

PLASMON ENTERPRISE D LIBRARY

SCSI REFERENCE MANUAL

PLASMON, INC.

This publication describes the SCSI software interface to Plasmon's Enterprise D library systems. It is intended to provide interfacing information to parties wishing to develop software and/or applications programs for the library system. This document corresponds to Product Revision Level 2.02 or later of the library system firmware.

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Technical Support Information

For technical support, contact ...

United States

Plasmon, Inc.
4425 ArrowsWest Drive
Colorado Springs, CO 80907-3489
Tel: (719) 593-4437
Fax: (719) 593-4192
Email: support@plasmon.com
Internet: www.plasmon.com

European Headquarters:

United Kingdom

Plasmon Data Limited
Whiting Way
Melbourn, Herts. SG8 6EN
Tel: +44(0)1763 262 963
Fax: +44(0)1763 264 444
Email: techsupport@plasmon.co.uk
Internet: www.plasmon.co.uk

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CONTENTS

1.	Introduction.....	1
2.	Glossary of Terms Used.....	2
3.	Library System Operating Modes.....	4
3.1	Normal On-line.....	4
3.2	Library Set Up Mode.....	4
3.3	Library Maintenance Mode.....	4
4.	SCSI Command Overview.....	5
5.	SCSI Buses and Addresses.....	7
6.	Element Addresses and Counts.....	7
7.	SCSI Communication.....	9
7.1	Supported Messages.....	9
7.2	Supported Status Byte Codes.....	9
8.	Recommended Command Timeouts.....	10
9.	Special SCSI States/Conditions.....	10
9.1	Reset State.....	10
9.2	Not Ready State.....	10
9.3	Unit Attention Condition.....	11
10.	SCSI Commands.....	13
10.1	EXCHANGE MEDIUM Command.....	13
10.2	INITIALIZE ELEMENT STATUS Command.....	13
10.3	INITIALIZE ELEMENT STATUS WITH RANGE Command.....	14
10.4	INQUIRY Command.....	14
10.4.1	Supported Vital Product Data Pages Page (00h).....	16
10.4.2	Unit Serial Number Page (80h).....	16
10.4.3	Additional Unit Information Page (C0h).....	17
10.5	LOG SELECT Command.....	17
10.5.1	Unit Statistics Page (30h).....	18
10.5.2	Error Statistics Page (31h).....	18
10.5.3	Error Log Page (32h).....	18
10.5.4	Event History Page (33h).....	19
10.5.5	Micro-Operation Page (34h).....	19
10.5.6	Library Time Page (35h).....	19

10.5.7 Drive Load Counts Page (36h)	20
10.6 LOG SENSE Command.....	21
10.6.1 Supported Log Pages Page (00h).....	21
10.6.2 Unit Statistics Page (30h)	22
10.6.3 Error Statistics Page (31h)	24
10.6.4 Error Log Page (32h)	25
10.6.5 Event History Page (33h).....	28
10.6.6 Micro-Operation Page (34h).....	28
10.6.7 Library Time Page (35h).....	29
10.6.8 Drive Load Counts Page (36h)	29
10.7 MODE SELECT (6) Command.....	30
10.7.1 Library Mode Parameters Page 1 (00h).....	31
10.7.2 Library Mode Parameters Page 2 (20h).....	31
10.7.3 Library Mode Parameters Page 3 (21h).....	32
10.7.4 Drive Assignments Page (22h)	33
10.7.5 Front Panel Display Mode Page (23h).....	34
10.7.6 Magazine Indicator Page (27h).....	35
10.8 MODE SELECT (10) Command.....	35
10.9 MODE SENSE (6) Command	36
10.9.1 Element Address Assignment Page (1Dh).....	37
10.9.2 Transport Geometry Parameters Page (1Eh)	37
10.9.3 Device Capabilities Page (1Fh)	38
10.9.4 Library Mode Parameters Page 1 (00h).....	38
10.9.5 Library Mode Parameters Page 2 (20h).....	39
10.9.6 Library Mode Parameters Page 3 (21h).....	39
10.9.7 Drive Assignments Page (22h)	40
10.9.8 Front Panel Display Mode Page (23h).....	40
10.9.9 Magazine Indicator Page (27h).....	41
10.10 MODE SENSE (10) Command	41
10.11 MOVE MEDIUM Command	42
10.12 OPEN MAGAZINE DOOR Command.....	43
10.13 POSITION TO ELEMENT Command.....	43
10.14 PREVENT/ALLOW MEDIUM REMOVAL Command.....	44
10.15 READ BUFFER Command.....	44

10.15.1	Reading from the Echo Buffer to Test SCSI Communication.....	45
10.15.2	Reading the Medium Changer Device SCSI ID	45
10.15.3	Reading the Network IP Address and Subnet Mask.....	45
10.16	READ ELEMENT STATUS Command	46
10.16.1	Medium Transport Element Descriptor	48
10.16.2	Storage Element Descriptor	48
10.16.3	Import / Export Element Descriptor	49
10.16.4	Data Transfer Element Descriptor	50
10.17	READ MAGAZINE STATUS Command.....	51
10.17.1	Magazine Descriptor.....	52
10.18	RELEASE ELEMENT Command.....	53
10.19	REQUEST SENSE Command.....	53
10.20	RESERVE ELEMENT Command.....	58
10.20.1	Reserve Element Element List Descriptor.....	58
10.21	RESTORE DRIVES Command.....	59
10.22	REZERO UNIT Command.....	59
10.23	SEND DIAGNOSTIC Command	60
10.24	SERVICE DRIVES Command.....	60
10.25	TEST UNIT READY Command	61
10.26	WRITE BUFFER Command	61
10.26.1	Downloading Firmware	61
10.26.2	Writing to the Echo Buffer to Test SCSI Communication	62
10.26.3	Changing the Medium Changer Device SCSI ID	62
10.26.4	Assigning Network IP Address and Subnet Mask.....	63
11.	Event History Type and Event Description	65
12.	Error Codes	68
12.1	Medium Changer Device SCSI Error Codes	68
12.2	Internal Error Codes.....	71
12.3	Internal Error Context Codes.....	72
13.	Developer Notes	74
13.1	Predecessors to the Enterprise D	74
13.2	Identifying the Library and Model.....	74
13.3	Maintaining an Inventory.....	75
13.4	Using the Library (Moving Trays and Disks).....	75

13.5	Exchanging Magazines	75
13.6	Servicing Drives	76
13.7	Examining Errors	76
13.8	Cabinet Temperature and Low Fan Speed Warnings	76
14.	Drive Types.....	77

1. Introduction

Plasmon's Enterprise D robotic library systems are capable of holding a number of DVD drives and disks. The robotic device within each library system is referred to as a medium changer device and it uses the protocols and commands for medium changer devices as defined in the American National Standards Institute SCSI Specification. The Enterprise D library systems' medium changer device and the drives within the library system are all accessed independently.

There are a number of locations or elements within the library system which are capable of holding disks. These consist of the the storage elements, the import/export elements, the medium transport elements, and the data transfer elements. The disks are mounted on and transported via trays.

The storage elements, ST1 - STn, are locations within the library system's media store used to store disks. The first 50 storage elements, ST1 - ST50, are slots within removable magazines. There are five magazines each of which can hold up to 10 disks. Magazines may be inserted or removed by opening the magazine access door using a proper sequence of button presses on the library system front panel. The magazine access door is located behind the front service door. The remaining storage elements, ST51 - STn, are fixed slots within the media store.

The import/export elements, IE1 - IE10, are slots within a sixth removable magazine located below the five storage element magazines. This magazine may be inserted or removed in the same manner as the storage element magazines.

The medium transport elements, MT1 and MT2, are the tray transport mechanisms used to remove disks from or return disks to the the storage elements, or the data transfer elements (the drives). The medium transport elements are also referred to as the pickers.

