



**Plasmon M-Series *M52, M104, M156, and M258*
Optical Disk Library Systems**

Technical Reference Manual

Plasmon Data

The purpose of this Technical Reference Manual is to provide technical service personnel with sufficient information to maintain and repair the **M52, M104, M156, and M258** Library Systems. Any other use of the information contained herein or of this document is prohibited. This manual shall not be reproduced in part or in whole without the prior written consent of Plasmon Data.

NOTE: The equipment to which this document pertains has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

NOTE: This digital apparatus does not exceed the Class A limits for radio noise for digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

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Preface

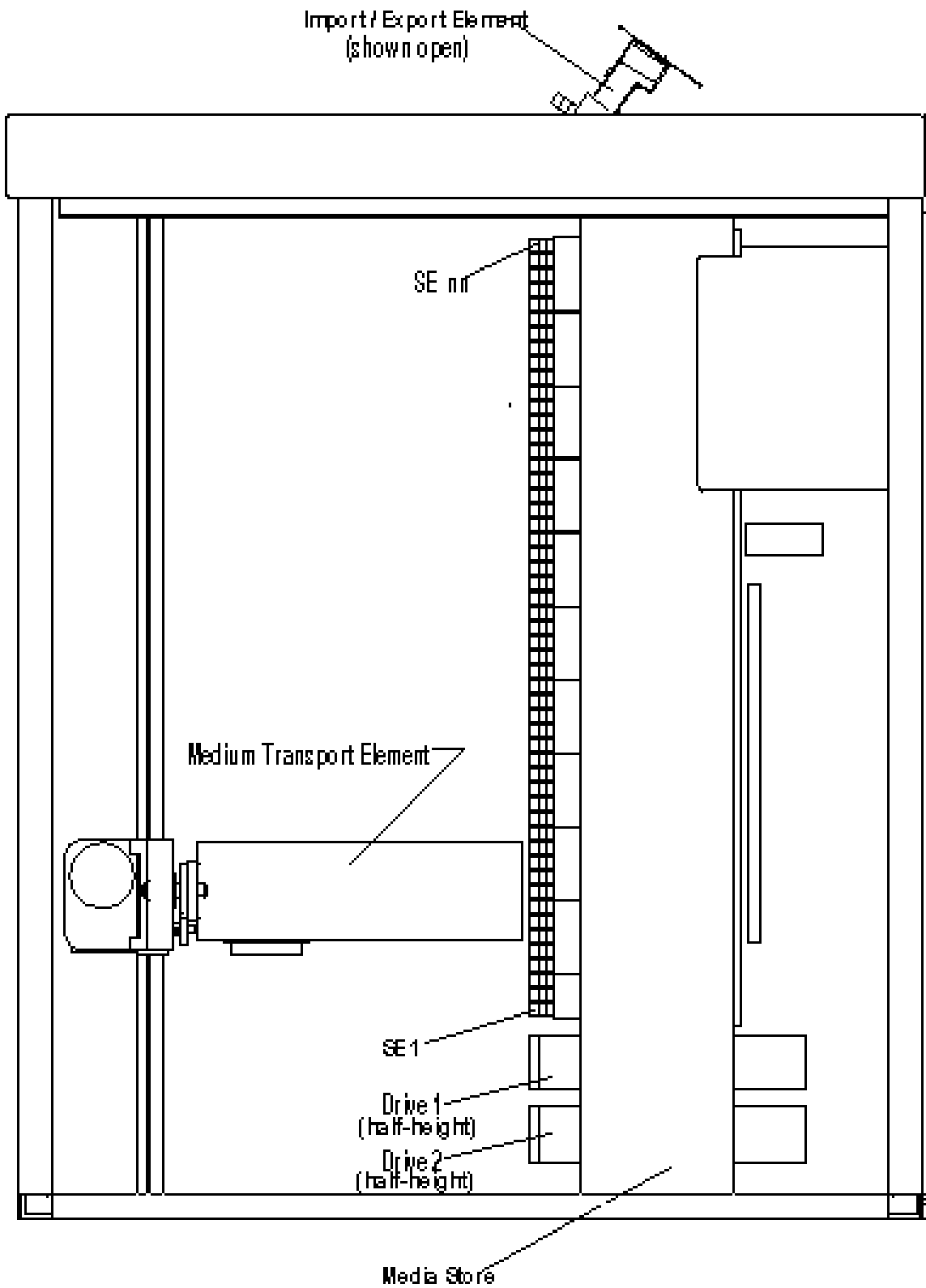
This publication is for reference purposes and is intended for Engineers, Technicians and persons with a knowledge of electronics and sophisticated electromechanical devices.

The information contained herein describes the hardware, operation and maintenance of the *M52*, *M104*, *M156*, and *M258* Library Systems and is divided into the following sections:

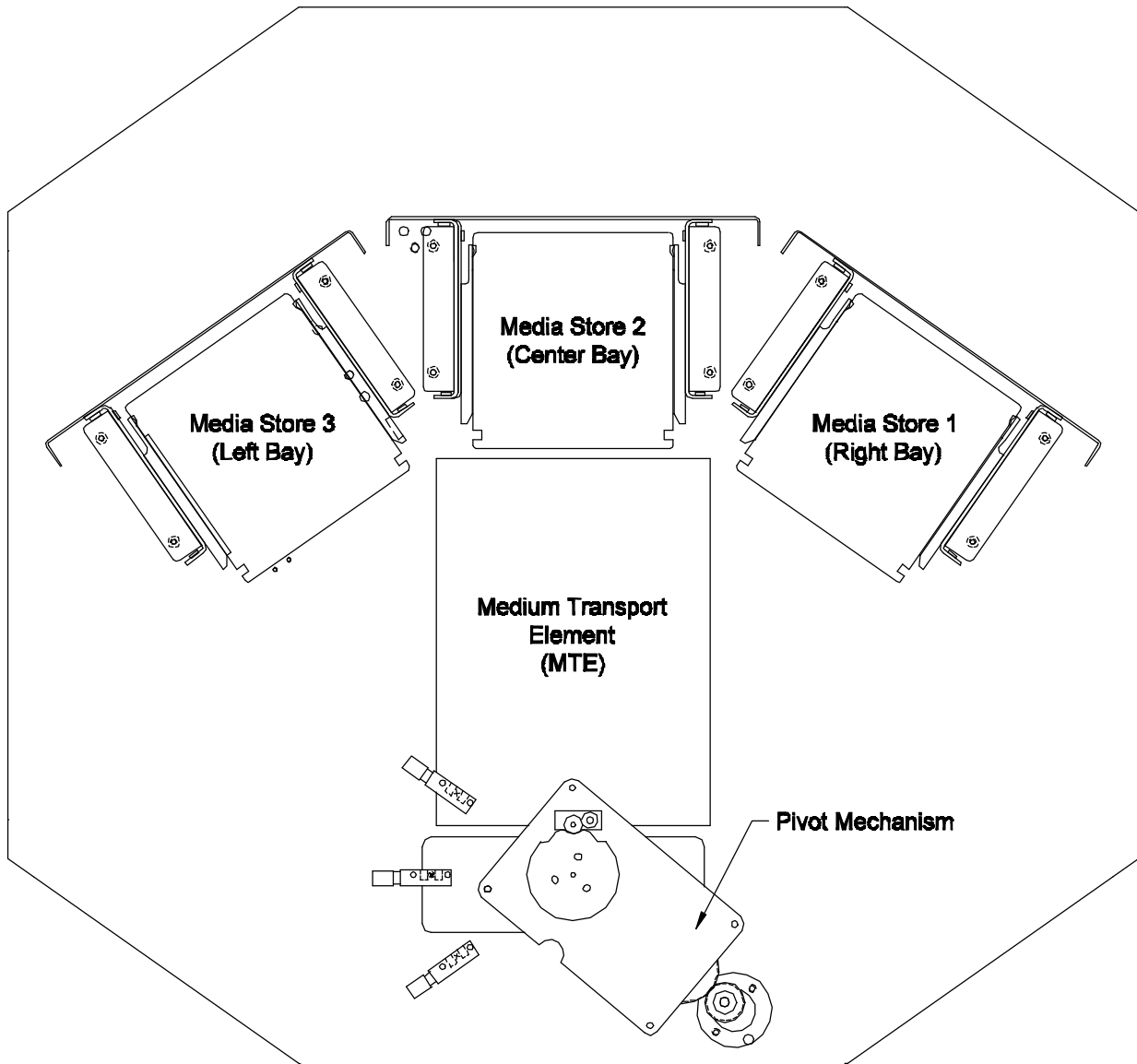
Section 1	General	Functional description of the Library Systems and their major components.
Section 2	Requirements and Specifications	Power, operating and regulatory requirements and performance specifications.
Section 3	Setup / Installation	Unpacking (and packing) instructions, configuration parameter settings and connecting the SCSI Interface.
Section 4	Hardware	Description and theory of operation.
Section 5	Diagnostics and Maintenance	Function and operation of self contained maintenance firmware and maintenance routines.
Section 6	Library System Adjustments	Optical drive and hard drive removal instructions and Library System adjustment details.
Section 7	Appendix	Error codes, switches and PWA layouts.

Section 1

General



Right Side View - All Models



Top Plan View - *M104*, *M156*, and *M258*

General

Product Description

The *M-Series* Library Systems are very high performance, mass storage library units. The following shows the cartridge capacity of each unit. The number in parentheses indicates the number of optical disk drives that can be accommodated.

<i>M52</i>	-	52 (2)
<i>M104</i>	-	104 (4)
<i>M156</i>	-	156 (6)
<i>M258</i>	-	258 (6)

These library systems are SCSI devices and are controlled via the SCSI bus using SCSI-2 Common Command set commands.

Recovery firmware is contained in the Library System's controller to assure the fullest possible recovery in the event power is lost during operation. The recovery firmware will make every attempt to return media to its correct location within the Media Store.

Diagnostic firmware is also contained in the Library System's controller to assist in diagnosis and troubleshooting. Certain configuration parameters are set using this built-in firmware and are then stored in the Library's non-volatile memory.

Functional Description

The Library Systems are composed of six major elements.

Media Store

A Media Store is composed of horizontal slots - each of which can hold one optical disk cartridge. The individual slots are called **Storage Elements** and are numbered from the bottom (closest to the optical disk drives) up. The *M52* Library System has a single media store. The *M104* Library System has two media stores with the right-hand media store being the location of the first storage element. The *M156* and *M258* Library Systems have three media stores with the right-hand media store again being the location of the first storage element.

Medium Transport Element

The Medium Transport Element (MTE) is used to move optical disk cartridges between Storage Element locations within the Media Stores and the Optical Disk Drives. The MTE itself is itself composed of three mechanisms.

Picker Mechanism

The Picker Mechanism moves optical disk cartridges from the Media Stores or from the optical disk drive(s) into the Flipper Mechanism and from the Flipper Mechanism into the Media Stores or into the optical disk drives. A servo motor provides highly accurate positioning.

Flipper Mechanism

Presently available Optical Disk Drives have but one laser read/write head assembly. To read or write on either side of an optical disk cartridge, a mechanism for inverting (flipping) the disk cartridge is required.

Lift Mechanism

The Lift Mechanism raises and lowers the Flipper Mechanism for the transport of optical disk cartridges to and from the Media Store. A servo motor provides highly accurate positioning.

Pivot Mechanism (*M104, M156, and M258*)

The Pivot Mechanism rotates the Flipper and Lift Mechanisms to a position in front of the desired Media Store. The right-hand media store (as viewed from the front of the library system) is always the location of the first storage element.

Import / Export Element

Optical disk cartridges are introduced into or removed from the Library System via the Import / Export Element (IEE) which is located in the top cover. The presence of a disk cartridge in this element is detected automatically. This element is not congruent with any storage element.

Data Transfer Element (the Optical Disk Drive)

The Library Systems are designed to accommodate high-capacity, half-height, ISO Standard optical disk drives. See the publication *Switch Settings for Qualified Optical Disk Drives for Use in the Multi and M-Series Families of Library Systems* - Document No. 303075 - for information on which optical drives are suitable for use in these Library Systems and the Library System switch settings for those drives.

Control Electronics

Control Electronics consists of several Printed Wiring Assemblies (PWAs), firmware and a membrane switch panel located on the front of the Library.

Main Controller PWA

An Intel 8032 microcontroller, motor controllers, sensor interfaces, SCSI interface, firmware and non-volatile memory are contained on the Main Controller PWA.

Keypad / Display Controller PWA

The Keypad / Display Controller is mounted to the Library's front center bezel. The display is a twenty (20) character per line, two (2) line Liquid Crystal Display utilizing supertwist technology.

Section 2
Requirements and Specifications

Requirements and Specifications

Power Requirements

AC Input	100 - 240 VAC, Autoranging
Frequency	50/60 Hz
Wattage - <i>M52</i>	110 Watts (375 Btu/Hr)
Wattage - <i>M104, M156, M258</i>	220 Watts (750 Btu/Hr)

Environmental Limits, Operating

Ambient Temperature	10 to 40 ° C (50 to 104 ° F)
Gradient	10 ° C / hour (18 ° F / hour)
Humidity	20 to 80 % RH, non-condensing

Environmental Limits, Non-operating

Ambient Temperature	- 40 to 70 ° C (-40 to 158 ° F)
Humidity	5 to 95 % RH, non-condensing

Dimensions and Weight - *M52*

Dimensions	14" (35.6 cm) W; 39" (99.1 cm) H; 28.5" (72.4 cm) D
Weight	152 lbs (69 kg) with two typical optical drives installed
Shipping	217 lbs (99 kg)

Dimensions and Weight - *M104*

Dimensions	32" (81.3 cm) W; 40.5" (102.9 cm) H; 29.5" (74.9 cm) D
Weight	265 lbs (120 kg) with four typical optical drives installed
Shipping	390 lbs (177 kg)

Dimensions and Weight - *M156*

Dimensions	32" (81.3 cm) W; 40.5" (102.9 cm) H; 29.5" (74.9 cm) D
Weight	275 lbs (125 kg) with six typical optical drives installed
Shipping	400 lbs (182 kg)

Dimensions and Weight - *M258*

Dimensions	32" (81.3 cm) W; 58.25" (148.0 cm) H; 29.5" (74.9 cm) D
Weight	425 lbs (193 kg) with six typical optical drives installed
Shipping	550 lbs (250 kg)

Regulatory Approvals

Each of the Library Systems is designed to meet the following:

Safety

VDE 0805
UL 1950
CUL 950
IEC 950
EN 60950

Emissions

FCC Class A
CISPR 22 Class B

Immunity

EN 50082-1

Performance Specifications

MSBF	1,000,000 cartridge swap cycles.
MTTR	30 minutes.

Interface

SCSI-2 (ANSI X3.131-1994 Small Computer System Interface-2).
Internal SCSI cable length is 12 feet (3.6 m).

Note: It is recommended that a high quality braided and foil shielded external SCSI cable be used to conform to approved emission levels.

Section 3

Setup and Installation

Setup and Installation

Unpacking

The Library Systems are shipped from the factory assembled and aligned. There is no packaging material to be removed from inside the unit. Allow sufficient time for the Library System to normalize to room temperature before applying power

- Unpack the Library System according to instructions provided separately with the unit.
- Save all shipping materials.

Packing for Shipment

- See **Setup Mode, 12 -- Park Jukebox** later in this section for instruction on 'parking' the Medium Transport Element.
- Turn OFF the AC power switch.
- Remove the SCSI Host Adapter Cable, terminator plug and power cable from the rear of the Library System.
- Pack the Library System according to instructions provided separately with the unit.

