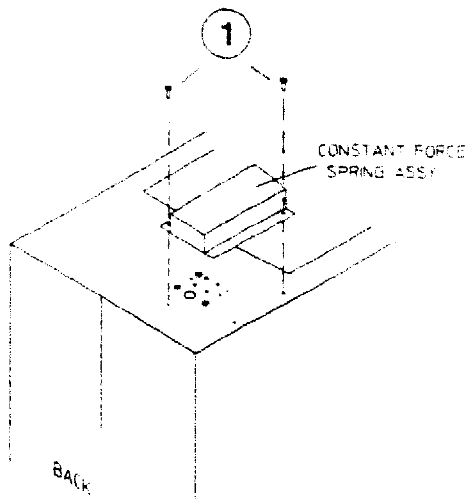


Figure 8-35. Removing the Vertical Tensioner Assembly

8.7 Removing the Carriage Motor

If this is a Deskside unit (a Vertical Tensioner Assembly is on the top of the chassis), refer to Section 8.6, "Removing the Vertical Tensioner Assembly." This uncovers the screws mounting the Carriage Motor. Continue with the steps below.

Refer to Figure 8-36.

1. Loosen the screws holding the Carriage Motor (Figure 8-36,(1)).
2. Remove the belt between the Carriage Motor and the Leadscrew.
3. Remove the Carriage Motor.

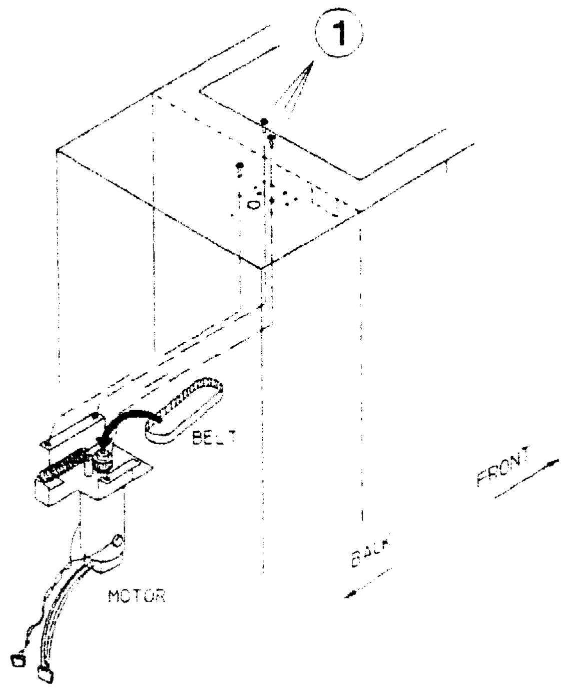


Figure 8-36. Removing the Carriage Motor

8.8 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 8-37 (1)).

3. Lift out the Leadscrew.

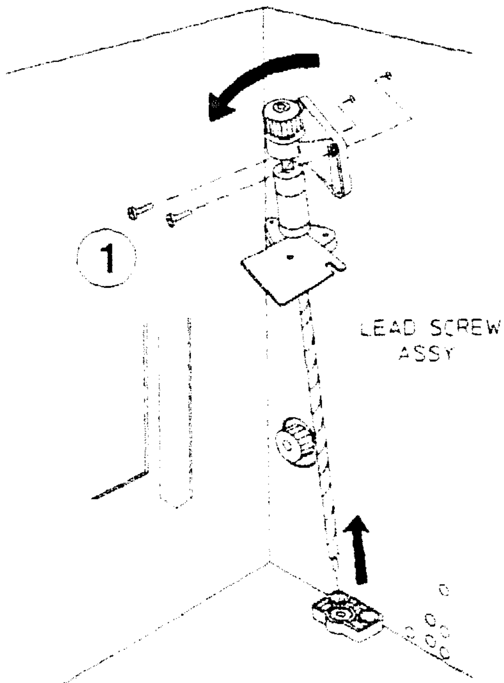


Figure 8-37. Removing the Carriage Leadscrew Assembly

8.9 Removing the Picker Motor

Refer to Figure 8-38, Figure 8-39, and Figure 8-41

1. Remove the Autochanger Controller PCA (refer to Section 8.2, "Removing PCAs," under "Autochanger Controller PCA").
2. Pull the MO Controller PCAs back (refer to Section 8.2, "Removing PCAs," under "MO Drive Control PCAs").

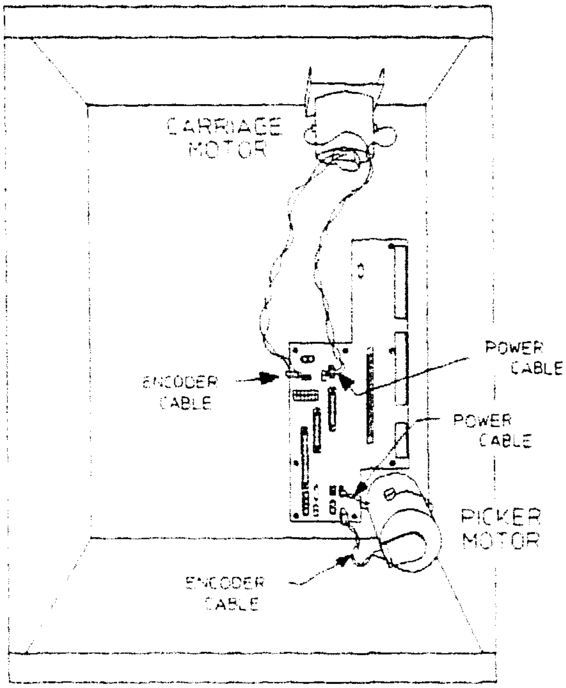


Figure 8-38. Carriage and Picker Motors

3. Remove the two cables connecting the Picker Motor to the Motherboard PCA (see Figure 8-38).

Refer to Figure 8-39

4. LOOSEN the motor mount screw on the inside of the electronics area (Figure 8-39 (1)) and the two mounting screws on the outside of the chassis (Figure 8-39 (2)). Do not remove the screws.
5. Remove the Picker Belt.

6. Remove the three Picker Motor mounting screws.
7. Loosen the tensioner spring (See Figure 8-41).
8. Remove the Picker Motor.

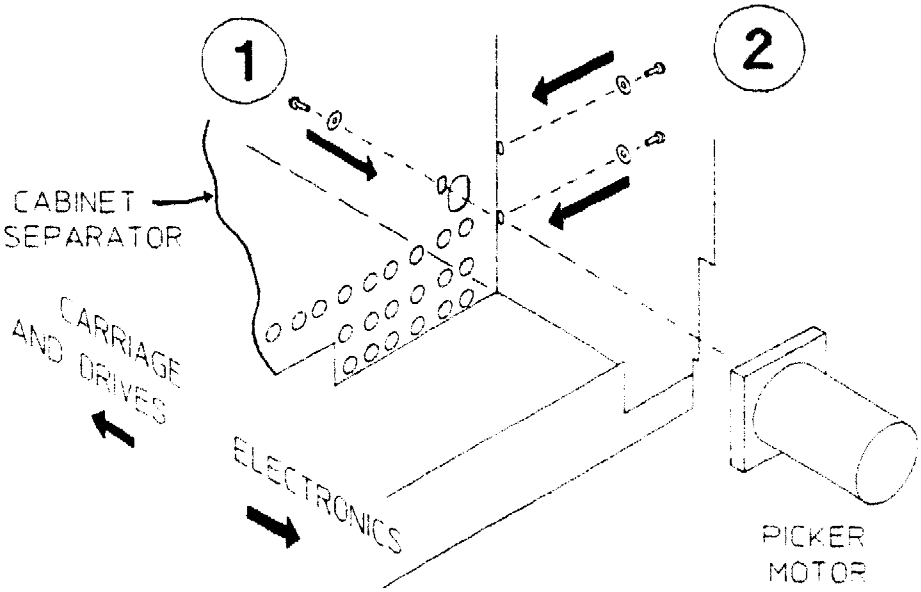


Figure 8-39. Picker Motor Mounting Screws

When re-assembling:

1. Put the replacement Picker Motor into the unit and START all three mounting screws. Do not fully tighten the screws yet.

2. Replace the Picker Belt. Tighten the screw located behind the Carriage Leadscrew (Figure 8-39 (1)).

3. Tighten the two remaining screws (Figure 8-39 (2)).

4. Check that the Picker Assembly can move and flip freely.

5. Replace the two Picker Motor cables (Figure 8-38).

6. Replace the Autochanger Controller PCA.

7. Replace the MO Drive Controller PCAs.

8.10 Removing the Leadscrew-side Carriage Way (rail)

1. Remove the Carriage/Picker Assembly.

   Use the appropriate procedures for removing the Carriage/Picker described in Section 8-5 (if a Deskside Option, the Vertical Tensioner T-bar will have to be separated from the Carriage Support Bracket, seen in Figure 8-31).

Refer to Figure 8-40

2. 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.

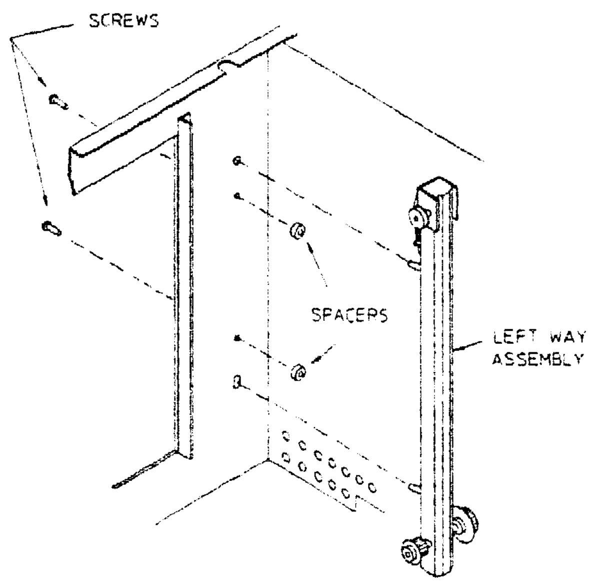


Figure 8-40. Removing the Leadscrew-side Carriage Way (rail)

Refer to Figure 8-41.

3. Loosen the tension on the belt between the Picker Motor and the pulley on the way.

   LOOSEN—but do not remove—the three screws that secure the Picker Motor. Two of the motor mounting screws are located on the outside of the chassis and the third is located behind the leadscrew.

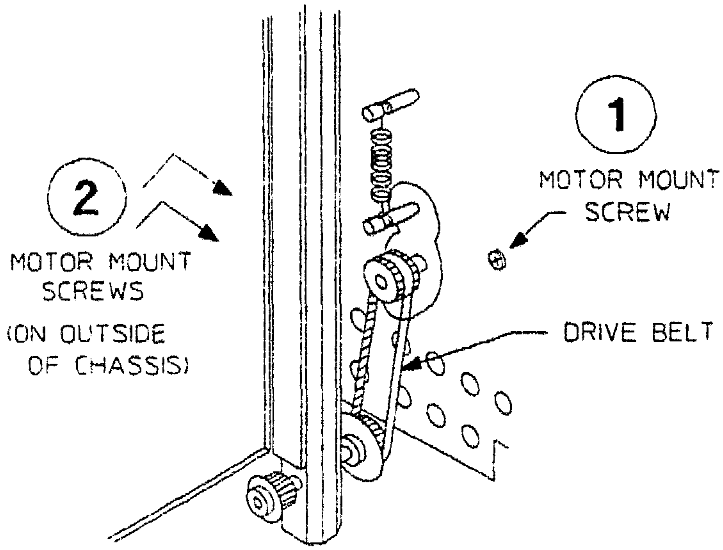


Figure 8-41. Picker Motor Mounting Screws and Drive Belt

4. Remove the Picker Motor belt from the bottom pulley on the way.
5. Remove the way from the chassis.

When re-assembling:

When re-mounting the Picker Motor belt on the way pulley, adjust the tension on the belt before tightening the three motor mount screws.

Do not forget the spacers that go between the way and the side of the chassis.

8.11 Removing the Mailslot

Refer to Figures 8-42 and 8-43.

1. Remove the Front Panel.

Refer to Section 8.1 "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 8-42 (1)).
3. Disconnect the mailslot sensor cable.

4. Pull the mailslot out.

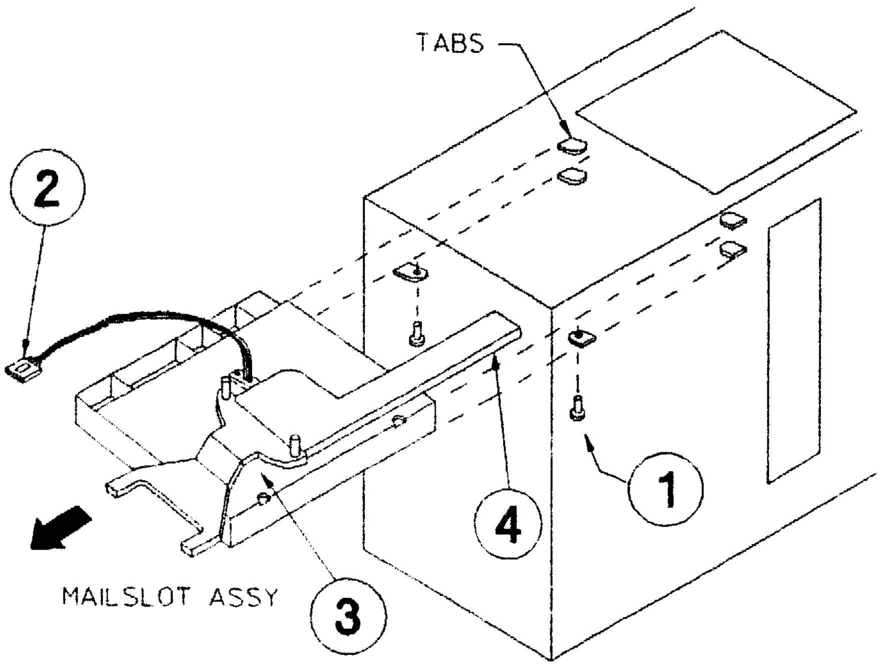


Figure 8-42. Removing the Mailslot Assembly

When re-assembling:

Pull the actuator arm on the mailslot (Figure 8-43) all the way back (towards the rear of the unit) before placing the Front Panel into position.

Pulling the arm back raises the mailslot door and makes it possible for the Front Panel to be placed into position.

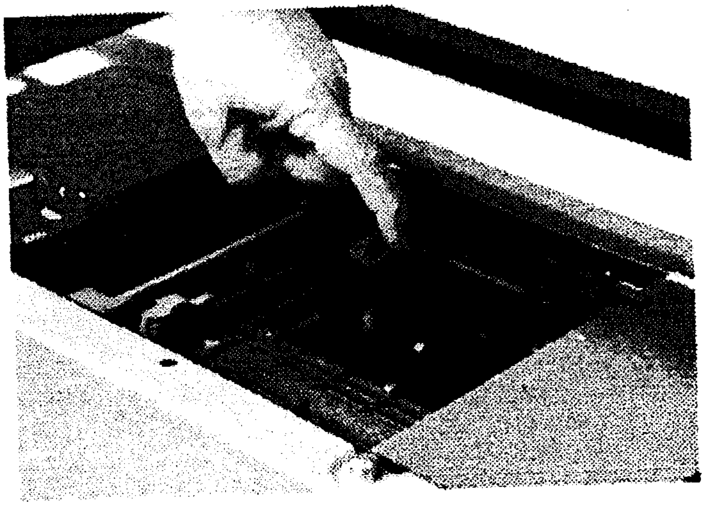


Figure 8-43. Actuator Arm Retraction Before Installing the Front Panel

8.12 Wiring Diagrams

Note The following wiring diagrams use the Deskside Option orientation (the Carriage/Picker Assembly moves vertically).

Internal placement of components is the same for the Rackmount Option.