The data transfer elements, DT1 - DTn, are the library system's drives.

The medium changer device within the library system responds to commands as defined by and in accordance with the ANSI X3.301-1997 standard - SCSI-3 Primary Commands (SPC), and the ANSI NCITS 314-1998 standard - SCSI-3 Medium Changer Commands (SMC). The commands are sent to the medium changer device by a logical protocol and physical interconnect in accordance with the ANSI SCSI-3 Architecture Model (SAM) standard. The currently supported logical protocol is the SCSI-3 Interlocked Protocol (SIP). The currently supported physical interconnect is the SCSI-3 Parallel Interface, version 2 (SPI-2).

Each command is structured in the form of a Command Descriptor Block (CDB). Some commands require an list of parameters to be sent along with the command in the form of a separate outgoing block of data. Other commands return a block of information from processing the command into a buffer in the host application software. The contents of this buffer may be interpreted by the application at the completion of the command and acted upon accordingly. This document does not specify how this information is to be used by the application.

This document describes the SCSI commands (CDB's) for the library system's medium changer device. Refer to the corresponding drive reference manual for information on SCSI commands for the library system's drives. SCSI reference manuals for the library system's drives may be obtaining by contacting Plasmon Technical Support.

The aforementioned SCSI standards may be obtained by contacting ANSI at the following address.

American National Standards Institute, Inc.
11 West 42nd Street, New York, NY 10036
+1-212-642-4900
Internet: www.ansi.com

2. Glossary of Terms Used

A number of terms are used throughout this document. Some of these terms are defined here.

ASC/ASCQ: Additional Sense Code/ Additional Sense Code Qualifier. Bytes 12 and 13 of the Sense Data block returned by the Request Sense command in response to a CHECK CONDITION from a target device. These bytes, along with the Sense Key in byte 2, indicate the type of error sensed.

CD: Compact Disc. A 120 mm disk physically defined by the Red Book standard for storing audio and data.

CD-R: CD-Recordable. A CD which can be recorded on the desktop rather than mass-reproduced.

CD-ROM: A CD used to store data formatted according to the ISO 9660 standard.

CD-RW: A drive which can read, write, and rewrite data.

CDB: Command Descriptor Block. The structure used to communicate commands from a SCSI initiator device to a SCSI target device.

Data Transfer Elements (DT's): The drives within the library system.

Drive Service: Unloading a drive, turning the drive off (removing drive power), and disconnecting the drive from the internal SCSI bus to allow an operator to remove or replace the drive.

Drive Type: A numeric classification of the type of library drive installed. This value is encoded in jumpers on the drive interface board associated with the drive.

DVD: Digital Video Disc or Digital Versatile Disc.

DVD-R: DVD-Recordable. The high-density replacement for CD-R.

DVD-RAM: A rewritable disk based phase change technology.

DVD-ROM: The high-density replacement for CD-ROM.

DVD+RW: The high-density replacement for CD-RW.

Element: An addressable location within the library system. The library system contains four types of elements: medium transport elements (MT's), storage elements (ST's), import/export elements (IE's), and data transfer elements (DT's). **Event History List:** A list of code bytes associated with events occurring within the library system or communication occurring between a host and the library system. The particular bytes logged depend upon the value of the event history type. This list is used only for error analysis and debugging.

Event History Type: A byte defining the type of bytes logged in the event history list.

Export: Moving a full tray to an import/export element so that the operator may remove a disk from the library system.

Flash: A nonvolatile, electrically erasable area of memory used to store microcode for the library system.

Flipping Station: A mechanism to change between side-A and side-B for double sided media.

Front Service Door: The door on the front of the library system through which the library on/off switch may be accessed, the magazine access door may be accessed, library drives may be inserted or removed, and the library's printed circuit boards and cables may be accessed.

Hot Swap: To replace a power supply while the library system remains on-line.

Import: Moving an empty tray to an import/export element so that the operator may introduce a disk into the library system.

Import/Export Elements (IE's): Slots within the import/export magazine which may be used to add disks to or remove disks from the library system.

LSB: Least significant bit.

Lift: The tray transport assembly particularly when moving vertically.

Load: Moving a disk into a drive and clamping the disk in the drive.

Magazine: An operator-accessible carrier containing up to ten disks.

Magazine Access Door: The door on the library system through which magazines are inserted or removed.

Magazine Exchange: Placing the library system (either through the front panel or via the SCSI bus) in a state in which magazines may be inserted, replaced, or removed. The inserted or replaced magazines are automatically scanned for the presence of media when the magazine access door is closed.

Medium Transport Elements (MT's): The tray transport mechanisms in the library system. The library system contains two medium transport elements. They are also referred to as the pickers.

Medium Transport Assembly (MTA): An assembly of medium transport elements within a single housing.

Micro-Operation List: A list of operations performed by the library system for a single tray movement command.

MSB: Most significant bit.

Picker: A medium transport element particularly when pulling or pushing a tray.

Pivot: The portion of the library system responsible for rotating the medium transport assembly between columns of slots or drives.

Printed Wire Assembly (PWA): A populated library system circuit board.

Rear Service Door: The door on the rear of the library system through which maintenance service may be performed.

SCSI: Small Computer System Interface. An ANSI specification defining the transfer of commands and data between two devices such as a host computer and a computer peripheral. The third version of this specification is known as SCSI-3.

SCSI ID: A unique address for each device on an SCSI bus. The the medium changer device must each have an SCSI ID between 0 and 15, inclusive. The drives must each have an SCSI ID between 0 and 7.

SCSI Initiator: An SCSI device, such as a host computer, that issues SCSI commands.

SCSI Target: An SCSI device that performs an operation requested by an initiator. The library system contains several SCSI targets: an SCSI medium changer device, and one or more SCSI multimedia storage devices (the drives).

Storage Elements (ST's): Locations within the library system's medium store used to store disks. Some locations are within removable magazines.

Tray: A carrier for disks.

Unload: Unclamping a disk from a drive and moving the disk from the drive.

3. Library System Operating Modes

The library system can operate in one of three modes: on-line, library set up, and library maintenance.

3.1 Normal On-line

This is the normal operating mode of the library system. Element statuses are displayed on the front panel of the library system. A menu may be selected for exchanging magazines, displaying library status values, turning drives on or off, servicing and restoring drives, and entering one of the other two operating modes of the library.

3.2 Library Set Up Mode

This mode may only be invoked from the front panel. It takes the medium changer device completely off-line (the drives remain on-line). For more information refer to the Enterprise D User's Guide and Service Manuals.

3.3 Library Maintenance Mode

This mode may only be invoked from the front panel. It takes the medium changer device completely off-line. For more information refer to the Enterprise D User's Guide and Service Manuals.

4. SCSI Command Overview

The following is a brief description of each of the SCSI commands supported.

The **Inquiry** command requests medium changer device parameters be sent to the SCSI initiator device.

The **Mode Select (6)** and **Mode Select (10)** commands provide a means of selecting medium changer device parameters.

The **Mode Sense (6)** and **Mode Sense (10)** commands provide a means for reporting medium changer device parameters to the initiator.

The **Send Diagnostic** command provides a means for performing diagnostic tests on the medium changer device.

The **Rezero Unit** command is used to 'reset' the medium changer device.

The **Test Unit Ready** and **Request Sense** commands are necessary to interface the medium changer device.

The **Reserve Element** and **Release Element** commands are used to reserve the medium changer device or elements within it for multiple initiator applications. Many implementations will not require these commands.

The **Position to Element** command instructs the medium changer device to position one of the two medium transport elements (MT's) in front of an element in preparation for a move from the element. Use of this command is not required.