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Initial Power-up

- Plug the AC Power Cord supplied with the Library System into the Power Receptacle at the lower left rear of the unit.
- Plug the SCSI Terminator supplied with the Library System into either of the SCSI Connectors at the lower right rear of the unit. If the Library System is equipped with the optional differential SCSI interface, the differential terminator should be attached to one of the connectors on the back, and the single-ended terminator must be attached to the connector located below the differential SCSI interface box.
- Do *NOT* attach an external SCSI Bus cable to the other connector at this time.
- Turn on the AC Power Switch at the upper left rear of the unit.

When you turn on AC power, the Liquid Crystal Display on the front of the Library System will display ...

```
nn DISK, SN nnnnn-L
FIRMWARE V2.XX
```

... where the number of Storage Elements (Disks) is displayed, and the serial number displayed is the one the Library System was serialized with at the factory prior to shipment. The letter trailing the serial number is an identifier for the type of Optical Drives installed.

If the Library System was left in the Language Select state, the following will then be displayed ...

```
ENGLISH ?
[↵]  [-]  [⏏]  [⏏]
```

Press the keys under the [⏏] and [⏏] symbols to select a language to be used in subsequent displays and then press the [↵] key.

The Library System will then begin to perform a diagnostic check of its internal systems and display one of the following ...

```
ID:2; 3,4
CE --- --
```

... or ...

```
ID:6; 0,1,2,3
CE --- --
```

... or ...

```
ID:6; 0,1,2,3,4,5
CE --- --
```

... where the top line in the display indicates ...

 ID: 2; 3, 4 = Changer SCSI ID is 2, Drive 1 SCSI ID is 3, Drive 2 SCSI ID is 4 (*M52*),
or, ID: 6; 0, 1, ... = Changer SCSI ID is 6, Drive 1 SCSI ID is 0, Drive 2 SCSI ID is 1, and so on
 (*M104*, *M156*, and *M258*).

... and the second line indicates the enabled mode settings...

 CE = Changer Ejects

 Other possibilities are:

 WL = Wait on Cartridge Load

 SS = Slow Cartridge Slot Scans

 IP = Ignore SCSI Bus Parity

 RR = Report Recovered Errors

 LR = Limit Error Recovery

The Library System is auto-sensing and will then determine if the optical disk drives or their SCSI ID's have been manually changed. If so, the Library System will display the message **UNIT NOT SETUP** or **CAN'T INQUIRY DRIVE**. This can be corrected by running **Configure Drives** as described below.

The display panel will then change to ...

```
D:----- M:-- I:--*
[ ←SET UP ] [ - ] [ →>I ]
```

... indicating that the unit has successfully been configured, passed all the diagnostic checks of its internal systems, that all drives are empty, that MTE 1 and 2 are empty, and that the Import/Export Element is empty. Pressing and holding the leftmost key on the display panel will place the unit in Language Select state and a new language may be specified for subsequent displays. Pressing the rightmost button will open the door to the Import/Export Element to allow insertion of new optical disks and removal of existing ones. If an error is displayed, pressing the key under the **[C]** symbol will clear the message and display status information as above. Information about the error may still be obtained from the **Error Log** as described below.

If the SCSI ID's assigned to the robotic changer or to the optical disk drives are not compatible with your host or other peripherals on your system, or you wish to make any other changes to the setup of the Library System, they can be changed as detailed below.

Press (but do not hold) the leftmost key on the display panel. The unit will respond ...

```
          TAKE OFFLINE ?
[ - ]   YES   [ - ]   NO
```

You must press the key under the word **YES** to proceed. The Library System will then go into **Setup Mode**.

These units are shipped from the factory with certain factory default settings. They are ...

Changer SCSI ID	=	2 (M52), or 6 (M104, M156, M258)
Drive 1 SCSI ID	=	3 (M52), or 0 (M104, M156, M258)
Drive 2 SCSI ID	=	4 (M52), or 1 (M104, M156, M258)
Drive 3 SCSI ID	=	2 (M104, M156, M258)
Drive 4 SCSI ID	=	3 (M104, M156, M258)
Drive 5 SCSI ID	=	4 (M156, M258)
Drive 6 SCSI ID	=	5 (M156, M258)
Changer Ejects	=	enabled
Wait On Load	=	disabled
Slow Scans	=	disabled
Ignore Parity	=	disabled
Report Recovered Errors	=	disabled
Limit Error Recovery	=	disabled

These settings may be changed in **Setup Mode**. Upon entering **Setup Mode**, the following is displayed...

```
1 UNIT INFORMATION
[⌘] [⏎] [⏪] [⏩]
```

The membrane keys function as follows (press the key directly below the displayed symbol):

- [⌘]** is used to select the current option, Library System unit information in this case
- [⏎]** is used to exit **Setup Mode** and go back to on-line operation
- [⏪]** is used to display the previous option
- [⏩]** is used to display the next option

Press the key under the **[⏩]** symbol. The display will change to ...

```
2 FIRMWARE VERSION
[⌘] [⏎] [⏪] [⏩]
```

Press the **[⏩]** key again. The display will change to ...

```
3 CHANGER ADDRESS
[⌘] [⏎] [⏪] [⏩]
```

If you wish to change the SCSI ID (or address) of the robotic changer to make it compatible with your system or with the software you will be using, press the key under the **[⌘]** symbol. The display will change to ...

```
SCSI ADDRESS n
[-] [⏎] [+ ] [⏩]
```

Pressing the key under the **[+]** symbol will decrease the value of the Library System's robotic changer SCSI ID. Pressing the key under the **[⏩]** symbol will increase the value of the Library System's robotic changer SCSI ID.

When you have the value you want, press the **[↵]** key to write the new value into non-volatile memory. The display will now return to the main Setup Menu.

CAUTION: No two devices on a SCSI Bus may share the same SCSI ID. Be sure that you know for sure which IDs are not in use on your system and thus are available.

The SCSI ID's of the optical disk drives may also be changed, but you must proceed exactly as follows:

Two banks of 12-position DIP Switches are provided on the Library System's rear panel, or on each of the three rear panels for the **M104**, **M156**, and **M258**. These DIP Switches are connected by cables to the optical disk drives and are used to set their physical addresses (SCSI ID's).

The upper 12-position controls the upper drive in each bank, starting with Drive 1 (on the right-hand side as viewed from the front of the Library System). The two character LED display immediately above the upper 12-position switch displays the Drive Type of the upper drive.

The lower 12-position controls the lower drive in each bank, starting with Drive 2 (on the right-hand side as viewed from the front of the Library System). The two character LED display immediately above the lower 12-position switch displays the Drive Type of the lower drive.

Refer to the publication *Switch Settings for Qualified Optical Disk Drives for Use in the Multi and M-Series Families of Library Systems* - Document No. 303075 to determine how to set the SCSI ID's of the optical disk drives. Set the SCSI ID(s) of the optical disk drive(s) as required to meet the requirements of your system. The Library System must be turned off and on again for any switch setting changes to take effect.

Press the key under the word **[▲]** to display ...

```
4 CONFIGURE DRIVES
[✱] [□] [▼] [▲]
```

Pressing **[✱]** will display ...

```
      ID'S 3,4
[-] [□] [-] [✱]
```

... or ...

```
      ID'S 0,1,2,3
[-] [□] [-] [✱]
```

... or ...

```
      ID'S 0,1,2,3,4,5
[-] [□] [-] [✱]
```

where the numbers displayed are the previously determined SCSI ID's of the Optical Drives in the Library System.

Press **[✱]** to initiate a self-configuring process which may take several minutes.

The next group of settable options are the mode settings.

```
5 MODE SETTINGS
[ * ] [ 0 ] [ < ] [ > ]
```

Pressing [*] will display ...

```
A.CHANGER EJECT: Y
[ - ] [ 0 ] [ < ] [ > ]
```

If you want to disable the Library System's ability to spin down and eject cartridges from the optical drives when requested to move cartridges from the drives, press [<] to toggle this mode setting. Then, press [>] to display ...

```
B.WAIT ON LOAD: N
[ - ] [ 0 ] [ < ] [ > ]
```

If you want the Library System to wait for optical drives to spin up and become ready for media access when cartridges are moved into them, press [<] to toggle this mode setting. Then, press [>] to display ...

```
C.SLOW SCANS: N
[ - ] [ 0 ] [ < ] [ > ]
```

If you want the Library System to use tactile feedback rather than retro-reflective sensors to sense the empty/full status of cartridge slots, press the [<] key to toggle this mode setting. Then, press [>] to display ...

```
D.IGNORE PARITY: N
[ - ] [ 0 ] [ < ] [ > ]
```

If you want the Library System to ignore improper parity on the SCSI bus (to be compatible with other older devices), press the [<] key to toggle this mode setting. Then, press [>] to display ...

```
E.REPORT RECOVERY:N
[ - ] [ 0 ] [ < ] [ > ]
```

If you want the Library System to report errors that it has successfully recovered from, press the [<] key to toggle this mode setting. Then, press [>] to display ...

```
F.LIMIT RECOVERY: N
[ - ] [ 0 ] [ < ] [ > ]
```

If you want the Library System to limit the amount of error recovery that it performs, leaving in the Medium Transport Elements or the optical drives cartridges that it cannot move or return to their original location, press the [<] key to toggle this mode setting. Press [0] to return to the main Setup Menu.

The next display is the Configuration Summary.

```
6 CONFIG SUMMARY
[⌘] [⏏] [⏴] [⏵]
```

Pressing **[⌘]** will display a summary of the Library System parameters as presently configured.

The next display is the Element Status.

```
7 ELEMENT STATUS
[⌘] [⏏] [⏴] [⏵]
```

Pressing **[⌘]** will display ...

```
SLOTS: ALL EMPTY
[⌘] [⏏] [⏴] [⏵]
```

Pressing **[⏵]** and repeating will display ...

```
DRIVES: ALL EMPTY
[⌘] [⏏] [⏴] [⏵]
```

... followed by ...

```
MTE: BOTH EMPTY
[⌘] [⏏] [⏴] [⏵]
```

... followed by ...

```
IMPEXP: EMPTY
[-] [⏏] [⏴] [⏵]
```

Pressing **[⏏]** returns to the main Setup Menu.

The next display is Power-On Hours.

```
8 POWER-ON HOURS
[⌘] [⏏] [⏴] [⏵]
```

Pressing **[⌘]** will display ...

```
HOURS = 0
[-] [⏏] [-] [-]
```

The power-on hours clock is reset to zero before shipment from the factory. Press **[⏏]** to return to the option menu and then press **[⏵]**.

The next display is Load Counts.

```
9 LOAD COUNTS
[⌘] [□] [↵] [⏏]
```

Pressing [⌘] will display ...

```
DRIVE 1
[↵] [□] [↵] [↵]
```

Use [↵] or [↵] to select the desired drive and then press [↵]. The resulting display is ...

```
COUNT = 0
[-] [□] [-] [→0]
```

Drive load counts are reset to zero before leaving the factory.

The next display is **Scan Elements**. This command causes the Library System to test all elements for the presence of media. The Lift Mechanism places one of the Medium Transport Elements in front of each optical drive and an attempt is made to eject and reinsert a cartridge. It then raises the Medium Transport Element in front of the media store and either mechanical or opto-electronic means are used to detect the physical presence of disk cartridges.

```
10 SCAN ELEMENTS
[⌘] [□] [↵] [⏏]
```

The next display is **Unload Drives**. This is a very rarely used function as you should always let software unload the drives as this will maintain a correct catalog of the Library System's contents.

```
11 UNLOAD DRIVES
[⌘] [□] [↵] [⏏]
```

If either of the optical drives are loaded, pressing [⌘] will cause the Library System to issue eject commands to the drives and return their cartridges to the storage elements of origin.

The next display is **Park Jukebox**. This function is only used when preparing the Library System for shipment.

```
12 PARK JUKEBOX
[⌘] [□] [↵] [⏏]
```

Pressing [⌘] will cause the Library System to begin removing any optical disk cartridges from the optical drives and storage elements and delivering them to the Import / Export Element at the top of the Library System.

The display will keep you informed of what it is doing so that you can remove cartridges from the Import / Export Element as they are delivered -- the Import / Export Element can hold only one cartridge at a time.

The last four displays are Drive Tests, Error Statistics, Error Log and Event History. For a detailed explanation of these, see Section 5.

```
13 DRIVE TESTS
[⌘] [⏪] [⏩] [⏴]
```

```
14 ERROR STATISTICS
[⌘] [⏪] [⏩] [⏴]
```

```
15 ERROR LOG
[⌘] [⏪] [⏩] [⏴]
```

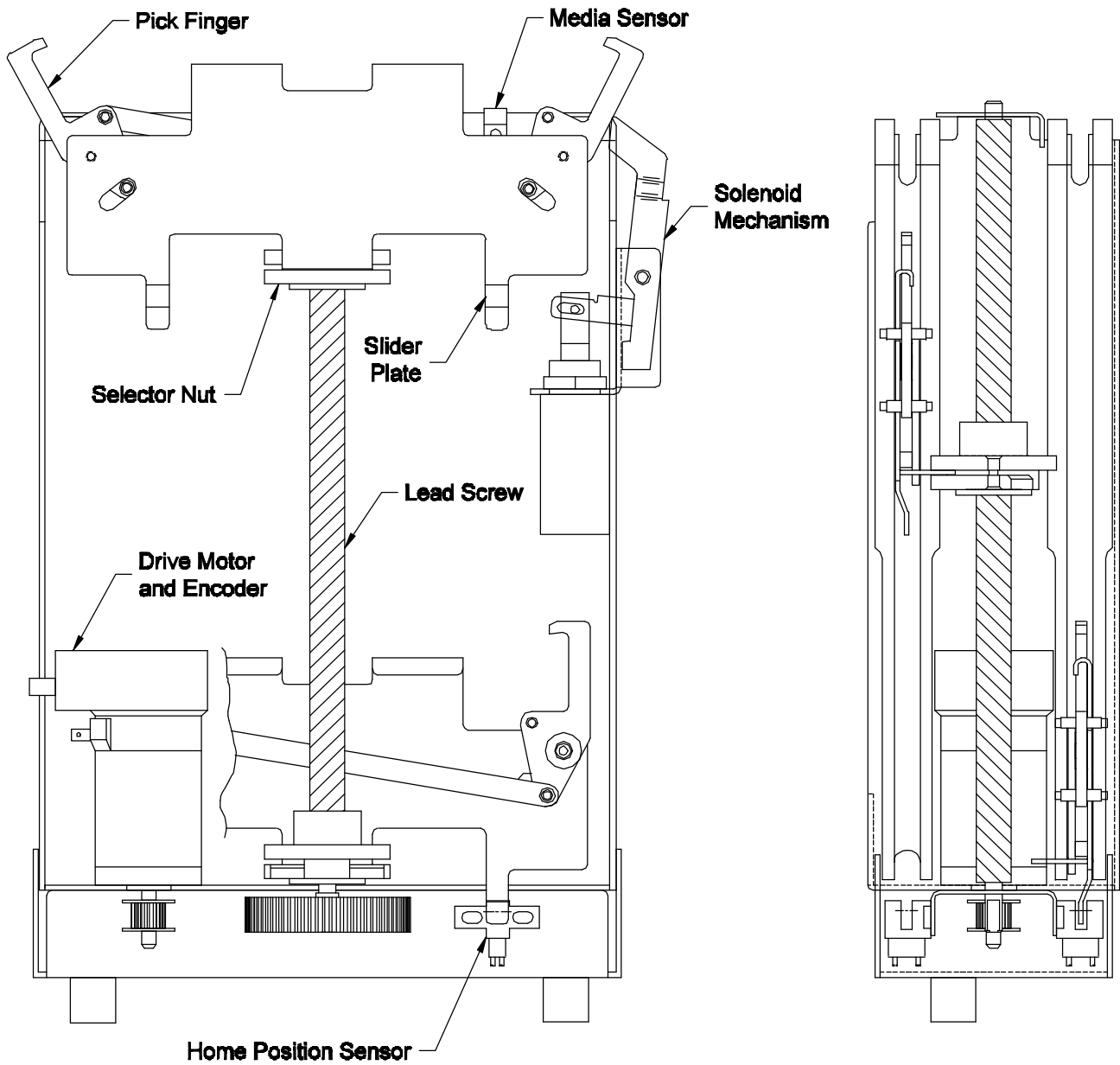
```
16 EVENT HISTORY
[⌘] [⏪] [⏩] [⏴]
```

Setup of the Library System should now be complete. Proceed as follows:

- Turn off AC power.
All communications with the Library System is performed by the Host computer via a SCSI Interface cable which must be connected to one of the 50-position SCSI connectors on the Library's rear panel.
- Plug the SCSI Bus Cable into either of the 50-position SCSI connectors at the rear of the Library System. If the Library System is at the end of the SCSI Bus (i.e., no other SCSI devices are connected beyond it) plug the Terminator Block supplied with the Library System in the open 50-position SCSI connector.
Be sure to secure the cable(s) in place with the bail clips on the connector shell(s).
- Turn on AC power. The Library System will once again go through its power-on sequence and diagnostic checks. When completed, the Library System will be on-line and ready to accept SCSI commands.