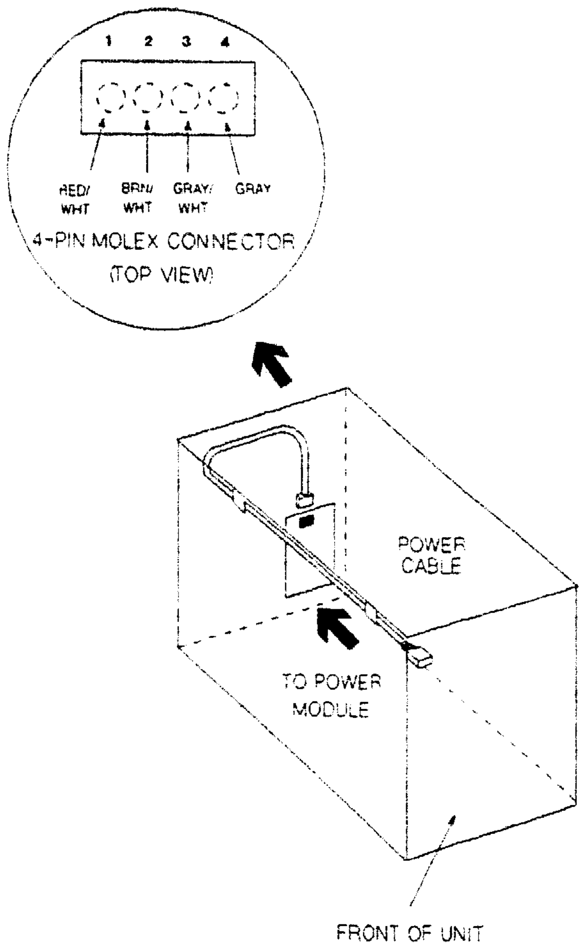


Figure 8-44. Power Cable

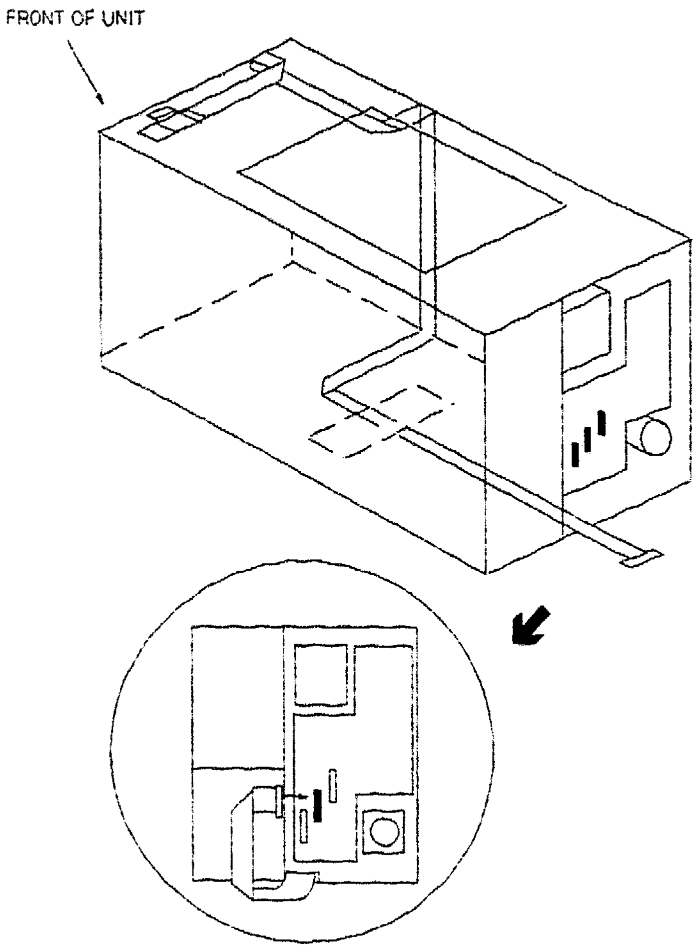


Figure 8-45. Control Panel Cable

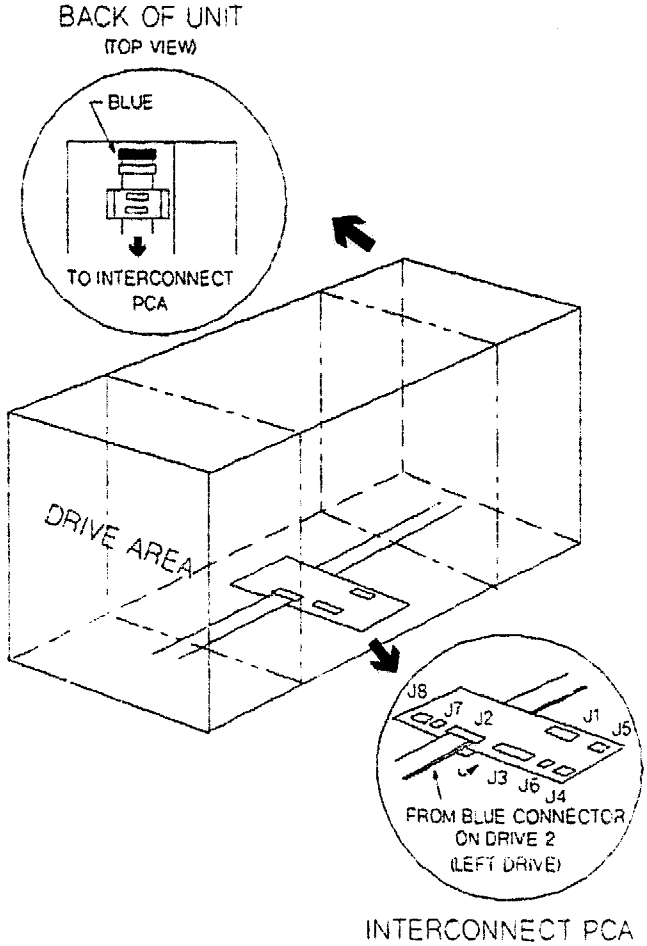


Figure 8-46. Drive 1 (left drive) Control Cable

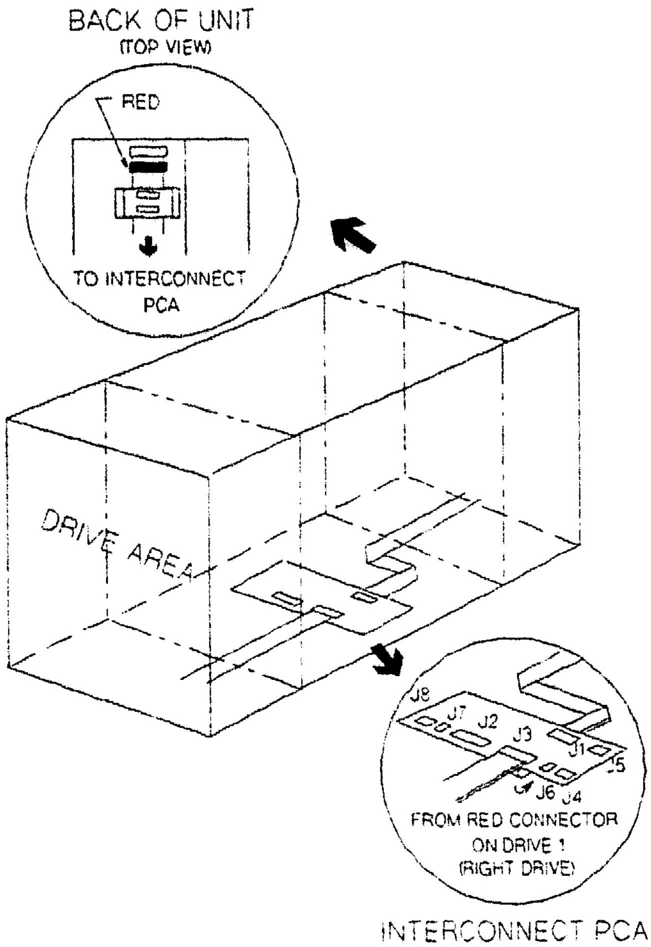


Figure 8-47. Drive 2 (right drive) Control Cable

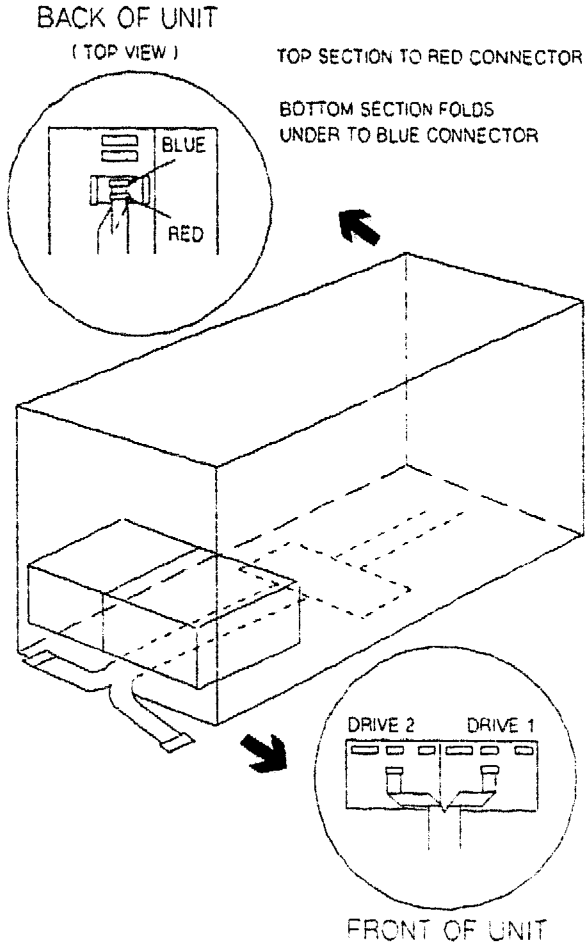


Figure 8-48. ESDI Data Cables

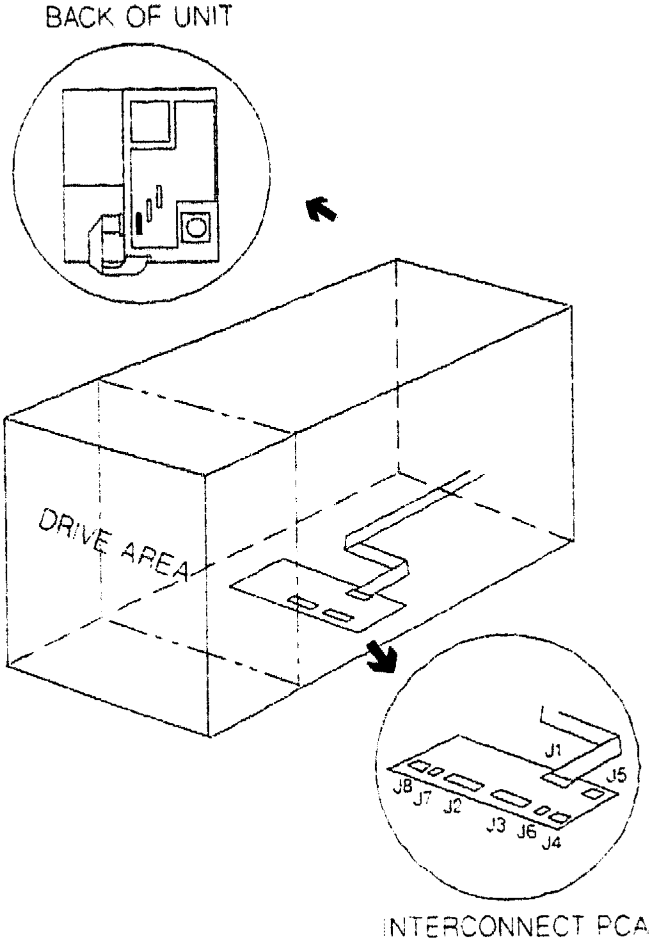


Figure 8-49. Sensor Cable

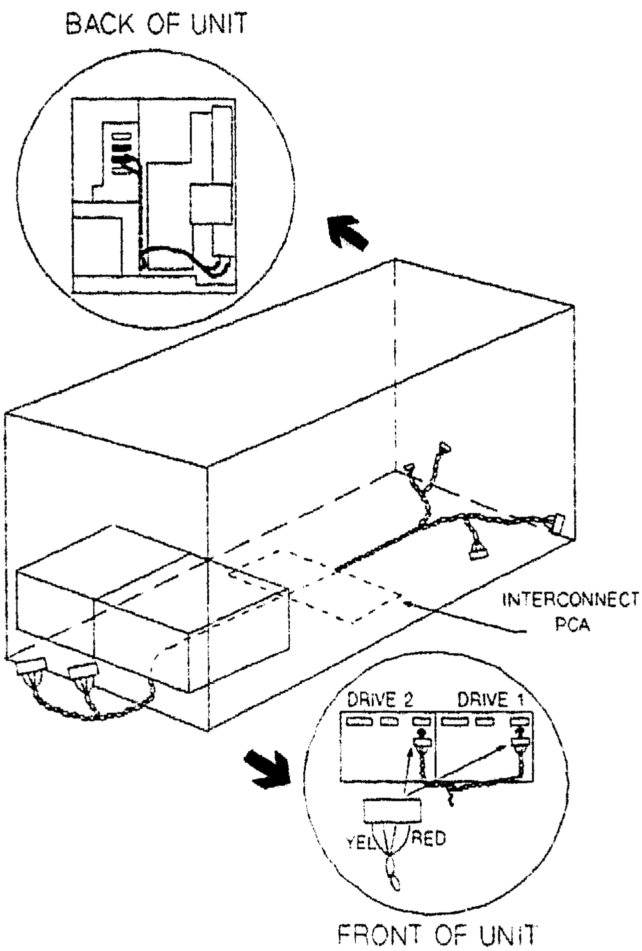


Figure 8-50. Drive Power Cables

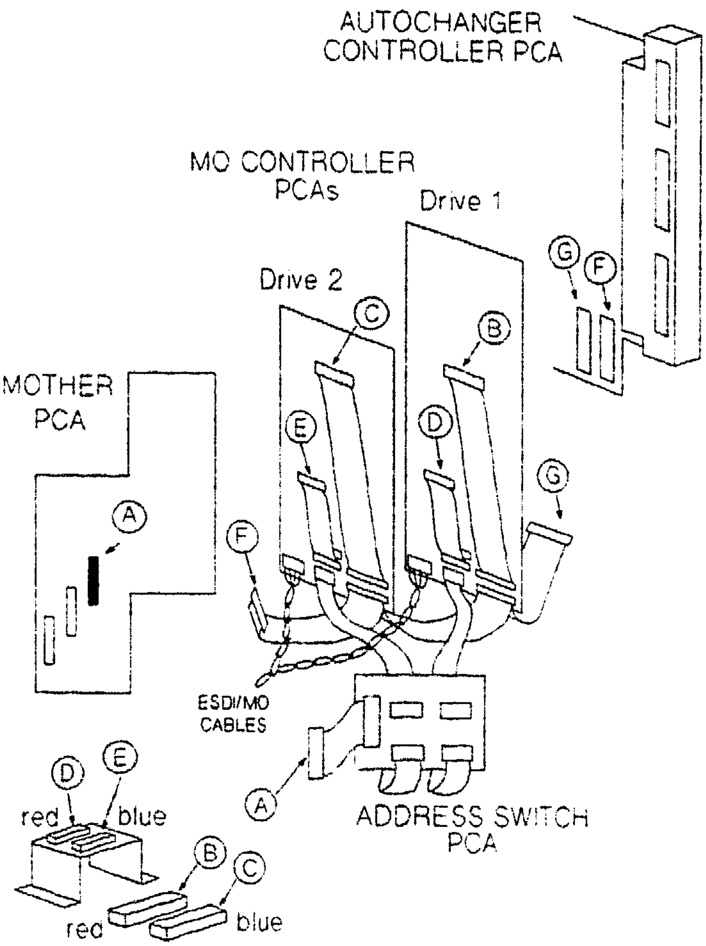


Figure 8-51. MO Controller PCA Cables

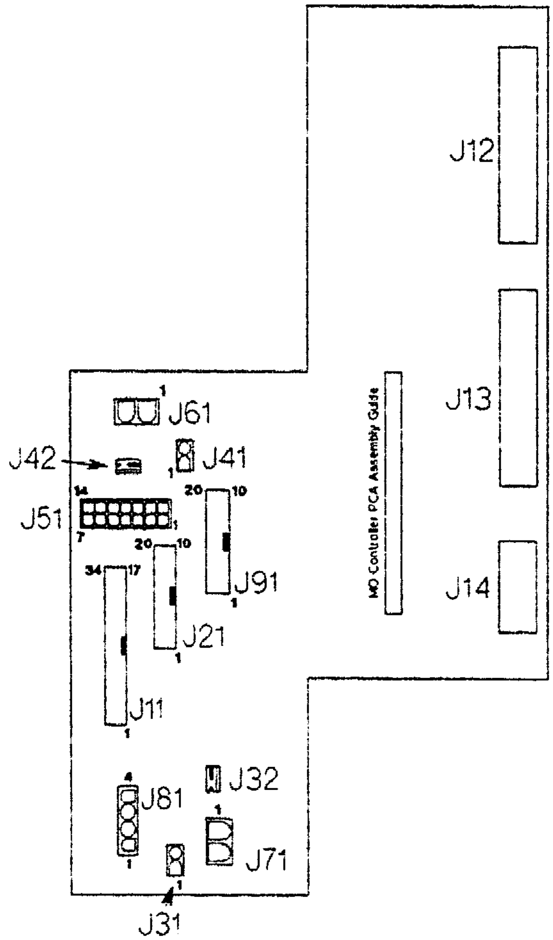


Figure 8-52. Mother PCA Connectors

Table 8-3. Cables Attached to the Mother PCA

Connector Code	Cable Name
J11	Sensor Cable (to Interconnect PCA)
J12	Controller Power/Address Switch (connector for Controller PCA)
J13	Interconnect/Front Panel (connector for Autochanger Controller PCA)
J14	Motor/Power (connector for Autochanger Controller PCA)
J21	Front Panel Cable
J31	Power Module Cooling Fan Cable
J32	Picker Motor Encoder Cable
J41	Cooling Fan
J42	Carriage Motor Encoder Cable
J51	Electronics Power Input to Mother PCA
J61	Carriage Motor Power Cable
J71	Picker Motor Power Cable
J81	24 Vac Power Cable
J91	ESDI PCA Address Switches Cable

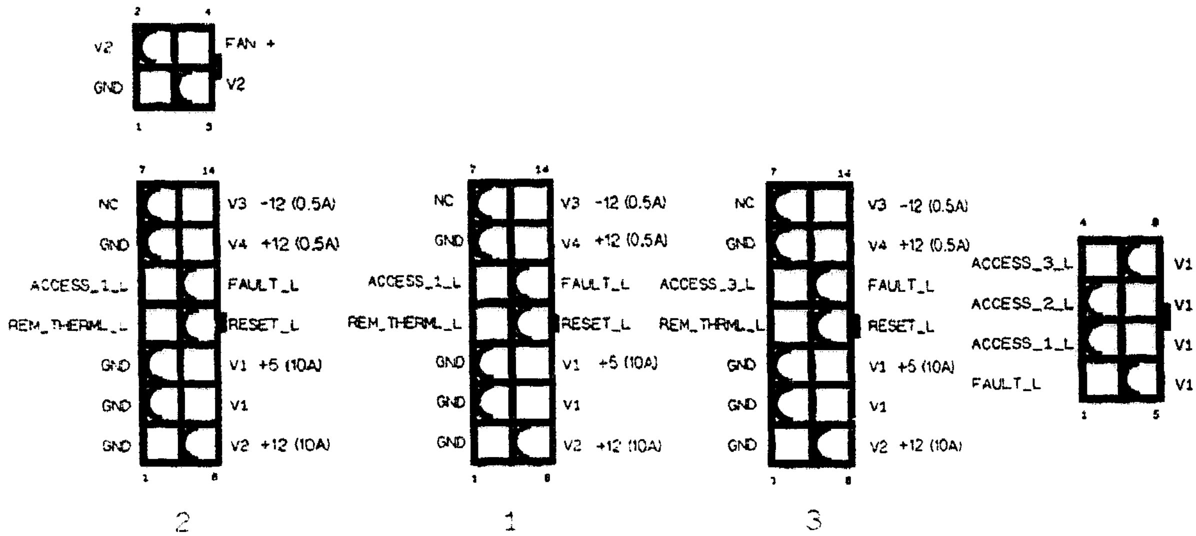


Figure 8-53. 12V and 5V Power Module Pinouts (Closeup of Figure 8-16 (2))

8.13 Removing the Power Supply Module (RSE)

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 8-54.

3. Remove the 11 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.

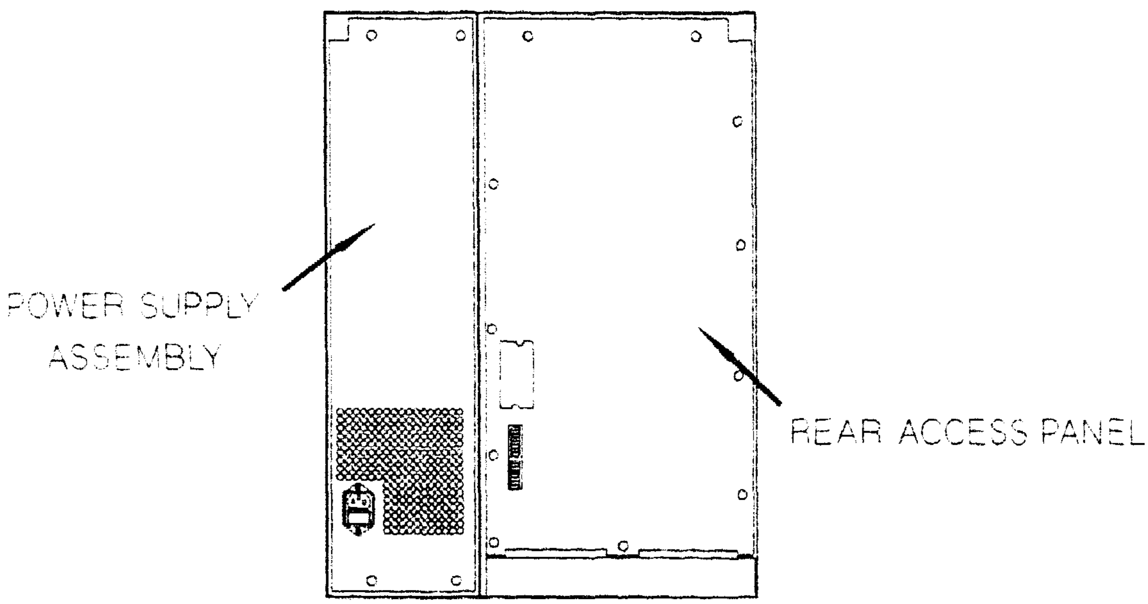


Figure 8-54. The Rear Access Panel and Power Supply

5. Remove the four screws that hold the power supply to the chassis.

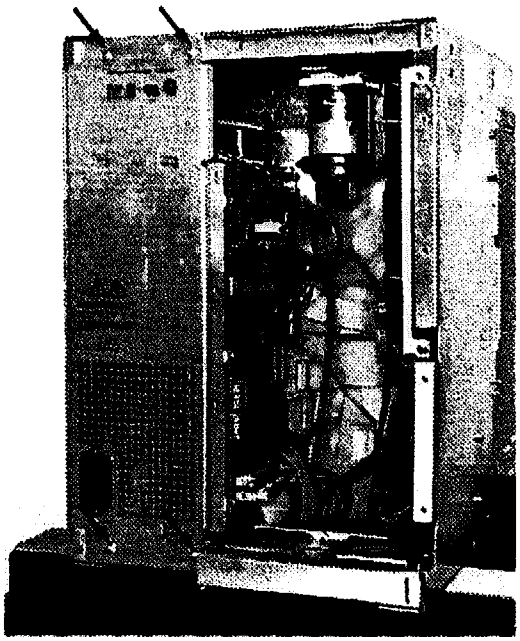


Figure 8-55. Power Supply Mounting Screws

6. Rotate the power supply out from the chassis far enough to disconnect the power cables from the power-receptacle end of the supply.

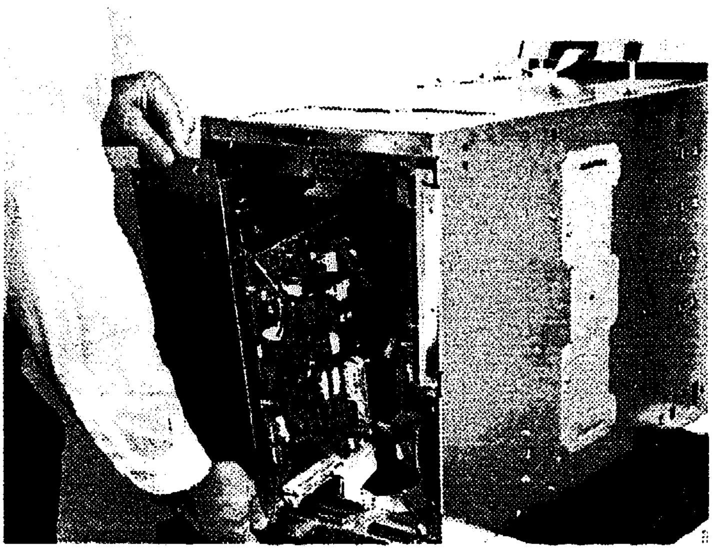


Figure 8-56. Rotating the Power Supply Module Out of the Chassis

7. If you have entered this procedure from another procedure, return to where you came from.

8.14 Removing PCAs (RSE)

Autochanger Controller PCA

1. Do the first SIX steps of "8.13 Removing the Power Supply Module (RSE)." Return here.

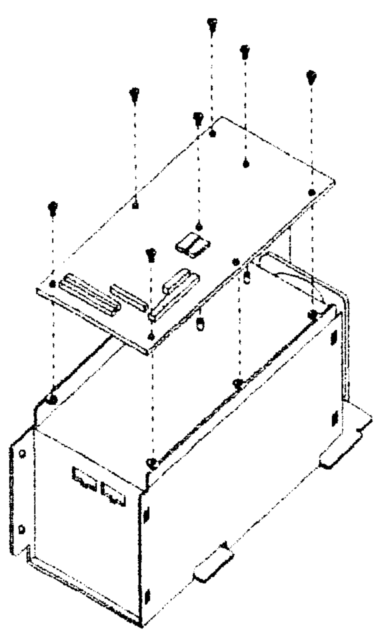


Figure 8-57. Removing the Autochanger Controller PCA

2. Remove the five mounting screws and washers that secure the Autochanger Controller PCA to the power supply assembly. Remove the PCA.
3. Check the configuration of the dip switches S1 and S2.

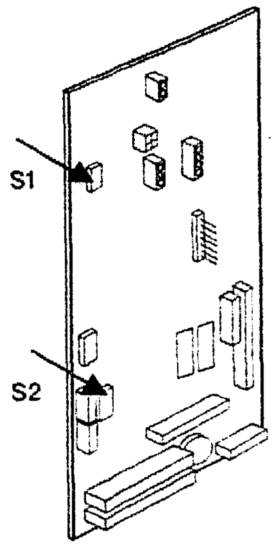


Figure 8-58. Dip Switch Locations on the Autochanger Controller PCA

Table 8-4.
S1 Switch Settings
(RSE-version Autochanger Controller PCA)

Position	Description	Default
1-4	Allows proper display of "A" or "M" product designation on Control Panel display	C17xxA versions— All "OFF" C17xxM versions— Pos. 3 "ON", All others "OFF"

Table 8-5. S2 Switch Settings (RSE-version Autochanger Controller PCA)

Position	Description	Default
1	Clear RAM	open
2	W_DR_IDfor non-Sony drives (returns "Invalid Configuration" if Open)	closed
3	"Full" or "Half" Autochanger configuration	
	"Full"	closed
	"Half"	open
4	"Full" or "Half" Autochanger	
	"Full"	open
	"Half"	closed
5	Termpower (see next table, "Termpower Settings")	-
6	Termpower (see next table, "Termpower Settings")	-
7	Termpower (see next table, "Termpower Settings")	-
8	Password (used with "1" to clear RAM)	open

Note

The default settings for a "Full" Autochanger Configuration (two magazines) are positions 2,3,5 closed.

The default settings for a "Half" Autochanger Configuration (four magazines) are positions 2,4,5 closed.

**Table 8-6.
Termpower Settings
(RSE-version Autochanger Controller PCA)
(SW 2, 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 five screws and washers that were previously removed. Loosely start each screw and then tighten them.
6. Re-connect the two power cables to the connectors on the end of the power supply assembly.
7. Rotate the power supply back into the chassis.
8. Mount the power supply using four screws.
9. Re-connect all the cables to the Autochanger Controller PCA. The cables are shown in Figure 8-59.

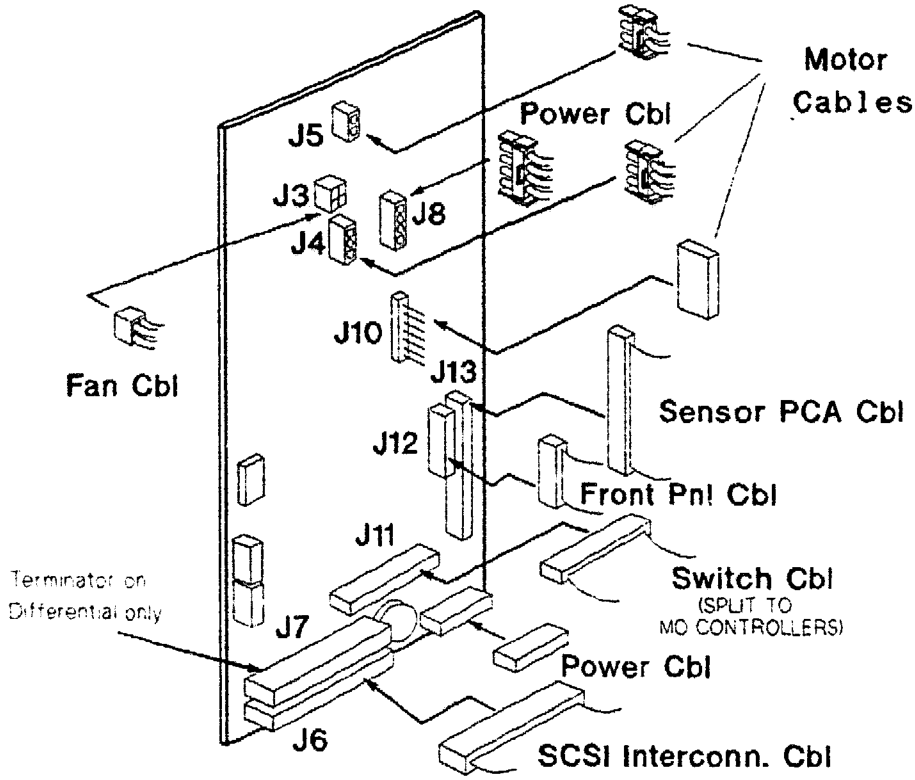


Figure 8-59. Autochanger Controller PCA Cable Connections

After re-assembling:

Clear and re-initialize the NVRAM:

—*Select* CONF 66—*Clear (zero all RAM)*
—*Select* CONF 16—*Clear (reset critical values)*
—*Select* CONF 18—*Clear (reset Autochanger odometers)*
—*Select* TEST 10—*Initialize Element Status (requires the password).*

See Section 8.21 for an explanation of variables that are being set.

MO Drive Controller PCAs

1. Do the first THREE steps of "8.13 Removing the Power Supply Module (RSE)."

   Return here.

2. Remove the two screws that hold the Drive Controller PCA mounting plate to the Disk Library System chassis.

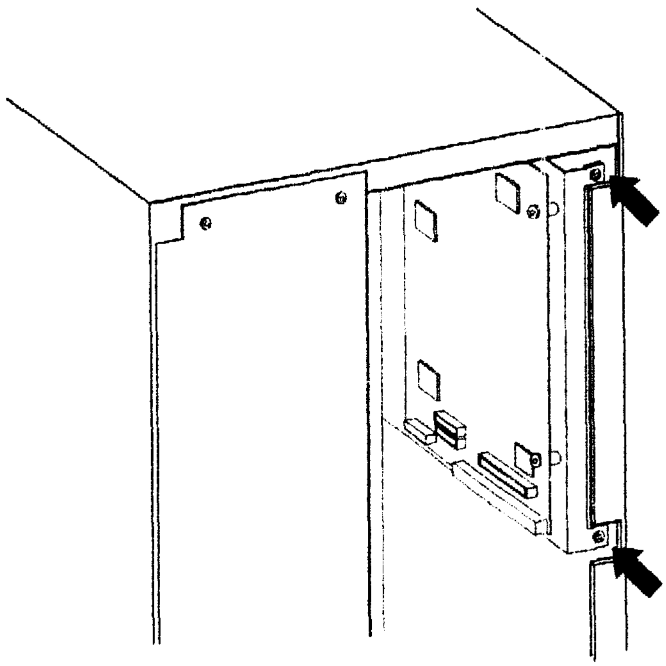


Figure 8-60. Removing the MO Drive Controller PCA Mounting Plate

3. Rotate the Drive Controller PCA mounting plate (which still holds the Drive Controller PCA(s)) out of the chassis far enough to make cable removal easy.

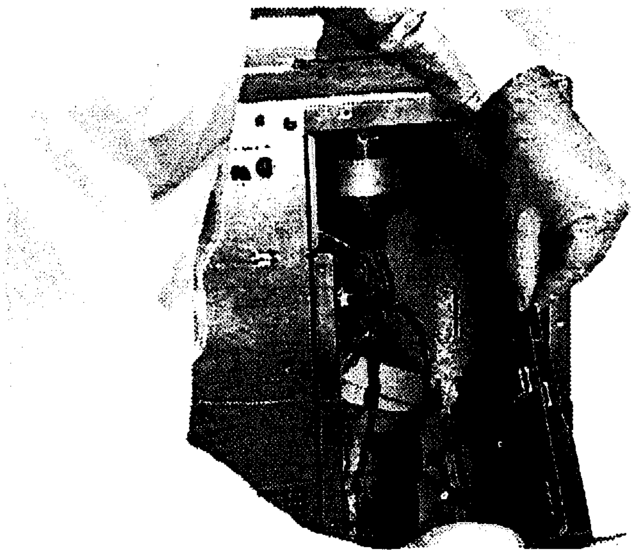


Figure 8-61.
Rotating the MO Drive Controller PCA Assembly Out of the Chassis

4. Disconnect the cables attached to the Drive Controller PCA (or PCAs).

5. For the Drive Controller PCA desired, remove the four screws that hold the PCA to the mounting plate.

When re-assembling:

Position the Drive Controller PCA(s) so that the component side of the board is facing towards the mounting plate and the edge connectors are on the bottom.

Connect the blue-striped SCSI and data cables go to Drive 2. The red-striped SCSI and data cables go to Drive 1.

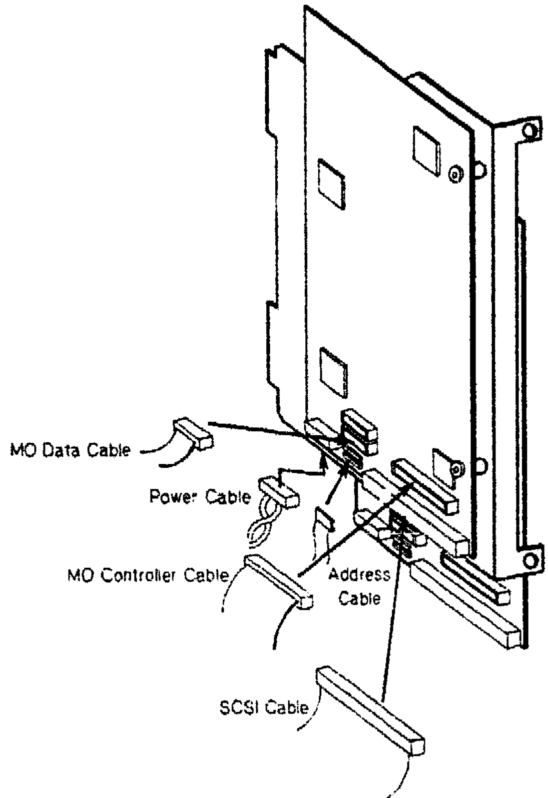


Figure 8-62. Number 1 Drive Controller PCA Cable Connections

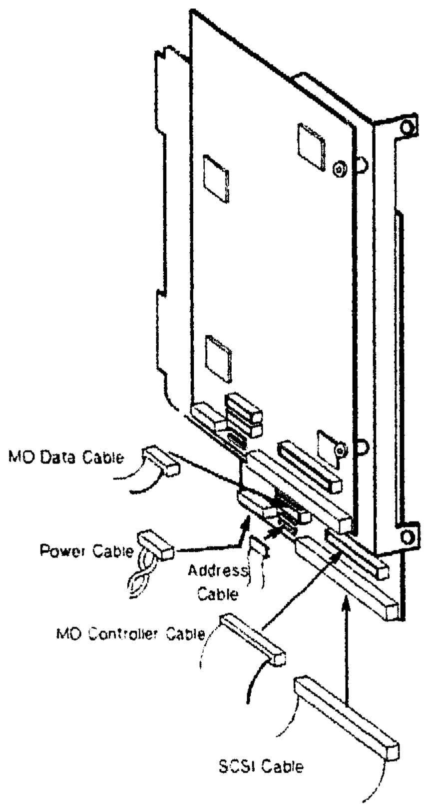


Figure 8-63. Number 2 Drive Controller PCA Cable Connections

8.15 Autochanger Controller PCA Code Changes (RSE)

1. Do the first SIX steps of procedure "8.13 Removing the Power Supply Module (RSE)."

   This separates the power supply/Autochanger Controller PCA from the chassis.

   Return here.