The **Move Medium** command instructs the medium changer device to move a disk from a source element to a destination element (e.g.: move a disk from the first slot of magazine 1 to drive 1). The Invert bit may be specified to flip the disk prior to depositing it into the destination element.

The **Exchange Medium** command instructs the medium changer device to exchange a disk in a source element with a disk in a destination element and place that disk in another destination element. Invert bits may also be specified.

The **Prevent/Allow Medium Removal** command instructs the medium changer device to either inhibit or permit opening of the magazine access door for magazine insertion or removal.

The **Open Magazine Door** command instructs the medium changer device to open the magazine access door for magazine insertion or removal.

The **Initialize Element Status** command causes the medium changer device to test all elements for the presence of trays and disks.

The **Initialize Element Status with Range** command causes the medium changer device to test a subset of elements for the presence of trays and disks.

The **Read Element Status** command is used to determine status of elements (e.g.: make a directory of trays and disks in the library system).

The **Read Magazine Status** command is used to determine the status of one or more magazines.

The **Service Drives** command prepares one or more drives for removal or replacement by electrically disconnecting the internal SCSI bus to which they are attached.

The **Restore Drives** command restores one or more drives to operation after servicing by electrically reconnecting the internal SCSI bus to which they were attached.

The **Log Sense** command provides a means for reporting medium changer device statistical and error log information.

The **Log Select** command provides a means of clearing certain unit statistics, error statistics, and error log information, and setting the library system date and time.

The **Write Buffer** command is used to write new firmware to the library system or to change certain parameters within the library system.

The **Read Buffer** command is used to read certain parameters from the library system..

5. SCSI Buses and Addresses

The SCSI buses and default SCSI ID's for the library system bus configurations are as follows.

SCSI Buses and Default SCSI ID's

Device	Bus Configuration 1		Bus Configuration 2		Bus Configuration 3		Bus Configuration 4		Bus Configuration 5		Bus Configuration 6	
	SCSI Bus	SCSI ID	SCSI Bus	SCSI ID	SCSI Bus	SCSI ID	SCSI Bus	SCSI ID	SCSI Bus	SCSI ID	SCSI Bus	SCSI ID
Library Drive 1	1	0	1	0	1	0	1	0	1	0	1	0
Library Drive 2	1	1	1	1	1	1	1	1	1	1	1	1
Library Drive 3	1	2	2	0	1	2	1	2	1	2	1	2
Library Drive 4	1	3	2	1	1	3	1	3	1	3	1	3
Library Drive 5					2	0	2	0	2	0	2	0
Library Drive 6					2	1	2	1	2	1	2	1
Library Drive 7							2	2	3	0	2	2
Library Drive 8							2	3	3	1	2	3
Library Drive 9									3	2	3	0
Library Drive 10									3	3	3	1
Library Drive 11											3	2
Library Drive 12											3	3
Medium Changer Device	1	6	1	6	1	6	1	6	1	6	1	6

6. Element Addresses and Counts

The following element addressing scheme has been implemented for the library system.

Element Addresses

Element Type	Element Addresses
Medium Transport, MT	8001, 8002
Storage, ST	1 - n*
Import/Export, IE	4001 - 4010
Data Transfer, DT	6001 - 6012

*See next page.

The following table lists the supported models and corresponding element counts.

Element Counts

Model	Number of Medium Transport Elements	Number of Storage Elements*	Number of Import/Export Elements	Number of Data Transfer Elements
D550	2	550	10	2 - 12
D875	2	875	10	2 - 12
D1525	2	1525	10	2 - 12
D2175	2	2175	10	2 - 12

* Data transfer elements (drives) may replace storage elements (slots) in quantities of 2 drives per 25 slots. The maximum number of storage elements per model will always be returned, but if more than 2 drives are installed, not all slots will be unavailable – since they have been replaced by drives. For these unavailable storage elements, the Read Element Status command will return element descriptors with the Access bit set to 0 (zero).

7. SCSI Communication

7.1 Supported Messages

In the course of communication between a SCSI initiator device, such as a host computer, and a SCSI target device, such as the library system medium changer device, messages are sent as part of protocol services. This includes both task and link management messages. The following messages are accepted by and/or sent by the medium changer device. The direction field indicates the direction of message transfer. The MESSAGE REJECT message is sent for all unaccepted messages.

Message Codes

Code	Message Name	Direction
06h	ABORT TASK SET (was ABORT in SCSI-2)	Out
0Ch	TARGET RESET (was BUS DEVICE RESET in SCSI-2)	Out
00h	TASK COMPLETE (was COMMAND COMPLETE in SCSI-2)	In
04h	DISCONNECT	In/Out
01h	Extended messages – SYNCHRONOUS DATA TRANSFER (01h) REQUEST and WIDE DATA TRANSFER REQUEST (03h)	In/Out
80h+	IDENTIFY	In/Out
05h	INITIATOR DETECTED ERROR	Out
09h	MESSAGE PARITY ERROR	Out
07h	MESSAGE REJECT	In/Out
08h	NO OPERATION	Out
02h	SAVE DATA POINTER	In
Key: In = Target (medium changer device) to Initiator, Out = Initiator to Target (medium changer device) 80h+ = Codes 80h through FFh are used for IDENTIFY messages		

7.2 Supported Status Byte Codes

A status byte code is sent from the medium changer device to the initiator at the termination of each command. The supported status byte code values are listed below.

Status Byte Codes

Status Byte Code	Status
0h	GOOD
2h	CHECK CONDITION
8h	BUSY
18h	RESERVATION CONFLICT
All other codes	Not Returned

GOOD. The medium changer device has successfully completed the command.

CHECK CONDITION. Any error, exception, or abnormal condition resulting in sense data being set causes a CHECK CONDITION status. A Request Sense command should be issued following a CHECK CONDITION status to determine the nature of the condition.

BUSY. The medium changer device is busy and cannot accept a command.

RESERVATION CONFLICT. A command has been sent by an initiator to the medium changer device when it is already reserved by another initiator.

8. Recommended Command Timeouts

The following values are the recommended timeout values for host software to use when issuing commands the medium changer device. The actual command execution times depend upon the various mode settings in effect (see Section 10.7.1), the type of drives used, concurrent front panel operations, and the number of retries performed to successfully complete a command.

Suggested Timeout Values

SCSI Command	Timeout
Inquiry, Mode Sense, Prevent/Allow Medium Removal, Request Sense, Reserve Element, Release Element, Test Unit Ready, Log Select, Log Sense, Write Buffer (mode 2), Read Buffer	10 sec
Mode Select,* Open Magazine Door*, Read Element Status*, Read Magazine Status*, Service Drives*, Restore Drives*	2 min
Send Diagnostic (without RecalOffs bit set), Position to Element, Move Medium, Exchange Medium, Rezero Unit, Initialize Single Element, Write Buffer (mode 7)	5 min
Send Diagnostic with RecalOffs bit set	10 min
Initialize Element Status	5 min times number of library columns

* Set to 5 mins for multiple initiator installations.

9. Special SCSI States/Conditions

9.1 Reset State

When the RST signal is asserted or a TARGET RESET message is received from the host, the medium changer device within the library system enters the RESET state. As a result, the following events will take place.

- All SCSI bus signals (except RST) will be released.
- All I/O processes (commands) will be terminated. The library system will be restored to the state it was in before the reset occurred.
- All device reservations will be released.
- All operating (Mode Select) modes will be restored to default or saved values.

The library system will be reset to the Allow Medium Removal state (see Prevent/Allow Medium Removal command).

- A Unit Attention condition will be generated.

Note that the medium changer device will itself never assert the RST signal.

9.2 Not Ready State

The medium changer device returns CHECK CONDITION status in response to Test Unit Ready command, or any tray movement commands, when it is in a state in which it is unable to process such commands. A subsequent Request Sense command issued to the medium changer device yields return

data containing a Sense Key of 2h - Not Ready. The device will remain in such a state for a specified period of time or until an action by an operator takes place.