Section 4

Hardware



Top and Side Views of the Picker Mechanism

General Description

Media Store

Each Media Store consists of two vertically arranged plates to which are attached plastic guide panels containing grooves as shown on the facing page. The grooves in the plastic guide panels form the slots or Storage Element locations of the Media Store in which optical disk cartridges are housed. The plastic guide panels have a low friction coefficient to avoid marring the optical disk cartridge case and to assure smooth, even insertion and withdrawal of the cartridges.


Plastic detents are installed inside the Media Store to hold the optical disk cartridges in place. The detents grip notches in the *tapered* end of the optical disk cartridges.

The detents are not strong enough to hold cartridges in the Media Store during movement or shipment of the Library System. Before moving or shipping the Library System, remove all media. See Section 3 for details.

The optical disk drives are mounted on sturdy metal plates which fit over rollers pressed into the side plates of the Media Store.

Import / Export Element

The Import / Export Element (IEE) is the means by which optical disk cartridges are normally entered into the Library System or removed from it. Cartridges may be added to or removed from the IEE at any time except when the Library System is executing a command to move cartridges to or from the IEE or the Library System is in the 'Prevent' state.

The IEE is mounted at the top of the Library System. Pressing the [] key on the front panel while in on-line mode will release the IEE up and out of the Media Store. Insert the cartridge between the guides, tapered end first, and lower the Element.

Two optical sensors are incorporated within the IEE. One detects the presence of a cartridge and the other detects whether the Element is open or closed.

Medium Transport Element

The Medium Transport Element (MTE) is used to move optical disk cartridges between Storage Element locations within the Media Stores and the optical disk drives. The MTE is itself made up of three mechanisms -- the Picker Mechanism, the Flipper Mechanism, and the Lift Mechanism.

Picker Mechanism

The Picker Mechanism is capable of transporting two cartridges at a time. This mechanism consists of a single drive motor and encoder and two separate Slider Plates. A single lead screw is provided with a special selection nut which can drive only one Slider Plate at a time. Home position sensors are used to determine which Slider Plate is engaged with the selection nut. Each Slider Plate has two Pick Fingers which are actuated by a single solenoid mechanism on the picker chassis.

The Slider Encoder measures the distance each Slider Plate travels from its home position. The Library System's microcontroller measures this travel distance and the time to determine the velocity of the Slider Plate and thus the load pressure exerted on optical disk cartridges when loading them into an optical disk drive. This is the reason why the Library System was designed to be self-configuring. The loading pressure for each manufacturer's optical drive is different. The location (height) of the drive's loading slot is also different.

All of this information is stored in the Library System's non-volatile memory. During power-on self-test, the Library System queries each installed optical disk drive to determine the manufacturer and model. It then looks this up in a table to find the Drive Type and activate that Drive Type's microcode.

The Drive Type setting is determined automatically by the Library System during the configure drive process. You cannot install an optical disk drive which has not been qualified for use in the Library System. If the Library System cannot find a corresponding Drive Type in its lookup table during the self-configuration, it will not operate.

When a cartridge is being loaded into an optical drive, the Pick Fingers open while the Slider Plate is pushing the cartridge into the drive. The open Pick Fingers will actually pass along side the drive's bezel as the cartridge is being loaded.

When a cartridge is to be ejected from the optical drive, the MTE is positioned in front of the drive at the correct height. The Slider Plate is positioned at a certain distance from the front of the drive. When the cartridge is ejected from the optical drive, optical sensing means detect the emergence of the cartridge from the drive.

The cartridge is stopped by the Slider Plate and the Pick Fingers immediately engage the cartridge and draw it back into the MTE.

Flipper Mechanism

The Flipper Mechanism consists of a Flipper Shaft extending through two ball bearings in the Lift Plate and a Flipper Motor. The Flipper Shaft attaches at one end to that section of the MTE.

Gearing on the Flipper Motor and the Flipper Shaft provide the means for rotating the MTE around its centerline so that optical disk cartridges can be placed in the optical drives or the Medium Store either Side A up or Side B up. A codewheel is used to track the flipper mechanism's position. The flipper is held in position by the flipper motor.

Lift Mechanism

The MTE moves vertically on two shafts which are mounted between the Library System's Baseplate and Top Plate in the *M52*, or between the Lower Pivot Plate and the Upper Pivot Plate in the *M104*, *M156*, and *M258*. High performance aerospace linear bushings are mounted within the MTE's Lift Plate and guide the Lift Plate up and down the Lift Guide Shafts.

A third shaft is a linear gear rack. A spur gear on the Lift Motor is in mesh with this linear gear rack. Through a gear train, the Lift Motor also drives the Lift Encoder which is mounted on a plate along with the Lift Motor.

Another optical sensor -- the Lift-Home OPTO -- is mounted on the Lift Interface PWA which is in turn mounted on the Lift Plate. The Lift-Home OPTO is operated by the Lift-Home Flag which is a pin mounted in the Top Plate in the *M52*, or in the Upper Pivot Plate in the *M104*, *M156*, and *M258*. When AC power is applied to the Library System, it goes through an initialization routine which includes slowly raising the MTE until the Lift-Home Flag interrupts the Lift-Home OPTO. All further vertical positioning of the MTE is then done by counting encoder position marks.

Should the MTE lose its position, it will automatically raise until the Lift-Home OPTO is interrupted to reinitialize itself.

The vertical position at which the optical disk drive is to be loaded is controlled by the Drive Type.

Pivot Mechanism (*M104*, *M156*, and *M258*)

The Pivot Mechanism rotates the Lift and Flipper Mechanisms to a position in front of each Media Store.

The Pivot Motor is mounted to the Top Plate of the library and drives a spur gear attached to the Upper Pivot Shaft through a gear train to rotate the Lift Assembly.

A spring-loaded cam follower operates on a precision detent attached to the Upper Pivot Shaft to control absolute positioning.

Optical sensors are arrayed on the Top Plate of the library system to detect the position of the Pivot Mechanism -- right (Media Store 1), center (Media Store 2) or left (Media Store 3).

Main Controller PWA

The Main Controller PWA contains an Intel 8032 microprocessor along with DC motor drivers and sensor inputs to control the operation of the Library System. Connectors are provided to interface the PWA to DC motors, optical sensors and the internal SCSI cable. A 20-position connector is provided as an external I/O interface to the Keypad / Display PWA. See Section 7, the Appendix, for a block diagram of the Main Controller PWA.

Memory

Non-volatile SRAM is used to store volume information and provide for power failure recovery.

Sensor Inputs

There are six photointerruptor OPTO inputs (nine on the *M104*, *M156*, and *M258*) along with two tone decoded OPTO inputs (four on the *M104*, *M156*, and *M258*), two encoders and several cable sensors. The tone decoded inputs are used to reject the effects of ambient light..

The sensors monitored are of three types: Photointerruptor, tone decoded, and encoder.

<u>Sensor Name</u>	<u>Sensor Type</u>
Slider-1 and 2-Home	Photointerruptor
Lift-Home	Photointerruptor
Import-Open	Photointerruptor
Import-Media	Photointerruptor
Store-Media	Tone decoded
Flip-Encoder	Photointerruptor
Media-Eject (L,M,R)	Tone decoded
Slider-Encoder	Encoder
Lift-Encoder	Encoder
Pivot (L,M,R)	Photointerruptor

Photointerruptor sensors are optical IC's. They contain biasing, detection circuitry and an open collector driver inside the OPTO case. The circuit requirements are + 5 VDC, signal ground and a signal path for the open collector output. When the OPTO is blocked its output is low.

The tone decoded sensors are operated by LM567 tone decoders. Each tone decoder is set up to output a different frequency which in turn is connected to the emitter portion of the assembly via a high current driver. The photo detector portion of the assembly picks up the frequency of the emitted/detected light and this signal is fed back into the tone decoder. The tone decoder will output a low active signal as long as it receives a signal strength greater than 200 mv P-P at the proper frequency of detected light.

Sensors

Slider-1 and 2- Home OPTO Photointerruptor

Calibrates the Slider Mechanisms and is the reference position for all Slider travel.

Slider Encoder

Measures the travel distance of the Slider Mechanism from its home position.

Lift-Home OPTO Photointerruptor

Calibrates the Lift Mechanism and is the reference position for all Lift travel. This sensor is located on the Lift Interface Adaptor PWA.

Flip-Encoder OPTO Photointerruptor

Tracks the position of the Flipper Mechanism.

Pivot OPTO Photointerruptors (*M104*, *M156*, *M258*)

Activated (blocked) when the Pivot Mechanism is positioned in front of the corresponding Media Store: the right-hand Media Store for the Pivot-Right OPTO, the center Media Store for the Pivot-Middle OPTO, and the left-hand Media Store for the Pivot-Left OPTO.

Import-Open OPTO Photointerruptor

Activated (blocked) when the Import / Export Element is in its lowered (closed) position.

Store-Media Retro-Reflective OPTO (tone decoded)

Detects the presence of media in a Storage Element location. It is mounted in the End Plate of the MTE.

Media-Eject (MIT) Discrete Optical (Emitter and Receiver -- tone decoded)

Determines if media is protruding from the corresponding Media Store or either of the two optical disk drives in the same column as the Media Store. The *M52* has one sensor pair, the *M104* has two, and the *M156* and *M258* have three: the Media-Eject-Right sensors for the right-hand Media Store and drives, the Media-Eject-Middle sensors for the center Media Store and drives, and the Media-Eject-Left sensors for the left-hand Media Store and drives. The Media-Eject devices are PWA mounted. The Emitter PWA works in conjunction with the Detector PWA to sense media protruding from an optical disk drive or a Storage Element.

Import-Med OPTO Photointerruptor

Determines if media is present in the Import / Export Element.

Lift Encoder

Measures the travel distance of the lift mechanism from its home position.

Motor Drivers

The Main Controller PWA contains four DC motor drivers. The drivers control the motor direction, torque and provide dynamic braking. Each driver has built in current limiting and thermal shut-down.

Switches

DIP switch SW1 (see Section 7, the Appendix) is used to select different operating modes and used to reset the CPU.

SCSI Terminator Power

Fuse F10 supplies terminator power to the SCSI cable through a non-removable auto-resetting fuse.
NOTE: *No more than five devices may supply terminator power.*

Keypad / Display Controller PWA

The Keypad / Display Controller PWA provides operator interface to the Library System. It contains the decoding and buffering to drive the LCD display module, a four key membrane switch type keypad, a sound transducer, a power LED and a active LED.

LCD

The LCD display is a twenty character per line by two line display utilizing supertwist technology with back lighting.

LED's

There are two LED's on the Keypad / Display Controller PWA. The Power LED is illuminated when +5 volts is present. The Active LED is under software control and is illuminated whenever the Library System is active or there is activity on the SCSI Bus.

Keypad

The Keypad / Display Controller PWA has an 8-position connector which connects to the membrane switch pad affixed to the front bezel of the Library System.

Lift Interface Adaptor PWA

The Lift Interface Adaptor PWA is used to connect the motors and sensors of the Medium Transport Element to the Main Controller Microprocessor PWA via a ribbon cable. It is mounted to the Lift Plate Assembly. The Lift Home Sensor and a Lift Brake Release Switch and are located on the this PWA.

Upper Sensors Adaptor PWA (*M104, M156, M258*)

The Upper Sensors Adaptor PWA is connected to the Main Controller PWA via a ribbon cable and is used to connect the devices located on the Top Plate. These include the Pivot Position Sensors, the Pivot Motor and the Import / Export Element sensors.

DTE Interface PWA

The DTE (Data Transfer Element) Interface PWA allows for the extension of drive function switches to the rear of the Library System via a DTE interface cable. The PWA contains several 12-position DIP switches, a board address DIP switch, and two 7-segment Drive Type displays. The PWA communicates with the Controller PWA via the PWA IO (Chatway) ribbon cable. See the publication *Switch Settings for Qualified Optical Disk Drives for Use in the Multi and M-Series Families of Library Systems* - Document No. 303075 - for more information.

Drive Power Switch PWA (*M104, M156, M258*)

The Drive Power Switch PWA is used to expand the number of controllable DC outputs to Drives 3-6. The input DC power source is a 110W power supply dedicated to this PWA. The control of each drive's DC output is via a 10-position ribbon cable from the Controller PWA. The Drive Power Switch PWA is located on the rear Media Store center position.

Section 5
Diagnostics and Maintenance

Diagnostics and Maintenance

CAUTION! *The Library System uses non-volatile memory to keep track of the status of the Storage Elements, the Medium Transport Element and the optical disk drives. This array may NOT be updated when using certain maintenance mode tests. If media is removed by hand or by running maintenance mode motor tests, it should be replaced before exiting maintenance mode or system errors may occur.*

Maintenance Mode

Maintenance Mode allows the Service Engineer to run a series of tests on the Library System using the device's LCD display and keypad.

When using Maintenance Mode, it is recommended that the Library System be disconnected from the Host computer by removing the SCSI Host Adaptor Cable from the rear of the unit and replacing it with a qualified Terminator Block.

If an error occurs during a Maintenance Mode test and retries do not correct the problem, the test will pause and the routine error, current position and load count will be displayed accompanied by a repetitive beep. When the **[]** membrane switch is pressed, the Library System will attempt to recover from the error which may cause the display of cascading errors.

NOTE: *A Lift Motor brake release switch is located on the Lift Interface PWA and also on the Main Controller PWA. This enables the Service Engineer to move the MTE up and down by hand. Refer to Section 7 -- Appendix -- for the location of the brake release switch.*

To enter Maintenance Mode, Switch 1 of the Main Controller PWA must be set to **ON** and the AC power cycled.

When AC power comes back on, the Library System will begin initializing itself to come up in Maintenance Mode.

Test 1 Sensors

When through initializing, the LCD display will show the following ...

```
Test 1  SENSORS ...
[ ]  [-]  [ ]  [ ]
```

The top row of the display shows the Maintenance Mode test -- in this case **Sensors**. An ellipsis (...) following a test name indicate that the test contains several sub tests.

The bottom line of the display shows the function of the membrane switch located just below the legend.

Pressing the **[]** switch will begin the Sensor Test and bring up ...

```
SLIDER-1-HOME OPTO
-0-  [ ]  [ ]  [ ]
```

... where ...