2. Place the power supply/Autochanger Controller PCA on a static mat.
3. Replace the ROMs.

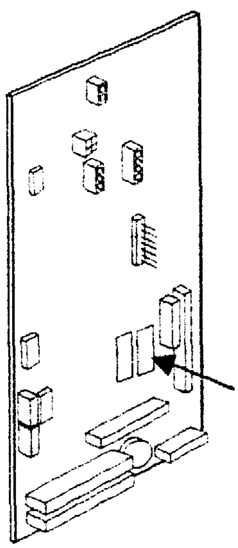


Figure 8-64. Autochanger Controller PCA ROM Location

4. Re-connect the cables to the bottom of the power supply.
5. Replace the power supply/Autochanger Controller PCA back into the chassis, secure the power supply with four screws, re-connect all cables to the Autochanger Controller PCA.
6. Replace the rear access panel.
7. Clear and re-initialize the NVRAM.

Clear and re-initialize the NVRAM:

—*Select* CONF 66—*Clear (zero all RAM)*
—*Select* CONF 16—*Clear (reset critical values)*
—*Select* CONF 18—*Clear (reset Autochanger odometers)*
—*Select* TEST 10—*Initialize Element Status (requires the password).*

See Section 8.21 for an explanation of variables that are being set.

8.16 MO Drive Controller PCA Code Changes (RSE)

1. Do the first SEVEN steps of "8.13 Removing the Power Supply Module (RSE)." In step 7, remove BOTH PCAs.

   Return here.

2. Place the PCAs on a static mat.
3. Replace the ROMS as necessary.
4. Re-attach the MO Controller PCAs onto the mounting plate.

   The component side of both PCAs faces left. This means that component side of the Number 2 Drive Controller PCA is facing the mounting bracket.

8.17 Removing the MO Drives (RSE)

1. Remove the front panel.

   Remove the front panel as described in Section 8.1, "Service Access." 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.

Refer to Figure 8-65.

3. Disconnect the drive power cables and ribbon interface cables from the rear of the drives.

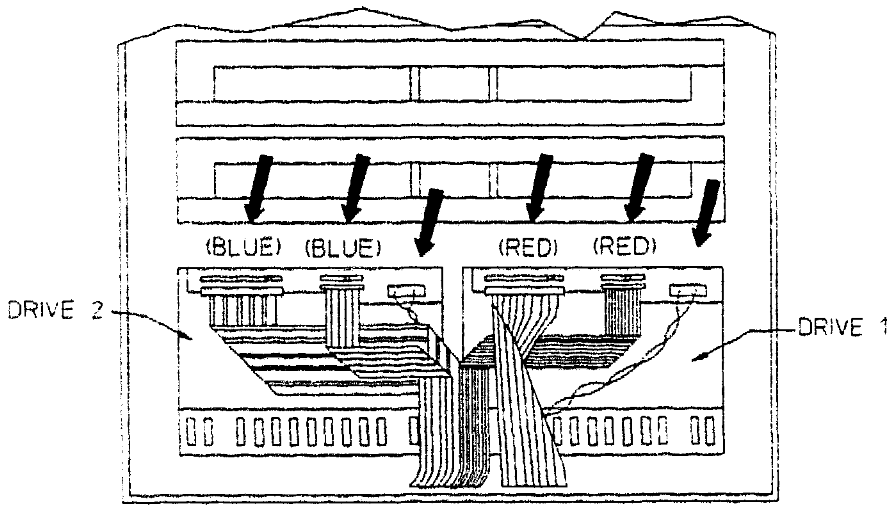


Figure 8-65. Removing the Control, Data, and Power Cables from the MO Drives

Refer to Figure 8-66.

4. Remove the plastic cover from the Interconnect PCA (not shown).
5. Disconnect the two Optical Sensor connectors from the Interconnect PCA.

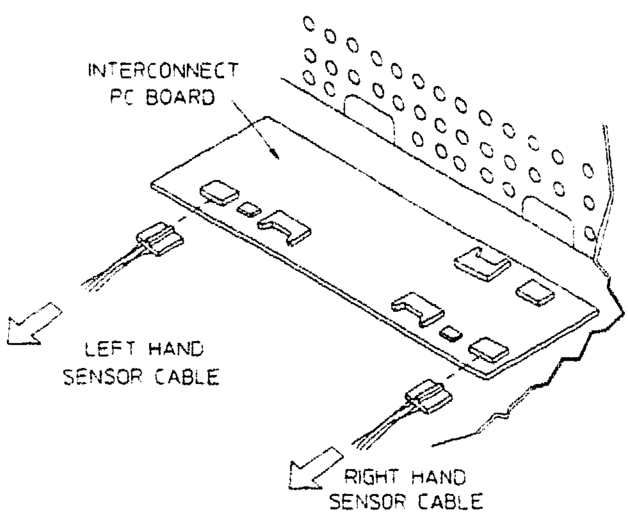


Figure 8-66. Removing the Sensor Cables from the Interconnect PCA

6. Loosen the two captive screws at each end of the front of the drive tray.

Caution Make sure the Picker is clear of the Optical Sensors at the front of the drives. A sensor tab on the end of the Picker can be damaged if it is between the prongs of an Optical Sensor when the drive tray is pulled out.

---

7. Slide the Drive Assembly out.

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

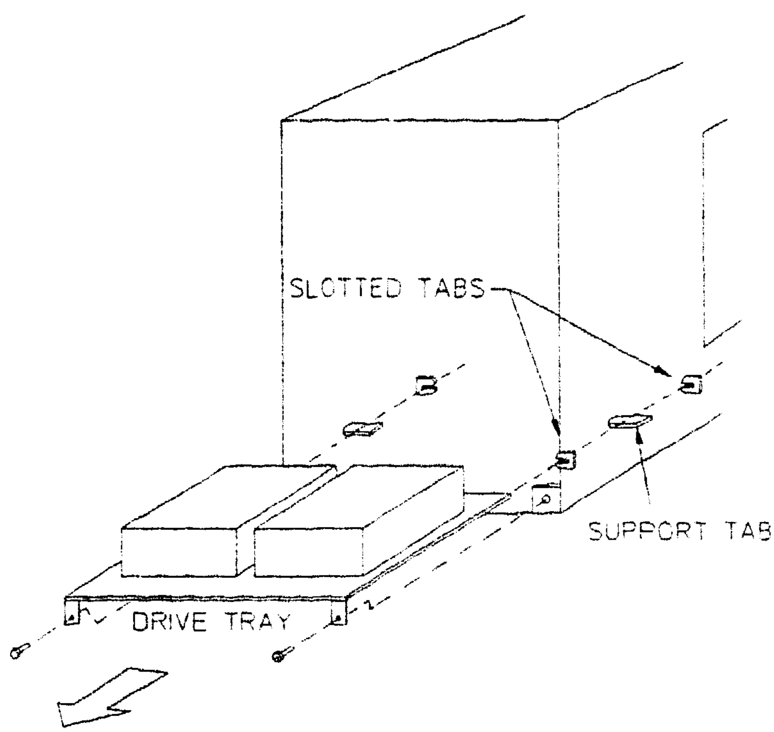


Figure 8-67. Removing the MO Drives

8. Remove the ground wires. The ground wires are white/black wires that go from the rear of each drive to the drive tray. The connector on the rear of each drive is a bayonet connector.

9. Each drive is attached to the tray with four screws. Remove screws as necessary to replace drive(s).

When re-assembling:

After reversing the disassembly steps and remounting the drives, refer to the re-assembly notes in Section 8.1, "Service Access," to correctly remount the front panel.

8.18 Removing the Carriage Motor (RSE)

Refer to Figure 8-68.

1. Loosen the screws holding the Carriage Motor (Figure 8-68 (1)).
2. Remove the belt between the Carriage Motor and the Leadscrew.
3. Remove the Carriage Motor.

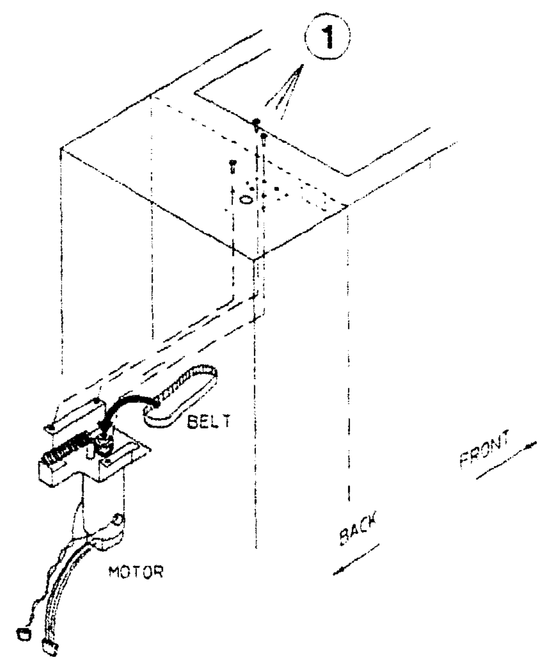


Figure 8-68. Removing the Carriage Motor

8.19 Removing the Picker Motor (RSE)

Refer to Figure 8-69 and Figure 8-70.

1. Do the first THREE steps of "8.13 Removing the Power Supply Module (RSE)."

   Return here.

2. Remove the two cables connecting the Picker Motor to the Autochanger Controller PCA.

3. Loosen the tensioner spring (see Figure 8-69).

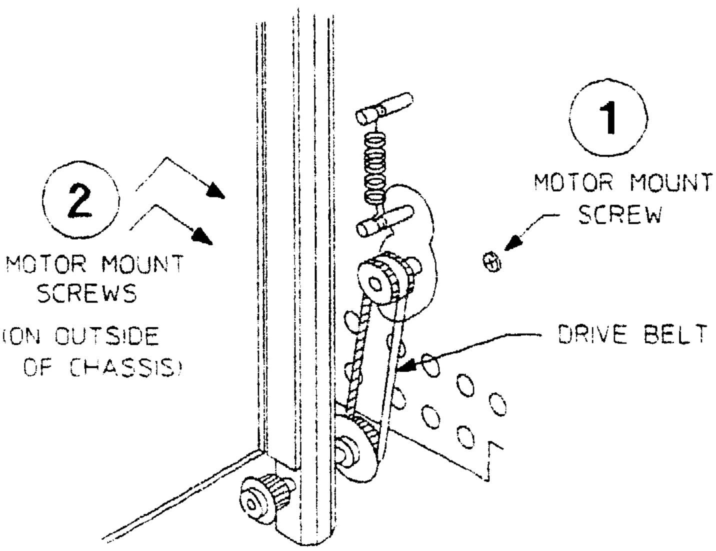


Figure 8-69. Picker Motor Mounting Screws and Drive Belt

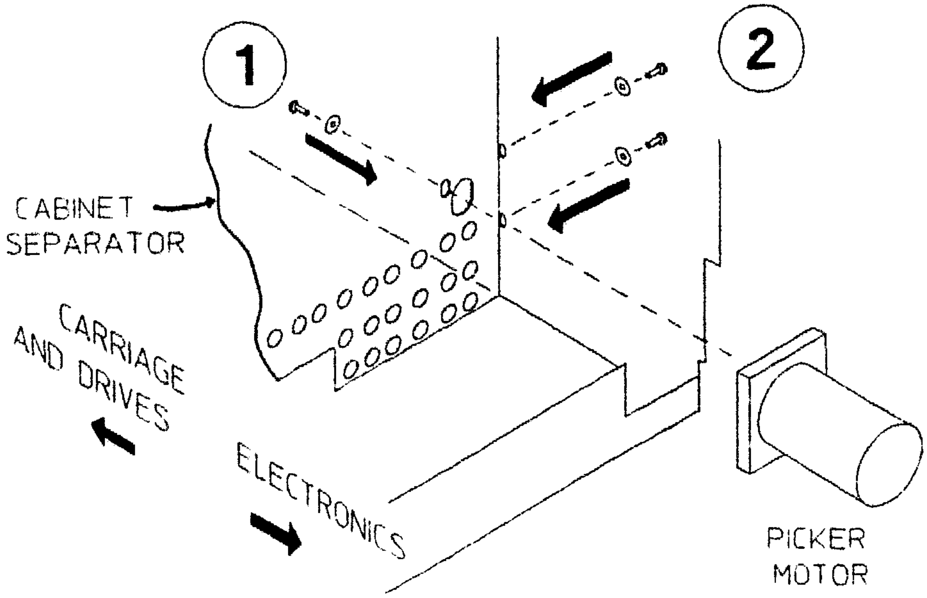


Figure 8-70. Picker Motor Mounting Screws

4. LOOSEN the motor mount screw on the inside of the electronics area (Figure 8-70 (1)) and the two mounting screws on the outside of the chassis (Figure 8-70 (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 START all three mounting screws. Do not fully tighten the screws yet.*
2. *Replace the Picker Belt. Tighten the screw located behind the Carriage Leadscrew (Figure 8-70 (1)).*
3. *Tighten the two remaining screws (Figure 8-70 (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.*

8.20 Removing the Power Supply Fan (RSE)

1. Do the first FIVE steps of "8.13 Removing the Power Supply Module (RSE)."

   Return here.

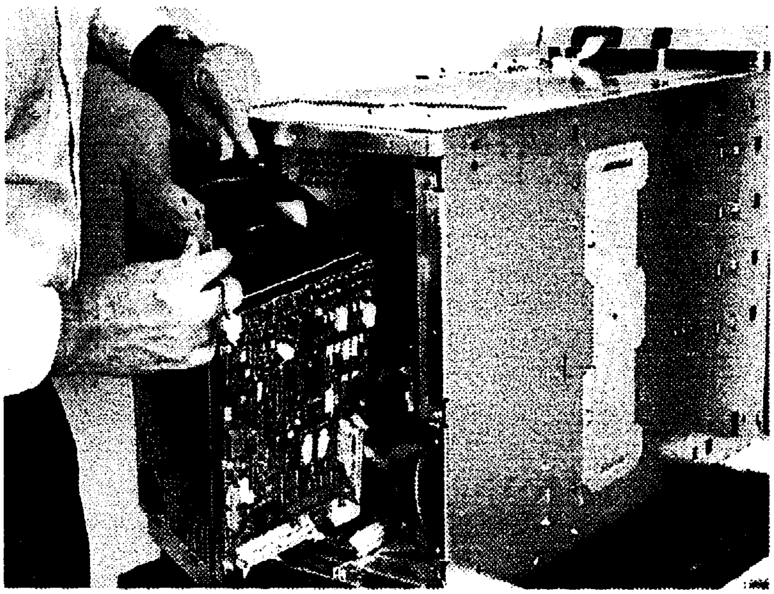


Figure 8-71. Rotating the Power Supply Out to Access the Fan

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.

8.21 Re-initializing Autochanger Controller PCA RAM After Service (all models)

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 Configs 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 (RSE versions only)

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 strange errors.

8.22 Replaceable Parts

Exchange Assemblies

C1700A/M and C1703A Exchange Assemblies

FRU	Exchange Part Number	Description
5	C1700-69005	MO Drive Controller PCA
20	C1700-69010	MO Drive
	HP C1700A Unique Parts, 2931A00100 - 3045Axxxxx	
1	C1700-69001	Autochanger Controller PCA - Model 20 GB/A
	HP C1700A Unique Parts, 3107Axxxxx	
1	C1700-69101	Autochanger Controller PCA - Model 20 GB/A
	HP C1703A Unique Parts, 3135A00100	
1	C1703-69011	Autochanger Controller PCA - Model 10 GB/A
	HP C1700A Unique Parts, 3136A00100	
	HP C1700M Unique Parts, 3145A00100	
1	C1703-69001	Autochanger Controller PCA - Model 20 GB/A
	HP C1703A and C1700A/M Common Parts	
28	C1703-69028	Power Supply Assembly

C1700A/M and C1703A Non-Exchange Assemblies/Parts

FRU	Part Number	Description
		HP C1700A Unique Parts
		2931A00100 thru 3045Axxxxx
0	C1700-60000	Motherboard PCA
4	C1700-60004	Interconnect PCA
56	C1700-60056	Front Panel Cable
71	C1700-60071	Mailslot Cable
	C1700-60072	Adapter Cable for Mailslot
		HP C1700A Unique Parts, 3107Axxxxx
0	C1700-60100	Motherboard PCA
	C1700-60159	Sensor Cable
56	C1700-60156	Front Panel Cable
71	C1700-60171	Mailslot Connector Cable
		HP C1700A Unique Parts
		2931A00100 thru 3045Axxxxx and 3107Axxxxx
22	C1700-60012	Rackmount Display Panel
33	C1700-60033	Constant Force Spring
	C1700-60013	Drive Address PCA
51	C1700-60051	ESDI/MO Power Cable
52	C1700-60052	5/12V Power Cable
53	C1700-60053	ESDI/MO Control Cable
54	C1700-60054	ESDI/MO Data Cable
55	C1700-60055	Interface SCSI Cable
58	C1700-60058	Motor Power Cable
59	C1700-60059	Interconnect Cable
66	C1700-60066	Line Switch Cable
22	C1700-60022	Deskside Display Panel

FRU	Part Number	Description
24	C1700-60014	Rackmount Front Panel
24	C1700-60024	Deskside Front Panel
38	C1700-60038	Fan Assembly
	C1700-60044	Top Access Panel
	C1700-60062	Rear Access Panel
75	C1700-60075	Interconnect Cable
	C1700-60076	Drive Address Cable
	C1700-60077	Right MO Cable
	C1700-60078	Controller Inter Cable
	C1700-60079	Switch Cable
	C1700-60080	Encoder Cable
67	C1700-60067	24V Power Cable
	HP C1703A Unique Parts, 3135A00000,	
	HPC1700A Unique Parts, 3136A00100	
	HP C1700M Unique Parts, 3145Axxxx	
22	C1700-60112	Rackmount Display Panel
22	C1700-60122	Deskside Display Panel
	C1700-60114	Rackmount Front Panel
51	C1700-60051	ESDI/MO Power Cable
	C1703-60050	18 to 14,4,4 Power Cable
	C1703-60053	Left MO Cable
54	C1703-60054	ESDI/MO Data Cable
	C1703-60055	Internal SCSI Cable
56	C1703-60056	Front Panel Cable

FRU	Part Number	Description
	C1703-60059	Sensor PCA Cable
	C1703-60066	Standby Mailslot Cable
	C1703-60044	Top Access Panel
	C1703-60062	Rear Access Panel
38	C1703-60068	Fan Assembly
	C1703-60077	Right MO Cable
	C1703-60079	Switch Cable
	C1703-60080	Encoder Cable
	HP C1703A Unique Parts, 3135A00000, HPC1700A Unique Parts, 3136A00100 and HP C1700A Unique Parts, 3107Axxxx	
4	C1703-60104	Interconnect PCA
	HP C1703A/C1700A/M Common Parts	
21	C1700-60021	Left Way
	C1700-60043	HP Grey Trim Panel
	C1700-60045	Side Access Panel
23	C1700-60023	Carriage Motor
24	C1700-60024	Deskside Front Panel
25	C1700-60125	Picker Motor
26	C1700-60026	Magazine
27	C1700-60027	Picker
29	C1700-60229	Mailslot Assembly
30	C1700-60030	Optical Sensor Assembly
32	C1700-60032	Leadscrew
34	C1700-60034	Picker Motor Belt

FRU	Part Number	Description
35	C1700-60035	Carriage Motor Belt
39	C1700-60139	Spring Bearing Block Assembly
40	C1700-60240	Carriage Assembly
	C1700-60070	Dual Mailslot Sensor Cable
65	C1700-60065	AC/24V Power Cable
	HP C1700A Deskside Firmware	
37	C1700-60437	C1700A #1AB Autochanger Controller ROM
36	C1700-60236	MO Drive Controller ROM
	HP C1700A Rackmount Firmware	
37	C1700-60737	C1700A #1AC Autochanger Controller ROM
36	C1716-60236	MO Drive Controller ROM
	HP C1703A Firmware, 3135A00000	
	HPC1700A Firmware, 3136A00100	
37	C1703-60037	C1703A/C1700A Autochanger Controller ROM
36	C1700-60236	MO Drive Controller ROM
	HP C1700M Firmware, 3145Axxxxx	
31	C1703-60037	C1700M Autochanger Controller ROM
36	C1716-60022	MF Drive Controller ROM

C1710A/M and C1713M Exchange Assemblies

FRU	Exchange Part Number	Description
5	C1700-69005	MO Drive Controller PCA
20	C1700-69010	MO Drive
	HP C1710A Unique Parts	
	2932A00100 - 3047Axxxxx	
1	C1700-69001	Autochanger Controller PCA - 20
	HP C1710A Unique Parts, 3105Axxxxx	
	HP C1710M Unique Parts, 3049Axxxxx	
1	C1700-69101	Autochanger Controller PCA - 20
	HP C1713M Unique Parts, 3137A00100	
1	C1703-69011	Autochanger Controller PCA - 10
	HP C1710A Unique Parts, 3133A00100	
	HP C1710M Unique Parts, 3134A00100	
1	C1703-69001	Autochanger Controller PCA - 20
	HP C1713M and C1710A/M Common Parts	
28	C1703-69028	Power Supply Assembly

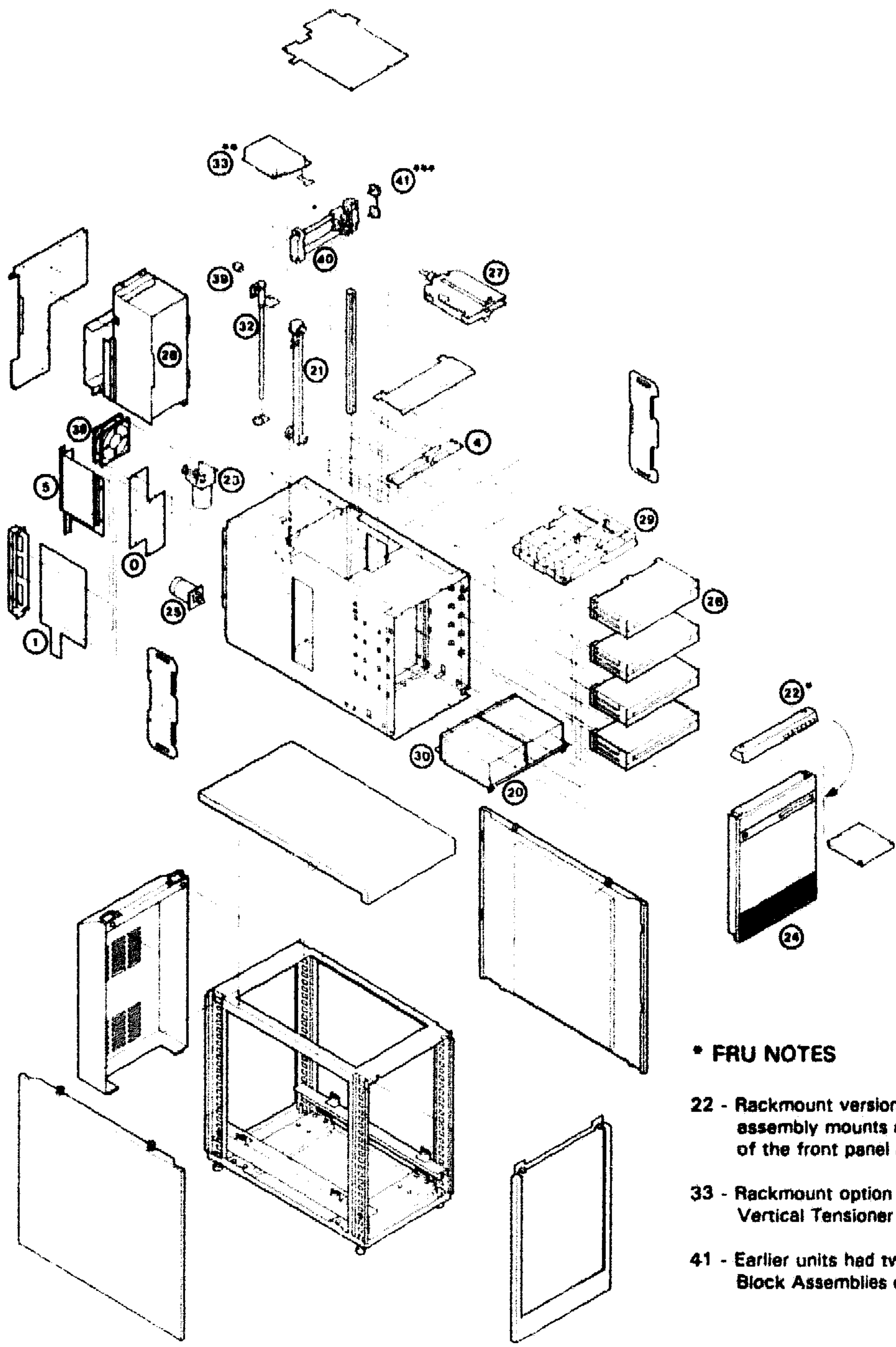
C1710A/M and C1713M Non-Exchange Assemblies/Parts

FRU	Part Number	Description
		HP C1710A Unique Parts
		2932A00100 THRU 3047Axxxxx
0	C1700-60000	Motherboard PCA
4	C1700-60004	Interconnect PCA
56	C1700-60056	Front Panel Cable
71	C1700-60071	Mailslot Cable
	C1700-60072	Adapter Cable for Mailslot
		HP C1710A Unique Parts, 3105Axxxxx
		HP C1710M Unique Parts, 3049Axxxxx
0	C1700-60100	Motherboard PCA
	C1700-60159	Sense Cable
56	C1700-60156	Front Panel Cable
71	C1700-60171	Mailslot Connector Cable
		HP C1710A Unique Parts
		2932A00100 THRU 3047Axxxxx & 3105Axxxxx
		HP C1710M Unique Parts, 3049Axxxxx
22	C1710-60012	Rackmount Display Panel
33	C1700-60033	Constant Force Spring
	C1700-60013	Drive Address PCA
51	C1700-60051	ESDI/MO Power Cable
52	C1700-60052	5/12V Power Cable
53	C1700-60053	ESDI/MO Control Cable
54	C1700-60054	ESDI/MO Data Cable
55	C1700-60055	Interface SCSI Cable

FRU	Part Number	Description
58	C1700-60058	Motor Power Cable
59	C1700-60059	Interconnect Cable
66	C1700-60066	Line Switch Cable
22	C1710-60022	Deskside Display Panel
24	C1710-60014	Rackmount Front Panel
24	C1710-60024	Deskside Front Panel
38	C1700-60038	Fan Assembly
	C1700-60044	Top Access Panel
	C1700-60062	Rear Access Panel
75	C1700-60075	Interconnect Cable
	C1700-60076	Drive Address Cable
	C1700-60077	Right MO Cable
	C1700-60078	Controller Inter Cable
	C1700-60079	Switch Cable
	C1700-60080	Encoder Cable
67	C1700-60067	24V Power Cable
	HP C1713M Unique Parts, 3137A00000	
	HP C1710A Unique Parts, 3133A00100	
	HP C1710M Unique Parts, 3134Axxxx	
22	C1710-60112	Rackmount Display Panel
22	C1710-60122	Deskside Display Panel
24	C1710-60114	Rackmount Front Panel
51	C1700-60051	ESDI/MO Power Cable
	C1703-60050	18 to 14,4,4 Power Cable
	C1703-60053	Left MO Cable
54	C1703-60054	ESDI/MO Data Cable
	C1703-60055	Internal SCSI Cable
56	C1703-60056	Front Panel Cable

FRU	Part Number	Description
	C1703-60059	Sensor PCA Cable
	C1703-60066	Standby Mailslot Cable
	C1703-60044	Top Access Panel
	C1703-60062	Rear Access Panel
38	C1703-60068	Fan Assembly
	C1703-60077	Right MO Cable
	C1703-60079	Switch Cable
	C1703-60080	Encoder Cable
	HP C1713M Unique Parts, 3137A00000	
	HP C1710A Unique Parts, 3133A00100	
	HP C1710A Unique Parts, 3105Axxxx	
	HP C1710M Unique Parts, 3134A00100	
	HP C1710M Unique Parts, 3049Axxxx	
4	C1703-60104	Interconnect PCA
	HP C1713M and C1710A/M Common Parts	
21	C1700-60021	Left Way
	C1700-60043	HP Grey Trim Panel
	C1700-60045	Side Access Panel
23	C1700-60023	Carriage Motor
24	C1710-60024	Deskside Front Panel
25	C1700-60125	Picker Motor
26	C1700-60026	Magazine
27	C1700-60027	Picker
29	C1700-60229	Mailslot Assembly
30	C1700-60030	Optical Sensor Assembly
32	C1700-60032	Leadscrew
34	C1700-60034	Picker Motor Belt
35	C1700-60035	Carriage Motor Belt

FRU	Part Number	Description
39	C1700-60139	Spring Bearing Block Assembly
40	C1700-60240	Carriage Assembly
	C1700-60070	Dual Mailslot Sensor Cable
65	C1700-60065	AC/24V Power Cable
		HP C1710A Deskside Firmware
		2932A01000 thru 3047Axxxxx and 3105Axxxxx
37	C1710-60437	C1710A #100/103 Autochanger Controller ROM
36	C1700-60236	MO Drive Controller ROM
		HP C1710A Rackmount Firmware
		2932A01000 thru 3047Axxxxx & 3105Axxxxx
37	C1710-60737	C1710A #101/104 Autochanger Controller ROM
36	C1716-60236	MO Drive Controller ROM
		HP C1713M Firmware, 3137A00000
		HP C1710A Firmware, 3133A00100
31	C1713-60037	C1713M/C1710A Autochanger Controller ROM
36	C1700-60236	MO Drive Controller ROM
		HP C1710M Firmware, 3134Axxxxx
31	C1713-60031	C1710M Autochanger Controller ROM
36	C1716-60022	MF Drive Controller ROM



*** FRU NOTES**

22 - Rackmount version of this display assembly mounts along the long side of the front panel as shown by arrow.