The events triggering Not Ready state in the library system are as follows.

- Upon power-up. The medium changer device will be Not Ready while drive power is being restored and the library system is initializing.
- While the rear service door is opened. The medium changer device will be Not Ready until the door is closed (A Unit Attention condition will be generated when the door is closed).

Initiating a magazine exchange either by selecting 'Exchange Magazines' via the front panel menus or by issuing the Open Magazine Door command. The medium changer device is Not Ready until the magazine access door is closed again and newly inserted magazines have been scanned for trays and media.

- Selecting 'Service Drives' via the front panel menus. The medium changer device will be Not Ready for 5 seconds after this option is selected to allow time for SCSI initiator devices to poll the changer device, sense the Not Ready state, and stop SCSI activity to drives on the selected bus.
- If all drives are turned off and placed in a service state because of a cabinet over-temperature or fan underspeed condition. After an appropriate delay to allow the drives to be unloaded, the medium changer device will be Not Ready for 5 seconds before the drives are turned off and electrically disconnected from their SCSI buses.
- Selecting 'Turn Drive Off' via the front panel menus. The medium changer device will be Not Ready for 5 seconds after this option is selected to allow time for SCSI initiator devices to poll the changer device, sense the Not Ready state, and stop SCSI activity to the drive being turned off.

9.3 Unit Attention Condition

The medium changer device returns CHECK CONDITION status in response to SCSI commands other than Inquiry when one or more conditions indicating a change in state of the library system has occurred. A subsequent Request Sense command issued to the medium changer device yields return data containing a Sense Key of 6h — Unit Attention. This does not indicate a problem with the particular command that was issued but rather a normal or abnormal change in the state of the library system. This change may signal a failure or require that a different sequence of commands be issued to the changer device. For instance, after a magazine door closure, a Read Magazine Status command may be required to determine which magazines were changed and a sequence of Move Medium commands may be required to move all disks in changed magazines to drives in order to read them. In some cases, no action is required at all, other than reissuing the original command.

The events triggering Unit Attention condition in the library system are as follows.

- The initial application of power to the library system or a bus or device reset.
- The closure of the magazine access door after the insertion, removal, or exchange of magazines.
- The start or end of drive service via the front panel 'Service Drives' or 'Restore Drives' selections, or a Service Drives or Restore Drives command from a host.
- A change to one or more of the library system settings via the front panel 'Set Up Library', 'Turn Drive Off', or 'Turn Drive On' selections, or a Mode Select command from a host.
- A change to one or more of the log values via the front panel 'Set Up Library' selection or a Log Select command from a host.
- Closing the rear service door signalling a transition from a Not Ready to a Ready state. The host software should do a reinventory of the library because of possible tampering by the operator.

- The removal or insertion of a library power supply.
- A change in the library system Flash microcode via a Write Buffer command.

When a Unit Attention condition occurs as a result of an SCSI command issued by an initiator, it is only reported to other initiators on the same SCSI bus and not to the initiator which issued the command.

10. SCSI Commands

10.1 EXCHANGE MEDIUM Command

The **Exchange Medium** command instructs the medium changer device to exchange a tray (usually full) in the source element with a tray (usually full) in the first destination element, and place that tray in an empty second destination element. Using this command instead of Move Medium can significantly decrease disk swap times.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (A6h)							
1	Reserved (00h)							
2 - 3	(MSB)	Medium Transport Address						(LSB)
4 - 5	(MSB)	Source Address						(LSB)
6 - 7	(MSB)	First Destination Address						(LSB)
8 - 9	(MSB)	Second Destination Address						(LSB)
10	Reserved (0)						Inv2	Inv1
11	Reserved (00h)							

The tray in the source element is moved to the first destination element and the tray which previously occupied the first destination element is moved to the second destination element. The second destination element may be the same as the source element, unless the source element is a picker. In this case, however, the opposite picker may be used as the second destination element.

Note that if the source and first destination elements contain full trays, the second destination element may contain an empty tray. In this case, the exchange takes place and the empty tray is moved to the source element.

Medium Transport Address specifies the medium transport element. A value of zero should be used. This will allow the disks to be exchanged in the most efficient manner possible.

Source Address specifies the source element.

First Destination Address and **Second Destination Address** specify the two destination elements. The first is the destination of the tray originally in the Source Address. The second is the destination of the tray originally in the First Destination Address.

Inv1 and **Inv2** specify the medium should be inverted (“flipped”) prior to being deposited in First Destination Address and Second Destination Address, respectively.

10.2 INITIALIZE ELEMENT STATUS Command

The **Initialize Element Status** command is used to cause the medium changer device to test all elements for the presence of media. This can be a very time-consuming process. The status of each element can then be read using the Read Element Status command.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (07h)							
1 - 5	Reserved (00h)							

The status of elements will not be checked if both medium transport elements are full. Also, the status of the drives will not be checked if the DsabLoEj bit in the Mode Select command is set. Note that newly exchanged magazines are automatically scanned for the presence of trays and media upon magazine access door closure apart from this command.

10.3 INITIALIZE ELEMENT STATUS WITH RANGE Command

The **Initialize Element Status with Range** command is used to cause the medium changer device to test a subset of elements for the presence of media. The status of the element can then be read using the Read Element Status command.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (E7h)							
1	Reserved (0)							Range
2 - 3	(MSB)			Starting Element Address				(LSB)
4 - 5	Reserved (00h)							
6 - 7	(MSB)			Number of Elements				(LSB)
8 - 9	Reserved (00h)							

Range equals 1 if a subset of all elements (as specified by Starting Element Address and Number of Elements) is to be checked for trays and disks, or 0 (zero) if all elements are to be checked.

Starting Element Address specifies the minimum element address to check. This field is only effective if the Range bit is set.

Number of Elements specifies the number of elements to check. This field is only effective if the Range bit is set.

See the conditions for checking elements in the description of the Initialize Element Status command.

10.4 INQUIRY Command

The **Inquiry** command is issued by the initiator to request medium changer device information.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (12h)							
1	Reserved (0)							EVPD
2	Page Code							
3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

EVPD (Enable Vital Product Data) equals 1 if the vital product data page as specified by the Page Code field is to be returned or zero if standard Inquiry data is to be returned.

Page Code defines the parameter page for vital product to be returned. A value of 00h, 80h, or C0h must be used. These pages are described following the standard Inquiry data format.

Allocation Length specifies how many bytes of data are to be returned.

The following page details the standard Inquiry Data Format for an Allocation Length of 46.

Standard INQUIRY Data Format

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)				
1	RMB (1)	Device-Type Qualifier (0)						
2	ISO Version (0)		ECMA Version (0)			ANSI-Approved Version (3)		
3	AERC (0)	Reserved (0)			Response Data Format (2)			
4	Additional Length (29h)							
5	Reserved (00h)							
6	Reserved (0)							Addr16 (1)
7	RelAdr (0)	Rsvd (0)	Wbus16 (1)	Sync (1)	Linked (0)	Rsvd (0)	CmdQue(0)	Rsvd (0)
8 - 15	Vendor Identification ("PLASMON ")							
16 - 31	Product Identification (see table below)							
32 - 35	Product Revision Level (e.g., "200 ")							
36 - 43	Firmware Release Date ("MM/DD/YY")							
44	Reserved (00h)							
45	Model Identification (see table below)							

Peripheral Qualifier equals zero indicating connection to a logical unit, or 3h indicating an invalid Logical Unit Number.

Peripheral Device Type equals 08h indicating a medium changer device, or 1Fh indicating an invalid Logical Unit Number.

RMB (Removable Media Bit) equals 1 indicating medium is removable.