-0- indicates the state of the OPTO -- Photointerruptor OPTOs will read zero if blocked and one if unblocked

[] is used to exit back to the **Sensor Test**

[] is used to go to the previous sensor

[] is used to go to the next sensor.

An audible tone will sound each time the status of the sensor changes -- high pitch = 1, low pitch = 0. Use the [↵] and [⏏] membrane keys to select the sensor to be tested.

The following OPTO sensors and cables are testable in **Sensors**:

Slider-1-Home	MIT-Left	(M104,M156,M258)
Slider-2-Home	MIT-Middle	(M104,M156,M258)
Lift-Home	MIT-Right	(M104,M156,M258)
Import-Open	Pivot-Aligned	(M104,M156,M258)
Import-Media	Pivot-Left	(M104,M156,M258)
Store-Media	Pivot-Middle	(M104,M156,M258)
Flip-Encoder	Pivot-Right	(M104,M156,M258)
Sensor-Cable	Pivot-Cable	(M104,M156,M258)
Lift-Cable	Aux-Power-Cable	
Media-Eject (MIT)	Terminator-Power	

Test 2 Motors / Solenoids

```

Test 2  MOTORS ...
[⏏]  [-]  [↵]  [⏏]
  
```

CAUTION! Do not overrun travel. Motors do not stop with sensors in this test.

Press the [⏏] key in the above display to enter Motor Test ...

```

FINGERS CLOSE
[⏏]  [⏏]  [↵]  [⏏]
  
```

Use the [↵] and [⏏] keys to select the motor or solenoid to be tested.

Operate the selected motor or solenoid by holding the [⏏] key depressed. The motors do not run at full power during this test. Solenoids will turn off after one second.

The following motor tests are available in **Motors**:

Fingers Close (Solenoid)	Lift Motor Down
Slider Forward	Lift Brake Off (Solenoid)
Slider Reverse	Import Door Open (Solenoid)
Flipper CW	Pivot Right (M104,M156,M258)
Flipper CCW	Pivot Left (M104,M156,M258)
Lift Motor Up	

Test 3 Disk Side

```

Test 3  DISK SIDE
[⏏]  [-]  [↵]  [⏏]
  
```

Pressing the [⏏] key will display ...

```

DISK SIDE = 2
[↵]  [⏏]  [-]  [⏏]
  
```

With Disk Side = 2, operations involving the movement of cartridges will flip the cartridge. If you do not want the cartridge flipped, press the [⏏] key to toggle the display to 1 and then press the [↵] key. The display will return to the main menu.

Test 4 Initialize

```
Test 4 INITIALIZE
[⌘] [-] [↵] [⏏]
```

Pressing [⌘] calls the initialize routine which is normally called on power up. The Library System must be initialized before Tests Test 7 , Test 8 , Test 9 , or Test 10 can be run.

Test 5 Rezero Unit

```
Test 5 REZERO UNIT
[⌘] [-] [↵] [⏏]
```

If the Library System is not initialized, pressing the [⌘] switch will initialize the unit and then return any disk not in its 'home' Storage Element.

Test 6 Position

```
Test 6 POSITION
[⌘] [-] [↵] [⏏]
```

Pressing the [⌘] switch will display ...

```
CP = 20 NP = 1
[⌘] [□] [↵] [⏏]
```

Pressing the [⌘] switch positions the Medium Transport Element to the Next Position (NP =) that is specified. Use the [↵] and [⏏] keys to select a new position. Possible positions are as follows:

- IE The Import / Export Position.
- D1 to D6 The Drive Load Positions.
- 1 - nnn Storage Elements where SE 1 is closest to the upper Drive in the right-hand Media Store.

The Current Position (CP =) is also displayed on line one of the display. A question mark (?) means the current position is unknown.

Test 7 Load Media (into Optical Disk Drive)

```
Test 7 LOAD MEDIA
[⌘] [-] [↵] [⏏]
```

Pressing [⌘] will display ...

```
DRIVE 1
[⌘] [□] [↵] [⏏]
```

Use **[←]** or **[→]** to select the drive to be loaded and then press **[*]** to load the media in the current slot (the slot to which a Medium Transport Element is positioned) into the selected drive. If the disk side is set to 2 (Test Test 3), the media will be inverted prior to loading. The Library System must be initialized (Test Test 4 or Test 5) before this test can be run.

Test 8 Unload Media (from Optical Disk Drive)

```
Test 8  UNLOAD MEDIA
[*]  [-]  [↵]  [←]
```

Pressing **[*]** will display ...

```
DRIVE 1
[*]  [□]  [←]  [→]
```

Use **[←]** or **[→]** to select the drive to be unloaded and then press **[*]** to unload the media and return it to its slot of origin. If the disk side is set to 2 (Test Test 3), the media will be inverted during the unload. The Library System must be initialized (Test Test 4 or Test 5) before this test can be run.

Test 9 Move Media

```
Test 9  MOVE MEDIA
[*]  [-]  [↵]  [←]
```

Moves media from one slot to another. Pressing the **[*]** switch will display ...

```
FROM =  n  TO =  n
[*]  [□]  [F→] [T→]
```

The first display line shows the FROM position and the TO position. Use the **[F→]** key to change the FROM position and the **[T→]** key to change the TO position. If the disk side is set to 2 (Test 3), the media will be inverted during the move. The Library System must be initialized (Test 4 or 5) before this test can be run. Press **[*]** to start the move.

The possible positions are the same as shown in Test Test 6 . Press **[□]** to return to the Setup menu.

Test 10 Reload Media

```
Test 10  RELOAD
MEDIA
[*]  [-]  [↵]  [←]
```

Pressing **[*]** will display ...

```
DRIVE 1
[*]  [□]  [←]  [→]
```

Use **[+]** or **[-]** to select the drive to be reloaded and then press **[*]**. This test will eject the disk from the selected drive and reload it back into the drive immediately after flipping it (if Disk Side is set to 2).

Test 11 Home Lift

```
Test 11  HOME LIFT
[*]  [-]  [v]  [u]
```

Pressing **[*]** will slowly raise the Lift Plate Assembly until the Lift-Home OPTO on the Lift Interface PWA is blocked by the Lift-Home Pin in the Library System's Top Plate.

Test 12 Home Slider

```
Test 12  HOME SLIDER
[*]  [-]  [v]  [u]
```

Pressing **[*]** will send the Slider Mechanism to its 'home' position.

Test 13 Change Sliders

```
Test 13  CHANGE
SLIDERS
[*]  [-]  [v]  [u]
```

Pressing **[*]** will display ...

```
SLIDER = 1
[~]  [E]  [-]  [u]
```

Press **[u]** to toggle the display from 1 to 2. Press **[~]** to change the active slider.

Test 14 Slider Store

```
Test 14  SLIDER
STORE
[*]  [-]  [v]  [u]
```

Pressing **[*]** moves the Slider Mechanism forward to the position at which a cartridge is fully returned to the Media Store.

Test 15 Slider Pick

```
Test 15  SLIDER PICK
[⌘]  [-]  [↵]  [⇧]
```

Pressing [⌘] will engage the Pick Fingers and pull a disk into an MTE.

Test 16 Push In Drive

```
Test 16  PUSH IN
DRIVE
[⌘]  [-]  [↵]  [⇧]
```

Pressing [⌘] moves the Slider Mechanism to the position at which it loads the Drive. The MTE must be positioned in front of a drive for this test to run.

Test 17 Slide Unload

```
Test 17  SLIDE
UNLOAD
[⌘]  [-]  [↵]  [⇧]
```

Pressing [⌘] moves the Slider Mechanism to the position at which it waits for a disk cartridge to be ejected from the Drive.

Test 18 Eject Media

```
Test 18  EJECT MEDIA
[⌘]  [-]  [↵]  [⇧]
```

Pressing [⌘] will display ...

```
DRIVE 1
[⌘]  [□]  [⇨]  [⇩]
```

Use [⇨] or [⇩] to select the drive to be ejected and then press [⌘]. This test will eject the disk from the selected drive. If the cartridge does not eject, verify proper SCSI bus termination and drive address settings.

Test 19 Flip

```
Test 19  FLIP
[⌘]  [-]  [↵]  [⇧]
```

Pressing [⌘] rotates the MTE's from Side A to Side B (or vice versa).

Test 20 Lift Encoder

```
Test 20  LIFT
ENCODER
[↩]  [-]  [↵]  [⏏]
```

Pressing [↩] displays the current lift encoder count.

Test 21 Slider Encoder

```
Test 21  SLIDER
ENCODER
[↩]  [-]  [↵]  [⏏]
```

Pressing [↩] displays the current slider encoder count.

Test 22 Interrupt Test

```
Test 22  INTERRUPT
TEST
[↩]  [-]  [↵]  [⏏]
```

Pressing [↩] will display ...

```
TEST INTERRUPT
[-]  [□]  [-]  [-]
```

Carefully rotate the MTE. A beep will sound and the Active LED will light indicating that the interrupt works.

Test 23 Memory Test

```
Test 23  MEMORY TEST
[↩]  [-]  [↵]  [⏏]
```

Pressing [↩] will display ...

```
TEST SRAM
[-]  [□]  [-]  [↩]
```

Pressing [↩] will cause the Library System to test its memory. At test completion, it will display PASS or FAIL.

Test 24 Cycle Count

```
Test 24  CYCLE COUNT
[⌘]  [-]  [↵]  [⏏]
```

Pressing [⌘] will display ...

```
  CYCLE = nnnnnnnn
[-]  [□]  [-]  [→0]
```

Press [□] to exit or [→0] to clear the cycle count. This counter is incremented only by the various Maintenance Mode cycle test.

Test 25 Cycle Fingers

```
Test 25  CYCLE
FINGERS
[⌘]  [-]  [↵]  [⏏]
```

Pressing [⌘] continuously cycles the Finger Solenoid. Terminate the test by pressing any key.

Test 26 Cycle Flip

```
Test 26  CYCLE FLIP
[⌘]  [-]  [↵]  [⏏]
```

Pressing [⌘] cycles the Flipper Mechanism and Slider Mechanism continuously. If the MTE is positioned in front of a Storage Element housing a cartridge, the cartridge will be picked, flipped and returned to the Storage Element in a repeating cycle.

While cycling, the display will show the cycle count, the current position of the Lift and the last error logged. Press any key to terminate this test.

Test 27 Cycle Slider

```
Test 27  CYCLE
SLIDER
[⌘]  [-]  [↵]  [⏏]
```

Pressing [⌘] cycles the Slider Mechanism continuously. While cycling, the display shows the cycle count, the current Lift position and the last error logged. Press any key to terminate this test.

Test 28 Cycle Lift

```
Test 28  CYCLE LIFT
[⌘]  [-]  [↵]  [⏏]
```

Pressing **[⌘]** cycles the Lift Mechanism continuously in a random pattern. If Disk Side is set to 2 (Test Test 3), the Flipper Mechanism will rotate with each position. While cycling, the display shows the cycle count, the current lift position and the last error logged. Press any key to terminate this test.

Test 29 Cycle Slot (to a Drive)

```
Test 29  CYCLE SLOT
[⌘]  [-]  [↵]  [⏏]
```

Pressing **[⌘]** will display ...

```
DRIVE 1
[⌘]  [□]  [↵]  [⏏]
```

Use **[↵]** or **[⏏]** to select the drive to which you want to continuously cycle a disk cartridge and then press **[⌘]**. While cycling, the display will show you what functions are being performed while also showing the cycle count and the last error logged. If Disk Side is set to 2 (Test Test 3), the cartridge will be flipped before being inserted into the Drive. This cycle repeats using the other slider. Press any key to terminate this test.

Test 30 Cycle Drive

```
Test 30  CYCLE DRIVE
[⌘]  [-]  [↵]  [⏏]
```

Pressing **[⌘]** will display ...

```
DRIVE 1
[⌘]  [□]  [↵]  [⏏]
```

Use **[↵]** or **[⏏]** to select the drive to which you want to continuously cycle a disk cartridge and then press **[⌘]**.

The MTE must be positioned in front of an occupied Storage Element. That cartridge will then be picked and moved to the selected Drive. If Disk Side is set to 2 (Test Test 3), the cartridge will be flipped before being inserted into the Drive. After loading the Drive, the Library System will change its active slider and issue an eject command to the Drive.

When the cartridge is ejected, it will be withdrawn fully into the MTE and then immediately reinserted into the Drive. While cycling, the display will show the cycle count and the last error logged. Press any key to terminate this test.

Test 31 Cycle 2-Disks

```
CYCLE 2-DISKS
[⌘] [-] [↵] [⏏]
```

This test requires two cartridges loaded in any two slots. Pressing [⌘] will initialize the Library System -- during which it will determine where the two cartridges are located. Then, one of the cartridges will be moved to a Drive.

After loading, the Drive will be unloaded and its cartridge moved to the Storage Element immediately above the other cartridge. This process then repeats with the other cartridge using the other slider.

If disk side is set to 2 (Test Test 3), the cartridges will be flipped every other transit of the Media Store. While cycling, the display will show the cycle count and the last error logged. Press any key to terminate this test.

Test 32 Cycle Full

```
Test 32 CYCLE FULL
[⌘] [-] [↵] [⏏]
```

This test will work with cartridges in any of the Storage Element locations. Pressing [⌘] will initialize the Library System and then begin moving cartridges to the drives. If disk side is set to 2 (Test Test 3), the cartridges will be flipped every other transit of the Media Store. After every cycle, the active slider is changed.

While cycling, the display will show the cycle count and the last error logged. Press any key to terminate this test.

Test 33 Demonstration

```
Test 33
DEMONSTRATION
[⌘] [-] [↵] [⏏]
```

This test will work with cartridges in any of the Storage Element locations. A minimum of three cartridges are required. For the most interesting results, up to one-third (1/3) of the total capacity of cartridges are recommended. Pressing [⌘] will initialize the Library System during which it will determine how many cartridges are present and where they are.

It will then begin to randomly pick cartridges and either move them to an empty Storage Element or to one of the drives. Cartridges in the drives will be randomly exchanged with cartridges in the Storage Elements.

While cycling, the display will show the operations being performed. Press any key to terminate this test.

Test 34 Constants

```
Test 34 CONSTANTS
...
[⌘] [-] [↵] [⏏]
```

Constants consist of Library System offsets. Offsets are one of the most significant features of the Library System. Generally, all adjustment you are likely to make to a Library System will be the keys on the display panel and the feature offsets.

The Library System was fine tuned at the factory for the installed drives and for a standard suite of test media. The cartridges you will be using may be slightly different and may require changing one or more of the offset values. It is highly recommended that you write down the current value of any offset before you change it. That way, you can easily go back to the previous setting if your new value doesn't work.

The Library System's self-configuring feature automatically loads the nominal settings for Lift position, Slider position, Drive load positions and the location of the Import / Export Element and the location of Storage Element 1 into non-volatile memory based on the Drive Type encountered.

Offsets lets you fine tune these values to suit the particulars of your installation. Pressing **[*]** will display ...

```
1 BOTTOM SLOT OFFSET
[*] [-] [↵] [↑]
```

Press the **[*]** key. For the *M104*, *M156*, and *M258*, the following will be displayed ...

```
COLUMN 1
[*] [□] [↵] [↑]
```

Press the **[↵]** or the **[↑]** keys to select the desired column of Storage Elements, column 1 being the Media Store on the right-hand side (facing the front of the Library System). Press the **[*]** key. The following will be displayed ...

```
BOTTOM SLOT = 100
[-] [□] [↵] [↑]
```

Pressing the **[↵]** key will lower the MTE in fine increments and pressing the **[↑]** key will raise the MTE in fine increments. There are limits -- +/- 100 counts. Pressing either the **[↵]** or the **[↑]** keys will instantly write that value to non-volatile memory. The cartridge should be centered (up and down) just as it enters the store guide. When you have achieved perfect alignment, press **[□]**.