33 - Rackmount option does not have this Vertical Tensioner Assembly.

41 - Earlier units had two separate Bearing Block Assemblies on this side.

Figure 8-72. Disk Library System Exploded View (with Deskside Cabinet)

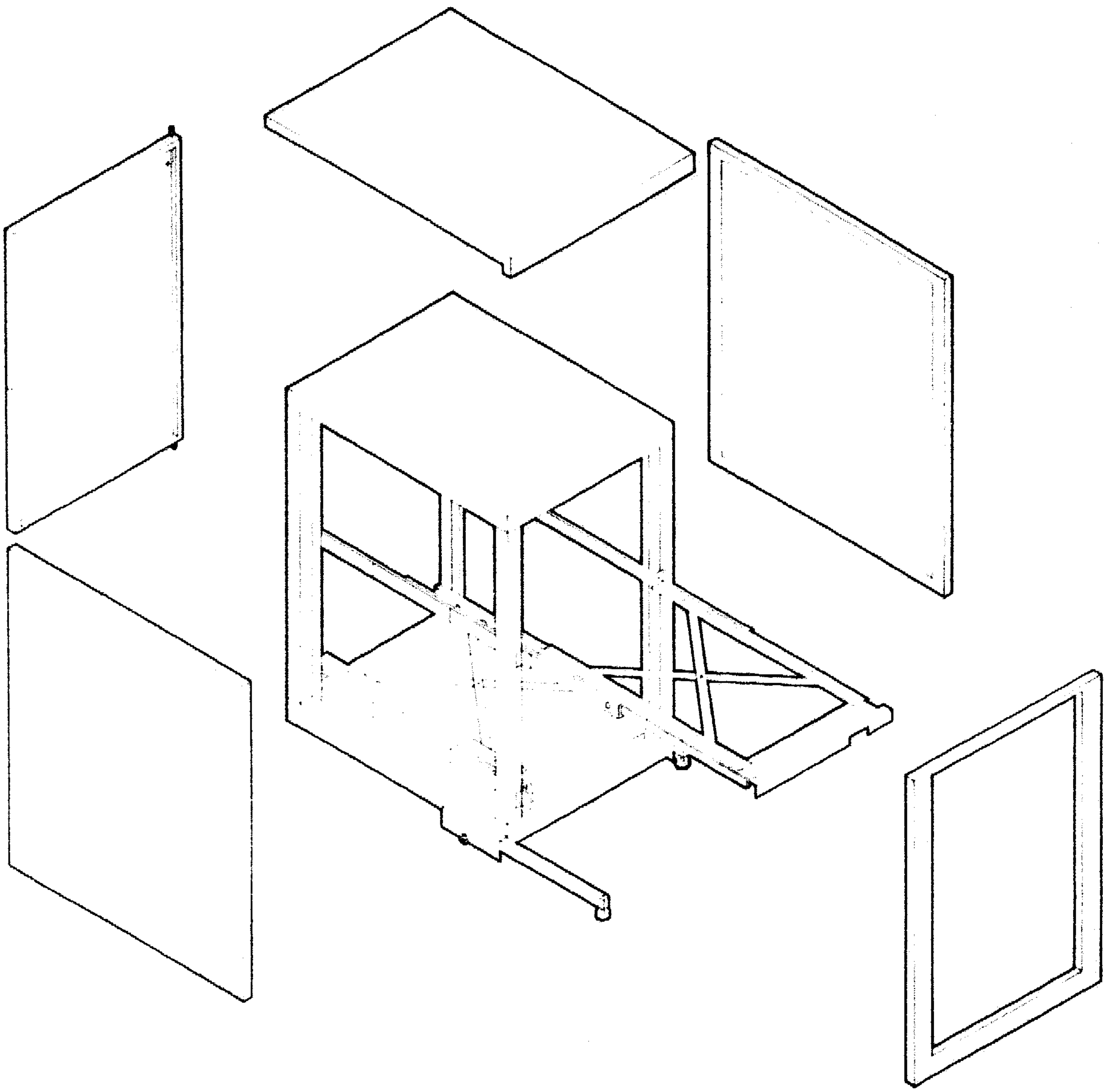


Figure 8-73. Rackmount Cabinet Exploded View

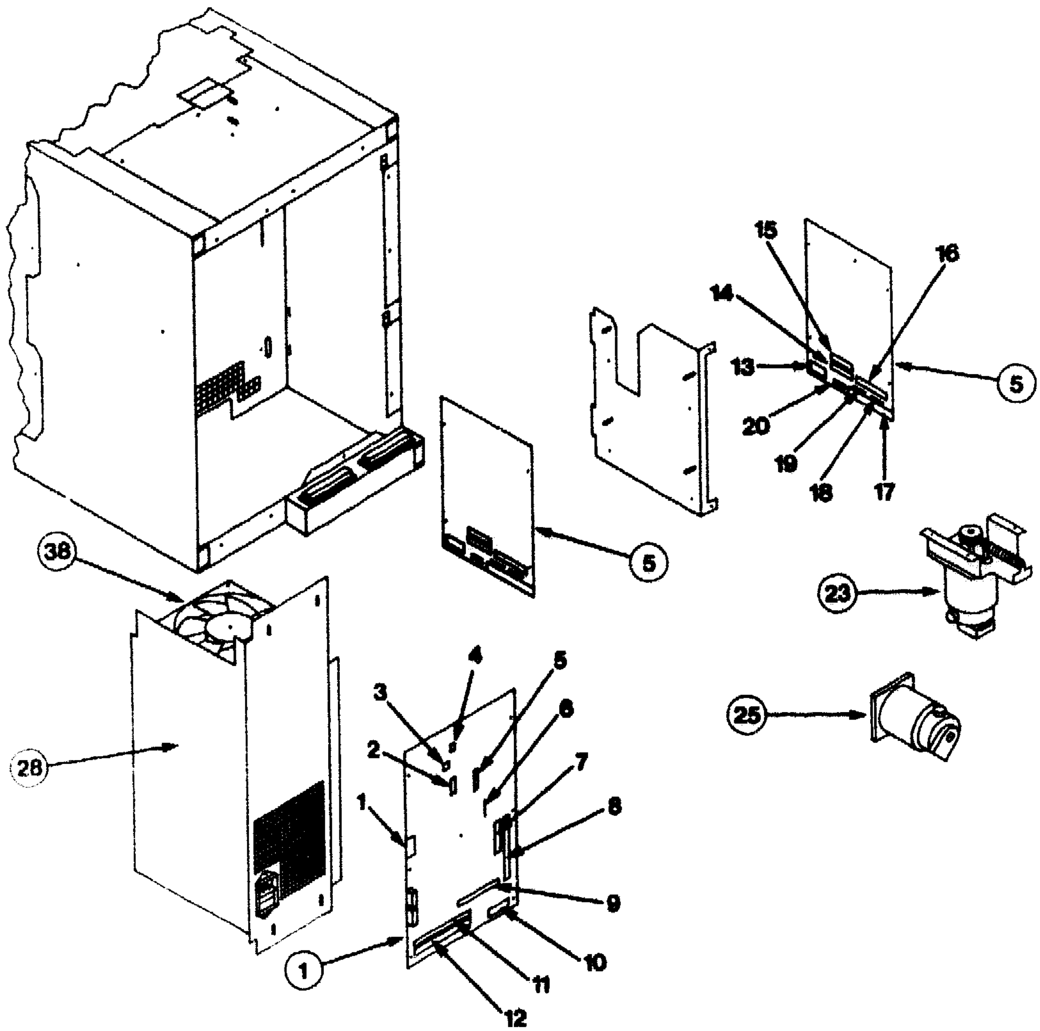


Figure 8-74. Rear, Exploded View of RSE Versions

Table 8-7.
Autochanger Controller and Drive Controller PCA Cables

Nuumber	Cable
Autochanger Controller PCA	
1	not used
2	Leadscrew Motor Power
3	Fan
4	Picker Motor Power
5	Power Supply
6	Motor Encoders
7	Control Panel
8	Interconnect
9	ESDI Address
10	Power In from Power Supply
11	SCSI Connector
12	SCSI Connector
Magneto-Optical Drive Controller PCA	
13	Power
14	ESDI Data
15	not used
16	ESDI Control
17	SCSI bus
18	not used
19	not used
20	SCSI ID

Miscellaneous

Chassis	C1700-00100
Power Switch Clamp	1400-1209
Front Panel Cable Clamp	1400-1538
Data Cable Clamp	1400-0985
Drive Cable Clamp	1400-0611
Front Panel	C1700-00200
Large Access Panel (end of Carriage rails)	C1700-00202
Power Cover Panel	C1700-00203
Supply Panel	C1700-00204
Motor Panel	C1700-00205
Slim Access Panel	C1700-00206
20 mm Pulley	C1700-43600
Cable Pulley	C1700-43602
15 mm Pulley	C1700-43603
External loopback connector	88780-60095
Rackmount Installation Strap (Goes with Hoist Adapter Kit 07980-67190)	C1712-68202
Optical Disk Cleaning Kit	C1700-88800
Optical Disk Cleaner Accessory Kit (extra swabs and alcohol)	C1700-88801
Optical Disk Lens Cleaning Kit	C1700-88802

Description	Part Number	Where Used
#0-80x.25,socket-head cap (1/16 Allen)	3030-0421	Encoder Mounting
#0 washer	3050-0828	Encoder Mounting
#2-28x.375, panhead, plastite	0624-0453	Optical Sensor Mounting
#2-56x.25 w/lk, panhead, (Pozi.#1)	0520-0174	Power Switch Mounting
#4-40x.188 panhead, patchlock, (Pozi.#1)	2200-0592	Voltage Select Switch
#4-40x.25, panhead, (Pozi.#1)	2200-0139	Card Cage Controller PCA (SCSI conn.)
#4-20x.225 tapping, (Torx T9)	0624-0620	Mailslot Sensor Mounting
#4-40x.625 w/sq. cone, (Torx T9)	2200-0600	Picker Slide Assembly
#4-40x.375 w/lk, panhead, (Pozi.#1)	2200-0107	Cable Connectors
#4 flat washer	3050-0716	Cable Connectors
#6-32x.25 flathead, patchlock, (Pozi.#2)	2360-0333	Large Access Cover
#6-32x.25 w/lk, panhead, (Pozi.#2)	2360-0113	Access Covers, ESDI, Alignment Sensor Mounting
#6-32x.438 w/lk, panhead, (Pozi.#2)	2360-0119	General
#6-32x.625 w/lk	2360-0123	CF Spring Pulley
#6-32x.75 socket head, (7/64 Allen)	3030-0645	Carriage, Bearing Blocks
#6-32x1.0 socket head, (7/64 Allen)	3030-0158	Carriage, Bearing Blocks
#6-32x.875 w/lk, panhead, (Pozi.#2)	2360-0127	Motor Mounting, Leadscrew-side Way Mounting

Description	Part Number	Where Used
#6-19x.25 tapping	0624-0402	Power Module
#6-19x.50 tapping, panhead, (Pozi.#2)	0624-0400	General
#6-19x.875 tapping, panhead, (Pozi.#2)	0624-0725	Mailslot, Picker
#6-32x.187 setscrew, (1/16 Allen)	3030-0033	General
#6 flat washer	3050-0066	General
#8-32x.375 w/lk, panhead, (Pozi.#2)	2510-0045	Power Supply
#8-16x.375 tapping, panhead, (Pozi.#2)	0624-0458	Front Panel
#10-14x.625 tapping, (Torx T20)	0624-0661	Fan Mounting
M3x6 w/lk, panhead, (Pozi.#1)	0515-1146	MO Drive Ground Wire, Power Supply Wire
M3x6 flathead, (Pozi.#1)	0515-0890	MO Drives
M3.5x10 w/lk, panhead, (Pozi.#2)	0515-0356	Power Supply
0.23x0.05 curved washer	3050-1018	At Picker Shaft Mounting Screw
0.375 thick washer	3050-1337	Picker Shaft
Rivet 0.125x0.25L, pop rivet	0361-0155	Registration Springs
Rivet 0.125x0.170L, push-pin	0361-1299	Power Distribution PCA, (Phillips pn D30-0125-02)
Rivet 0.125x0.145L, push-pin	0361-1300	Mother PCA
E-Ring 0.188	0510-0045	Hublock, Needle Bearing, Snubber Bearing
Snap Ring 0.25	0510-0005	20 mm Pulley Assembly

Description	Part Number	Where Used
Clip Ring 0.375	T-105260	Picker Hub
Loctite 493	0470-0523	Power Supply Grommet, Vertical Carriage, Picker Sleeves
Loctite 290	0470-0532	Bonding pulleys to shafts, Lead Screw Bracket Mounting Screws
Tinnerman Retainer, 0.25	0510-1256	Translate Bar, Translate Lock Pivot

9

Diagrams

At printing time there were no additional diagrams needed for this section. You may use this section to file diagrams of your choice.

10

Theory of Operation

10.1 Introduction

The Autochanger contains a Power Supply assembly, an Autochanger Controller PCA, two disk mechanism controller PCAs, the Autochanger mechanics, 16 or 32 disk storage slots ("half" or "full" capacity configuration), and a mailslot (disk loading/unloading) assembly.

10.2 The Autochanger Mechanism

The mechanics consist of the following major assemblies:

- Carriage assembly
- Picker assembly (mounted to the Carriage assembly)
- Mailslot (disk loading and ejecting assembly)
- Carriage Motor and Carriage leadscrew
- Picker Motor

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

The Carriage has a slot at both ends of a rail that spans the Carriage. When the Picker is translated to either end, a latch on the Picker can enter the slot. When latched at either of these two positions, the Picker may be flipped.

The Picker may be tranlated from one side of the Carriage to the other when the translate roller contacts the translate bar mounted across the drive end of the chassis.

The disk insertion slot, referred to as the mailslot, accepts a disk (inserted shutter-end-first) and rotates the disk 180 degrees. This allows the Picker to grasp the rear of the disk and insert the disk shutter-end into a drive or storage slot. The Picker mechanism supplies the force to rotate the mailslot mechanism from one slot orientation to the other.

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

The Picker Motor provides drive to translate and flip the Picker. Power is transferred from the Picker Motor to the Picker assembly by a toothed belt.

10.3 The Controller PCA

The Autochanger Controller PCA contains the following major components:

- Microprocessor
- SCRAP Chip (Interface from digital-to-analog Pulse Width Modulation)
- SPIFI Chip (SCSI Bus control)
- ROM
- RAM
- Pulse Width Modulation Amplifier
- Front Panel Control and Filament Drive
- SCSI Interface
- Multi-function Peripheral Chip

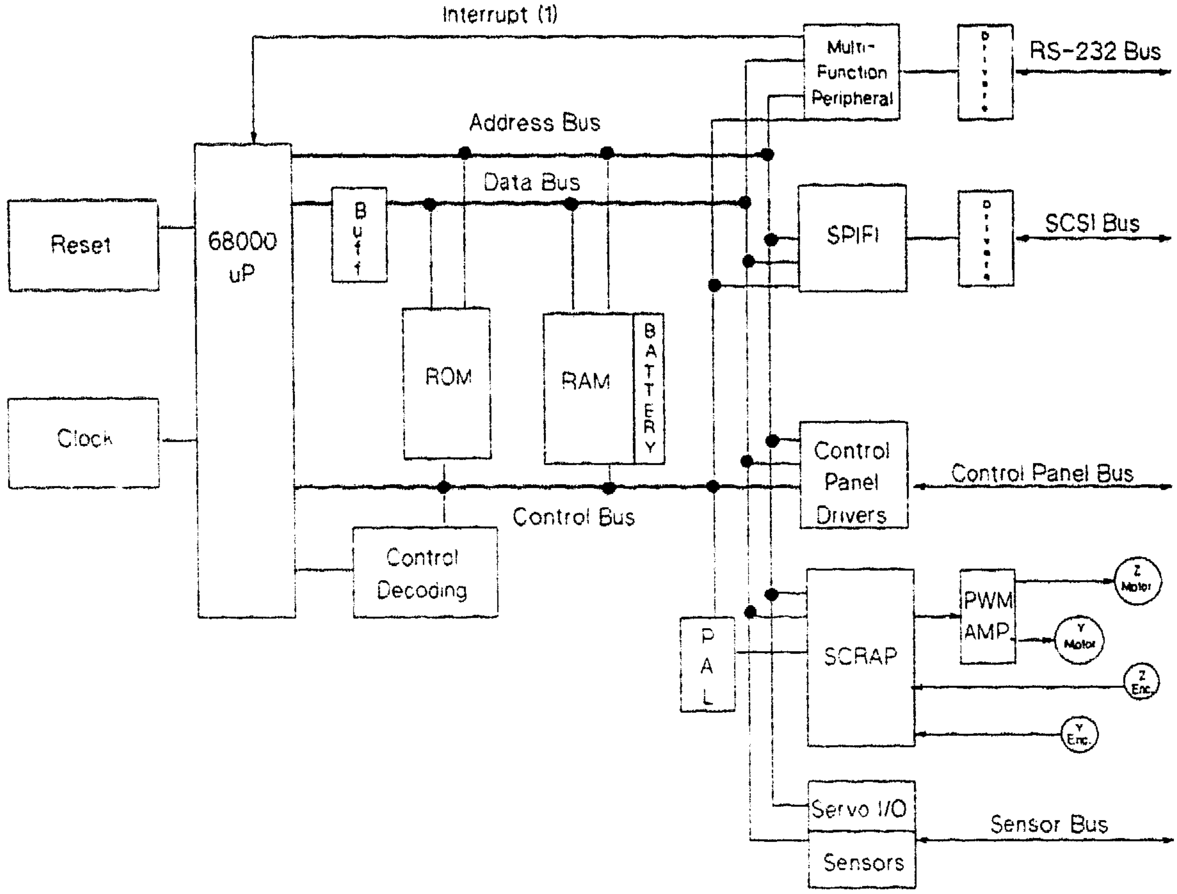


Figure 10-1. Autochanger Controller PCA Block Diagram

The MICROPROCESSOR is a Motorola 68000 running at 12 MHz. This microprocessor controls all processes on the Controller PCA such as servos, SCSI interface, and commands to the Control Panel.

Associated with the microprocessor is clocking circuitry, ROM, battery-backed-up RAM, and decoding logic.

The SCRAP CHIP is the interface between the 68000 processor and the servo system. The SCRAP Chip reads the position encoders via Schmitt triggers and uses that information to increment or decrement counters on the chip. The SCRAP Chip also provides Pulse Width Modulation (PWM) output signals to drive the motor circuitry.

A Programmed Array Logic interfaces the SCRAP Chip with the 68000 architecture. This PAL generates address strobes, read and write pulses, and a DTACK signal for the 68000. Bus multiplexing is handled through a bidirectional buffer and address buffer.

The SPIFI Chip handles the SCSI protocol of the SCSI Interface.

ROM. The Controller firmware resides in two 128K X 8, 170 ns EEPROMs.

RAM. The two RAM chips are special, low-power CMOS static RAMs. A standby battery on the PCA takes over powering these chips if main power is lost. The chips remain in standby mode, providing a non-volatile memory storage capability on the PCA.

The PULSE WIDTH MODULATION (PWM) AMPLIFIER takes the signals from the SCRAP Chip and changes them into voltages for the Picker Motor (Z on Fig. 5-1) and Carriage (Y on Fig. 5-1) Motor. Motor speed control is by feedback from the Picker and Carriage Motors through the Z and Y Encoders back to the SCRAP Chip.

The FRONT PANEL DISPLAY and key pad is controlled by a 8751 microcontroller. This microcontroller sequences and refreshes the vacuum fluorescent display and reads/debounces keystrokes from the keypad.

The vacuum filament display uses 7.5-volt supply tied to a 5-volt reference resulting in an exitation voltage of from 2-3 volts. The grids of the display are at approximately 20 volts.

The SCSI INTERFACE is basically the SPIFI chip and its associated transceiver. All SCSI protocol is handled by the SPIFI under control of the main 68000 processor. The bus transceiver provides the necessary drive to operate the bus properly.

The MULTI-FUNCTION PERIPHERAL Chip controls interrupts, RS-232 functions, and certain timers throughout the Controller PCA.

The SERVO, I/O, and SENSORS circuitry handles the servo communications (e.g., shutdown control), I/O communications (e.g., Drive Eject and Drive Busy) and sensor communications (e.g., Mailslot Sensor and Vertical Calibration Sensors).

10.4 Error Detection

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

Error Detection Processes

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

- Overforce shutdown.
- Sense of Touch.
- Motor position.

An overforce shutdown occurs when the motors exert more force than is expected or required. If this occurs, the servo automatically shuts itself down to prevent parts damage. After an overforce shutdown occurs, the Autochanger analyzes the situation, self-calibrates, and attempts a retry.

Sense of Touch is the process where actual force used is compared to recommended force for each move. The Autochanger uses this information to detect errors or qualify moves. The difference between Sense of Touch and overforce shutdown is that the servo is not automatically shut down if Sense of Touch detects an error.

The positions of the motors are continuously monitored by the Controller PCA. The position, along with the Sense of Touch feedback, is a valuable source of error detection.

These processes also combine to detect errors. For example, the Sense of Touch and the motor position process continuously monitor the motor position and motor force levels to sense whether a potential error has occurred. It does not imply a sensing of complete force profiles, but the ability to continuously sample the force profile.

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

There are two forms of sensors:

- Drive Handshake.

  The drive provides a "BUSY" signal back to the Autochanger Controller to indicate status of certain loader operations.

- Optical Sensors.

  Optical sensors detect conditions that are otherwise difficult to detect and are used to calibrate the unit. There are two mailslot sensors to detect if a cartridge is properly inserted into the mailslot, and two sensors for detecting which side of the Picker faces the mailslot-end of the chassis and allow calibration of the Picker's position in relation to the drives and storage slots.

Error Recovery Processes

The Autochanger uses the following processes to recover from errors:

- Inline recovery.
- Find Home Sequence.
- Calibrate.

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

The purpose of Find Home is to initialize the machine to a known state. For poweron, this means finding a "Home" ("zero") position for the Carriage/Picker assembly.

The Calibrate procedure is then called to further locate reference points other than the zero locations found during Find Home. Using sensors, the Picker is characterized as to its relationship with the mechanism. The positions of the drives, mailslot, and magazines are calculated based on the location of the sensors.

For recovery after poweron, many subsets of Find Home may be called. One mode, for example, only determines which side of the Picker faces the mailslot-end of the chassis. If any of the subsets of Find Home fail, the full Find Home sequence is run. A successful running of Find Home gives the

Autochanger code the exact positions of each end of the Carriage Rails and the rear plane of the Picker assembly. Also, the Autochanger will know which side of the Picker is facing the mailslot-end of the chassis and whether the Picker holds a disk or not.

SCSI Detected Errors

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

- The machine not being ready for a new command due to another previously-issued command or a previously-detected hardware fault that prevents motion.
- Illegal request to move cartridge from empty locations or to a full location.
- Illegal requests to perform unsupported commands and operations.
- Invalid syntax or parameters in the command.
- Various bus-level communication errors.

In all of these cases, the command will be rejected immediately and the Autochanger is not moved.

Move Errors

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

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

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

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

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

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

Hardware Error Codes

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

A routine is called automatically that performs a process of elimination for various FRUs. This routine attempts to isolate the error to three (or less) FRUs. If no error can be found (or if recovery was made from the error), the unit returns a "no error" status. If an error is found, a Hardware Error Code and a Move Error Code is returned when the command completes. Up to three FRU numbers are returned. The FRUs, and a time stamp, are listed in decreasing order of probability.

Hardware Error Codes are listed in Chapter 5, "Diagnostics" under "Hardware Error Codes."

Real Time Event Logging

Logs

The Disk Library System provides information logs about the Autochanger's operation and error history. The logs can provide predictive information which could lead to early detection of Autochanger problems.

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

Error Log. The Autochanger maintains a history of past diagnostic test errors which have occurred within the Autochanger, together with a time stamp of when they occurred. The error message maintained for each error indicates the failure and the possible FRUs which may have caused the failure.

Move Success Log. A cumulative number of move recoveries and a total move count are maintained. This gives service a view of the history of the Autochanger soft error rate. The last 10 hard errors are marked in this log by indicating how many good moves occurred since the last hard error.

Force Log

Each cartridge move is actually a sequence of many small moves, known as Micro-Moves. This log is a record of the maximum force measured during every different Micro-Move situation.

Recovery Log

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

Drive Log

This data indicates the number of times the Autochanger uses each drive.

Run-Time Log

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

Odometer

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

Diagnostics Strategy

Internal Autochanger Diagnostics

The diagnostic tests provided by the Disk Library System provide diagnostic capabilities that are not available in the standard set of SCSI Autochanger commands. The tests may be run individually or as a sequences of tests.