ANSI-Approved Version equals 3 indicating compliance with SCSI-3 standard.

AERC (Asynchronous Event Reporting Capability) equals 0 indicating no support of this feature.

Response Data Format equals 2 indicating compliance with SCSI-3 standard.

Additional Length equals 28h.

Addr16 (Address - 16 bits) equals 1 indicating support of 16-bit SCSI addresses.

RelAdr (Relative Address) equals zero indicating no support of this feature.

WBus16 (Wide Bus - 16 bit) equals 1 indicating support of this feature.

Sync (Synchronous Data Transfers) equals 1 indicating support of this feature.

Linked (Linked Commands) equals 0 (zero) indicating no support of this feature.

CmdQue (Command Queuing) equals 0 (zero) indicating no support of this feature.

Vendor Identification is "PLASMON ".

Product Identification and **Model Identification** are set according to the tables below.

Product Revision Level starts with "200 " (2.00).

Model	Product Identification	Model Identification
unknown	"D-SERIES D???? "	0
D550	"D-SERIES D550 "	9
D875	"D-SERIES D875 "	10
D1525	"D-SERIES D1525 "	11
D2175	"D-SERIES D2175 "	12

10.4.1 Supported Vital Product Data Pages Page (00h)

The Supported Vital Product Data Pages Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)				
1	Page Code (00h)							
2	Reserved (00h)							
3	Page Length (03h)							
4	1st Supported Page (00h)							
5	2nd Supported Page (80h)							
6	3rd Supported Page (C0h)							

10.4.2 Unit Serial Number Page (80h)

The Unit Serial Number Page is as follows.

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)					
1	Page Code (80h)								
2	Reserved (00h)								
3	Page Length (10h)								
4 - 19	(MSB)			Product Serial Number					(LSB)

Product Serial Number is a sixteen character ASCII representation of the library system's factory serial number. The least significant digit is in byte 19. ASCII spaces (20h) will be prepended to the serial number in order to fill the field.

Peripheral Qualifier and Peripheral Device Type are as in the Standard Inquiry Data Format.

10.4.3 Additional Unit Information Page (C0h)

The Additional Unit Information Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)				
1	Page Code (C0h)							
2	Reserved (00h)							
3	Page Length (24h)							
4	Maximum Number of Magazines							
5	Maximum Number of Drives							
6 - 7	Reserved (00h)							
8 - 17	Firmware Part Number ("XXXXXXXXXX")							
18 - 19	Firmware Checksum							
20	Firmware Development Level							
21	Hardware Development Level							
22 - 39	Reserved (00h)							

Maximum Number of Magazines equals the maximum number of ten-slot magazines supported.

Maximum Number of Drives equals the maximum number of drives supported.

Firmware Part Number is the ten digit part number of the library system firmware.

Firmware Checksum is the checksum of the library system firmware.

Firmware Development Level equals one of the following.

Alpha	0
Beta	1
Release	2

Hardware Development Level equals one of the following.

Prototype	0
Pre-Production	1
Production	2

10.5 LOG SELECT Command

The **Log Select** command provides a means of clearing certain unit statistics, error statistics, and error log information, and setting the library system date and time.

Bit Byte	7	6	5	4	3	2	1	0	
0	Operation Code (4Ch)								
1	Reserved (0)					PCR (0)	SP (1)		
2	PC (1)		Reserved (0)						
3 - 6	Reserved (00h)								
7 - 8	(MSB)			Parameter List Length				(LSB)	
9	Reserved (00h)								

PCR (Parameter Code Reset) equals 0 (zero) indicating that not all log parameters are to be reset. Certain parameters, such as the total power-on hours count and library cycle count, cannot be reset.

SP (Save Parameters) equals 1 indicating that all parameter value changes are to be saved in non-volatile memory.

PC (Page Control) equals 1 indicating that current cumulative values are to be affected.

Parameter List Length specifies the length in bytes of the Log Select parameters list.

The Log Select parameter list consists of one or more of the following supported pages.

10.5.1 Unit Statistics Page (30h)

The Log Select Unit Statistics Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (30h)					
1	Reserved (00h)							
2-3	(MSB) _____		Page Length (00h)				_____ (LSB)	

This page is retained for compatibility with previous D-Series libraries. See also the Log Select Drive Load Counts Page in Section 10.5.7.

10.5.2 Error Statistics Page (31h)

The Log Select Error Statistics Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (31h)					
1	Reserved (00h)							
2-3	(MSB) _____		Page Length (00h)				_____ (LSB)	

Sending this page will clear all library error statistics information.

10.5.3 Error Log Page (32h)

The Log Select Error Log Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (32h)					
1	Reserved (00h)							
2-3	(MSB) _____		Page Length (00h)				_____ (LSB)	

Sending this page will clear all library error log information.

10.5.4 Event History Page (33h)

The Log Select Event History Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (33h)					
1	Reserved (00h)							
2-3	(MSB) _____		Page Length (04h)				_____ (LSB)	
4-5	(MSB) _____		Number of Events Recorded (00h)				_____ (LSB)	
6-7	Reserved (00h)							

Sending this page will clear all event history information.

10.5.5 Micro-Operation Page (34h)

The Log Select Micro-Operation Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (34h)					
1	Reserved (00h)							
2-3	(MSB) _____		Page Length (01h)				_____ (LSB)	
4	Number of Micro-Operations Recorded (00h)							

Sending this page will clear all micro operation information.

10.5.6 Library Time Page (35h)

The Log Select Library Time Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (35h)					
1	Reserved (00h)							
2-3	(MSB) _____		Page Length (08h)				_____ (LSB)	
4	Current Library Time - Seconds (0 - 59)							
5	Current Library Time - Minutes (0 - 59)							
6	Current Library Time - Hour (0 - 23)							
7	Reserved (ignored)							
8	Current Library Time - Day (1 - 31)							
9	Current Library Time - Month (1 - 12)							
10	Current Library Time - Year (1 for 2001, 2 for 2002, ...)							
11	Reserved (00h)							

Current Library Time is the current time as maintained by the library system. Sending this page sets the library system time clock.

10.5.7 Drive Load Counts Page (36h)

The Log Select Drive Load Counts Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved (0)		Page Code (36h)						
1	Reserved (00h)								
2 - 3	(MSB) _____		Page Length (24h)						(LSB)
4 - 6	(MSB) _____		Drive 1 Load Count						(LSB)
7 - 9	(MSB) _____		Drive 2 Load Count						(LSB)
10 - 12	(MSB) _____		Drive 3 Load Count						(LSB)
13 - 15	(MSB) _____		Drive 4 Load Count						(LSB)
16 - 18	(MSB) _____		Drive 5 Load Count						(LSB)
19 - 21	(MSB) _____		Drive 6 Load Count						(LSB)
22 - 24	(MSB) _____		Drive 7 Load Count						(LSB)
25 - 27	(MSB) _____		Drive 8 Load Count						(LSB)
28 - 30	(MSB) _____		Drive 9 Load Count						(LSB)
31 - 33	(MSB) _____		Drive 10 Load Count						(LSB)
34 - 36	(MSB) _____		Drive 11 Load Count						(LSB)
37 - 39	(MSB) _____		Drive 12 Load Count						(LSB)

If any of the **Drive 1-12 Load Count** fields is equal to zero, the load count of the corresponding drive will be set to zero.

10.6 LOG SENSE Command

The **Log Sense** command provides a means for reporting medium changer device statistical and error log information.

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Operation Code (4Dh)								
1	Reserved (00h)								
2	PC (1)		Page Code						
3-6	Reserved (00h)								
7-8	(MSB)				Allocation Length				(LSB)
9	Reserved (00h)								

PC (Page Control) equals 1 indicating that current cumulative values are to be returned.

Page Code defines the parameter page to be returned. A value of 00h, 30h, 31h, 32h, 33h, 34h, 35h, or 36h must be used. The corresponding page as described below is returned.