NOTE: If a cartridge is protruding from a slot or a drive, it will trigger the Media-Eject sensor and prevent the MTE from repositioning during this adjustment.

Press **[↑]** to display ...

```
2 FLIP OFFSET
[*] [-] [↵] [↑]
```

Pressing **[*]** will display ...

```
FLIP = 100
[-] [□] [↵] [↑]
```

Flip Offset is adjusted only at slot 1 and is set the same way as is Bottom Slot Offset. When you have achieved perfect alignment, press **[□]**. Remember, a protruding cartridge will prevent the MTE from repositioning.

Press **[▲]** to display ...

```
3 TOP SLOT OFFSET
[⌘] [-] [▼] [▲]
```

Press the **[⌘]** key. For the *M104*, *M156*, and *M258*, the following will be displayed ...

```
COLUMN 1
[⌘] [□] [↵] [↑]
```

Press the **[↵]** or the **[↑]** keys to select the desired column of Storage Elements, column 1 being the Media Store on the right-hand side (facing the front of the Library System). Press the **[⌘]** key. The following will be displayed ...

```
TOP SLOT = 100
[-] [□] [↵] [↑]
```

Top Slot Offset is set the same way as is Bottom Slot Offset. When you have achieved perfect alignment, press **[□]**.

Press **[▲]** to display ...

```
4 IMPORT OFFSET
[⌘] [-] [▼] [▲]
```

Pressing **[⌘]** will move the MTE to the Import / Export Element. The display will change to ...

```
IMPORT = 100
[-] [□] [↵] [↑]
```

Pressing **[↵]** will lower the MTE in fine increments and pressing **[↑]** will raise the MTE in fine increments. There are limits -- +/- 100 counts. Pressing either the **[↵]** or the **[↑]** keys will instantly write that value to non-volatile memory. The cartridge should be centered (up and down) just as it enters the Import / Export Element. When you have achieved perfect alignment, press **[□]**.

Press **[▲]** to display ...

```
5 DRIVE OFFSETS
[⌘] [-] [▼] [▲]
```

Pressing **[⌘]** will display ...

```
DRIVE 1
[⌘] [□] [↵] [↑]
```

Use **[↵]** or **[↑]** to select the drive to be aligned and then press **[⌘]**. The display will change to ...

```
DRIVEn = 100
[-] [□] [↵] [↑]
```

The MTE will move to the drive so that you can determine how well the entrance slot to the MTE aligns with a cartridge in the drive. Pressing [↵] will lower the MTE in fine increments and pressing [↑] will raise the MTE in fine increments. There are limits -- +/- 100 counts. Pressing either the [↵] or the [↑] keys will instantly write that value to non-volatile memory. The cartridge should slide easily into the MTE as it is ejected from the drive. When you have achieved perfect alignment, press [□]. Remember, a protruding cartridge will prevent the MTE from repositioning.

Press [↵] to display ...

```
6 SLIDER OFFSETS
[↵] [-] [↵] [↑]
```

Pressing [↵] will change the display to ...

```
S1 = nn S2 = nn
AUTO SENSE
```

followed by ...

```
CONTINUE ?
[-] YES [-] NO
```

Pressing YES will cause the offsets for both sliders to be automatically determined and displayed. A cartridge must be placed in slot 1 for setting this offset.

Test 35 Setup

```
Test 35 SETUP ...
[↵] [-] [↵] [↑]
```

Twelve of the sixteen functions and settable options available under Setup are covered in depth in Section 3 -- Setup and Installation. Refer to that Section for details on the first twelve functions.

Setup Submenus 13, 14, 15, and 16 are covered below. They can be accessed by pressing the [↵] key to enter Setup Mode and then by pressing the [↵] key.

Setup Test 13 Drive Tests

```
13 DRIVE TESTS
[↵] [□] [↵] [↑]
```

Pressing [↵] will display ...

```
DRIVE 1
[↵] [□] [↵] [↑]
```

Use [↵] or [↑] to select the drive to be aligned and then press [↵].

The first test will display optical disk drive and cartridge information. The following will be displayed ...

```
A.DRIVE INFORMATION
[ * ] [ 0 ] [ > ] [ + ]
```

Pressing [*] will display ...

```
LOAD NEW DISK ?
[ - ] YES [ - ] NO
```

Press NO if the currently loaded cartridge is to be used or if no cartridge is currently loaded in the optical disk drive selected. Pressing YES will display ...

```
INSERT CARTRIDGE
[ - ] [ 0 ] [ - ] [ * ]
```

Insert a cartridge into the Library's Import / Export Element and then press [*]. The following will be displayed ...

```
PUSH A KEY AFTER
EACH DISPLAY-NOW
```

Press any key on the display and keep pressing as each new screen of information is displayed. Stop when the following is displayed ...

```
END OF INFO !
[ - ] [ 0 ] [ - ] [ - ]
```

Press [0] to return to the Drive Tests menu.

The next test will low level format a cartridge. The following will be displayed ...

```
B.FORMAT CARTRIDGE
[ * ] [ 0 ] [ > ] [ + ]
```

Pressing [*] will display ...

```
INSERT CARTRIDGE
[ - ] [ 0 ] [ - ] [ * ]
```

Insert a cartridge into the Library's Import / Export Element and then press [*]. The following will be displayed ...

```
LL FORMAT WILL
ALTER CARTRIDGE
```

followed by ...

```
ARE YOU SURE ?  
[ - ] YES [ - ] NO
```

Pressing YES will display ...

```
LL FORMATTING  
(30 MIN)...
```

After approximately thirty (30) minutes, the following will be displayed ...

```
END OF INFO !  
[ - ] [ ] [ - ] [ - ]
```

Press [] to return to the Drive Tests menu.

The next test will perform a destructive read / write test on a cartridge. The following will be displayed ...

```
C.READ/WRITE TEST  
[ ] [ ] [ ] [ ]
```

Pressing [] will display ...

```
INSERT CARTRIDGE  
[ - ] [ ] [ - ] [ ]
```

Insert a cartridge into the Library's Import / Export Element and then press []. The following will be displayed ...

```
MEDIA TEST WILL  
ALTER CARTRIDGE
```

followed by ...

```
ARE YOU SURE ?  
[ - ] YES [ - ] NO
```

Pressing YES will display ...

```
WRITING ... 1024  
PRESS TO STOP
```

The writing portion of the text can be run to completion (about an hour) or any key on the keypad can be pressed to stop the test. The following is then displayed ...

```
READING ...    0
COMPARING    1024
```

After the read-back portion of the test is completed, the following is displayed ...

```
TEST PASSED !
[ - ] [ ] [ - ] [ - ]
```

Press [] to return to the Drive Tests menu.

Setup Test 14 Error Stats

```
14 ERROR STATISTICS
[ * ] [ ] [ * ] [ * ]
```

Pressing [*] will display ...

```
- NO ERRORS -
[ - ] [ ] [ - ] [ - ]
```

If recorded errors had been present, the following would have been displayed.

```
# 1 E# nnh    nnx
[ - ] [ ] [ * ] [ * ]
```

where ...

- ... #1 is the most frequently logged error
- E# is the hexadecimal error number
- nnx is the number of occurrences of this error

Pressing [*] will display the next most frequently logged error. Pressing [] will display ...

```
ERRORS LISTED = nn
[ - ] [ ] [ - ] [ * ]
```

Pressing [] will exit the routine back to Error Stats. Pressing [*] will completely erase the error statistics log.

Setup Test 15 Error Log

```
15 ERROR LOG
[ * ] [ ] [ * ] [ * ]
```

Pressing [F6] will display ...

```
- NO ERRORS -  
[ - ] [E] [ - ] [ - ]
```

If recorded errors had been present, the following would have been displayed.

```
#1 E# nnh POS nn  
[F6] [E] [F7] [F8]
```

where ...

- ... #1 is the most recent error logged (a top down stack is used for error logging)
- E# is the hexadecimal error number
- POS nn is the Storage Element position at the time the error occurred.

For each error, more information may be displayed by pressing the [F6] key. The following will be displayed ...

```
SETUP MODE 1→40i  
[ - ] [E] [ - ] [ - ]
```

If the error occurred while in Setup Mode, the above message is displayed. Otherwise, one of the following will be displayed.

Message	State in which Error Occurred
NO COMMAND	During initialization
REZERO	During Rezero Unit command
INIT ELEM	During Initialize Element Status command
POSITION	During Position command
MOVE MED	During Move Medium command
EXCHANGE	During Exchange Medium command
MAINT MODE	During Maintenance Mode

The source and destination elements are as displayed. An 'i' will also be displayed if a cartridge invert (flip) was involved. Certain errors have additional information. If the error was due to a low-level SCSI communications problem, the following will be displayed ...

```
COULD NOT TALK  
TO DRIVE 1
```

After a few seconds, the following will be displayed ...

```
ERROR #F6 L 1  
[ - ] [E] [ - ] [ - ]
```

These errors are listed in Section 7. The L (location) codes are also listed in Section 7.

If the error was due to a drive or media problem, the following will be displayed ...

```
REQUEST SENSE  
INFO DRIVE 1
```

After a few seconds, the following will be displayed ...

```
ASC=3Ah ASCQ=00h
[ - ] [ ] [ - ] [ - ]
```

The errors are listed in the Drive Manufacturer's Technical Reference Manual. They are the Additional Sense Code and Additional Sense Code Qualifier fields returned in response to a Request Sense command sent to the drive.

Press [] until the following is displayed ...

```
ERRORS LOGGED = nn
[ - ] [ ] [ - ] [ →0 ]
```

Pressing [] will exit the routine back to Error Log. Pressing [→0] will completely erase the error log.

Setup Test 16 Event History

```
16 EVENT HISTORY
[ ↵ ] [ ] [ ↵ ] [ ↵ ]
```

Pressing [↵] will display ...

```
EVENT TYPE = 59
[ ↵ ] [ ] [ ↵ ] [ ↵ ]
```

Pressing [↵] again will display ...

```
- LIST EMPTY -
[ - ] [ ] [ - ] [ - ]
```

If recorded events had been present, the following would have been displayed.

```
0001: nn nn nn nn nn
[ - ] [ ] [ ↵ ] [ → ]
```

The hexadecimal numbers displayed define SCSI and machine control events that may be helpful to technical support personnel in the event of an error. Press [→] to scroll the list to the right and [↵] to scroll the list back to the left. The first number displayed is the list index. Pressing [] will display the following ...

```
EVENTS LOGGED = nn
[ - ] [ ] [ - ] [ →0 ]
```

Pressing [] will exit the routine back to Event History. Pressing [→0] will completely erase the event history list.

Test 36 Open Door

Test 36 OPEN DOOR
【*】 【-】 【↖】 【↗】

Pressing the 【*】 key will open the door to the Import/Export Element.

Section 6
Library System Adjustments

Adjustments

CAUTION! *Various mechanisms of the Library System are factory assembled using sophisticated permanent fixtures and measuring devices. This is done to eliminate the need for field adjustments and / or alignment.*

Never attempt to align or adjust any mechanism for which specific instructions are not provided herein.

Never loosen any screw which has been painted with red paint. Red paint is used to warn you that this screw was tightened while the mechanism was on a precision fixture. Loosening these screws can cause the loss of precision alignment of a mechanism resulting in an inoperable Library System.

General Comments

Maintenance utilities have been provided for your convenience which allow you to operate the motors at low speed and power to position things where you need them. See **Section 5 -- Diagnostics and Maintenance** for details on how to access and use these utilities.

It is a wise practice to remove the SCSI Host Adapter Cable from the back panel of the Library System and install a SCSI terminator plug while performing maintenance.

All tests and adjustments detailed herein require that the Library System be placed in **Maintenance Mode**.

Gaining Internal Access

1. Removing the Side Covers

M52

To remove either side cover ...

- Turn the power switch to the OFF (0) position.
- Remove the center screw in the side cover at the rear of the Library System.
- Loosen the remaining two screws holding the cover to the rear panel.
- Swing the rear of the cover outward in a slight arc and then bump it forward slightly.

Tabs on the front of the cover will disengage from slots in the front bezel of the Library System. The cover can now be removed.

The side covers are interchangeable side to side. One has viewing ports and one is solid. You can move the view ported cover to whichever side will be the most visible for your customer.

M104, M156, and M258

To remove either side cover ...

- Turn the power switch to the OFF (0) position.
- Remove the three screws securing the side cover at the rear of the Library.
- Swing the rear of the cover outward in a slight arc and then bump it forward slightly.

Tabs on the front of the cover will disengage from slots in the front bezel of the Library. The cover can now be removed.

The side covers are interchangeable side to side.

2. Removing the Internal Cooling Covers

To remove either cooling cover ...

- Remove the hex socket head cap screws securing the cover with a 9/64 hex wrench.

Cooling covers are required to provide proper cooling for the optical drives. Never operate the optical drive for an extended period with an internal cooling chamber cover removed.

Replacing an Optical Drive

1. Removing the Optical Drive

The optical drives are mounted on sturdy metal plates which slide over guides pressed into the Media Store Plates. The drive mounting plates are equipped with two metal Z brackets which fit against the front of the left and right Media Stores. Screws secure these brackets to the Media Stores.

- Be sure that the MTE is positioned well above the drive mounting area.
- Remove the SCSI cable from the rear of the drive to be removed.
- Remove the Drive Power Cable from the rear of the drive to be removed.
- Remove the Drive ID and Function Cable from the rear of the drive to be removed.
- Remove the screws holding the drive's mounting plate Z brackets to the Media Stores and slide the drive on its mounting plate towards the MTE until it is clear of the Media Store.
- Remove the screws holding the drive to its mounting plate and remove the drive. Be sure to observe the orientation of the drive to the mounting plate and be sure to save the mounting hardware.

2. Installing an Optical Drive

To install an optical drive ...

- Attach the drive to the top of the drive mounting plate using the drive mounting screws removed in the above procedure.
- Carefully slide the optical drive's mounting plate over the guides pressed into the Media Stores and secure the mounting plate Z brackets to the Media Store using the screws removed in the above procedure.
- Connect the SCSI, SCSI ID and power cables to the optical drive. Insure that the proper cables go to the appropriate drives.
- Power up the Library System and run **Test Test 35 Setup, Subtest 4 -- Config Drives**. Verify the proper Drive Type and SCSI address for the newly installed drive.

Adjustments

Positioning

1. Bottom Slot Position

The Medium Transport Element should position in front of the selected bottom Storage Element so that a cartridge in this element is in-line with the opening to the MTE.

This position is controlled by bottom slot offset -- Test Test 34 Constants, Subtest 1 -- Bottom Slot Offset. See Section 5.

2. Flipper Asymmetry

Flipper side 2 will be positioned up in front of Storage Element 1 so that a cartridge in this element is in line with the opening to the MTE.

This position is controlled by flip offset -- Test Test 34 Constants, Subtest 2 -- Flip Offset. See Section 5.

3. Top Slot Position

The Medium Transport Element should position in front of the selected top Storage Element so that a cartridge in this element is in-line with the opening to the MTE.

This position is controlled by top slot offset -- Test Test 34 Constants, Subtest 3 -- Top Slot Offset. See Section 5.

4. Import / Export Element Position

The Medium Transport Element should position in front of the Import / Export Element so that a cartridge in the I/E is in-line with the opening to the MTE.

This position is controlled by import offset -- Test Test 34 Constants, Subtest 4 -- Import Offset. See Section 5.

5. Drive Positions

The Medium Transport Element should position in front of the selected Drive so that a cartridge being ejected from the drive is in-line with the opening to the MTE.

This position is controlled by drive offset -- Test Test 34 Constants, Subtest 5 -- Drive Offset. See Section 5.