With the exception of the Poweron sequence test and the FRU isolation code, the running of tests is not automatic. All tests may be initiated through the Control Panel TEST option.

Online Diagnostics

OPUTIL is a diagnostic utility that enables you to send SCSI optical device commands through the SCSI interface on an HP 9000 Series 300 system to the Autochanger mechanism or each drive in the Autochanger. Described in Appendix A.

Offline Diagnostics

ACDIAG+ is a standalone diagnostic for the Autochanger mechanism. This diagnostic is run from the Portable HP Portable PLUS. or the Vectra PC (or equivalent). Described in Appendix B.

ACDIAG is a standalone diagnostic for the Autochanger mechanism. This diagnostic is run from the Vectra PC (or equivalent). Described in Appendix B.

MODIAG is a standalone diagnostic for optical drives. This diagnostic is run from the Vectra PC (or equivalent). Described in Appendix B.

SCSIMO is a standalone diagnostic for optical drives run through the HP-IL interface. Described in Appendix B.

10.5 The Magneto-Optical Drives

The drive mechanisms in the Disk Library System use a standard 5.25-inch (130mm) magneto-optical disk, and comply with the ANSI and ISO Continuous Composite format standard. A magneto-optical disk written with 1,024 bytes per sector has a capacity of 650 Mbytes while a disk written with 512 bytes per sector has a 594-Mbyte capacity.

The drives have a 2,400 rpm rotational speed and achieve a maximum sustained write transfer rate of 340 Kbytes per second and a maximum sustained read transfer rate of 680 Kbytes per second (depending on the host system).

Two types of drives are used in the Disk Library System. One type of drive uses rewritable operation; the other type can operate in both rewritable and write-once modes. The second type of drive is called a "multifunction" drive.

Multifunction drives sense the disk type and select either rewritable or write-once mode automatically. To use both modes of the drives, the host must implement the corresponding commands.

The drive assembly contains the following components:

- Mechanical components to rotate the disk and move the head
- The read/write laser
- The writing magnet
- Analog circuitry for data separation
- Digital circuitry for drive control, formatting, and Controller communication

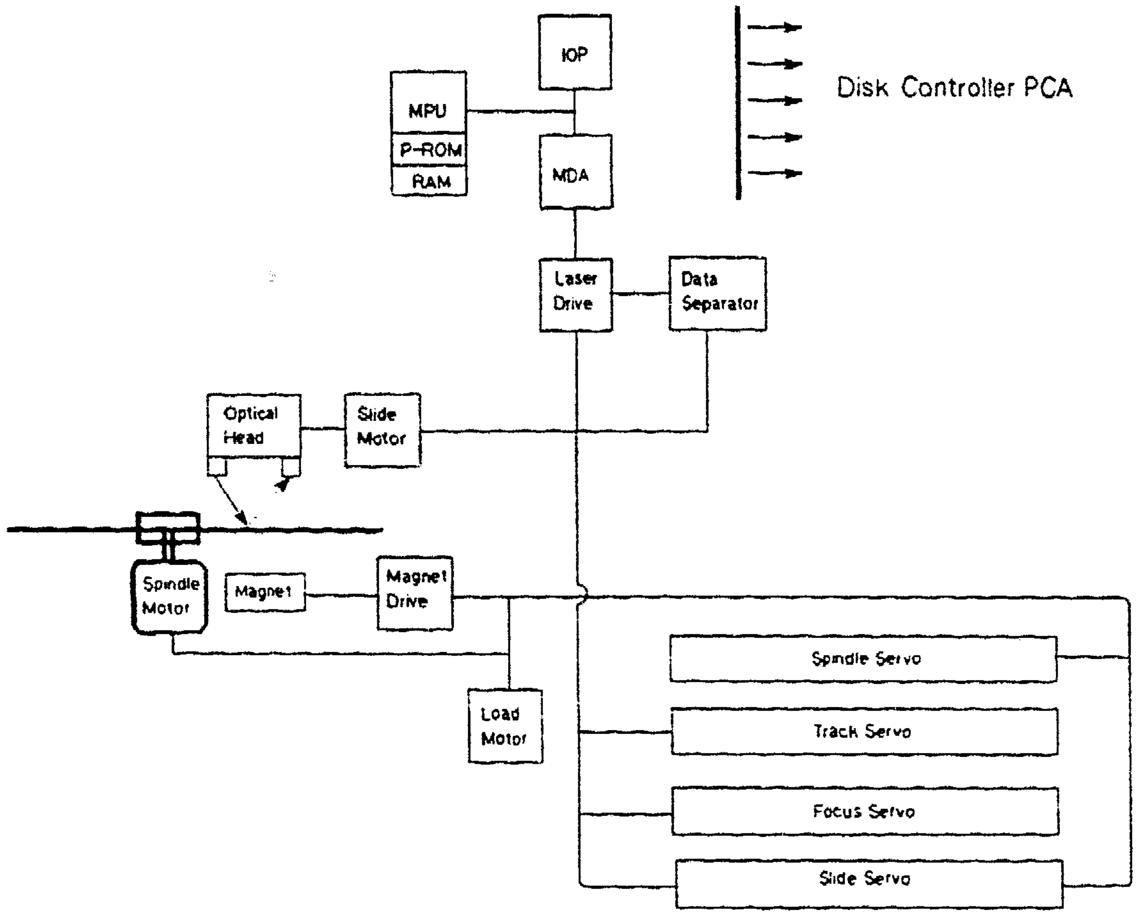


Figure 10-2. Drive Mechanism

The OPTICAL (laser) HEAD contains the laser diode used for reading, writing and erasing, and the photo detectors used for sensing magnetic bit orientation (reading). The head also contains the laser diode driver, and preamplifiers for radio frequency (RF laser drive) and the servos.

Circuitry in the LASER DRIVE section controls the power to the laser diode. One laser is used, at different power levels, for reading, writing, and erasing. Reading requires a low-power beam for data detection. A powerful, heating beam is required for writing and erasing.

The DATA SEPARATOR block decodes the data and servo information sensed by the photo-detectors. The demodulated RF signal is separated into data and servo signals. A Phase-Locked Loop (PLL) is also generated within this block to clock the incoming data.

The SERVO SYSTEM contains four functional blocks: Spindle Servo, Focus Servo, Track Servo, and Slide Servo. The Spindle Servo circuitry controls the speed of the SPINDLE MOTOR, keeping it at a constant 2400 rpm. The Focus Servo keeps the laser beam focused on the disk data surface using a two-axis actuator/astigmatism focusing method. The Tracking Servo controls a two-axis actuator to follow the data track. The Slide Servo drives a flat linear motor (Slide Motor) to access the target track during a seek operation.

The BIAS MAGNET control circuitry senses the polarity of the writing/erasing MAGNET to provide a writing/erasing bias field.

The LOADING block consists of a disk loading motor and the switches used to load and eject the disk cartridge.

The MICROPROCESSOR (MPU) block consists of a microprocessor, 32 Kbytes of P-ROM and 8 Kbytes of RAM. The MPU controls and supervises all drive operations. Some MPU signals are passed first through the IOP (Input/Output Processor) block, while others are connected directly to the MPU.

The IOP block provides control information signals from the analog/mechanical circuitry and manages control commands issued by the Disk Controller PCA.

The MDA (Modulator, Demodulator, and Address decoder) block encodes data to be written to the disk, and decodes the data read from the disk. The MDA provides the Laser Drive circuitry with the control signals for laser power-level selection, and provides control for the RF detection circuitry.

10.6 The Disk Controller

The Disk Controller PCA contains the following modules:

- Microprocessor (MPU)
- Buffer Memory Manager
- Buffer Memory
- SCSI Controller
- Drive Interface Controller

- Error Correction Encoder
- Bus Control Logic (#1,#2)

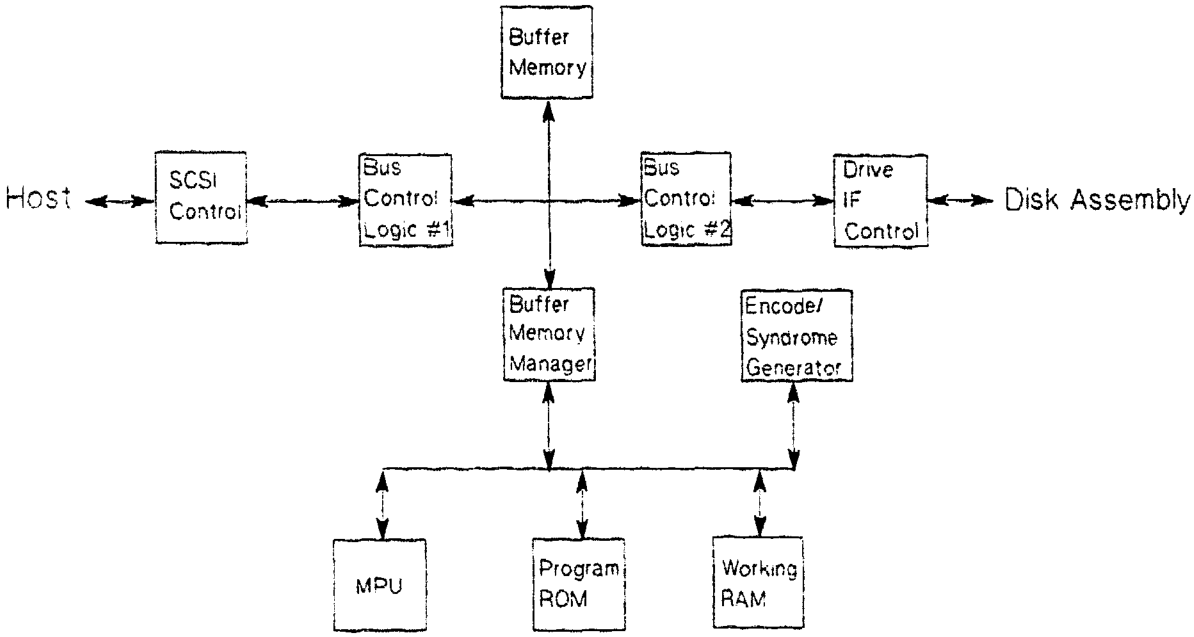


Figure 10-3. Disk Controller PCA

The MPU block manages and performs the following:

- Manages all other modules
- Manages SCSI communication via the SCSI block
- Controls the drive assembly via the Drive I/O block
- Performs error correction and detection via Error Correction Encoder
- Controls diagnostic functions

The BUFFER MEMORY MANAGER manages data going to, and coming from, buffer memory.

The BUFFER MEMORY is composed of 64 Kbytes of static RAM.

The SCSI CONTROLLER is the translator between the host SCSI information and the low-level format understood by the internal bus.

The DRIVE INTERFACE CONTROLLER transfers data and commands to and from the drive assembly. This module also performs serial-to-parallel and parallel-to-serial data conversion.

The ENCODE/SYNDROME GENERATOR encodes and decodes the algorithms used for error correction and detection.

The BUS CONTROL LOGIC module consists of two sections. One switches either the MPU bus or data bus to the SCSI Controller bus, the other selects user data, control data or error correction/detection data.

10.7 Drive Defect Management

The drives in the Disk Library System support Mode 3 defect management. Mode 3 defect management is the only mode that meets the ISO Optical Disk standard and is the only mode explained here.

Note Format Mode is one of the SCSI Mode Select/Sense parameters specifying how the drive manages the medium.

Disk Layout

The disk surface is divided into 3 areas as follows:

- Inner Definition Zone (physical tracks 0-2).
- User data and spare tracks (physical tracks 3-18747).
- Outer Definition Zone (last 3 physical tracks 18748-18750).

The definition zones have four copies of the current defect management information for the disk. Two copies are in the Inner Definition Zone and two copies are in the Outer Definition Zone.

The defect management information starts at Track 0, Sector 0. The first entry is the Disk Definition Structure (DDS) which specifies which defect allocation algorithm is being used and how the user area and primary spare area are divided.

The next entries are the Primary Defect List (PDL) and the Secondary Defect List (SDL) which contain the remap information for individual sectors.

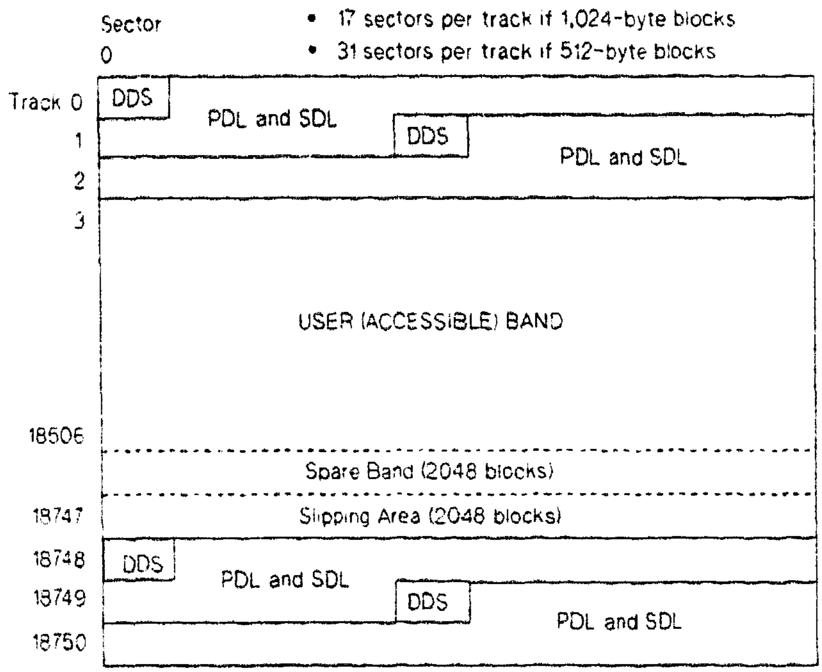


Figure 10-4. Disk Layout

Table 10-1. Zone/Area Boundaries (1,024-byte blocks)

Begin Track	End Track	Number of Sectors	Type
0	2	51	Inner Definition Zone
3	18506	314568	User Band
18507	18627-	2048	Spare Band
18627+	18747	2048	Slipping Area
18748	18750	51	Outer Definition Zone

Replacement Algorithms

Two replacement algorithms are available in Mode 3; "Sector Slipping" and "Linear Replacement."

The "Sector Slipping" algorithm is used when defective sectors are known (previously detected) or are detected during the formatting process.

The "Linear Replacement" algorithm is used when defective sectors are detected AFTER the formatting process.

Defective sector information is stored in the Primary Defect List (PDL) and Secondary Defect List (SDL). When a disk is loaded into the drive unit, the drive spins the disk up, reads the DDS, PDL, and SDL, and stores the defective sector information in the internal RAM area.

Slipping Sectors

In the "Sector Slipping" algorithm, defective sectors known before the FORMAT UNIT command is issued or sectors detected during the certification process are logged as defective. These defective sectors are skipped in future reads or writes.

As defective sectors are detected, the physical address of each defective sector is put in the PDL. The next good sector on the disk becomes the replacement for the defective sector. Each time the drive must go forward one sector to replace a defective sector the user data area slips one sector forward into the slip area.

Linear Replacement

In the "Linear Replacement" algorithm, defective sectors detected during a write operation are re-allocated into the spare area located at the end of the user band.

When a defective sector is detected during a write operation, and the Automatic Write Re-allocation (AWRE) bit is set to 1 (default setting), that defective sector is re-allocated automatically into the spare band.

Note Automatic Write Re-allocation (AWRE) is one of the SCSI Mode Select/Sense parameters.

Unless a re-allocation is done after formatting, logical block addresses are always allocated to the user band. Re-allocation is done either when the REASSIGN BLOCKS command is issued or when the automatic write re-allocation routine is called during a write operation that failed due to medium defects.

In the latter case, automatic write re-allocation occurs during a write command when:

- a recoverable hardware error occurs because of a medium defect (for example, a tracking or focus failure)
- the data error exceeds the specified criteria during the WRITE AND VERIFY command.

The physical address of the re-allocated bad sector is stored in the SDL.

The maximum allowable number of re-allocated sectors is 2,048.

Defect Example

Assume that during a FORMAT UNIT command two errors are detected during the certification process. The defective sectors are at physical Track 3, Sector 3 and physical Track 4, Sector 4.

Both of these areas would be added to the Primary Defect List and the next good sector following each becomes the replacement for the defective sector (see Table 10-2).

In addition, let us assume that logical block 10 (physical Track 3, Sector 11) now has a medium-related error detected during a SCSI WRITE command (with the AWRE bit at its default setting of 1). Because AWRE is set to 1, a replacement sector is chosen from the Spare Band. The data that was to be written to logical block 10 is now written to the spare sector (new logical block 10), and the old logical block 10 is flagged as bad.

Note The advantages of using the "Slipping Sectors" method rather than the "Linear Replacement" method are described later in this section under "Advantages of Slipping Sectors vs Linear Replacement."

The following is a Logical-to-Physical Map.

Table 10-2. Defect Management Example

Log Block	Physical Track	Sector (1,024 byte)	Status
0	3	0	OK
1	3	1	OK
2	3	2	OK
X	3	3	BAD ..sector slip
3	3	4	OK
4	3	5	OK
5	3	6	OK
6	3	7	OK
7	3	8	OK
8	3	9	OK
9	3	10	OK
10	3	11	OK ..linear replace. (mapped to spare area)
11	3	12	OK
12	3	13	OK
13	3	14	OK
14	3	15	OK
15	3	16	OK
16	3	17	OK
17	4	0	OK
18	4	1	OK
19	4	2	OK
20	4	3	OK
X	4	4	BAD ..sector slip
21	4	5	OK
..	.	.	OK
..	.	.	OK
314568	18506	1	OK

Table 10-3. Primary Defect List

Physical Track	Sector
3	3
4	4

Table 10-4. Secondary Defect List

Physical Track	Sector
3	11

Note It is not possible to view the Secondary Defect List by itself. The drive returns a Growing List that consists of the Primary Defect List and the Secondary Defect List.

Error Thresholds

Each sector header contains three copies of track, sector, and a Cyclic Redundancy Check (CRC). Error Correction Code (ECC) information for the sector may be seen by issuing a SCSI READLONG command.

Table 10-5. Error Thresholds

Operation	Sector IDs	ECC Level
FORMAT	2	3
WRITE	2	-
ERASE	2	-
VERIFY	2	4
READ(RECOVERED)	1	7
READ	1	8

Sector IDs refer to the correct reading of the track, sector, and the CRC. Each sector contains three IDs and each interleave has an ECC correction value between 0 and 8.

Advantages of Slipping Sectors vs Linear Replacement

The advantages of the Sector Slipping algorithm are:

- Seek and rotational latency overhead needed to access the replacement sector is less.
- Translation between the intermediate address space and physical address space is a simple, fast calculation.

If secondary defects are converted to primary defects the disk will be placed in the condition of having slipped sectors.

Caution Data is destroyed in the following procedure. Back up the disk first.

To convert sectors in the Secondary Defect List (SDL) to sectors in the Primary Defect List (PDL) you can use the SCSI FORMAT UNIT command.

For example:
This command may be issued via the SCSIMO diagnostic using the "Retain Primary Defects Only" option.

Using FORMAT with this option

- deletes the Secondary Defect List
- retains the original Primary Defect List
- re-assigns the defective sectors found during the certification process to the Primary Defect List.

If a drive develops a WRITE problem (with AWRE bit set to 1), it may begin sparing a large number of sectors that are not defective. The procedure above returns the good sectors for use.

10.8 The Power Supply Module

Power Supply Module Before RSE

The Power Supply Module contains two power supplies. One supplies 24 Vdc only and is used for the Autochanger motors. The other supply provides voltages used for the optical disk drives and the Autochanger electronics.

24-Vdc Power Supply

This power supply is a 24V-240W, open-L-frame, 100 KHz switcher. The supply includes protection against misconfigured input voltages and Finland-approved X and Y capacitors. This supply provides vertical and horizontal motor power to the Autochanger.

OUTPUT SPECIFICATIONS.

	Nominal Vdc	Min Vdc	Max Vdc	Min Idc	Max Idc	Peak Idc *
V1	24.00	23.30	25.20	0.0	8.00	10.00

Maximum continuous output power will not exceed 240 watts @ 40 degrees C.

*10.00 amps for .5 second duration at 7-second duty cycle.

The power supply will maintain regulation at maximum load when power line voltage falls from 108 Vac to 0 Vac for 20 milliseconds and then returns to 108 Vac.

The overvoltage shutdown threshold is >= 30.0Vdc and <= 34.0Vdc.

This power supply can survive a continuous short circuit load with no permanent damage. Maximum output current is 12.0 amperes.

Electronics and Optical Drive Power Supply

This switching power supply is configured in an open-L-bracket and has a 5-circuit AC harness attached.

OUTPUTS

Voltage, Current, and Maximum Wattage.

	Nominal Vdc	Min Vdc	Max Vdc	Min Idc	Max Idc	Max Peak	Start Up Surge
V1	5.0	4.85	5.15	1.3	10.0		
V2	12.0	11.40	12.60	0.8	10.0	*13.5	**15.0
V3	-12.0	-12.60	-11.40	0.0	0.5		
V4	12.0	11.64	12.36	0.0	0.5		

Maximum continuous output power is 182 watts.
* 13.5 amperes for 30 ms, undefinable duty cycle.
** 15.0 amperes for 8 seconds maximum.

The power supply will maintain regulation at maximum load when power line voltage falls from 90 Vac to 0 Vac for 10 milliseconds and then returns to 108 Vac. It will maintain regulation during a 20-millisecond drop to 0 Vac at a 70% load.

The overvoltage shut-down threshold is >= 30.0Vdc and <= 34.0Vdc.

This supply provides the Poweron RESET Signal.

All outputs are protected against overcurrent and short circuit conditions to prevent damage to the power supply. This may be accomplished by having a fuse blow.

The +5 V output is protected against overvoltage conditions.

Power Supply Module After RSE

The Power Supply Module consists of an AC PCA and a DC PCA in a distributed power architecture.

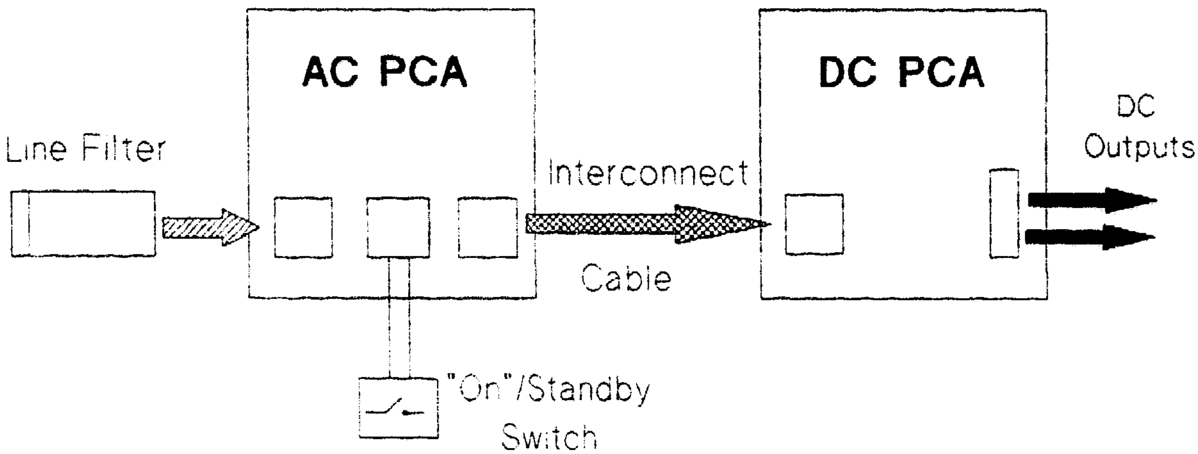


Figure 10-5. Overall diagram of the power supply

The AC PCA

The AC PCA

- Takes the LINE and NEUTRAL from the site power
- Converts the AC to DC by rectifying it
- Produces a 300 Vdc (nominal) crudely-regulated output bus.
- Produces an ENABLE signal

LINE FILTER (not shown) - filters some transients and conducted interference noise. This filter also provides a plug for the line input. The filter is inside the Power Supply cage.

The EMI/LINE SPIKE FILTER block passes the primary and neutral inputs while attenuating noise that the power supply tries to conduct back to the line. The circuit also filters line transients such as high voltage noise, lightning, etc.

This filter, in combination with the LINE FILTER, enables the Power Supply to withstand 6 KV spikes.

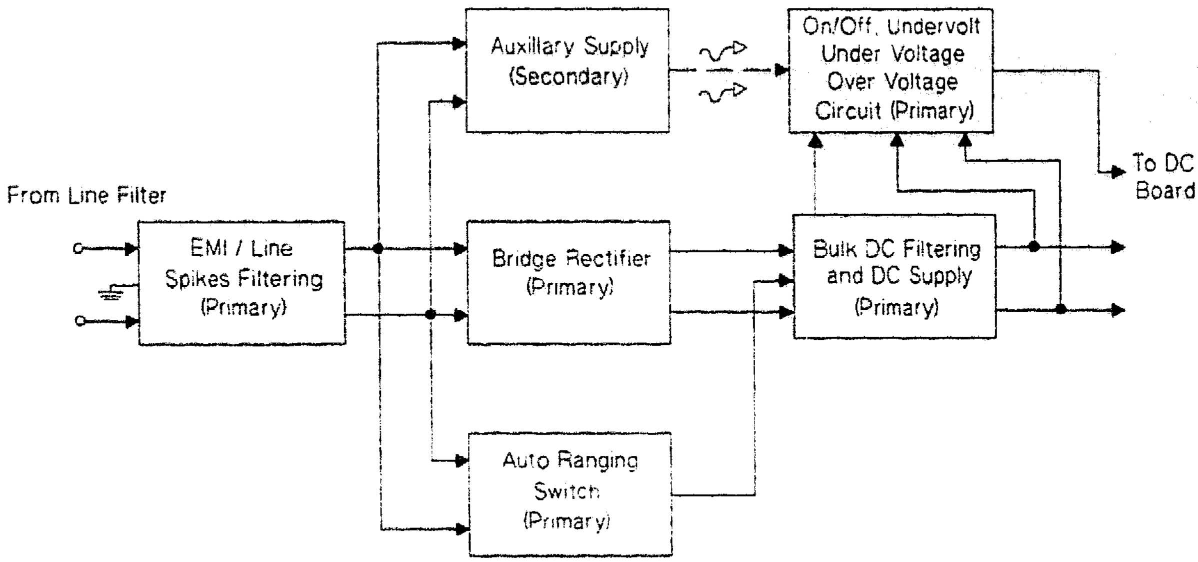


Figure 10-6. The AC PCA in the Power Supply

The BRIDGE RECTIFIER block takes the sinusoidal ac signal and turns it into pulsating dc voltage. This dc voltage is stored in the bulk filtering capacitors at the nominal value of 300 Vdc.

The AUTORANGING SWITCH is a hybrid chip that senses the voltage across the primary. If the voltage is below 145 Vac, the neutral line is connected to the middle of the two bulk filtering capacitors. That, in effect, makes the Bridge Rectifier/capacitor combination a voltage doubler; enabling a 300-volt output from 120-volt input.