Allocation Length specifies how many bytes of data are to be returned.

10.6.1 Supported Log Pages Page (00h)

The Log Sense Supported Log Pages Page is as follows.

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Reserved (0)		Page Code (00h)						
1	Reserved (00h)								
2-3	(MSB)				Page Length (08h)				(LSB)
4	1st Supported Page (00h)								
5	2nd Supported Page (30h)								
6	3rd Supported Page (31h)								
7	4th Supported Page (32h)								
8	5th Supported Page (33h)								
9	6th Supported Page (34h)								
10	7th Supported Page (35h)								
11	8th Supported Page (36h)								

10.6.2 Unit Statistics Page (30h)

The Log Sense Unit Statistics Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved (0)		Page Code (30h)						
1	Reserved (00h)								
2 - 3	(MSB) _____		Page Length (56h)						_____ (LSB)
4 - 6	(MSB) _____		Library Power-On Hours						_____ (LSB)
7 - 9	(MSB) _____		Library Cycle Count						_____ (LSB)
10 - 27	Reserved								
28	OverTemp	SCC Cable	IntlckCable	NoTermPwr	PivotCable	VPSE Cable	PSM Cable	DoorOpen	
29	Reserved (0)		Drv 6 Disc	Drv 5 Disc	Drv 4 Disc	Drv 3 Disc	Drv 2 Disc	Drv 1 Disc	
30	Reserved (0)		Drv 12 Disc	Drv 11 Disc	Drv 10 Disc	Drv 9 Disc	Drv 8 Disc	Drv 7 Disc	
31	InitReqd	LastMT		Reserved (0)		Pwr Sup 3	Pwr Sup 2	Pwr Sup 1	
32 - 35	(MSB) _____		Cumulative Lift Movement Count						_____ (LSB)
36 - 39	(MSB) _____		Cumulative Picker Movement Count - Picker 1						_____ (LSB)
40 - 43	(MSB) _____		Cumulative Picker Movement Count - Picker 2						_____ (LSB)
44 - 47	(MSB) _____		Cumulative Change of Picker in Use Count						_____ (LSB)
48 - 51	(MSB) _____		Cumulative Pivot Column Movement Count						_____ (LSB)
52 - 55	Reserved (00h)								
56 - 59	(MSB) _____		Cumulative Magazine Access Door Open Count						_____ (LSB)
60 - 63	Reserved (00h)								
64 - 67	(MSB) _____		Cumulative Lift Distance Count						_____ (LSB)
68 - 71	(MSB) _____		Cumulative Picker Distance Count						_____ (LSB)
72 - 75	(MSB) _____		Cumulative Pivot Rotation Count						_____ (LSB)
76 - 79	(MSB) _____		Cumulative Disk Flip Count						_____ (LSB)
80 - 83	Reserved (00h)								
84	Library Power-On Minutes								
85	Library Power-On Seconds								
86 - 89	Reserved (00h)								

Library Power-On Hours equals the total number of hours that power has been applied to the library.

Library Cycle Count equals the total number of times that a tray has been loaded into any of the drives in the library - even if those drives were later removed or replaced.

OverTemp equals 1 if the cabinet is above safe operating temperature for drive operation.

SSC Cable equals 1 if the SCSI converter control interface cable (CJ12) is not properly connected.

IntlckCable equals 1 if the interlock interface cable (CJ7) is not properly connected.

TermPwr equals 1 if the SCSI bus terminator power is low.

PivotCable equals 1 if the pivot / lift / MTA interface cable (CJ4) is not properly connected.

VPSE Cable equals 1 if the VP sensor encoder interface cable (CJ5) is not properly connected..

PSM Cable equals 1 if the power supply monitor cable (CJ10) is not properly connected.

DoorOpen equals 1 if the library system rear service door is open.

Drv 1-12 Disc equals 1 if the interface cable to the corresponding drive is not properly connected.

InitReqd equal 1 if the next SCSI command using the library's robotics will cause the library to initialize itself before performing the command. This is usually the case after a hardware error in which the library is unable to return trays to their source locations and restore itself to its original state.

LastMT contains the number of the last medium transport element used - 1 or 2.

Pwr Sup 1-3 equals 1 if the corresponding power supply voltage is bad or the power supply fan is not functioning properly.

The **Cumulative Lift Movement Count** is incremented every time the medium transport element is moved vertically (up or down).

The **Cumulative Picker Movement Counts - Pickers 1, 2** are incremented every time the corresponding medium transport element is moved horizontally (in or out).

The **Cumulative Change of Picker in Use Count** is incremented every time the picker in use is changed. An Exchange Medium command, for example, typically requires three changes of picker.

The **Cumulative Pivot Movement Count** is incremented every time the lift assembly is pivoted to reach another column of slots or drives.

The **Cumulative Magazine Access Door Open Count** is incremented every time the magazine access door is opened.

The **Cumulative Lift Distance Count** is incremented by the distance traveled every time the medium transport element is moved vertically. The count is in units of meters.

The **Cumulative Picker Distance Count** is incremented by the distance traveled every time either medium transport element is moved horizontally. The count is in units of meters.

The **Cumulative Pivot Rotation Count** is incremented by the angular distance traveled every time the medium transport element is rotated. The count is in units of radians.

The **Cumulative Flip Count** is incremented every time a disk is inverted (flipped).

Library Power-On Minutes equals the total number of minutes (after subtracting the total number of hours) that power has been applied to the library.

Library Power-On Seconds equals the total number of seconds (after subtracting the total number of hours and minutes) that power has been applied to the library.

See the Enterprise D User's Guide or Service Manual for further information about these values.

10.6.3 Error Statistics Page (31h)

The Log Sense Error Statistics Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (31h)					
1	Reserved (00h)							
2 - 3	(MSB)		Page Length (64h)				(LSB)	
4 - 13	First Most Frequent Error Info							
14 - 23	Second Most Frequent Error Info							
	:							
94 - 103	Tenth Most Frequent Error Info							

Each set of most frequent error parameters contains error rate information for one of the most frequently occurring errors. The format of these error parameters is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Error Code							
1 - 2	(MSB)		Error Count				(LSB)	
3 - 4	(MSB)		Number of Recoverable Errors				(LSB)	
5 - 6	(MSB)		Number of Unrecoverable Errors				(LSB)	
7 - 9	(MSB)		Library Cycle Count at Last Occurrence				(LSB)	

Error Code is a code for the error which occurred. The error codes are listed in Section 12.2. Only hardware errors are recorded.

Error Count is a count of the number of times that the error occurred. A value of 65535 indicates that the error occurred this many or more times.

Number of Recovered Errors is a count of the number of times that the library system was able to recover from this error - that is, the number of times that it returned Sense Key 1 Recovered Error status to the host in response to a Request Sense command issued after this error was generated; or that it was able to successfully complete the operation in progress when this error was generated in maintenance or setup modes.

Number of Unrecovered Errors is a count of the number of times that the library system was unable to recover from this error even after performing retries.

Library Cycle Count at Last Occurrence is the cumulative library system cycle count when this error last occurred.

10.6.4 Error Log Page (32h)

The Log Sense Error Log Page is as follows.

Bit	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (32h)					
1	Reserved (00h)							
2 - 3	(MSB)		Page Length (1D0h)				(LSB)	
4 - 19	First Most Recent Error Info Block A							
20 - 35	Second Most Recent Error Info Block A							
	:							
148 - 163	Tenth Most Recent Error Info Block A							
164 - 165	Reserved (00h)							
166 - 195	First Most Recent Error Info Block B							
196 - 225	Second Most Recent Error Info Block B							
	:							
436 - 465	Tenth Most Recent Error Info Block B							
466 - 467	Reserved (00h)							

There are two blocks of error information – block A and block B – for each of the ten most recent errors.