6. Slider-Store Position

This is an automated adjustment, and is set with a cartridge in Storage Element 1. Travel is controlled by slider offsets -- Test Test 34 Constants, Subtest 6 -- Slider Offsets. See Section 5.

7. Lift Pivot Position (*M104, M156, and M58*)

The Lift Pivot Mechanism should position the MTE squarely in front of each Media Store so that optical disk cartridges enter the MTE and/or the Media Stores smoothly and squarely.

This adjustment is factory set using special fixtures and alignment gauges and should, under normal circumstances, never require field readjustment.

Should it become necessary to readjust Lift Pivot positioning, proceed exactly as follows.

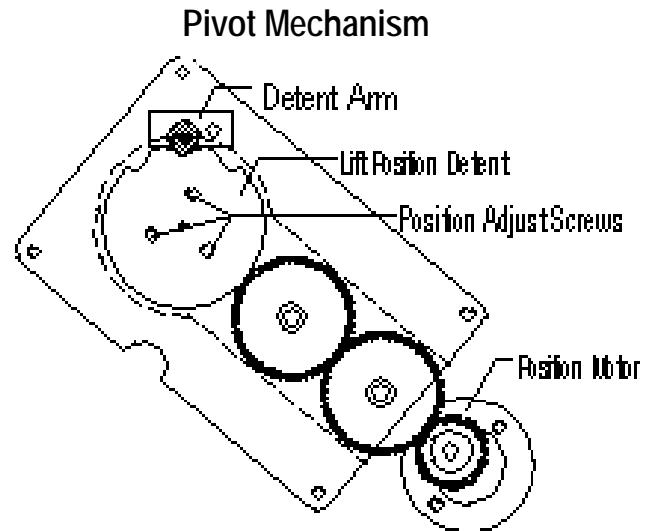
- Remove the left and right Side Covers of the Library as well as the Top Cover. Four 1/4-28 Hex Socket Cap Head Screws hold the Top Cover to the Top Plate. They are accessible from the underside of the Top Plate.
- Position the MTE halfway up the center Media Store column.
- Loosen the three hex socket cap head screws atop the Pivot Mechanism Detent.
- Use a 6" steel rule against the sides of the MTE chassis to check the alignment of the Media Store. The distance should be equal side to side.
- Carefully tighten the three hex socket cap head screws atop the Pivot Mechanism Detent in sequence while holding the Detent Bearing tightly in the center notch of the Detent.
- Recheck the alignment of the MTE chassis to the Media Store and its molded Storage Elements.
- Position the MTE to the left Media Store.
- Check the alignment of the MTE to the left Media Store. It must be close enough to being centered that cartridges can pass freely from the MTE into the left Media Store and vice versa.
- Perform the same alignment check for the right Media Store.

If the MTE is still not centered to the Media Store, it is suggested that you contact Plasmon Technical Support for additional instructions.

8. Lift Pivot Position OPTOs (*M104, M156, and M58*)

The appropriate Lift Position OPTO must be blocked when the Lift is positioned in front of a Media Store. Use Test Test 1 — Sensors, Pivot-Aligned (see Section 5) to test.

- If adjustment is required, loosen the hex socket button head screw holding the appropriate OPTO slightly. The OPTO can be swung in an arc to center it on the Flag of the Upper Pivot Plate. Be sure to retighten the screw but do not over tighten as you can crush the plastic case of the OPTO. All three OPTOs adjust the same way.
- Verify proper alignment by slowly moving the MTE side to side noting the distance traveled each way from center when the OPTO becomes unblocked.



Section 7

Appendix

Error Codes and Locations

Library System Processor Error Codes

Error	Description	Cause / Corrective Action
01h	EPROM 1 Checksum Failure	Fatal error. Replace the Main Controller PWA or install new BIOS. <i>Note: Setup may have to be performed.</i>
02h	SRAM Failure	Fatal error. Replace the Main Controller PWA or install new BIOS. <i>Note: Setup may have to be performed.</i>
04h	Mismatched EPROM's	Fatal error. Replace one or both BIOS EPROM's to ensure compatibility.
05h	EPROM 2 Checksum Failure	Fatal error. Replace the Main Controller PWA or install new BIOS. <i>Note: Setup may have to be performed.</i>
07h	5380 Chip Failure	Fatal error. Replace the Main Controller PWA or check SCSI connections.
0Ah	Bad Element Code	Fatal error. Replace the Main Controller PWA.
0Ch	Undo Overflow	Fatal error. The Main Controller PWA may need replacement. To recover from this error, reset the Library System by cycling AC power.
0Dh	Internal Error	Fatal error. The Main Controller PWA may need replacement. To recover from this error, reset the Library System by cycling AC power.

Library System Hardware Error Codes

Error	Description	Cause / Corrective Action
10h	Unit Not Set Up	<p>Check</p> <ul style="list-style-type: none"> • Drive Switch settings. • Run Configure Drives in Setup Mode.
12h	Park Lift Failure	<p>Check...</p> <ul style="list-style-type: none"> • Is a cartridge projecting from a drive or from the Media Store?
15h	Pivot Cable Error	<p>Check ...</p> <ul style="list-style-type: none"> • Pivot interface ribbon cable.
16h	Aux Power Cable Error	<p>Check ...</p> <ul style="list-style-type: none"> • Aux power interface cable.
17h	Lift Cable Error	<p>Check ...</p> <ul style="list-style-type: none"> • Lift ribbon cable and connections. • MTE ribbon cable and connections. • Slider ribbon cable and connections.
18h	Sensor Cable Failure	<p>Check ...</p> <ul style="list-style-type: none"> • Discrete sensor cable connection at Main Controller PWA.
1Ah	Drive Not Installed	<p>The unit tried to load an uninstalled drive.</p> <p>Check ...</p> <ul style="list-style-type: none"> • Drive switch settings. • Run Configure Drives in Setup Mode.
1Bh	Source is Empty	<p>No cartridge was detected in the Storage Element to which the MTE was directed.</p> <p>Check ...</p> <ul style="list-style-type: none"> • Store-Media OPTO. Is a disk actually present? • Check SRAM. • Unit may have received a command to move to an element that is truly empty.
1Ch	Destination is Full	<p>A cartridge was detected in the Storage Element to which the MTE was directed.</p> <p>Check ...</p> <ul style="list-style-type: none"> • Store-Media OPTO. Is a disk actually present? • Check SRAM. • Unit may have received a command to move to an element that is truly full.
1Dh	Element Unexpectedly Empty	<p>No cartridge was detected in the Storage Element to which the MTE was directed.</p> <p>Check ...</p> <ul style="list-style-type: none"> • Is a disk actually present? • If running Cycle-2-Disks, you need two cartridges in the Library

Error	Description	Cause / Corrective Action
1Eh	Element Unexpectedly Full	<p>System.</p> <ul style="list-style-type: none"> If running Demonstration, you need three cartridges in the Library System. <p>A cartridge was detected in the Storage Element to which the MTE was directed.</p> <p>Check ...</p> <ul style="list-style-type: none"> Is a disk actually present? If running Cycle-2-Disks, you have too many cartridges in the Library System.
1Fh	MTE is Full	<p>A cartridge was detected in the Medium Transport Element preventing the Lift from being positioned.</p> <p>Check ...</p> <ul style="list-style-type: none"> Is there really a disk in the MTE? Check SRAM. Unit may have received a command to move an element into the MTE.
20h	Pick Disk Fail	<p>Check ...</p> <ul style="list-style-type: none"> Finger Solenoid and connections. Pivot alignment. Slider/Flipper Motor and Encoder. Media-Eject OPTOs. Lift position offsets in Setup Mode.
21h	Store Disk Fail	<p>Check ...</p> <ul style="list-style-type: none"> Slider/Flipper Motor and Encoder. Pivot alignment. Media-Eject OPTOs. Lift position offsets in Setup Mode.
23h	Drive Not Ready	<p>Check ...</p> <ul style="list-style-type: none"> Drive switch settings. Run Configure Drives in Setup Mode. SCSI cable connections. Does drive have power? Try different media.
24h	Drive Load Fail	<p>Check ...</p> <ul style="list-style-type: none"> Slider/Flipper Motor and Encoder. Media-Eject OPTOs. Is there already a disk in the drive? Lift position offsets in Setup Mode. If Lift is not aligned with drive, check Drive Switch settings and run Configure Drives in Setup Mode.
25h	Unload Drive Fail	<p>Check ...</p>

Error	Description	Cause / Corrective Action
		<ul style="list-style-type: none"> • Slider/Flipper Motor and Encoder. • Media-Eject OPTOs. • Is there really a disk in the drive? • Lift position offsets in Setup Mode. • If Lift is not aligned with drive, check Drive Switch settings and run Configure Drives in Setup Mode.
26h	Eject Fail	Check ... <ul style="list-style-type: none"> • Drive switch settings. • Run Configure Drives in Setup Mode. • SCSI cable connections. • Does drive have power? • Try different media.
28h	Can't Inquiry Drive	Check ... <ul style="list-style-type: none"> • Drive switch settings. • Run Configure Drives in Setup Mode. • SCSI cable connections. • Does drive have power?
29h	No Terminator Power	Check ... <ul style="list-style-type: none"> • SCSI cable connections. • SCSI terminator.
2Ah	Incompatible Drive Types	Check ... <ul style="list-style-type: none"> • Drive switch settings. • Run Configure Drives in Setup Mode. • SCSI cable connections. • Drive(s).
2Bh	Cannot Export	Check ... <ul style="list-style-type: none"> • Is the Import / Export Element already occupied? • Import Media sensor and cable.
2Ch	Import Door Open	Check ... <ul style="list-style-type: none"> • Is Import / Export Element ajar? • Cable connections to Import-Door OPTO.
2Dh	Medium Removal Prevented	An operation command was made to open the import door while in the Prevent state.
2Eh	Unit Not Initialized	An operation command was given prior to unit initialization.
2Fh	Pivot Fail	Check ... <ul style="list-style-type: none"> • Pivot cable. • Pivot alignment sensors and cables. • Lift cable. • Pivot motor and connections.

Error	Description	Cause / Corrective Action
31h	Lift-Home Fail	<ul style="list-style-type: none"> • Is a cartridge projecting from a Storage Element or Drive? <p>Check ...</p> <ul style="list-style-type: none"> • Is the Power Supply delivering 24 VDC? • The Slider Mechanism must be 'homed' after initial power-on before the Lift will 'home'. • Press and hold the Lift Brake Release Switch while slowly raising the Lift to the top of its travel. Any obstructions? • Test the Lift Brake (Test Test 2 - Motors). • Lift-Home OPTO and flag alignment. • Lift Motor and connections. • Lift Encoder (Test Test 20 - Lift Encoder); also, connections. • Is a cartridge projecting from a drive or Storage Element?
32h	Position Fail	<p>Check ...</p> <ul style="list-style-type: none"> • Lift Motor and connections. • Lift Encoder and connections. Run Test Test 20 . • Press and hold the Lift Brake Release Switch while slowly raising the Lift to the top of its travel. Any obstructions? • Test the Lift Brake (Test Test 2 - Motors). • Is a cartridge projecting from a drive or Storage Element?
33h	Lift Blocked	<p>Check ...</p> <ul style="list-style-type: none"> • Is a cartridge projecting from a drive or Storage Element? • Media-Eject OPTOs and connections.
34h	Pivot Not Aligned	<p>Check ...</p> <ul style="list-style-type: none"> • Pivot sensors. • Pivot motor and connections. • Any obstructions which may be preventing the Pivot Lift from pivoting?
35h	Flip Fail	<p>The Flipper Mechanism was unable to flip to the directed side.</p> <p>Check ...</p> <ul style="list-style-type: none"> • Flip Codewheel OPTO and connections. • Flipper Motor and connections; Flipper gears. • Flipper interrupts (Test Test 22). • Any obstructions?
36h	Flip Timeout	<p>The Flipper Mechanism was unable to flip in the allotted time.</p> <p>Check ...</p> <ul style="list-style-type: none"> • Flip Codewheel OPTO and connections. • Flipper Motor and connections; Flipper gears. • Flipper Interrupts (Test Test 22). • Any obstructions?
37h	Flip Align Fail	<p>The Flipper Mechanism was unable to align itself to either side.</p>

Error	Description	Cause / Corrective Action
38h	Flip Not Aligned	<p>Check ...</p> <ul style="list-style-type: none"> • Flip Codewheel OPTO and connections. • Flipper Motor and connections; Flipper gears. • Any obstructions? <p>The Flipper Mechanism was not aligned at either Side 1 or 2 when the Lift was trying to position or was not aligned after positioning.</p>
3Ah	Slider Home Fail	<p>Check ...</p> <ul style="list-style-type: none"> • Flip Codewheel OPTO and connections. • Flipper Motor and connections; Flipper gears. • Any obstructions causing Flipper misalignment during positioning?
3Bh	Slider Position Fail	<p>Check ...</p> <ul style="list-style-type: none"> • Is power supply delivering 24 VDC? • Slider-Home OPTOs and flag alignment. • Slider Motor and connections. • Slider Encoder and connections; run Test Test 21 . • Any obstructions? • Are Fingers catching on anything?
3Ch	Swap Slider Fail	<p>Check ...</p> <ul style="list-style-type: none"> • Slider Motor and connections. • Slider Encoder and connections; run Test Test 21 . • Any obstructions? • Are Fingers ca/'tching on anything? <p>Check ...</p> <ul style="list-style-type: none"> • Slider Motor and connections. • Slider Encoder and connections; run Test Test 21 . • Any obstructions? • Are Fingers catching on anything? • Slider Selector Nut operation; run Test Test 13 .
3Dh	Slider Load Fail	<p>Check ...</p> <ul style="list-style-type: none"> • Did cartridge stay in drive after loading? Try a different cartridge. • Any obstructions? • Are Fingers catching on drive bezel? • Is cartridge catching in drive? • Slider Encoder and connections; run Test 21.
3Eh	Slider Jammed	<p>Check ...</p> <ul style="list-style-type: none"> • Slider Motor and connections. • Slider Encoder and connections; run Test Test 21 . • Any obstructions? • Are Fingers catching on anything?

Error	Description	Cause / Corrective Action
3Fh	Slider Mispositioned	<ul style="list-style-type: none"> Slider Selector Nut operation; run Test Test 13 . <p>Slider is not in a safe position for the Lift to move.</p> <p>Check ...</p> <ul style="list-style-type: none"> Reinitialize unit. Slider Motor and connections; gears. Slider Encoder and connections; run Test Test 21 .
40h	Pivot Align Failure	<p>Check ...</p> <ul style="list-style-type: none"> Pivot sensors. Pivot motor and connections. Any obstructions which may be preventing the Pivot Lift from pivoting?
43h	Cannot Open Access Door	<p>Check ...</p> <ul style="list-style-type: none"> Import solenoid and connections; run Test Test 36 . Access door opening blocked.
44h	MTE Not At Drive	<p>The MTE was not positioned in front of the drive during a load or unload attempt.</p> <p>Check ...</p> <ul style="list-style-type: none"> Reinitialize unit.
45h	Element Scan Failed	<p>Check ...</p> <ul style="list-style-type: none"> Is the Power Supply delivering 24 VDC? Lift Motor and connections. Lift Encoder (Test Test 20 - Lift Encoder); also, connections. Is a cartridge projecting from a drive or Storage Element?
46h	SRAM Reset	<p>Check ...</p> <ul style="list-style-type: none"> This is normal if a new Main Controller PWA or SRAM is being powered up for the first time. Power Supply. Was Main Controller powered up without EPROMs. Check SRAM.
F1h	SCSI Bus Unavailable	<p>Check...</p> <ul style="list-style-type: none"> SCSI terminators. Terminator power. SCSI cable. Do two different devices have the same SCSI address?
F2h	SCSI SelectionTime Out	<p>Check...</p> <ul style="list-style-type: none"> SCSI terminators. Terminator power. SCSI cable. Do two different devices have the same SCSI address?
F3h	Two ID's On SCSI Bus	<p>Check...</p>

Error	Description	Cause / Corrective Action
		<ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
F4h	Undefined SCSI Phase	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
F5h	SCSI Phase Error	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
F6h	SCSI Bus Not Terminated	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
F7h	SCSI Parity Error	Check... <ul style="list-style-type: none"> • Initiator must use parity. • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
F8h	Unexpected Loss of Busy	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
F9h	Abort Message Received	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
FAh	Improper Message Received	Check... <ul style="list-style-type: none"> • SCSI host adapter.
FBh	Two Devices Responding to Same Selection	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
FCh	SCSI Command Time Out	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
FEh	Drive is Busy	Check...