If the chip senses more than 145 Vac, the Autoranging Switch stays out of the circuit and the Bridge Rectifier passes its output to the bulk dc supply.

This switch supplies the function of a 120/240 switch, automatically correcting for any input.

The ON/OFF AND LIMITS block works in parallel with the BULK DC block on the 300 Vdc bus. The circuitry here senses the dc voltage on the bus and turns the power modules on the DC PCA ON or OFF according to the operating range needs of the modules.

The dc power modules must have between 200 and 400 volts to operate without damage. While the dc bus is powering up, the LIMITS block keeps the dc power modules OFF until the voltage level reaches 200. If a surge increases the voltage level to above 400 volts, the dc power modules are turned OFF to prevent them from being damaged.

The dc power modules may also be turned ON or OFF through the Operation Switch and the Auxiliary Supply circuit.

The Operation Switch is a "Safe Extra-Low Voltage" (SELV) switch on the operator's Control Panel. In previous products, this switch on the Control Panel cut primary power, but in RSE versions this switch is on the secondary side, isolated from line potentials through the AUXILLARY SUPPLY block. Placing this switch to ON supplies the ENABLE signal to the dc power modules.

The Operation Switch, in combination with the AUXILLARY POWER SUPPLY and ON/OFF/LIMITS circuitry, allows the dc power modules to operate if all of the following conditions are met:

- the Operation Switch is ON
- the ON/OFF and LIMITS circuitry senses more than 200 volts on the BULK DC bus
- the ON/OFF and LIMITS circuitry senses less than 400 volts on the BULK DC bus.

THE AC PCA IS ALWAYS LIVE AS LONG AS THE UNIT IS PLUGGED IN.

The DC PCA

The DC PCA receives the 300-volt Bulk dc input from the AC PCA and converts this to regulated outputs of +5, +12, and +24 volts if the ENABLE signal is present.

Some of the +5 Vdc that is generated is fed into a chip that further converts this to +9.5 Vdc. This voltage is used to bias some op amps.

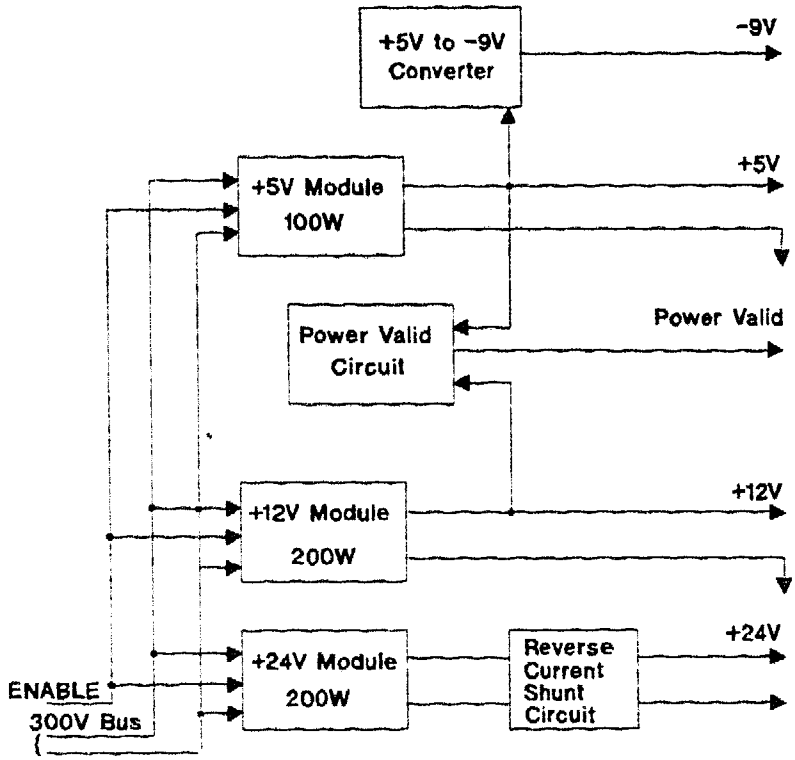


Figure 10-7. The DC PCA in the Power Supply

The POWER VALID block looks at the +5 V and +12 V outputs. When these outputs rise to operating range (~4.5 V and ~11 V), this circuit triggers a Poweron RESET.

The REVERSE CURRENT SHUNT block absorbs any reverse current generated by the Autochanger motors as they slow down.

Table 10-6. Input Requirements

	Range
Input Voltage	88 to 137 Vac RMS 176 to 268 Vac RMS
Input Frequency	47 to 66 Hertz
Input Current	< 6 Amperes ac RMS
Input Power	< 300 W
Inrush Current	< 40.0 amperes peak at cold start
Input Fusing	on PCA
Power Factor	> 0.6
Line Surge	Steps from 129 to 150 Vac for 500 milliseconds with no failure (including fuse)
Line Sag	Steps from 108 to 80 Vac for 500 milliseconds with no failure (including fuse)
Line Brownout and Recovery	a. Linearly decrease from 90 to 0 Vac in 30 minutes. Then 120 volts is re-applied b. Linearly increase input voltage from 0 to 90 Vac in 30 minutes
Total Output Power	250 W (sum of all outputs)

11

Related Documents

Document Name	Part No.	Edition/ Date
Configuring and Using the Optical Disk Library System On HP 9000 Series 300/400 Computers (packaged with the Service Manual (C1700-90080) and shipped with each unit)	C1700-90079	Ed.2 12/91
Configuring and Using the Optical Disk Library System On HP 9000 Series 800 Computers (packaged with the Service Manual (C1700-90080) and shipped with each unit)	C1700-90078	Ed.2 12/91
Configuring and Using the Optical Disk Library System On HP 9000 Series 700 Computers (packaged with the Service Manual (C1700-90080) and shipped with each unit)	C1700-90077	Ed.2 12/91
900 Series HP 3000 Computer Systems, Installing and Using the Optical Disk Library System (packaged with the Service Manual (C1700-90080) and shipped with each unit)	C1700-90076	Ed.1 4/91
Setup Guide Kit. Contains the *Optical Disk Library System, Models 10 and 20 Setup Guide for Deskside Models* and the *Optical Disk Library System, Models 10 and 20 Setup Guide for Rackmount Models.* (packaged with the Service Manual (C1700-90080) and shipped with each unit)	C1700-90050	Ed.1 9/91
Optical Disk Library System User's Guide, Models 10 and 20 (shipped with each unit)	C1700-90075	Ed.1 9/91
Optical Disk Library System Technical Reference Manual	5959-3559 (GSD)	Ed.1 11/90

Document Name	Part No.	Edition/ Date
Rewritable Optical Disk Library System Applications Guide	5959-3544 (GSD)	Ed.3 11/90
The Optical Storage Primer	5180-0043 (CPS)	Ed.2 3/90
The Multifunction Optical Storage Primer	5952-0334 (LDC)	Ed.1 3/91
Unpacking Instructions (all optical disk library systems—shipped with each unit)	C1700-90073	Ed.2 9/91
HP C1700A Self-Paced Guide	C1700+49A -90031	Ed.2 11/90
HP C1700A Self-Paced Training Kit	C1711+49A -90201	Ed.2 11/90
HP C1700A Audio Refresher	5062-8330	3/89

12

Service Notes/IOSMs

C1700A

Num.	Change	Date	Serial Number
01	C1700-69028 Power Module being modified to improve ease of assembly.	2/90	2931A00000 to 2931A00131
02	Erroneous selftest failures if the MO Drive Subsystem incorrectly connected to (or disconnected from) SCSI bus.	4/90	0000A00000 to 9999Z99999
03	Autochanger Controller PCA ROM firmware update (C1700-60237) to prevent SCSI bus hangs.	4/90	0000A00000 to 2931A00126
04	Drive Controller PCA ROM firmware update (C1700-60136) to prevent SCSI bus hangs and improved internal drive operation (Rev. 2.13).	8/90	2931A00000 to 2931A99999
05	Fails poweron selftest when the chassis access cover at the end of the Carriage rails (ways) is removed.	7/90	2931A00031 to 9999Z99999
06	Modification of Carriage and Left Way assembly to dissipate static discharge during Autochanger operation.	10/90	2931A00001 to 3027A00386
07	MO Drive Controller PCA ROMS firmware update (C1700-60236) to prevent overwrite problems.	12/90	2931A00001 to 3027A99999
08	MO drive modifications that allow operation in a rackmount version of the Autochanger.	10/90	0000A00000 to 9999Z99999

Num.	Change	Date	Serial Number
09	Unique parts for servicing the rackmount version of the C1700A.	10/90	3045A00440 to 9999A99999
10	Changes to error recovery algorithms to improve integration.	01/91	0000A00000 to 3045A00433
11	Additional parts needed to service the C1700A with a dual-sensor mailslot.	02/91	3107A00000 to 9999A99999
12	Changes to the Autochanger firmware to support the dual-sensor mailslot, fix bugs, and add configuration options.	02/91	0000A00000 to 3045A99999
13	Describes the differences in the Disk Library System Installation between HP-UX Version 7.0 and 8.0.	05/91	0000A00000 to 9999Z99999
14	Procedure to clear Non-volatile RAM.	06/91	0000A00000 to 9999Z99999

C1710A

Num.	Change	Date	Serial Number
01	C1700-69028 Power Module being modified to improve ease of assembly.	2/90	2932A00000 to 2932A00116

A

Online Diagnostics

OPUTIL—Diagnostic for HP 9000 Series 300 Systems

OPUTIL is a diagnostic utility that enables you to send SCSI optical device commands through the SCSI interface on an HP 9000 Series 300 system to the Autochanger mechanism or each drive in the Autochanger.

The OPUTIL diagnostic utility is available as a binary file from Greeley Storage Division and may be obtained three ways:

- Request it through HPDESK.
- Request it though Internet
- Download it from the Greeley Storage Division BBS.

To receive OPUTIL over HPDESK, send a request to GSD HDWSUPP. Enter OPUTIL at the "Subject;" prompt. No entry is needed at the "Text:" prompt. You will receive the file in an AUTOANSWER.

Over HP-UX mail, use gsd_hdwsupp@hpgrla.gr.hp.com as the address and specify "OPUTIL" as the subject. No other text is required. If you are on the HP Global Database, you will receive the file in an AUTOANSWER.

The Greeley Storage Division BBS number is (303) 350-4777. This is a TBBS system that responds to baud rates of from 300 to 2400 baud, 8 data bits, 1 stop bit, no parity. (Please do not use 300 baud, if at all possible.)

If you are a new user, you will be prompted for a password. It usually takes 24 hours to activate your password and at that time you will be able to access information and download files.

The binary OPUTIL utility may be downloaded using the following file transfer protocols: XMODEM (either Checksum or CRC), YMODEM (sometimes called YMODEM-1k), YMODEM-Batch (sometimes called "True YMODEM"), SEAlink, KERMIT, and SuperKERMIT.

Note If you need detailed information about SCSI commands, refer to the "Optical Disk Library System Technical Reference Manual," 5959-3559, available from Greeley Storage Division.

Running OPUTIL

To run OPUTIL, first determine the device number for the standalone optical disk or the Autochanger, as applicable, then log on as "superuser". Type "oputil" to run the utility. Follow the menus.

Buffering is used to keep long explanations from scrolling off the screen.

Although you may type out the full command name, the program uses only the first four letters to determine the command you select.

To stop, type "exit" at any prompt.

User Commands

For Help

Typing "HELP" gives you a list of the commands implemented and what command to type to issue those commands.

Typing "EXPLain" gives you a list of short explanations for each command; the list determined by whether you selected a standalone disk or an Autochanger as the device.

Commands for DISKS:

TEST UNIT READY (Test Unit Ready 00H)

Determines if the drive is ready. Verifies that the system is communicating with the drive.

```
ENTER COMMAND: TEST
```

DIAGNOSTIC TESTS (Send Diagnostic 1D)

Calls the poweron selftest for the disk and the subtests that make up that test: Controller self-diagnostics, drive self-diagnostics, drive functional diagnostics, and disk access diagnostics.

```
ENTER COMMAND: SELFtest
```

REASSIGN BLOCK (Reassign Block 07)

Reassigns the given block.

```
ENTER COMMAND: REASsign
```

WRITE ERASED BLOCK (Write 2A)

Enables writes to the given erased block.

```
ENTER COMMAND: WRITe
```

UNLOCK (Prevent/Allow Media Removal 1E)

Allows disk cartridges to be ejected from the drive using front panel controls.

```
ENTER COMMAND: UNLOck
```

LOCK (Prevent/Allow Media Removal 1E)

Disallows ejection of a disk from the drive using front panel controls.

```
ENTER COMMAND: LOCK
```

REQUEST SENSE (Request Sense 03)

Returns sense bytes from the drive. Sense bytes are: Sense key, Additional Sense Code, and Internal Error Code. Refer to Chapter 5, Subsection 5.5, "Error Identification," for a detailed description of information returned by the Request Sense command.

```
ENTER COMMAND: REQUest
```

INQUIRY (Inquiry 12)

Returns vendor ID, model number, and firmware revision.

```
ENTER COMMAND: INQUiry
```

RESERVE (Reserve 16)

Reserves the drive for the program's initiator.

```
ENTER COMMAND: RESErve
```

RELEASE (Release 17)

Releases the unit reserved with RESERVE.

```
ENTER COMMAND: RELEase
```

REZERO UNIT (Rezero Unit 01)

Returns the drive to its starting block.

```
ENTER COMMAND: REZEro
```

START UNIT (Start/Stop Unit 1B)

Starts the rotation of the disk in the drive.

```
ENTER COMMAND: STARt
```

STOP UNIT (Start/Stop Unit 1B)

Stops the rotation of the disk in the drive.

```
ENTER COMMAND: STOP
```

EJECT MEDIA (Start/Stop Unit 1B)

Ejects the disk from the drive.

```
ENTER COMMAND: EJECt
```

READ CAPACITY (Read Capacity 25)

Returns the capacity of the active side of the disk in the drive (in bytes).

```
ENTER COMMAND: READ
```

MODE SENSE (Mode Sense 1A)

Returns information about the drive, disk and controller. Information returned is the write protect status, retry count, buffer full/empty ratios, format mode, number of bands, and size of the spare band.

```
ENTER COMMAND: MSENse
```

SEEK (Seek 2B)

Allows incremental, butterfly, alternate, random block-specific seeks and track-specific seeks.

```
ENTER COMMAND: SEEK
```

ERASE (Erase 2C)

Erases all data from the active side of the disk in the drive.

```
ENTER COMMAND: ERASe
```

VERIFY (Verify 2F)

Verifies all data on the active side of the disk in the drive or a single block with looping.

```
ENTER COMMAND: VERIfy
```

MODE SELECT (Mode Select 15)

Allows changing of all the parameters returned by MODE SENSE.

```
ENTER COMMAND: MSELect
```

MEDIA FORMAT (Format 04)

Allows the active side of the disk in the drive to be formatted.

```
ENTER COMMAND: FORMat
```

FIRMWARE REVISION(Inquiry 12)

Reads the firmware revision of the drive controller.

```
ENTER COMMAND: FIRMware
```

DEFECT DATA (Read Defect Data 37)

Reads the reassign block information for the disk in the drive.

```
ENTER COMMAND: DEFEct
```

WORKOUT MO (Command Compilation)

Sends the following commands: TEST UNIT READY, LOCK, UNLOCK, RESERVE, RELEASE, STOP, START, READ CAPACITY, REQUEST SENSE, DIAGNOSTICS, SEEK, FIRMWARE REVISION, and READ DEFECT DATA.

User must supply input to the DIAGNOSTICS, SEEK, and READ DEFECT sections.

```
ENTER COMMAND: WOMO
```

READ BLOCK (Read 28)

Reads the specified block on the disk in the drive.

```
ENTER COMMAND: RBLK
```

CHANGE DEVICE

Change the device under test to another specified device.

```
ENTER COMMAND: CHANge
```

Commands for AUTOCHANGERS:

TEST UNIT READY (Test Unit Ready 00)

Determines if the Autochanger is ready. Verifies that the system is communicating with the Autochanger.

```
ENTER COMMAND: TEST
```

UNLOCK (Prevent/Allow Media Removal 1E)

Opens the Mailslot and allows I/O through the Mailslot. The Autochanger is unSECUREd after this command.

```
ENTER COMMAND: UNLOck
```

LOCK (Prevent/Allow Media Removal 1E)

Closes the Mailslot and disallows I/O through the Mailslot. The Autochanger is SECUREd after this command.

```
ENTER COMMAND: LOCK
```

REQUEST SENSE (Request Sense 03)

Returns sense bytes from the Autochanger. Sense bytes are: Sense Key, Additional Sense Code, and Error Code.

```
ENTER COMMAND: ACREquest
```

INQUIRY (Inquiry 12)

Returns vendor ID, model number, and firmware revision.

```
ENTER COMMAND: INQUiry
```

RESERVE (Reserve 16)

Closes the Mailslot and disallows I/O through the Mailslot. The Autochanger is SECUREd after this command.

```
ENTER COMMAND: RESErve
```

RELEASE (Release 17)

Opens the Mailslot and allows I/O through the Mailslot. The Autochanger is unSECUREd after this command.

```
ENTER COMMAND: RELEase
```

REZERO UNIT (Rezero Unit 01)

Zeros the Autochanger by running TEST 1.

```
ENTER COMMAND: REZEro
```

INITIALIZE ELEMENT STATUS (Initialize Element Status 07)

Scans the Mailslot, all slots, and the drives in the Autochanger to determine if any of these locations contain disks.

```
ENTER COMMAND: INITel
```

POSITION TO ELEMENT (Position to Element 2B)

Moves the Picker to the specified location.

```
ENTER COMMAND: POSItion
```

READ ELEMENT STATUS (Read Element Status B8)

Returns the information obtained from INITIALIZE ELEMENT STATUS.

```
ENTER COMMAND: ELEMstat
```

MOVE MEDIUM (Move Medium A5)

Moves the disk from one specified location to another specified location. Flips of the disk are allowed. To prevent inadvertantly leaving a disk in a new location, this command moves the disk to the specified location and then immediately moves it back.

Note By reversing the effect of the move, this utility helps prevent disk mixup.

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.

```
ENTER COMMAND: MOVE
```

EXCHANGE MEDIUM (Exchange Medium A6)

Exchanges two disks between three locations. Flips of the disk are allowed.

To prevent inadvertantly leaving a disk in a new location, this command exchanges the specified disks and then immediately replaces them back to their original locations.

Note By reversing the effect of the exchange, this utility helps prevent disk mixup.

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.

```
ENTER COMMAND: EXCHange
```

LOG SENSE (Log Sense 4D)

Returns information from the following logs: Error, Move Success, Recovery, Drive, Odometer, Runtime, Retry, and Move History.

```
ENTER COMMAND: LOGSense
```

AUTOCHANGER MODE SENSE (Mode Sense 1A)

Returns the following information: Element Address Assignments, Transport Geometry Parameters, Device Capabilities.

```
ENTER COMMAND: ACMOde
```

AC DIAGNOSTICS (Send Diagnostic 1D)

Allows running and looping of all of the Autochanger internal tests. These tests are listed in Chapter 5, Section 5.2.

```
ENTER COMMAND: ACDIagnostics
```

FIRMWARE REVISION (Inquiry 12)

Reads the firmware revision of the Autochanger controller.

```
ENTER COMMAND: FIRMware
```

WORKOUT AC (Command Compilation)

Sends the following commands: TEST UNIT READY, LOCK, UNLOCK, RESERVE, RELEASE, REQUEST SENSE, DIAGNOSTICS and FIRMWARE REVISIONS.

User must supply input to the DIAGNOSTICS section.

```
ENTER COMMAND: WOAC
```

CHANGE DEVICE

Change the device under test to another specified device.

```
ENTER COMMAND: CHANge
```

B

Offline Diagnostics

Diagnostics Available; ACDIAG, ACDIAG+, MODIAG and SCSIMO

The four diagnostics available for optical autochangers and optical drives are ACDIAG and ACDIAG+ (for autochangers - using the Vectra and Portable Plus computers respectively), MODIAG and SCSIMO (for drives).

ACDIAG, ACDIAG+, and MODIAG are documented in this manual and are supported by Greeley Storage Division. Instructions for using SCSIMO are in the *Using Mass Storage Diagnostics with the HP-IL Interface*, (5960-0163).

ACDIAG and ACDIAG+ diagnostics fully exercise the autochanger mechanism of a library.

MODIAG and SCSIMO diagnostics fully exercise the rewritable and write-once modes of a library.

The common hardware and software issues are explained in the beginning of this appendix and detailed information on the running of each program is explained in its own section later in the appendix.

ACDIAG and MODIAG

Hardware and Software Requirements for ACDIAG and MODIAG

- An HP Vectra or AT-compatible computer with MS-DOS 3.3 or later.
- ANSI.SYS with a date code of 6-10-88 or later (normally shipped with MS-DOS).
- An Adaptec 1540/42B Interface PCA.
- ASPI4DOS.SYS Driver for the Adaptec PCA (Version 2.0 or 2.1).
- An autochanger.
- One SCSI cable.
- ACDIAG and/or MODIAG program.

Obtaining the Hardware and Software for ACDIAG and MODIAG

HARDWARE

The Adaptec 1540B/1542B Interface may be obtained from many hardware/software distributors.

SOFTWARE

Download the ACDIAG and MODIAG diagnostics through HPDESK or UNIX mail.

Through HPDESK—

Diagnostic distribution will occur through HPDESK node autoreply and can be accessed from either HPDESK or UNIX mail. The diagnostics may be obtained as follows by using an HPDESK node autoreply function.

1. From HPDESK, type "SEND TO GSD HDWSUPP/HP5800/01" <return>
2. For the Subject matter, type "ACSCSI" (for the ACDIAG diagnostics) or "MOSCSI" (for the MODIAG diagnostics) and press <return>
3. For the Text, type "//" <return>
4. Mail the message.

A JOBSTREAM is run 3 times each day which sends the correct auto- reply for the diagnostic request.

Through UNIX mail—

1. From the UNIX environment type:

   `mailx` gsd_support@hp5800.desk.hp.com

2. For the Subject matter, type "ACSCSI" (for the ACDIAG diagnostics) or "MOSCSI" (for the MODIAG diagnostics)

3. Enter <CNTL> "d" to send the message.

Hardware Configuration for ACDIAG and MODIAG

Configure the Adaptec PCA as follows:

1. *For AHA-1542B only.* On Jumper Block J8, remove the connection to PIN 1 (disables Floppy Enable).

2. On Jumper Block J6, remove the connection to PIN 1 (disables BIOS Enable).

   Depending on the version you have of Adaptec's ASPI4DOS.SYS—

   - Version 2.1—Go to Step 3.
   - Version 2.0—take the jumper wire that was connected to PIN 1 and connect it to PIN 5 (disable Autosense)

Note There is a bug in ASPI4DOS.SYS, Version 2.0 that prevents it from picking up all Request Sense Bytes for the Autochanger if Autosense is enabled. When Autosense is disabled, all the Request Sense Bytes can be obtained.

Note If you are using only MODIAG, it is not *necessary* to disable Autosense. But if you might also use ACDIAG in the future, it is better to configure the interface to handle BOTH programs at this time.

---

3. Ensure that all other jumpers are set to default values (see the *Adaptec AHA-1540B/1542B User's Manual*).

Note A functional SCSI device must be installed on the SCSI bus before booting the PC. If the Adaptec Interface PCA does not detect a working SCSI device, it will not initiate the loading of the ASP14DOS.SYS driver.

Depending on the condition of the device you are trying to service, this may mean ADDING another SCSI device to the bus so that you can begin testing.

Possible Configuration Error Messages with ACDIAG and MODIAG

If you attempt to run ACDIAG or MODIAG and ASPI4DOS.SYS has not been loaded, you will receive the following message just after the initial diagnostic startup screen is displayed:

```
open_driver: Error Code = 0x00, 0x02: No such file or directory
```

If you attempt to run ACDIAG or MODIAG and the `SCSI` file, which contains the address of the Adaptec PCA, is **missing**, you will receive the following message just before the initial diagnostic startup screen is displayed:

```
File SCSI needed by ACDIAG does not exist, create (Y/N)[Y]?
                              or
File SCSI needed by MODIAG does not exist, create (Y/N)[Y]?
```

If you choose not to create the `SCSI` file, (select `N`) the program will stop, giving you the following message:

```
File SCSI not created, ACDIAG program terminated.
                              or
File SCSI not created, MODIAG program terminated.
```

If you attempt to run ACDIAG or MODIAG and the `SCSI` file, which contains the address of the Adaptec PCA, is **wrong**, you will receive the following message just after the initial diagnostic startup screen is displayed:

```
initcard: cannot open device file / scsi: No such file or directory
```

Note If you need detailed information about SCSI commands, refer to the "Optical Disk Library System Technical Reference Manual," 5959-3559, available from Greeley Storage Division.

Running ACDIAG

ACDIAG may be started two ways: by typing ACDIAG or ACDIAG # at the MS-DOS prompt (where # is the SCSI ID of the device to be tested).

If you type ACDIAG, the program displays a program information banner (shown under the Revision command) and then gives you a listing of all devices it found. The display also shows which devices are valid for ACDIAG to test (are identified as "Medium Changer" devices).

For example:

```
Id = 0 Device = HP S6300.650A
Id = 1 No device found
Id = 2 No device found
Id = 3 Device = HP C1700A      <-- valid device
Id = 4 Device = HP S6300.650A
Id = 5 Device = HP S6300.650A
Id = 6 No device found

No current ID selected, Select target ID of device => 0 3 4 5 [3]?
```

The program will automatically select the first valid device it finds. To continue, either press RETURN to select the device indicated or select another device to test.

If you type ACDIAG #, the device to be tested is selected at that point. No banner or device selection display is shown, and the next prompt you see is Show Inquiry Data.

If you pick a device that is not a known, Hewlett-Packard Autochanger, the program tells you this and asks if you want to continue. You can run all tests for common operations but cannot test anything unique to that particular unit.

The help screen, which can be invoked by typing the word HELP, shows which commands/tests are available.

The REVision command brings up the initial information screen and may be used to check the revision of the program while running it.

A maximum of seven SCSI devices can be tested by ACDIAG. Either a maximum of two Autochangers (with two drives apiece) may be tested, or, if all drives are disabled, a maximum of seven Autochangers may be tested.

Note All error and log information is translated into plain English.

INTERNAL LOGS: The Autochanger has a series of internal logs that are maintained during every phase of operation. These logs can be used during the troubleshooting process to speed repair time.

For this diagnostic, the various logs have been grouped together according to their relationship to each other. The following sections provide a brief description of the logs. Also, an explanation of the terms and conventions used in the descriptions are given below.

```
          b  - refers to a binary number.
          n  - refers to a decimal number.
          h  - refers to a hexadecimal number.
         [  ]     - text inside brackets gives a description of
                    the text that will actually be displayed by
                    the diagnostic.
         (  )     - text inside parenthesis are additional
                    notes explaining the diagnostic output.
                    This text is not replaced by actual displayed
                    text.
```

Note Some of the screen listings that follow have be modified to fit within the left/right margins of this manual.