The format of block A is as follows.

Bit	7	6	5	4	3	2	1	0
0	Error Code							
1	Initiating Command							
2 - 3	(MSB)		Source Address				(LSB)	
4 - 5	(MSB)		Destination Address				(LSB)	
6	Reserved (0)				MT Number		Invert	
7 - 8	(MSB)		Failure Address				(LSB)	
9 - 10	(MSB)		Recurrence Count				(LSB)	
11 - 13	(MSB)		Library Cycle Count at First Occurrence				(LSB)	
14 - 15	Reserved (00h)							

Error Code is a code for the error that occurred. The error codes are listed in Section 12.2. Only hardware errors are recorded.

Initiating Command is the operation code of the SCSI command that initiated the operation or a value from the following table.

Command	Meaning
0 - F7h	Operation code of initiating SCSI command
F8h	Error occurred during library and drive power-up
F9h	Error occurred during on-line library initialization
FAh	Error occurred while performing some operator-initiated action
FBh	Error occurred during routine sensor and cable checks
FCh	Error occurred during some remotely initiated operation
FDh	Error occurred while performing some on-line menu operation
FEh	Error occurred while in library set up mode
FFh	Error occurred while in library maintenance mode

Source Address and **Destination Address** are the source and destination addresses for the Position to Element, Move Medium, and Exchange Medium commands. For the Exchange Medium command, these represent either the Source and First Destination Addresses, the First and Second Destination Address or some other intermediate addresses.

MT Number is the number of the medium transport element (1 or 2) in use when the error occurred.

Invert equals 1 for the Move Medium and Exchange Medium commands if the medium was to be inverted (flipped) prior to being deposited in the destination element.

Failure Address is the address of the closest element to which the medium transport element specified by the MT Number was positioned when the error occurred.

Recurrence Count is a count of the number of consecutive times that the error occurred, including retries, with all other information being identical between instances. The total of these identical instances is recorded as one log entry.

Library Cycle Count at First Occurrence is the cumulative library system cycle count when this error first occurred.

The format of block B is as follows.

Bit	7	6	5	4	3	2	1	0
0	Component Number							
1	Error Subcode							
2	Error Type							
3	Error Context							
4 - 5	Internal Error Location							
6 - 7	Reserved (0)							
8	Lift Elevation State							
9 - 12	(MSB)	Lift Offset						(LSB)
13 - 14	(MSB)	Picker Step Count						(LSB)
15 - 16	(MSB)	Pivot Offset						(LSB)
17 - 21	Reserved (00h)							
22	Time at First Occurrence – Year (1 for 2001, 2 for 2002, ...)							
23	Time at First Occurrence – Month (1 - 12)							
24	Time at First Occurrence – Day (1 - 31)							
25	Time at First Occurrence – Hour (0 - 23)							
26	Time at First Occurrence – Minutes (0 - 59)							
27	Time at First Occurrence – Seconds (0 - 59)							
28 - 30	(MSB)	Library Cycle Count at First Occurrence						(LSB)
31	Reserved (00h)							

Error Type indicates the general type of error and the interpretation of the **Component Number** and **Error Subcode** fields. The relationship between Error Type and Component Number is shown in the following table. The Error Subcodes are listed in the G-Series User's Guide and Service Manuals.

Error Type	Meaning of Error Type	Component Number
1	General hardware errors	Not used
2	Errors associated with a specific element position	Picker number
3	Errors associated with a specific library system column	Column number
4	Errors associated with a specific library system drive	Drive number
6	Errors associated with a specific power supply	Power supply number
7	Errors associated with a specific drive module	Drive module number
9	Errors associated with a specific printed wire assembly	PWA number

Error Context is a code for the context in which the error occurred. The error context codes are listed in Section 12.3.

Lift Elevation State is the current state of the lift's elevation for performing various library operations. The lift elevation states are as follows.

State	Meaning
0	Lift at elevation at which to pick a tray from a slot
1	Lift at elevation at which to store a tray to a slot
2	Lift at elevation at which to load a tray into a drive
3	Lift at elevation at which to unload a tray from a drive
FFh	Lift at indeterminate elevation

Lift Offset is a signed lift encoder count offset from the count associated with the Failure Address in block A at the Lift Elevation State above.

Internal Error Location is a number which is useful to Plasmon technical support.

Picker Step Count is a signed motor step count for the active picker when the error occurred.

Pivot Offset is a signed pivot step count offset from the count associated with the Failure Element Address in block A.

Time at First Occurrence is equal to the library time (see Library Time page) when this error first occurred (recurrence count = 1).

10.6.5 Event History Page (33h)

The Log Sense Event History Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved (0)		Page Code (33h)						
1	Reserved (00h)								
2 - 3	(MSB) _____		Page Length (0804h)						_____ (LSB)
4 - 5	(MSB) _____		Number of Events Recorded						_____ (LSB)
6 - 7	(MSB) _____		Number of First Unread Byte						_____ (LSB)
8 - 2055	Event List								

Number of Events Recorded is the number of significant bytes in the Event List.

Number of First Unread Byte is the number (starting from 8) of the first byte in the Event List not previously read by a Log Sense command, or a value of FFFFh if the event list filled and some bytes were discarded before they were read. This number is kept on a per-initiator basis.

Event List is a list of events from most recent to least recent within the library system. The contents of this list is determined by the Event History Type field of the Library Mode Parameters Page 2 of the Mode Select command (see Section 10.7.2). For a description of possible events within this list see Section 11. This list may be helpful to technical support personnel in diagnosing problems with the library system.

10.6.6 Micro-Operation Page (34h)

The Log Sense Micro-Operation Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved (0)		Page Code (34h)						
1	Reserved (00h)								
2 - 3	(MSB) _____		Page Length (x-3)						_____ (LSB)
4	Number of Micro-Operations Recorded								
5	Size of Block for Each Micro-Operation								
6 - x	Micro-Operation List								

Number of Micro-Operations Recorded is the number of blocks of information recorded in the micro-operation list.

Size of Block for Each Micro-Operation is the size of each block of information in the micro-operation list.

Micro-Operation List is a list of operations performed by the library system for the last failing tray movement command. This list may be helpful to technical support personnel in diagnosing problems with the library system.

10.6.7 Library Time Page (35h)

The Log Sense Library Time Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (35h)					
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (08h)				(LSB)
4	Current Library Time - Seconds (0 - 59)							
5	Current Library Time - Minutes (0 - 59)							
6	Current Library Time - Hour (0 - 23)							
7	Current Library Time - Day of Week (1=Sunday, 2=Monday, ...)							
8	Current Library Time - Day (1 - 31)							
9	Current Library Time - Month (1 - 12)							
10	Current Library Time - Year (1 for 2001, 2 for 2002, ...)							
11	Reserved (00h)							

Current Library Time is the current time as maintained by the library system. The time may be set using the Log Select command.

10.6.8 Drive Load Counts Page (36h)

The Log Sense Drive Load Counts Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (36h)					
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (24h)				(LSB)
4 - 6	(MSB)			Drive 1 Load Count				(LSB)
7 - 9	(MSB)			Drive 2 Load Count				(LSB)
10 - 12	(MSB)			Drive 3 Load Count				(LSB)
13 - 15	(MSB)			Drive 4 Load Count				(LSB)
16 - 18	(MSB)			Drive 5 Load Count				(LSB)

19 - 21	(MSB)	Drive 6 Load Count	(LSB)
22 - 24	(MSB)	Drive 7 Load Count	(LSB)
25 - 27	(MSB)	Drive 8 Load Count	(LSB)
28 - 30	(MSB)	Drive 9 Load Count	(LSB)
31 - 33	(MSB)	Drive 10 Load Count	(LSB)
34 - 36	(MSB)	Drive 11 Load Count	(LSB)
37 - 39	(MSB)	Drive 12 Load Count	(LSB)

Drive 1-12 Load Count equals the number of times the corresponding drive has been loaded.