Error	Description	Cause / Corrective Action
		<ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?
FFh	Cannot Get Sense Info	Check... <ul style="list-style-type: none"> • SCSI terminators. • SCSI cable. • Do two different devices have the same SCSI address?

Library System SCSI Communication Error Location Codes

Error	Location
1	Selection phase (host selecting changer).
2	Receiving the disconnect message (from the host).
3	Checking for reselection by drive or selection by another initiator while busy processing a command (drive-changer or other initiator-changer).
4	Reselection phase (changer reselecting host).
10	Command phase (host-changer nexus).
11	Data out phase (host-changer nexus).
12	Message out phase (host-changer nexus).
13	Status phase (host-changer nexus).
14	Data in phase (host-changer nexus).
15	Message in phase (host-changer nexus).
20	Command phase while disconnected and busy (other initiator-changer nexus).
21	Data out phase while disconnected and busy (other initiator-changer nexus).
22	Message out phase while disconnected and busy (other initiator-changer nexus).
23	Status phase while disconnected and busy (other initiator-changer nexus).
24	Data in phase while disconnected and busy (other initiator-changer nexus).
25	Message in phase while disconnected and busy (other initiator-changer nexus).
30	Arbitration phase (changer arbitrating for bus).
31	Selection phase (changer selecting optical drive).
32	Waiting for new information transfer phase (changer-drive nexus).
40	Command phase (changer-drive nexus).
41	Data out phase (changer-drive nexus).
42	Message out phase (changer-drive nexus).
43	Status phase (changer-drive nexus).
44	Data in phase (changer-drive nexus).
45	Message in phase (changer-drive nexus).

Library System SCSI Request Sense Error Codes

The sense codes conform to the SCSI-2 Specification. For detailed definitions of the Sense Key, ASC and ASCQ errors, refer to the SCSI-2 Specification (Document Number X3.131-1994).

Sense Key	ASC	ASCQ	Error Description
02h	04h	01h	Logical Unit is in process of becoming ready
02h	04h	03h	Logical Unit not ready; manual intervention required
02h	80h	2Ch	Import door is open
04h	40h	00h	Diagnostic failure (EPROM)
04h	43h	00h	Message error
04h	44h	00h	Internal target failure
04h	45h	00h	Select or Reselect failure
04h	47h	00h	SCSI parity error
04h	48h	00h	Initiator detected error message received
04h	49h	00h	Invalid message error
04h	4Bh	00h	Data Phase error
04h	80h	10h	Unit has not been set up
04h	80h	12h	Park failure
04h	80h	15h	Pivot cable failure
04h	80h	16h	Aux power cable failure
04h	80h	17h	Lift cable failure
04h	80h	18h	Sensor cable failure
04h	80h	1Ah	Drive not installed
04h	80h	1Dh	Element unexpectedly empty
04h	80h	1Eh	Element unexpectedly full
04h	80h	20h	Pick-disk failure
04h	80h	21h	Store-disk failure
04h	80h	23h	Drive not ready
04h	80h	24h	Drive load failure
04h	80h	25h	Drive unload failure
04h	80h	26h	Eject failure
04h	80h	28h	Can't inquiry drive
04h	80h	29h	SCSI terminator power is low
04h	80h	2Ah	Incompatible drive types
04h	80h	2Bh	Cannot export cartridge
04h	80h	2Eh	Unit not initialized
04h	80h	2Fh	Pivot failure
04h	80h	31h	Lift-home failure
04h	80h	32h	Lift-position failure
04h	80h	33h	Cartridge projecting from slot or drive
04h	80h	34h	Pivot not aligned
04h	80h	35h	Flip failure
04h	80h	36h	Flip timeout
04h	80h	37h	Flip-align failure
04h	80h	38h	Flip not aligned
04h	80h	3Ah	Slider-home failure
04h	80h	3Bh	Slider-position failure
04h	80h	3Ch	Swap slider failure
04h	80h	3Eh	Slider jammed
04h	80h	3Fh	Slider misposition
04h	80h	40h	Pivot align failure
04h	80h	43h	Cannot open access door
04h	80h	45h	Element scan fail
05h	1Ah	00h	Parameter list length error

Sense Key	ASC	ASCQ	Error Description
05h	20h	00h	Invalid command operation code
05h	21h	01h	Invalid element address
05h	24h	00h	Invalid field in CDB
05h	25h	00h	Logical Unit not supported
05h	26h	00h	Invalid field in parameter list
05h	28h	01h	Import/Export element accessed
05h	3Bh	0Dh	Medium destination element full
05h	3Bh	0Eh	Medium source element empty
05h	3Dh	00h	Invalid bits in identify message
05h	53h	02h	Medium removal prevented
05h	81h	00h	Volume tag information already defined
05h	84h	00h	Host serial number mismatch
05h	86h	00h	Transport element full
05h	87h	00h	Position with transport full
06h	29h	00h	Power-on, Reset, or Bus Device Reset occurred
06h	2Ah	00h	Log Parameters changed
06h	2Ah	01h	Mode parameters changed
06h	80h	46h	SRAM reset

Switches

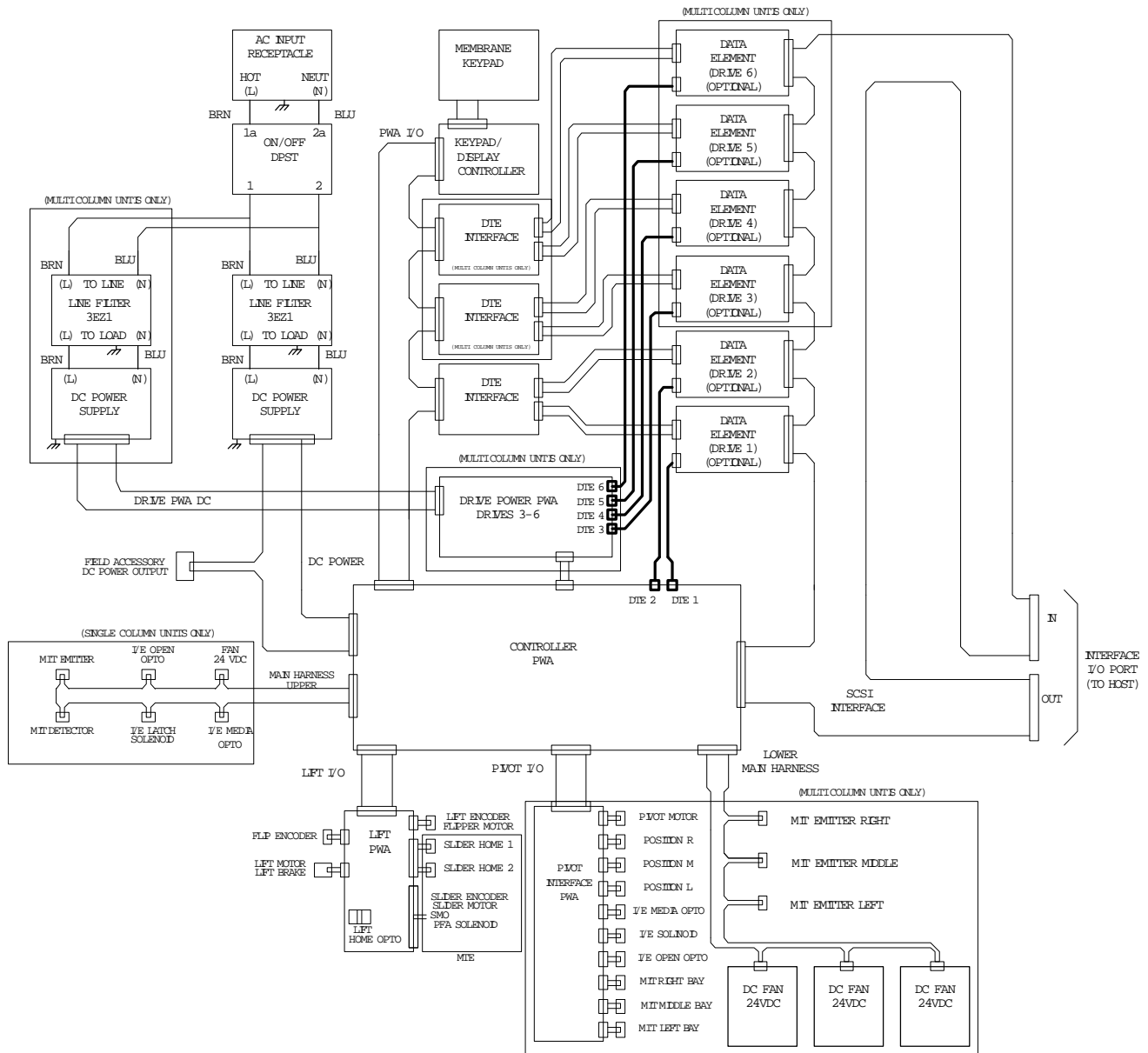
Main Controller PWA

SW1 DIP Switches

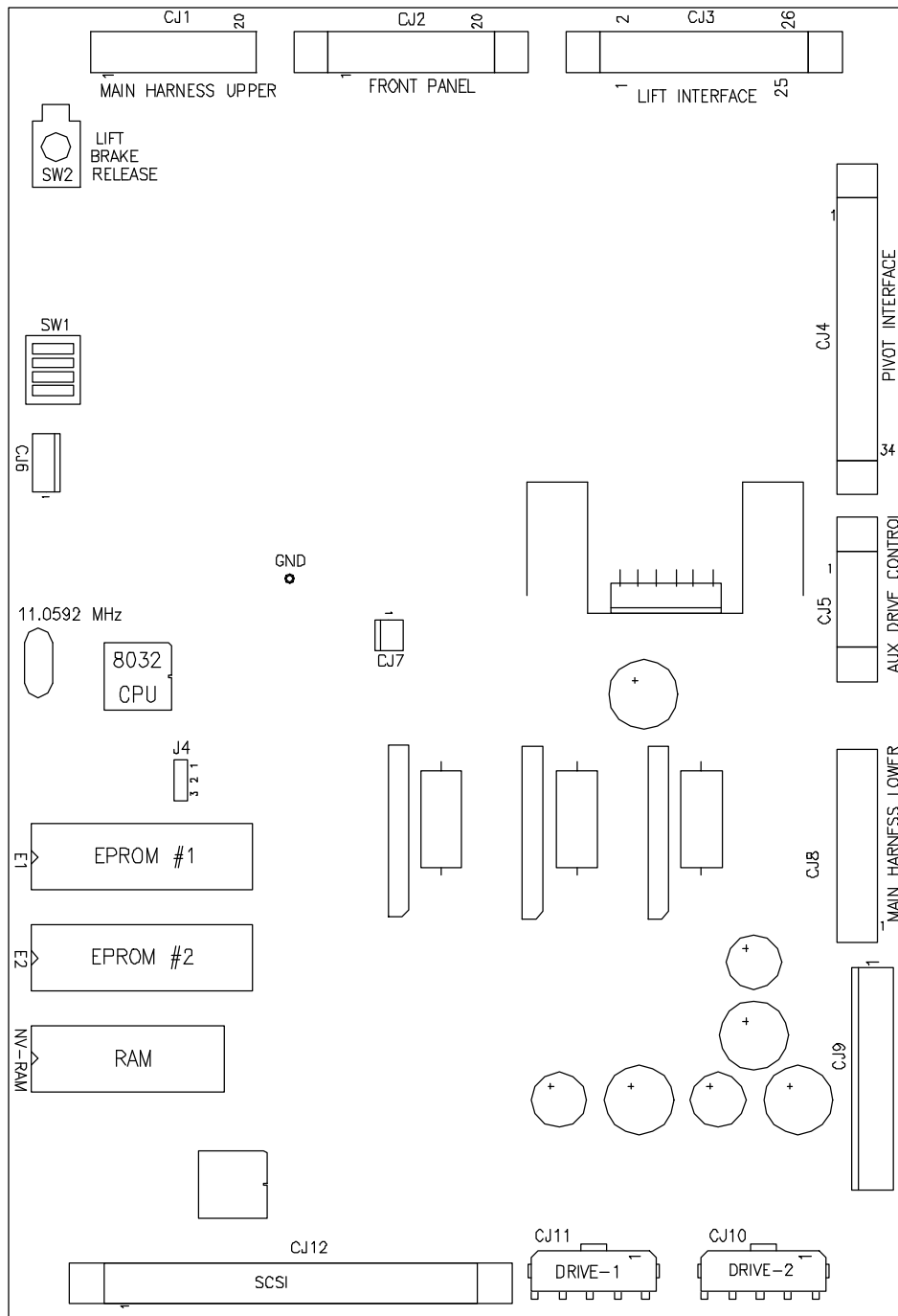
Switch ON	Function	
SW1-1	Maintenance Mode	Places unit in Maintenance Mode if on at power-up. If turned off after power-up with SW1-3 on, Cycle 2-Disk will only move cartridges within the Storage Elements — not to drives. Installed drives are not required for Cycle 2-Disk under this condition.
SW1-2	Cycle Limit	Stops all cycle tests at 2,000 cycles (4,000 cycles for <i>M104</i> , and 6,000 cycles for <i>M156</i> and <i>M258</i>) when in Maintenance Mode (SW1-1 on).
SW1-3	Load Drive Limit	Stops Cycle 2-Disk from loading installed drives after each drive has been loaded 200 times.
SW1-4	Hardware Reset	Same effect as turning Library System off and on again.

Sw 1 Brake Release Switch -- located on Lift PWA and Sw 2 Brake Release Switch -- located on Main Controller PWA

The Brake Release Switch disengages the Lift Motor Brake Armature allowing the Service Engineer to move the MTE by hand.