Also, some listings are too long to fit on one page.

ERROR LOGS - Error Logs contain all previous diagnostic errors that have occurred during diagnostic and power-on tests. No entries are made in this log during normal operation (other than power-on). The Error Log can contain up to 50 individual error logs, which will be displayed as follows:

```
LOG ENTRY NUMBER                    :  [Most recent log first]

AUTOCHANGER FAILURE INDICATOR AND DESCRIPTION
  n - [description]
     (Valid failure values)
          0 - Poweron
          1 - Front Panel
          2 - SCSI Bus
          3 - FRU Isolation
          4 - Error Recovery
          5 - SCSI Reset
          6 - SCSI Abort
          7 - RS-232 port

HARDWARE ERROR CODE AND DESCRIPTION
  hh - [description]

FRU DESCRIPTIONS
  1st FRU Number    =  nn - [description]
  2nd FRU Number    =  nn - [description]
  3rd FRU Number    =  nn - [description]

Time when error occurred : hhhhhhhh
```

RECOVERY LOG - The recovery log records retries (soft errors) and related information on error recovery method and success. It is always reset to zero before every Macro-Move. Any error that occurs during the move or during the subsequent error recovery is logged and, therefore, information in the recovery log is valid only for the most recent move.

```
LOG ENTRY NUMBER  :  [Most recent log first]

MACRO-MOVE ID AND DESCRIPTION
  hh - [description]
     - [description]

ERROR RECOVERY STATE AND DESCRIPTION
  ddd - [description]
```

```
MICRO-MOVE ID AND DESCRIPTION
  hh - [description]

MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh - [description]

Y input position from the encoder            :hhhhhhhh
Expected Y input position from the encoder   :hhhhhhhh
Z input position from the encoder            :hhhhhhhh
Expected Z input position from the encoder   :hhhhhhhh
```

RUN TIME LOG - The Run Time log contains movement failures, or when any type of error recovery is required. The log contains both accumulative run time data and up to 10 individual run time log entries at any given time.

```
Total number of Macro-Moves          : hhhhhhhh
Total number of Retries              :     hhhh  LOG ENTRY
Total number of Inline Recoveries    :     hhhh  NUMBER
Total number of Fatal Errors         :     hhhh  [Most recent
                                                   log first]
Macro-Moves at time of error         : hhhhhhhh


MACRO-MOVE ID AND DESCRIPTION
  hh - [description]
     - [description]

FIRST MICRO-MOVE ID IN THE RECOVERY LOG
  hh -  [description]

MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh -  [description]

SECOND MICRO-MOVE ID IN THE RECOVERY LOG
  hh -  [description]
```

```
MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh - [description]
```

ODOMETER LOGS - The Autochanger maintains a set of logs that hold information in the way of counters. The Odometer Logs contain the following information:

```
Moves               : hhhhhhhh
Flips               : hhhhhhhh
Translates          : hhhhhhhh
Mailslot Rotations  : hhhhhhhh
Power-on Hours      : hhhhhhhh
```

MOVE SUCCESS LOG - The Move Success Logs contain information relating to the actual movements that take place within the Autochanger. During diagnostic testing, the Move Success Logs are not updated. The log contains both accumulative move success data (Move Success Log - Table) and up to 10 individual hard error log entries (Move Success Log - Individual Entries) at any given time. At the time a hard error occurs, the number of good moves and the number of retries (soft errors) are recorded in this log. Each time an individual entry is made into this log, a new count is started.

```
Total number of good moves since last hard error  : hhhhhhhh
Total number of soft errors since last hard error :     hhhh
```

MOVE SUCCESS LOG TABLE

INDIVIDUAL ENTRIES AT TIME OF HARD ERROR

LOG ENTRY	GOOD MOVES	RECOVERY COUNT
8	hhhhhhhh	hhhh
7	hhhhhhhh	hhhh
6	hhhhhhhh	hhhh
5	hhhhhhhh	hhhh
4	hhhhhhhh	hhhh
3	hhhhhhhh	hhhh
2	hhhhhhhh	hhhh
1	hhhhhhhh	hhhh

DRIVE LOGS - The Drive Logs contain information about the interaction between the Autochanger and the individual MO drives.

	Drive #1	Drive #2
	=========	==========
Medium insertions	hhhhhhhh	hhhhhhhh
Medium source	[description]	[description]
Medium flipped ?	YES/NO	YES/NO
ID Valid ?	YES/NO	YES/NO
LUN Valid ?	YES/NO	YES/NO
SCSI ID	n	n
SCSI LUN	n	n

RETRY LOG -

```
Inline Retries      : hhhh
Major Retries       : hhhh
```

MOVE HISTORY LOG - The Move History Log contains a maximum of 10 logs. Each log contains the last 6 move IDs prior to failure and the move ID that experienced the failure. The log is displayed as follows:

```
LOG ENTRY NUMBER    : [Most recent log first]

LEAST RECENT MOVE ID AND DESCRIPTION
  hh - [description]

  hh -  [description]

  hh -  [description]

  hh -  [description]

  hh -  [description]

MOST RECENT MOVE ID AND DESCRIPTION
  hh -  [description]

MOVE ID ERROR CODE AND DESCRIPTION
  hh -  [description]
```

Autochanger Commands

ALLOW MEDIUM REMOVAL

Allows optical cartridges to be manually removed from the library by enabling the Eject Button on the Control Panel.

COMMANDS

Displays the current commands list.

DIAGNOSTIC

Allows selection of a single Autochanger internal diagnostic. This command automatically reads the results of the selftest that was called and displays the results. Tests that do not function through the SCSI interface have been deleted from the menu of available diagnostics.

The following is a typical display.

```
 1 - Poweron Selftest               2 - Wellness Test
 3 - Controller Test                5 - Initialize Mechanism
10 - Initialize Element Status     11 - Mechanism Exercise Test
12 - Carriage Move Test            13 - Translate Test
14 - Flip Test                     15 - Storage Slot Test
16 - Drive I/O Test                17 - Mailslot I/O Test
20 - Set Speed Factor to Full      21 - Set Speed Factor to Half
     Speed                              Speed
22 - Set Speed Factor to           23 - Shipping
     Quarter  Speed
26 - Zero Runtime Log              27 - Set minimum retries
28 - Set to Default Number of      30 - Microprocessor Operation
     Retries                            Test
31 - ROM Checksum Test             32 - RAM Checksum Test
33 - Non-Destructive RAM Test      35 - Multi-Function Peripheral
                                        IC Test
36 - Motor Control Chip IC Test 37 - Drive Connect Test
38 - Control Panel Light Show      39 - Control Panel Button Check
40 - Power Supply Test             44 - Cartridge-in-Path Sensor
                                        Test (Model 60/100 only)
50 - Find Home Sequence            51 - Carriage/Picker Assembly
```

```
                                        Calibration Test
52 - Solenoid Test                 60 - FRU Isolation Test
     (Model 60/100 only)
65 - Calibrate Magazines           66 - Clear Magazine Offset
67 - Calibrate Mailslot            68 - Clear Mailslot Offset

Diagnostic Tests (Enter 0 to Exit) (1 thru 68) [0]?
Input the loop count (1 thru 256) [1]?
```

EXIT

Terminates the ACDIAG program.

HELP

Displays the available valid commands for the device being tested. Capital letters show minimum input needed to run the command.

The following is a typical display.

```
                     HELP DISPLAY

 1. Allow medium removal         10. MODe sense
 2. Commands                     11. MOVe test
 3. Diagnostic                   12. POsition test
 4. Exit                         13. PRevent medium removal
 5. Help                         14. REAd element status
 6. ID                           15. REQuest sense
 7. INItialize element status    16. REVision
 8. INQuiry                      17. REZero unit
 9. Log sense                    18. Test unit ready
```

ID

Allows a new target destination to be chosen. The following is a typical display from this command.

The following is a typical display.

```
Checking for valid IDs
  Id = 0   Device = HP S6300.650A
  Id = 1   No Device found
  Id = 2   No Device found
```

```
Id = 3   Device = HP C1700A   <-- valid device
Id = 4   Device = HP S6300.650A
Id = 5   Device = HP S6300.650A
Id = 6   No Device found

Select target ID of device => 0 3 4 5 [3]?
```

INITIALIZE ELEMENT STATUS

Checks each element type for the presence of a cartridge. It also checks each element type for its status. Status information is retained within the Autochanger and can be accessed using the READ ELEMENT STATUS command.

INQUIRY

Requests that information about the Optical Disk Library be sent to the initiator.

The following is a typical display.

```
Inquiry Data:   Medium Charger Device
-----------------------------------------
Removable Media        = YES
Vendor ID              = HP
Product ID             = C1700A
Firmware Revision      = 4.78
```

LOG SENSE

Used to obtain specific log information from the Autochanger. A menu of the various logs available within the Autochanger is displayed.

The following is a typical display.

```
Autochanger Logs
================
0 - Exit - Press RETURN
1 - Error Log
2 - Move Success Log
3 - Recovery Log
4 - Drive Log
5 - Firmware Revision
```

```
6 - Odometer Log
7 - Runtime Log
8 - Retry Log
9 - Move History Log

Autochanger Log Number (0 thru 9)[0]?
```

MODE SENSE

Displays geometric parameter information about the Autochanger.

The following is a typical display.

```
Mode Sense Data
Element Address Assignment Page:
-----------------------------------------------
First Medium Transport Element Address :   0
Number of Medium Transport Elements    :   1
First Storage Element Address          :  11
Number of Storage Elements             :  32
First Import/Export Element Address    :  10
Number of Import/Export Elements       :   1
First Data Transfer Element Address    :   1
Number of Data Transfer Elements       :   2
Transport Supports Rotation            : YES
```

MOVE TEST

Moves optical disk cartridges between elements. An element is the Mailslot, a drive, or a storage slot.

To ensure data integrity, all cartridges are returned to their original locations in their original orientation at the completion of each loop. This test may be looped from 1 to 256 times.

The user has two options when running this test: 1) select a source element and a destination element or 2) select a source element and the test provides a random destination element.

When you choose the option where you select both the source element and the destination element, you are prompted for a source location, a destination location, and whether you want the cartridge to be flipped during the test. The source location you choose must contain a cartridge and the destination must be empty.

When you choose the option where you select the source element but the the destination element is randomly chosen in the test, you are prompted for a source location and whether you want the cartridge to be flipped during the test. The source location you select must contain a cartridge and the Mailslot must be empty. The destination element (chosen by the test) may contain a cartridge or it may be empty.

If the destination element is empty, the SCSI Move Medium command is issued; if the destination element is full, the SCSI Exchange Medium command is issued.

The SCSI Move Medium command is implemented as follows. The cartridge in the source element is moved to the destination element. The source element address is then swapped with the destination address and the SCSI Move Medium command is re-issued to return the cartridge to its original location.

The SCSI Exchange Medium command is implemented as follows. The cartridge in the destination element is moved to the Mailslot and the cartridge in the source location is then moved to the destination element. To return the cartridges to their original locations, the source element address is swapped with the Mailslot address. The SCSI Exchange Medium command is then re-issued.

Note The following display is generic for HP Autochangers. The display may vary according to the type of autochanger under test.

```
MOVE CARTRIDGE TEST:
  S = Selected Source/Destination
  R = Selected Source/Random Destination
  E = Exit command

Enter the test type (S/R/E)[S]?
```

```
Slot#   Slot#
  1*     17
  2      18
  3      19
  4      20
  5      21
  6      22
  7      23
  8*     24
  9      25
 10      26
 11      27*
 12      28
 13      29
 14      30
 15*     31
 16      32*
Transport    Mailslot      Drive1     Drive2
  Empty        Full         Empty      Empty

Element types: 2-Slots  3-Mailslot  4-Drives

Source element type 2 thru 4 [2]?
Storage Slot 1 thru 32 [1]?

Destination element type 2 thru 4 [2]?
Storage Slot 1 thru 32 [1]?

Flip the Picker Assembly (Y/N) [N]?
Enter the loop count 1 thru 256 [1]?

Loop = 1
```

POSITION TEST

Positions the Picker in front of various elements within the Autochanger. An element is the Mailslot, a drive, or a storage slot. This test may be looped from 1 to 256 times. No cartridges are moved during this test.

Two options are available when running this test: 1) select a destination element from which a series of selected-destination-to-random-destination loops are run or 2) run a series of random-destination-to-random-destination loops. With either option, you may choose whether or not to flip the picker.

When you choose the option where you select a destination element, the picker is first positioned in front of this element. A random destination is then generated and the picker is moved to the new destination. The picker is then moved back to the selected destination element. Twenty moves from the selected destination to random destinations and back is one loop.

When the random-destination-to-random-destination option is selected, the test randomly selects an element address and the picker is positioned in front of that element. The picker is then moved to the next randomly-selected element. Twenty destination-to-destination moves is a loop.

Random test - 20 random positions. Selected test - 20 selected and 20 random positions.

Note The following display is generic for HP Autochangers. The display may vary according to the type of autochanger under test.

```
POSITION TRANSPORT TEST:
  S = Selected Destination
  R = Random Destination
  E = Exit command

Enter the test type (S/R/E)[S]?
```

```
Slot#   Slot#
  1*      17
  2       18
  3       19
  4       20
  5       21
  6       22
  7       23
  8*      24
  9       25
 10       26
 11       27*
 12       28
 13       29
 14       30
 15*      31
 16       32*
Transport    Mailslot      Drive1     Drive2
  Empty        Full         Empty      Empty

Element types:  2-Slots  3-Mailslot  4-Drives

Destination element type 2 thru 4 [2]?
Storage Slot 1 thru 32 [1]?

Flip the Picker Assembly (Y/N) [N]?
Enter the loop count 1 thru 256 [1]?

Loop = 1
Moving to Storage Slot # 1
```

PREVENT MEDIUM REMOVAL

Prevents optical cartridges from being removed from the library by disabling the Eject Button on the Control Panel.

READ ELEMENT

Displays the current status of the various elements.

Note The following display is generic for HP Autochangers. The display may vary according to the type of autochanger under test.

```
        Slot#   Slot#
          1*      17
          2       18
          3       19
          4       20
          5       21
          6       22
          7       23
          8*      24
          9       25
         10       26
         11       27*
         12       28
         13       29
         14       30
         15*      31
         16       32*
        Transport     Mailslot        Drive1      Drive2
          Empty          Full           Full        Empty
              Slot# 13
              Inverted
```

REQUEST SENSE

Used to determine the specific error condition when the drive fails to successfully execute a command and returns a CHECK CONDITION. Sense data is preserved for the initiator until retrieved by a Request Sense command or until receipt of any other command.

This command is issued automatically by the diagnostic whenever a CHECK CONDITION is returned by the Autochanger. The data is then displayed in hexadecimal notation along with an error description.

The following is the general format of the output. See the following pages for Request Sense information.

```
                         INITIAL ERROR DATA


SENSE KEY
  hh - [description]

SENSE CODE
  hh - [description]

EXPLANATION :
  [description]

INTERNAL STATE :
  [description]

RECOMMENDED ACTION :
  [description]


Show Additional Sense Data (Y/N)[Y]?


                  ADDITIONAL SENSE DATA MENU


Request Sense - Decode Additional Sense Data
============================================
          0 - Exit - Press Return
          1 - Move Errors
          2 - Hardware Error/FRUs
          3 - Mechanism State Bit Map
          4 - Retry Algorithm Bit Map
          5 - Recover Algorithm Bit Map
          6 - Source Element Bit Map
          7 - First Destination Bit Map (Second Move)
```

```
        8 - First Destination Bit Map (First Move)
        9 - Second Destination Bit Map
        10 - Y & Z Input/Output Positions

Which area to Decode (0-10)[0]?

                    MOVE ERRORS - PAGE 1


MOVE ERROR CODE AND DESCRIPTION
  hh - [description]

SENSE METHOD
  [description]

MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh - [description]


Show Micro-Move ID History Data (Y/N)[Y]?

                    MOVE ERRORS - PAGE 2

LEAST RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]
```

```
MOST RECENT MICRO-MOVE ID
  hh - [description]


Exit Additional Sense Data (Y/N)[N]?


                    HARDWARE ERROR / FRUs


HARDWARE ERROR CODE AND DESCRIPTION
  hh - [description]

FRU DESCRIPTIONS
  1st FRU Number     = nn - [description]
  2nd FRU Number     = nn - [description]
  3rd FRU Number     = nn - [description]


Exit Additional Sense Data (Y/N)[N]?
```

Note

There are a number of Bit Maps that may be accessed. Decoding of each bit is described on each screen within the diagnostic.

The titles of the Bit Maps available are shown below. The general format of the Bit Maps is shown on the next page.

```
MECHANISM STATE BIT MAP

RETRY ALGORITHM BIT MAP
RETRY COUNT =    n
```

```
RECOVER ALGORITHM BIT MAP
RECOVERY COUNT =    n

SOURCE ELEMENT BIT MAP
SOURCE = [description]

DESTINATION ELEMENT BIT MAP
DESTINATION ELEMENT  = [description]

SECONDARY SOURCE ELEMENT BIT MAP
SECONDARY SOURCE ELEMENT  = [description]

SECOND DESTINATION ELEMENT BIT MAP
SECOND DESTINATION = [description]

The format of the bit maps is as follows:

                                           76543210
Hex Number    = hh    Binary Number =    bbbbbbbb

BIT
  7 = b  [description or "Reserved" designation]
  6 = b  [                "                     ]
  5 = b  [                "                     ]
  4 = b  [                "                     ]
  3 = b  [                "                     ]
  2 = b  [                "                     ]
  1 = b  [                "                     ]
  0 = b  [                "                     ]

Exit Additional Sense Data (Y/N)[N]?
```

Note There is one other type of decoding available, shown below. This information is not intended for field use.

```
                    Y and Z INPUT/OUTPUT POSITIONS

DECODE Y & Z INPUT/OUTPUT POSITIONS

Y Input Position     : hhhhhhhh
Y Output Position    : hhhhhhhh
Z Input Position     : hhhhhhhh
Z Output Position    : hhhhhhhh

Exit Additional Sense Data (Y/N)[N]?
```

REVISION

Displays the current diagnostic revision number. The following is a typical display.

```
                    ACDIAG
                   REV. 3110

        HP Series 6300 - SCSI Autochanger
      Diagnostic/Utility Tool PN 5010-0012

   ACDIAG is designed for use by Hewlett-Packard
            Support Personnel Only.

     HP IS NOT LIABLE FOR DAMAGES RESULTING
            FROM UNAUTHORIZED USE.

    (c) Copyright Hewlett-Packard Co. 1991.
             All Rights Reserved.
```

REZERO UNIT

Sets the Optical Disk Library to a predefined state after recalibrating the mechanical system.

TEST UNIT READY

Used to determine the READY state of the Optical Disk Library. If the unit is in a READY state when it receives this command, it returns a GOOD status. If the drive is NOT READY when it receives this command, it should return a CHECK CONDITION with a sense key of NOT READY.

ACDIAG+

Software and Hardware Requirements for ACDIAG+

- 3 1/2-inch ACDIAG+ disk. Part Number: 5010-0011
- An HP Series 110 Portable PLUS PC with MS-DOS 2.11 or later.

  You may use a Vectra ES (or equivalent) with an HP-IL interface (82973A), with MS-DOS 3.1 or later instead of the Portable PLUS.
- An HP C1700A/M or C1710A/M.
- An HP-IL/SCSI Interface Module, part number 5061-3156, with an HP Series 82241A AC Adapter.
- An HP 9114B portable disk drive.
- One SCSI cable.
- Two HP-IL cables.

Note If you need detailed information about SCSI commands, refer to the "Optical Disk Library System Technical Reference Manual," 5959-3559, available from Greeley Storage Division.

Running ACDIAG+

Note ACDIAG+ will operate only on the Series 6300 Model 20GB/A (HP-connect) or Model 20 (non-HP connect) autochangers. It will not function on the "half" versions of these autochangers (Model 10 GB/A and Model 10).

ACDIAG+ is started by typing `ACDIAG` at the MS-DOS prompt.

The help screen, which can be invoked by typing the word HELP, shows which commands/tests are available for the type of device being tested.

INTERNAL LOGS: The Autochanger has a series of internal logs that are maintained during every phase of operation. These logs can be used during the troubleshooting process to speed repair time.

For this diagnostic, the various logs have been grouped together according to their relationship to each other. The following sections provide a brief description of the logs. Also, an explanation of the terms and conventions used in the descriptions are given below.

```
          b  - refers to a binary number.
          n  - refers to a decimal number.
          h  - refers to a hexadecimal number.
        [   ]     - text inside brackets gives a description of
                    the text that will actually be displayed by
                    the diagnostic.
        (  )      - text inside parenthesis are additional
                    notes explaining the diagnostic output.
                    This text is not replaced by actual displayed
                    text.
```

Note Some of the screen listings that follow have be modified to fit within the left/right margins of this manual.

Also, some listings are too long to fit on one page.

ERROR LOGS - Error Logs contain all previous diagnostic errors that have occurred during diagnostic and power-on tests. No entries are made in this log during normal operation (other than power-on). The Error Log can contain up to 50 individual error logs, which will be displayed as follows:

```
LOG ENTRY NUMBER                   :  [Most recent log first]

AUTOCHANGER FAILURE INDICATOR AND DESCRIPTION
  n - [description]
     (Valid failure values)
          0 - Poweron
          1 - Front Panel
          2 - SCSI Bus
          3 - FRU Isolation
          4 - Error Recovery
          5 - SCSI Reset
          6 - SCSI Abort
```

```
          7 - RS-232 port

HARDWARE ERROR CODE AND DESCRIPTION
  hh - [description]

FRU DESCRIPTIONS
  1st FRU Number     =  nn - [description]
  2nd FRU Number     =  nn - [description]
  3rd FRU Number     =  nn - [description]

Time when error occurred : hhhhhhhh
```

RECOVERY LOG - The recovery log records retries (soft errors) and related information on error recovery method and success. It is always reset to zero before every Macro-Move. Any error that occurs during the move or during the subsequent error recovery is logged and, therefore, information in the recovery log is valid only for the most recent move.

```
LOG ENTRY NUMBER  :  [Most recent log first]

MACRO-MOVE ID AND DESCRIPTION
  hh - [description]
     - [description]

ERROR RECOVERY STATE AND DESCRIPTION
  ddd - [description]

MICO-MOVE ID AND DESCRIPTION
  hh - [description]

MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh - [description]

Y input position from the encoder             :hhhhhhhh
Expected Y input position from the encoder    :hhhhhhhh
Z input position from the encoder             :hhhhhhhh
Expected Z input position from the encoder    :hhhhhhhh
```

RUN TIME LOG - The Run Time log contains movement failures, or when any type of error recovery is required. The log contains both accumulative run time data and up to 10 individual run time log entries at any given time.

```
Total number of Macro-Moves          : hhhhhhhh
Total number of Retries              :     hhhh  LOG ENTRY
Total number of Inline Recoveries    :     hhhh  NUMBER
Total number of Fatal Errors         :     hhhh  [Most recent
                                                   log first]
Macro-Moves at time of error         : hhhhhhhh


MACRO-MOVE ID AND DESCRIPTION
  hh - [description]
     - [description]

FIRST MICRO-MOVE ID IN THE RECOVERY LOG
  hh -  [description]

MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh -  [description]

SECOND MICRO-MOVE ID IN THE RECOVERY LOG
  hh -  [description]

MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh - [description]
```

ODOMETER LOGS - The Autochanger maintains a set of logs that hold information in the way of counters. The Odometer Logs contain the following information:

```
Moves                : hhhhhhhh
Flips                : hhhhhhhh
Translates           : hhhhhhhh
Mailslot Rotations   : hhhhhhhh
Power-on Hours       : hhhhhhhh
```

MOVE SUCCESS LOG - The Move Success Logs contain information relating to the actual movements that take place within the Autochanger. During diagnostic testing, the Move Success Logs are not updated. The log contains both accumulative move success data (Move Success Log - Table) and up to 10 individual hard error log entries (Move Success Log - Individual Entries) at any given time. At the time a hard error occurs, the number of good moves and the number of retries (soft errors) are recorded in this log. Each time an individual entry is made into this log, a new count is started.

```
Total number of good moves since last hard error  : hhhhhhhh
Total number of soft errors since last hard error :     hhhh
```

MOVE SUCCESS LOG TABLE

INDIVIDUAL ENTRIES AT TIME OF HARD ERROR

LOG ENTRY	GOOD MOVES	RECOVERY COUNT
8	hhhhhhhh	hhhh
7	hhhhhhhh	hhhh
6	hhhhhhhh	hhhh
5	hhhhhhhh	hhhh
4	hhhhhhhh	hhhh
3	hhhhhhhh	hhhh
2	hhhhhhhh	hhhh
1	hhhhhhhh	hhhh

DRIVE LOGS - The Drive Logs contain information about the interaction between the Autochanger and the individual MO drives.

	Drive #1	Drive #2
Medium insertions	hhhhhhhh	hhhhhhhh
Medium source	[description]	[description]
Medium flipped ?	YES/NO	YES/NO
ID Valid ?	YES/NO	YES/NO
LUN Valid ?	YES/NO	YES/NO
SCSI ID	n	n
SCSI LUN	n	n

RETRY LOG -

```
Inline Retries      : hhhh
Major Retries       : hhhh
```

MOVE HISTORY LOG - The Move History Log contains a maximum of 10 logs. Each log contains the last 6 move IDs prior to failure and the move ID that experienced the failure. The log is displayed as follows:

```
LOG ENTRY NUMBER    : [Most recent log first]

LEAST RECENT MOVE ID AND DESCRIPTION
  hh - [description]

  hh - [description]

  hh - [description]

  hh - [description]

  hh - [description]

MOST RECENT MOVE ID AND DESCRIPTION
  hh - [description]

MOVE ID ERROR CODE AND DESCRIPTION
  hh - [description]
```

Autochanger Commands

DIAGNOSTIC

Allows selection of a single Autochanger internal diagnostic. This command automatically reads the results of the selftest that was called and displays the results. Tests that do not function through the SCSI interface have been deleted from the menu of available diagnostics.

```
ENTER COMMAND: DIagnostic
```

```
OUTPUT FORMAT:

  1 - Poweron Selftest             2 - Wellness Test
  3 - Controller Test              5 - Initialize Mechanism
 10 - Initialize Element Status   11 - Mechanism Exercise Test
 12 - Carriage Move Test          13 - Translate Test
 14 - Flip Test                   15 - Storage Slot Test
 16 - Drive I/O Test              17 - Mailslot I/O Test
 19 - Zero Maximum Force Log      20 - Set Speed Factor to Full
                                                         Speed
 21 - Set Speed Factor to Half    22 - Set Speed Factor
                         Speed          to Quarter Speed
 23 - Shipping                    26 - Zero Runtime Log
 27 - Set Minimum Retries         28 - Set to Default Number of
                                                       Retries
 30 - Microprocessor Operation    31 - ROM Checksum Test
                          Test
 32 - RAM Checksum Test           33 - Non-Destructive RAM Test
 35 - Multi-Function Peripheral   36 - Motor Control Chip IC Test
 37 - Drive Connect Test          38 - Control Panel Light Show
 39 - Control Panel Button Check  40 - Power Supply Test
 50 - Find Home Sequence          51 - Carriage/Picker Assembly
                                              Calibration Test
 60 - FRU Isolation Test

        Input the selftest number (1 <= cnt <=60) [1]?
        Input the loop count (1 <= cnt <=256)[1]?
```

EXIT

Terminates the ACDIAG+ program.

```
ENTER COMMAND: Exit
```

```
OUTPUT FORMAT:

There is no output from this command.
```

HELP

Displays the available valid commands for the device being tested.

```
ENTER COMMAND: Help

OUTPUT FORMAT:

                          HELP SCREEN

DIagnostic          - The Autochanger executes the selected
                      selftest.

Exit                - Exit the program.

Help                - Display this help file.

ID                  - Change SCSI Initiator ID or Target ID.

INIt element        - Checks all elements for the presence of
                      a cartridge and relevant status.
                      Information can be retrieved by using
                      the REAd Element command.

INQuiry             - Displays Autochanger and HP-IL parameters.

Log sense           - Retrieves log information from the
                      Autochanger.

Move test           - Moves optical disk cartridges between
```

```
                    elements.  Cartridge locations and
                    orientations are maintained.  The test
                    uses both the Move and Exchange Medium
                    SCSI commands.
                    Maximum move time ~ 14 seconds per loop.

POsition test     - Positions the transport in front of an
                    element.
                    Random test   - 20 random positions.
                    Selected test - 20 selected & 20 random
                                    positions.

PRevent           - Prevents or allows manual medium
                    insertion into the Autochanger.

REAd element      - Displays the current status of the
                    various elements.

REQuest sense     - Displays Sense data from the Autochanger.

REZero unit       - Sets the Autochanger to a known state
                    after recalibrating the mechanical system.
```

ID

Prompts the user to enter the Initiator ID of the host and the Target ID of the Autochanger device.

```
ENTER COMMAND: ID
```

```
OUTPUT FORMAT:

     Initiator ID number (0-7)[7]?    (Any number other than the
                                       device to be tested)

     Target ID number of the Autochanger (0-7)[3]?  (Default is
                                                     address 3)
```

INITIALIZE ELEMENT STATUS

Checks each element type for the presence of a cartridge. It also checks each element type for its status. Status information is retained within the Autochanger and can be accessed using the READ ELEMENT STATUS command.

```
ENTER COMMAND: INIt element

  OUTPUT FORMAT:

     Show Read Element Data (Y/N) [Y]?

     (See the REAd element status command for display
      information)
```

INQUIRY

Interrogates the Vital Data Log within the Autochanger.

```
ENTER COMMAND: INQuiry

  OUTPUT FORMAT:

    Inquiry Values:
    Medium Changer Device      - Removable Media
    Vendor ID                  = HP
    Product ID                 = C17nnA
    Firmware Revision          = n.nn
    HP-IL/SCSI Revision        = nnnn

    SCSI Initiator ID          = n
    SCSI Target ID             = n
    Output Device              = Control Panel
```

LOG SENSE

Used to obtain specific log information from the Autochanger. A menu of the various logs available within the Autochanger is displayed.

```
ENTER COMMAND: Log sense

  OUTPUT FORMAT:

     Autochanger Logs
     ================
     0 - Exit - Press RETURN
     1 - Error Log
     2 - Move Success Log
     3 - Recovery Log
     4 - Drive Log
     5 - Firmware Revision
     6 - Odometer Log
     7 - Runtime Log
     8 - Retry Log
     9 - Move History Log

     Autochanger Log Number (0-9)[0]?
```

MOVE TEST

Moves optical disk cartridges between elements. An element is the Mailslot, the Picker, a drive, or a storage slot.

To ensure data integrity, all cartridges are returned to their original locations in their original orientation at the completion of each loop. This test may be looped from 1 to 256 times.

The user has two options when running this test: 1) select a source element and a destination element or 2) select a source element and the test provides a random destination element.

When you choose the option where you select both the source element and the destination element, you are prompted for a source location, a destination location, and whether you want the cartridge to be flipped during the test. The source location you choose must contain a cartridge and the destination must be empty.

When you choose the option where you select the source element but the the destination element is randomly chosen in the test, you are prompted for a source location and whether you want the cartridge to be flipped during the test. The source location you select must contain a cartridge and the Mailslot must be empty. The destination element (chosen by the test) may contain a cartridge or it may be empty.

If the destination element is empty, the SCSI Move Medium command is issued; if the destination element is full, the SCSI Exchange Medium command is issued.

The SCSI Move Medium command is implemented as follows. The cartridge in the source element is moved to the destination element. The source element address is then swapped with the destination address and the SCSI Move Medium command is re-issued to return the cartridge to its original location.

The SCSI Exchange Medium command is implemented as follows. The cartridge in the destination element is moved to the Mailslot and the cartridge in the source location is then moved to the destination element. To return the cartridges to their original locations, the source element address is swapped with the Mailslot address. The SCSI Exchange Medium command is then re-issued.

```
ENTER COMMAND: Move test

  OUTPUT FORMAT:

Autochanger Element Types   Element Status    SLOT #  SLOT #
=========================   ==============    ==============
1 - Medium Transport        Transport - Empty  16        32
2 - Storage Slots (1-32)                       15        31
3 - Import/Export           Mailslot  - Empty  14        30
4 - Data Transfer (1-2)     Drive 1   - Empty  13        29 *
                            Drive 2   - Empty  12        28
MOVE CARTRIDGE TEST:                           11        27
S = Selected Source/Destination                10        26
R = Selected Source/Random Destination         9 *       25 *
E = Exit command                               8         24
                                               7         23
Enter the test type (S/R/E)[S]?                6 *       22 *
Source element type (1 <= cnt <=4) [2]? 2      5         21
Storage Slot (1 <= cnt <= 32)[1]? 9            4         20
Destination element type (1 <= cnt <=4) [2]? 4 3         19
Drive (1 <= cnt <= 2)[1]?                      2         18
Flip the Picker Assembly (Y/N) [N]?            1         17
Enter the loop count (1 - 256) [1]:
     Loop = 1                               * cartridge loaded
Test started (xx:xx:xx:xx)                  + error condition
Test completed (xx:xx:xx:xx)                D disabled
```

POSITION TEST

Positions the Picker in front of various elements within the Autochanger. An element is the Mailslot, a drive, or a storage slot. This test may be looped from 1 to 256 times. No cartridges are moved during this test.

Two options are available when running this test: 1) select a destination element from which a series of selected-destination-to-random-destination loops are run or 2) run a series of random-destination-to-random-destination loops. With either option, you may choose whether or not to flip the Picker.

When you choose the option where you select a destination element, the Picker is first positioned in front of this element. A random destination is then generated and the Picker is moved to the new destination. The Picker is then moved back to the selected destination element. Twenty moves from the selected destination to random destinations and back is one loop.

When the random-destination-to-random-destination option is selected, the test randomly selects an element address and the Picker is positioned in front of that element. The Picker is then moved to the next randomly-selected element. Twenty destination-to-destination moves is a loop.

```
ENTER COMMAND: POsition test

  OUTPUT FORMAT:


Autochanger Element Types  Element Status    SLOT #   SLOT #
=======================================    =============
1 - Medium Transport       Transport - Empty   16        32
2 - Storage Slots (1-32)                       15        31
3 - Import/Export          Mailslot  - Empty   14        30
4 - Data Transfer (1-2)    Drive 1   - Empty   13        29 *
                           Drive 2   - Empty   12        28
Test type:                                     11        27
S = Selected Destination                       10        26
R = Random Destination                          9 *      25 *
E = Exit command                                8        24
Enter the test type (S/R/E)[S]?                 7        23
                                                6 *      22 *
Destination element type (1 <= cnt <=4) [2]?   5        21
Storage Slot (1 <= cnt <= 32)[1]?               4        20
Flip the Picker Assembly (Y/N) [N]?             3        19
Enter the loop count (1 - 256) [1]:             2        18
Test started (08:50:44.48)                      1        17
Loop =   1
Moving to Storage Slot #  1

                                          * cartridge loaded
                                          + error condition
                                          D disabled
Test stopped (xx:xx:xx.xx)
```

PREVENT/ALLOW MEDIUM REMOVAL

Provides the user with a means to prevent manual removal/insertion of optical cartridges into the import/export element (Mailslot).

```
ENTER COMMAND: PRevent

  OUTPUT FORMAT:

Prevent medium from being removed (Y/N) [Y]?
```

READ ELEMENT STATUS

Displays the status of the various elements (storage slots, import/export (Mailslot), medium transport (Carriage/Picker), and MO drives) within the library.

```
ENTER COMMAND: REAd element

  OUTPUT FORMAT:

                                                    SLOT #    SLOT #
 Medium Transport Status:
 Transport is Empty.                                  16        32
                                                      15        31
                                                      14        30
Import/Export Status:                                 13        29
Last medium inserted by Autochanger
 in mailslot.                                         12        28
Mailslot is Empty.                                    11        27
                                                      10        26
                                                      9         25
                                                      8         24 *
                                                      7         23
                                                      6         22
                                                      5         21
Drive # 1 Status:   Drive # 2 Status:                 4 *       20
Drive is Empty.     Drive is Full.                    3         19
                                                      2         18
                                                      1         17
```

```
                                              * cartridge loaded
                  Medium was Inverted.        + error condition
     Storage slot :  0  Storage slot :  6     D disabled
```

REQUEST SENSE

Used to determine the specific error condition when the Autochanger fails to successfully execute a command or test.

```
        ENTER COMMAND: REQuest sense

   OUTPUT FORMAT:

       (See the following pages for the REQUEST SENSE INFORMATION)


                                   INITIAL ERROR DATA


            SENSE KEY
              hh - [description]

            SENSE CODE
              hh - [description]

            EXPLANATION :
              [description]

            INTERNAL STATE :
              [description]

            RECOMMENDED ACTION :
              [description]


            Show Additional Sense Data (Y/N)[Y]?
```

```
                ADDITIONAL SENSE DATA MENU

 Request Sense - Decode Additional Sense Data
 ============================================
           0 - Exit - Press Return
           1 - Move Errors
           2 - Hardware Error/FRUs
           3 - Mechanism State Bit Map
           4 - Retry Algorithm Bit Map
           5 - Recover Algorithm Bit Map
           6 - Source Element Bit Map
           7 - First Destination Bit Map (Second Move)
           8 - First Destination Bit Map (First Move)
           9 - Second Destination Bit Map
           10 - Y & Z Input/Output Positions

Which area to Decode (0-10)[0]?


                    MOVE ERRORS - PAGE 1


MOVE ERROR CODE AND DESCRIPTION
  hh - [description]

SENSE METHOD
  [description]

MICRO-MOVE ERROR CODE AND DESCRIPTION
  hh - [description]


Show Micro-Move ID History Data (Y/N)[Y]?
```

```
                          MOVE ERRORS - PAGE 2

LEAST RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]

NEXT RECENT MICRO-MOVE ID
  hh - [description]

MOST RECENT MICRO-MOVE ID
  hh - [description]


Exit Additional Sense Data (Y/N)[N]?


                          HARDWARE ERROR / FRUs


HARDWARE ERROR CODE AND DESCRIPTION
  hh - [description]

FRU DESCRIPTIONS
  1st FRU Number    =  nn - [description]
  2nd FRU Number    =  nn - [description]
  3rd FRU Number    =  nn - [description]


Exit Additional Sense Data (Y/N)[N]?
```

Note

There are a number of Bit Maps that may be accessed. Decoding of each bit is described on each screen within the diagnostic.

The titles of the Bit Maps available are shown below. The general format of the Bit Maps is shown on the next page.

```
MECHANISM STATE BIT MAP

RETRY ALGORITHM BIT MAP
RETRY COUNT =    n

RECOVER ALGORITHM BIT MAP
RECOVERY COUNT =    n

SOURCE ELEMENT BIT MAP
SOURCE = [description]

DESTINATION ELEMENT BIT MAP
DESTINATION ELEMENT  = [description]

SECONDARY SOURCE ELEMENT BIT MAP
SECONDARY SOURCE ELEMENT  = [description]

SECOND DESTINATION ELEMENT BIT MAP
SECOND DESTINATION = [description]
```

```
The format of the bit maps is as follows:

                                           76543210
Hex Number    = hh    Binary Number =      bbbbbbbb

BIT
  7 = b  [description or "Reserved" designation]
  6 = b  [                 "                    ]
  5 = b  [                 "                    ]
  4 = b  [                 "                    ]
  3 = b  [                 "                    ]
  2 = b  [                 "                    ]
  1 = b  [                 "                    ]
  0 = b  [                 "                    ]
```

```
Exit Additional Sense Data (Y/N)[N]?
```

Note There is one other type of decoding available as shown below. This information is not intended for field use.

```
                    Y and Z INPUT/OUTPUT POSITIONS

DECODE Y & Z INPUT/OUTPUT POSITIONS

Y Input Position     : hhhhhhhh
Y Output Position    : hhhhhhhh
Z Input Position     : hhhhhhhh
Z Output Position    : hhhhhhhh

Exit Additional Sense Data (Y/N)[N]?
```

Running MODIAG

Note Hardware, software, and the configurations needed to run MODIAG is explained in the first part of this appendix. Be sure your system is set up correctly before running MODIAG.

MODIAG may be started two ways: by typing `MODIAG` or `MODIAG #` at the MS-DOS prompt (where # is the SCSI ID of the device to be tested).

If you type `MODIAG`, the program displays a program information banner (shown under the Revision command) and then gives you a listing of all devices it found. The display also shows which devices are valid for MODIAG to test (are identified as "Direct-Access" devices).

For example:

```
Id = 0 Device = HP S6300.650A  <-- valid device
Id = 1 No device found
Id = 2 No device found
Id = 3 Device = HP C1700A
Id = 4 Device = HP S6300.650A  <-- valid device
Id = 5 Device = HP S6300.650A  <-- valid device
Id = 6 No device found

No current ID selected, Select target ID of device => 0 3 4 5 [0]?
```

The program will automatically select the first valid device it finds. To continue, either press RETURN to select the device indicated or select another device to test.

If you type `MODIAG #`, the device to be tested is selected at that point. No banner or device selection display is shown, and the next prompt you see is `Show Inquiry Data`.

If you pick a device that is not a known, Hewlett-Packard optical drive, the program tells you this and asks if you want to continue. You can run all tests for common operations but cannot test anything unique to that particular unit.

The help screen, which can be invoked by typing the word HELP, shows which commands/tests are available.

The REVision command brings up the initial information screen and may be used to check the revision of the program while running it.

A maximum of seven SCSI optical drives can be tested by MODIAG.

Note All error and log information is translated into plain English.

Drive Commands

ALLOW MEDIUM REMOVAL

Enables the Eject Button on the front of the drive, allowing the disk to be removed.

COMMANDS

Displays the current commands list.

EXIT

Exit the diagnostic.

FORMAT UNIT

Used to initialize the disk. The Format Unit Command supports format mode 3 only. All data is lost during this command. Because of this, two warnings are displayed within the format screen; one warning is given prior to the defect options, the second is given prior to the format command being sent to the drive. In both cases you have the option of exiting the command.

For non-formatted disks, option `D` is the only valid option.

The following is a typical display.

```
1st Warning
** WARNING FORMAT COMMAND WILL DESTROY DATA **

OPTIONS AVAILABLE:
  G = Convert Current Growing Defect List
      (Primary and Secondary Defects)
      to all Primary Defects. (Normal FORMAT)
  P = Retain ONLY the Current Primary Defect List.
  D = Delete Current Defect Lists and Rebuild a Primary
      Defect List from Errors Detected During the Format
      Process.
  E = Exit command - PRESS RETURN

Enter which option - RETURN TO EXIT (G/P/D/E)[E]? ");

2nd Warning
FORMAT WILL DESTROY DATA CONTINUE (Y/N)[N]?
```

HELP

Displays the help facility.

The following is a typical display.

```
                         HELP DISPLAY

  1. Allow (Enable Eject Button)        14. REASsign blocks
  2. Commands                           15. RO test (Read Only)
  3. Exit                               16. REQuest sense
  4. Format unit                        17. REZero unit
  5. Help                               18. SEEk
  6. ID (Changes Target ID)             19. SELftest
  7. INquiry                            20. STart stop test
  8. Loopback                           21. Test unit ready
  9. Mode sense                         22. Verify
 10. Prevent (Disables Eject Button)    23. WO test (Write Only)
 11. READ Capacity                      24. WTR tst (Write then
 12. READ Defect data                                      Read)
```

```
13. READ Long                          25. WTV test (Write then
                                                      Verify)

Press Return to Exit Help Command or .....
Enter command Number for more Information - 0 thru 25 [0]?
```

ID (Changes Target ID)

Changes the target destination, enables the Eject button and resets the AWRE bit and Retry Count to default values.

The following is a typical display.

```
Checking for valid IDs
  Id = 0   Device = HP S6300.650A  <-- valid device
  Id = 1   No Device found
  Id = 2   No Device found
  Id = 3   Device = HP C1700A
  Id = 4   Device = HP S6300.650A  <-- valid device
  Id = 5   Device = HP S6300.650A  <-- valid device
  Id = 6   No Device found

Select target ID of device => 0 3 4 5 [0]?
```

INQUIRY

Requests that information about the Controller and the drive be sent to the initiator.

The following is a typical display:

```
Inquiry Data:   Direct Access Device
-----------------------------------------------------
Removable Media                 = YES
Vendor ID                       = HP
Product ID                      = 5.25 MF Drv  000
Firmware Revision               = 4.00
DCP Revision Code               = 85
Max Block Address               = 576998
Block Length                    = 512 bytes
Format Mode                     = 3
Write Protection                = OFF
```

LOOPBACK

Sends data to the drive buffer (Write Buffer command) and reads data from the drive buffer (Read Buffer command). The data received is then compared, within the PC, to the data that was sent.

MODE SENSE

Used to acquire disk, drive, and drive controller parameters.

```
                               Current    Changeable  Default    Saved
 Error Recovery Page:
 -----------------------------------------------------------------------
 Automatic Write               Enabled    Enabled     Enabled    N/A
  Reallocation Enable:
 Read Continuous:              Disabled   Disabled    Disabled   N/A
 Retry Count:                  2          255         2          N/A

 Disconnect/Reconnect Control Page:
 -----------------------------------------------------------------------
 Buffer Full Ratio:            80H        FFH         80H        N/A

 Buffer Empty Ratio:           80H        FFH         80H        N/A

 Format Page:
 -----------------------------------------------------------------------
 Format Mode:                  3          255         3           3
 Format Type:                  0          1           1           1
 Size of User Band             576999     N/A         N/A        N/A
  (Logical Blocks):
 Number of Bands on Media:     N/A        65535       1           1
 Size of Spare Band            2048       65535       2048       2048
  (Logical Blocks):
```

PREVENT MEDIUM REMOVAL

Disables the Eject Button on the front of the drive which prevents disk removal.

READ CAPACITY

Reads the capacity of the disk in the drive.

The following is a typical display from the Read Capacity Command:

```
READ CAPACITY DATA:
-------------------------------------

Max Block Address               = 576998
Block Length                    = 512 bytes
```

READ DEFECT DATA

Reads disk surface defect information. You may view the growing list of defects (primary and secondary) or the primary list of defects.

The following is a typical display from the Read Defect Data Command:

```
READ DEFECT DATA:

    G = Growing List - Primary and Secondary Defects
    P = Primary List ONLY
    E = Exit command

Enter which list (G/P/E) [G]? g
Number of Defects = 4
Show Defect Data (Y/N) [Y] y

Physical Track  Physical Sector  Defect #
       3              12             1
       4               2             2
     108              20             3
    1260               0             4
```

READ LONG

Reads data starting at the specified Logical Block Address, including ECC data. Read data is not corrected using ECC.

The following Read Long Tests are available:

```
All tests include a loop counter allowing a maximum
of 256 loops.

RANDOM TEST    - 20 random logical block addresses are generated
                 per loop.

SELECTED TEST - Includes 3 subtests: Block, Volume and
                 User Defined.

BLOCK TEST     - Reads one block only per loop.
               - Allows the block read to be displayed in
                 hexadecimal and ASCII.

VOLUME TEST    - Reads all blocks from the first to last logical
                 block.

USER-DEFINED   - User inputs the starting and stopping logical
                 blocks.
```

REASSIGN BLOCKS

Used to reassign defective sectors on the disk.

A defect list containing the Logical Block Addresses to be reassigned is transferred to the drive. The Logical Block Address refers to the new assigned sector instead of the old defective sector. Data is NOT TRANSFERRED to the new assigned sector.

Two warnings are displayed within the reassign screen; when entering the reassign screen and prior to the reassign command being sent to the drive. In both cases, the Reassign Command may be exited at those points.

The following is a typical display.

```
1st Warning
WARNING THE REASSIGN BLOCKS COMMAND DOES NOT RETAIN DATA
CONTINUE (Y/N)? y

Enter the number of blocks to reassign 0 thru 10 [0]? 3

Enter a logical block address 0 thru 576998 [0]? 123
Enter a logical block address 0 thru 576998 [0]? 12345
Enter a logical block address 0 thru 576998 [0]? 123456

2nd Warning
WARNING DATA WILL BE DESTROYED - Reassign Blocks (Y/N) [N]? y

Upon successful completion of the blocks being reassigned, the
following message will appear:
Show defective data (Y/N) [Y]? y
```

RO TEST (Read Only)

The RO (Read Only) Test reads data starting at the specified Logical Block Address. Read data is corrected using ECC. The following RO Tests are available:

All tests include a loop counter allowing a maximum of 256 loops.

```
RANDOM TEST   - 20 random logical block addresses are generated
                per loop.

SELECTED TEST - Includes 3 subtests: Block, Volume and User
                Defined.

BLOCK TEST    - Reads one block only per loop.
              - Allows the block read to be displayed in Hex
                and ASCII.

VOLUME TEST   - Reads all blocks from the first to last logical
                block.
```

```
USER-DEFINED  - User inputs the starting and stopping logical
                blocks.
```

REQUEST SENSE

Used to determine the specific error condition when the drive fails to successfully execute a command and returns a CHECK CONDITION. Sense data is preserved for the initiator until retrieved by a Request Sense command or until receipt of any other command to the same drive.

This command is issued automatically by the diagnostic whenever a CHECK CONDITION is returned by the drive. The data is then displayed in hexadecimal notation along with an error description.

```
SENSE KEY
03H - Medium Error

SENSE CODE
11H - Unrecovered Read Error Of Data Blocks (3H - Medium Error).

INTERNAL ERROR CODE: 3509H

ERROR SOURCE (Bits 15 to 12):
Drive  Media

ERROR LEVEL (Bits 11 and 10):
Recoverable Error 1

ERROR CODE AND DESCRIPTION (Bits 9 to 0):
0109H - ECC error more than 8 bytes in any interleave.


Block in Error = 36552
```

REZERO UNIT

Recalibrates the optical head by moving the head to the innermost track (physical track 0).

SEEK

Seeks the optical head to the physical track where the specified Logical Block exists. The following Seek Tests are available:

All tests include a loop counter allowing a maximum of 256 loops.

```
RANDOM TEST     - 20 random logical block addresses are generated
                  per loop.

SELECTED TESTS - Includes 3 subtests: Block, Butterfly and
                  User-Defined.

BLOCK TEST      - Seeks the head to the specified block and then
                  recalibrates the head back to block 0.

BUTTERFLY TEST - Includes a Short (~3 min.), Medium (~10 min.)
                  and a Long (~18 min.) test.

USER-DEFINED    - User inputs the starting and stopping tracks
                  along with the direction of seek (increment
                  or decrement).
```

SELFTEST

Issues the Send Diagnostic command to the drive with the selftest bit set, to perform the internal poweron selftest. The user has the option of running the test within a loop. Maximum loop count is 256.

START STOP TEST

The Start Stop Test starts and stops rotation of the disk in the drive. Upon entering the test, the drive rotation is turned off before the test loop starts. Upon completion of the test loop, the drive rotation is then turned back on.

TEST UNIT READY

Used to determine the READY state of the drive. If the drive is in a READY state when it receives this command, it returns a GOOD status. If the drive is not ready when it receives this command it should return a CHECK CONDITION with a sense key of NOT READY.

VERIFY

Verifies previously written data integrity starting at the specified Logical Block Address by reading the data and checking the Error Correction Code. The verification threshold is set to approximately half of the error correction capability.

The following Verify Tests are available:

All tests include a loop counter allowing a maximum of 256 loops.

```
RANDOM TEST   - 20 random logical block addresses are generated
                per loop.

SELECTED TEST - Includes 3 subtests: Block, Volume and User
                Defined.


BLOCK TEST    - Verifies one block only per loop.


VOLUME TEST   - Verifies all blocks from the first
                to last logical block.

USER-DEFINED  - User inputs the starting and stopping logical
                blocks.
```

WO TEST (Write Only)

Writes data starting at the specified Logical Block Address.

The following WO Tests are available:

All tests include a loop counter allowing a maximum of 256 loops.

```
RANDOM TEST   - 20 random logical block addresses are generated
                per loop.

SELECTED TEST - Includes 3 subtests: Block, Volume and User
                Defined.
```

```
BLOCK TEST    - Writes one block only per loop.

VOLUME TEST   - Writes all blocks from the first to last logical
                block.

USER-DEFINED  - User inputs the starting and stopping logical
                blocks.
```

WTR TEST (Write then Read)

Note It is not recommended to run this test over large areas of the disk. The test takes a long time and is not as stringent as the Write then Verify Test.

Writes 1 block of data and then reads the block that was written. The data that was read is then compared against the data that was sent to the drive.

The following WTR Tests are available:

All tests include a loop counter allowing a maximum of 256 loops.

```
RANDOM TEST   - 20 random logical block addresses are generated
                per loop.

SELECTED TEST - Includes 3 subtests: Block, Volume and User
                Defined.

BLOCK TEST    - Writes then Reads one block only per loop.

VOLUME TEST   - Writes then Reads all blocks from the first to
                last logical block.  This test is not
                recommended due to time constraints.

USER-DEFINED  - User inputs the starting and stopping logical
                blocks.
```

WTV TEST (Write then Verify)

Note This is the recommended write test. The margins are less so this test will find errors that the Write-Then-Read test will not. This test also runs much faster than the Write the Read Test.

The WTV (Write then Verify) Test writes data to the disk and then verifies the write by reading the written data and checking the error correction code. The verification threshold is set to approximately one-half of the error correction capability of a read.

The following WTV Tests are available:

All tests include a loop counter allowing a maximum of 256 loops.

```
RANDOM TEST    - 20 random logical block addresses are generated
                 per loop.

SELECTED TEST - Includes 3 subtests: Block, Volume and User
                 Defined.

BLOCK TEST     - Writes then Verifies one block only per loop.

VOLUME TEST    - Writes then Verifies all blocks from the first to
                 last logical block.

USER-DEFINED   - User inputs the starting and stopping logical
                 blocks.
```