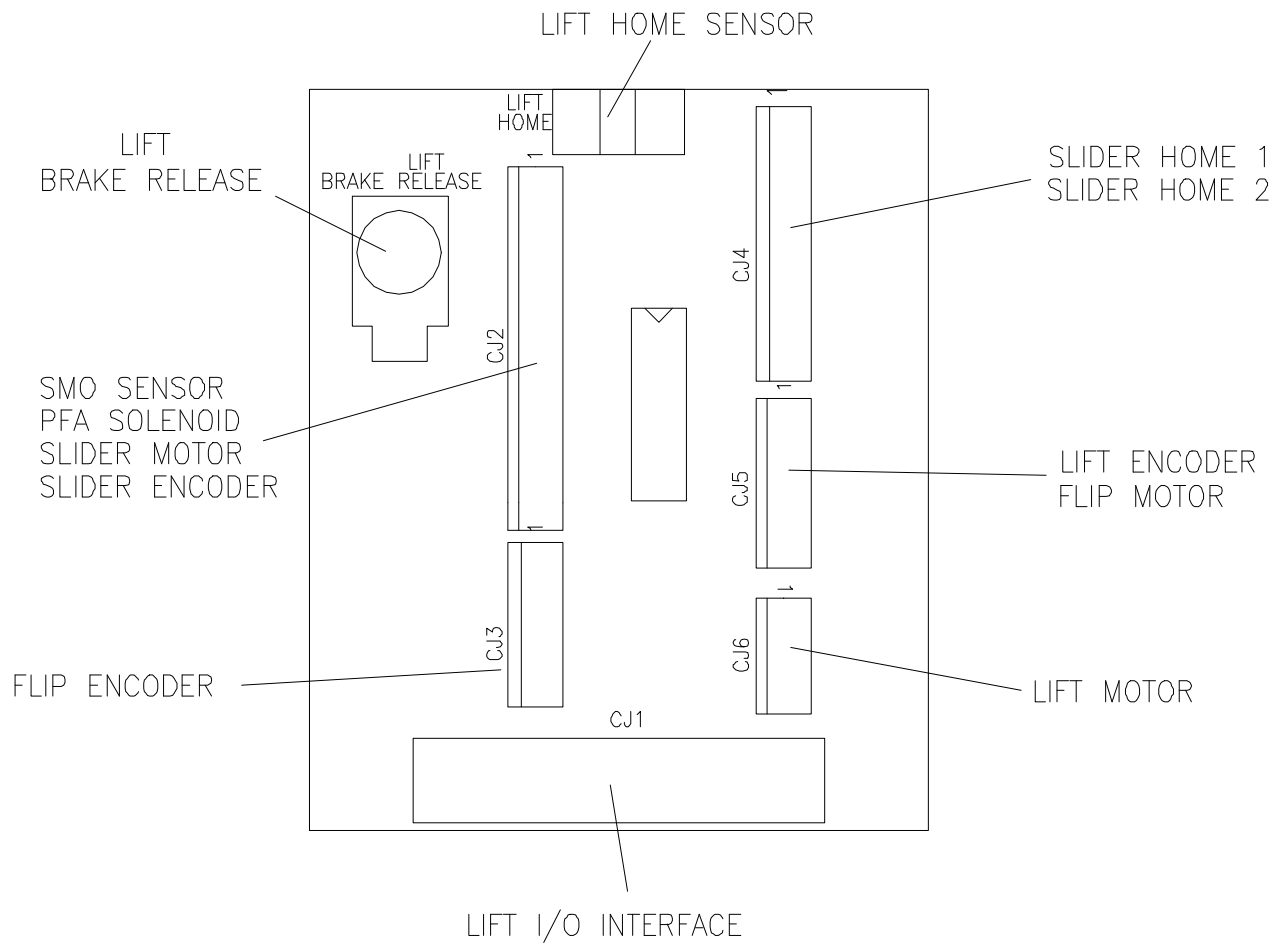
System Block Diagram



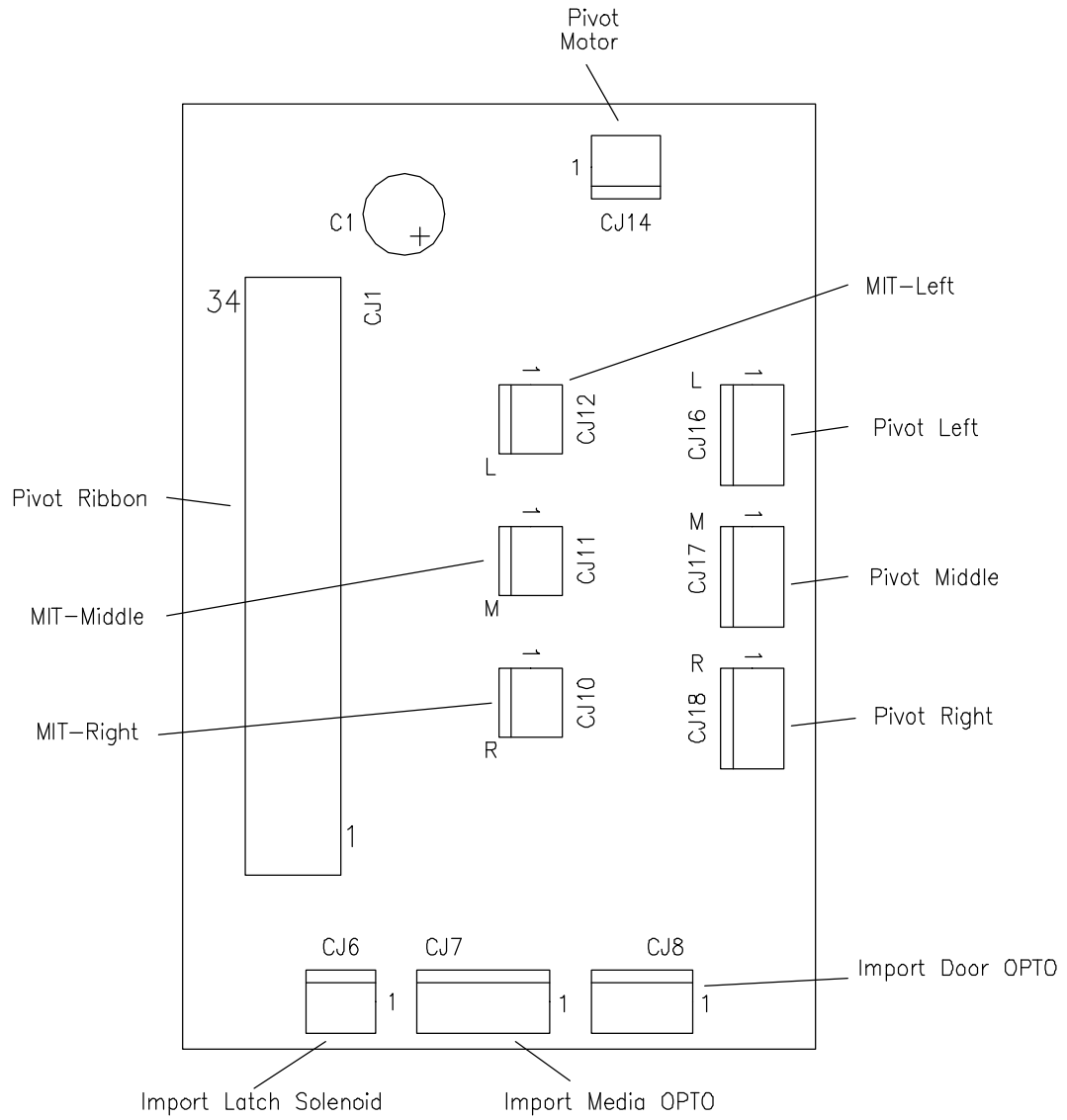
Main Controller PWA Component Layout

Note: The NV-RAM chip contains an internal lithium battery which could explode if incorrectly replaced. Replace only with a qualified replacement chip. Return the old chip to the manufacturer for disposal or dispose of in accordance with local regulations for the disposal of lithium batteries.

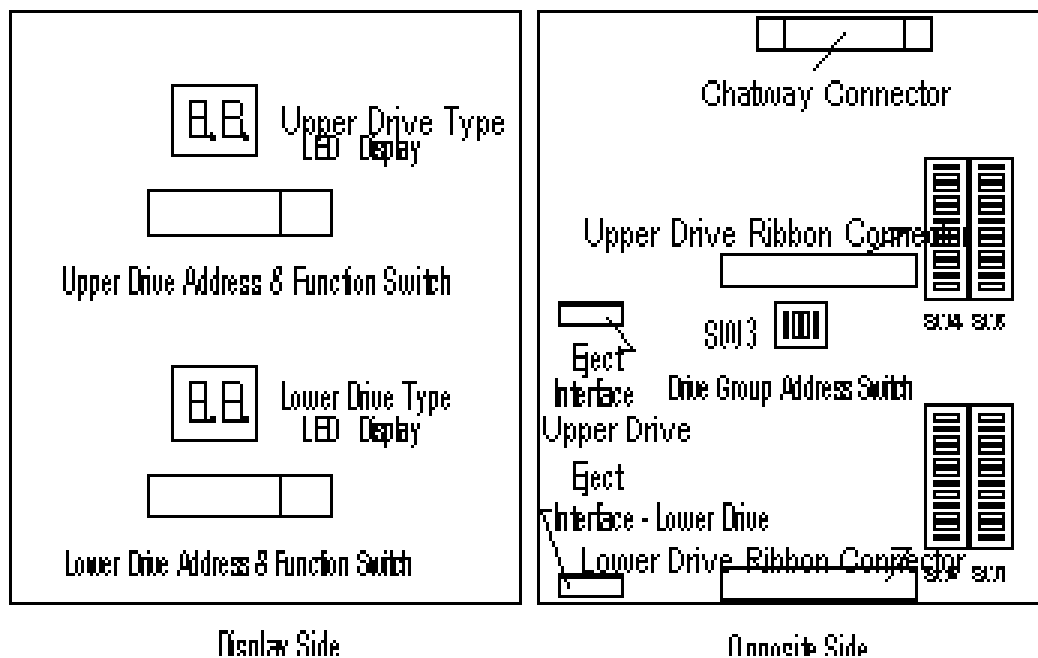
“ATTENTION: IL Y A DANGER D’EXPLOSION S’IL Y A REMPLACEMENT INCORRECT DE LA BATTERIE. REMPLACER UNIQUEMENT AVEC UNE BATTERIE DU MEME TYPE OU D’UN TYPE RECOMMANDE PAR LE CONSTRUCTEUR. METTRE AU REBUT LES BATTERIES USAGEES CONFORMEMENT AUX INSTRUCTIONS DU FABRICANT,”



Lift Interface Adaptor PWA



Upper Sensors Adaptor PWA Component Layout



DTE Interface PWA Component Layout

SW 3 Drive Group Address Switch

Each DTE Interface PWA is capable of handling two optical drives. In an **M156** and **M258** - which can support up to six drives - three DTE Interface Boards are used. The **M104**, however, only uses two DTE Interface Boards. The **M52** uses one DTE Interface Board. The unit must know which group of drives is being supported by each DTE Interface PWA. Thus, the Drive Group Address Switch is required.

The setting of this switch depends on which Media Store's drives are being supported. Set SW 3 as follows:

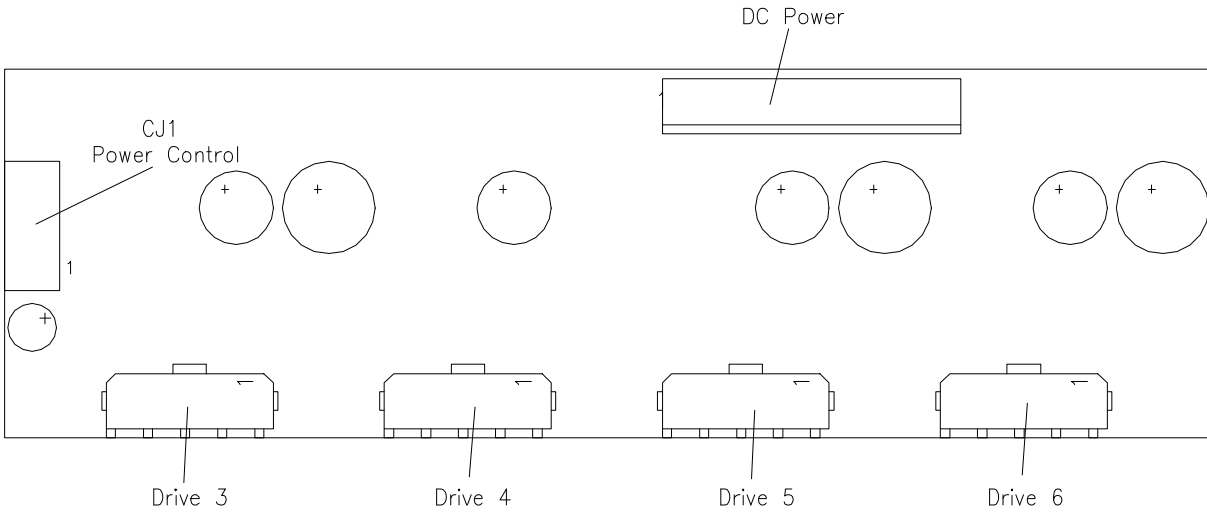
	<u>SW 3-1</u>	<u>SW 3-2</u>	<u>SW 3-3</u>	<u>SW 3-4</u>
Drives 1 and 2	OFF	OFF	OFF	OFF
Drives 3 and 4	ON	OFF	OFF	OFF
Drives 5 and 6	OFF	ON	OFF	OFF

SW 4, SW 5, SW 6 and SW 7 Common or Isolated Switches

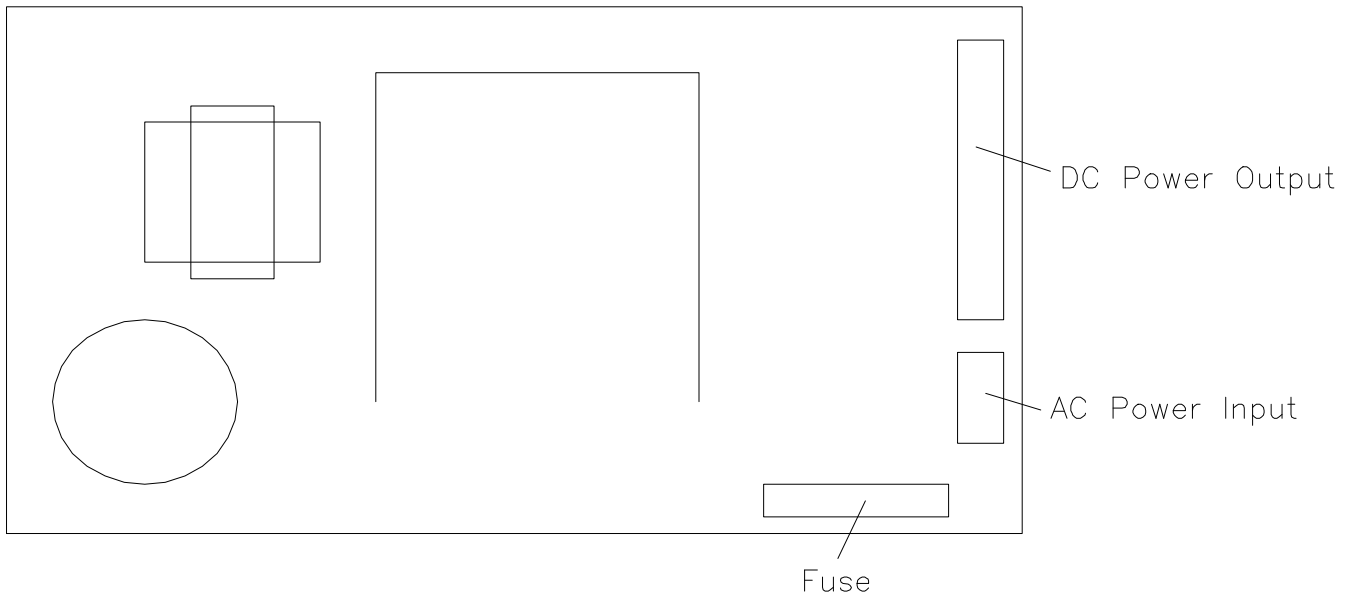
See the publication *Switch Settings for Qualified Optical Disk Drives for Use in the Multi and M-Series Families of Library Systems* - Document No. 303075 - for information on the proper setting of these switches.

Eject Interface Connectors

These connectors are reserved for use with optical drives which have 'jukebox connectors' and which require pulling a line low to cause the drive to eject a cartridge.



Drive Power Switch PWA Component Layout



Power Supply Component Layout

Caution! For continued protection against the risk of fire, replace only with same type and rating of fuse (2A 250VAC).

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