10.7 MODE SELECT (6) Command

The **Mode Select (6)** command provides a means for the initiator to select medium changer device parameters.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (15h)							
1	Reserved (0)			PF (0)	Reserved (0)			SP
2 - 3	Reserved (00h)							
4	Parameter List Length							
5	Reserved (00h)							

PF (Page Format) is ignored.

SP (Save Pages) equals 1 if the target is to save changeable parameters in pages, i.e., if values are to be saved to non-volatile memory. If this bit is 0 (zero), values are not saved when power is cycled to the library or when it receives a Bus Device Reset message or the SCSI Reset line is asserted.

Parameter List Length specifies the length in bytes of the Mode Select (6) parameter list.

The Mode Select (6) parameter list consists of a 4 byte header followed by one or more of the medium changer device's supported pages. The header is shown below followed by the supported pages.

Mode Select (6) Mode Parameter Header

Bit	7	6	5	4	3	2	1	0
Byte								
0	Mode Data Length (00h)							
1	Medium Type (00h)							
2	Device-Specific Parameter (00h)							
3	Block Descriptor Length (00h)							

10.7.1 Library Mode Parameters Page 1 (00h)

The Mode Select Library Mode Parameters Page 1 is as follows.

Bit	7	6	5	4	3	2	1	0
0	Page Code (00h)							
1	Parameter Length (0Eh)							
2	DsabTrayRet	RetOnPwr	Reserved (0)				DsabLoEj	
3 - 15	Reserved (00h)							

DsabTrayRet equals 1 if trays (and disks) from magazines but currently in drives *are not* to be returned to their source magazines when the proper key is pressed on the front panel to open the magazine access door, or 0 (zero) if trays (and disks) from magazines *are* to be returned when the front panel key is pressed. The magazine access door will not open if there are disks in drives which have been moved directly from magazines. This setting does not effect trays stored in or moved from fixed storage elements. The default for this bit is 0 (zero).

RetOnPwr equals 1 if trays (and disks) in drives are to be returned to their source magazines when power is first applied to the library system, or 0 (zero) if trays (and disks) are not to be returned on power-on. This setting does not effect trays stored in or moved from fixed storage elements. The default for this bit is 0 (zero).

DsabLoEj equals 1 if the medium changer device *is not* to clamp and start newly loaded drives nor stop and unclamp drives to be unloaded. If this bit is set, it is the responsibility of the host to issue the appropriate Start Stop Unit commands to the drives (with the LoEj bit set to 1 - see the command description in the appropriate drive manual) to start the drives after disks are moved to them, or stop the drives before disks are moved from them. If the DsabLoEj bit is 0 (zero), the medium changer device *is* to automatically clamp and start or stop and unclamp the drives as part of Move Medium, Exchange Medium, or Rezero Unit commands which move disks to or from them. The default for this bit is 0 (zero).

10.7.2 Library Mode Parameters Page 2 (20h)

The Mode Select Library Mode Parameters Page 2 is as follows.

Bit	7	6	5	4	3	2	1	0
0	Page Code (20h)							
1	Parameter Length (08h)							
2	NoRepRec	Rsvd (0)	LimitRec	Reserved (0)				
3	Reserved (0)		SetType	Event History Type (bits 8 - 12)				
4 - 5	Reserved (00h)							
6	SetBusConf	Reserved (0)				Bus Configuration		
7 - 8	Reserved (00h)							
9	Event History Type (bits 0 - 7)							

NoRepRec equals 1 if the medium changer device is to return GOOD status for all hardware errors which have been recovered from, or 0 (zero) if the medium changer device is to return CHECK CONDITION status and set Request Sense data for hardware errors which have been recovered from. In the latter case, a subsequent Request Sense command issued to the medium changer device will return sense data with the Sense Key field set to Recovered Error and the ASC and ASCQ fields set according to the initial hardware error which occurred. The default for this bit is 0 (zero).

LimitRec equals 1 if the medium changer device is to limit the extent of the error recovery that will perform. Setting this field to 1 will prevent the changer device from performing any transfers on a tray

that cannot be moved to a destination element or returned to its source element. Rather than placing the tray in another element, it will be left in the medium transport element. The host software is then responsible for moving the tray from this element. The default for this bit is 0 (zero).

SetType equals 1 if the Event History Type is to be changed.

Event History Type (bits 0-7, 8-12) specifies the type of event history to collect for diagnostic purposes (see Section 10.6.4). In order for this field to be effective, the SetType bit must be set. No history information will be collected for an Event History Type value of zero. For a further description of this byte see Section 11. The default for this byte is 0BBh (187 decimal).

SetBusConf equals 1 if the Bus Configuration is to be changed. Note that setting this bit will cause the power to all drives to be cycled. Therefore, all drive activity should be stopped until a few seconds after the Mode Select command has completed to allow time for the drives to fully power up. It should also be noted that some bus configurations allow for fewer drives. Therefore, some drives may not be turned back on.

Bus Configuration specifies the number and allocation of SCSI buses to the library drives and medium changer device. See the table in Section 5 for SCSI bus and address assignments for the available bus configurations.

10.7.3 Library Mode Parameters Page 3 (21h)

The Mode Select Library Mode Parameters Page 3 is as follows.

Bit	7	6	5	4	3	2	1	0
0	Page Code (21h)							
1	Parameter Length (08h)							
2	LightOff	Reserved (0)			DsabScanF	DsabScanI	DsabScanS	DsabScanD
3	SetOptions3	Reserved (0)		FVerOnWr	WrCaEnab	Rsvd (0)	PwrCycDr	Rsvd (0)
4 - 7	Reserved (00h)							
8	SetOptions8	Reserved (0)						EnabAllUA
9	Reserved (00h)							

LightOff equals a value of 1 if the medium changer device is to leave its front panel Active light off for future SCSI bus activity. This is useful for element status polling. The Active light will remain enabled for any motor activity regardless of the setting of this bit. A value of 0 (zero) reenables the Active light for SCSI bus activity. The default for this bit is 0 (zero).

DsabScanS equals 1 if storage elements (magazine and fixed slots) *are not* to be scanned for subsequent Initialize Element Status commands. Setting this also implies the DsabScanSF option. The default for this bit is 0 (zero).

DsabScanI equals 1 if the import/export elements (magazine slots) *are not* to be scanned for subsequent Initialize Element Status commands.

DsabScanD equals 1 if the data transfer elements (the drives) *are not* to be scanned for subsequent Initialize Element Status commands. The default for this bit is 0 (zero).

DsabScanF equals 1 if storage elements ST51 – STn (fixed slots) *are not* to be scanned for subsequent Initialize Element Status commands. The default for this bit is 0 (zero).

SetOptions3 equals 1 if any of the options in byte 3 are to be changed.

FVerOnWr equals 1 if the library is to configure all installed DVD-RAM drives to force verify on writes, or a value of 0 (zero) if the library is to configure all installed DVD-RAM drives not to force

verify on writes. The SetOptions3 bit must also be set for this bit to be effective. The default for this bit is 0 (zero).

WrCaEnab equals 1 if the library is to configure all installed DVD-RAM drives to enable write caching, or a value of 0 (zero) if the library is to configure installed DVD-RAM drives to disable write caching. This bit has no effect for other types of drives. The SetOptions3 bit must also be set for this bit to be effective. The default for this bit is 0 (zero).

PwrCycDr equals 1 if the AC power to a drive is to be cycled in an attempt to reset a badly seated disk (as part of the normal error recovery procedure), or a value of 0 (zero) if the AC power *is not* to be cycled. The SetOptions3 bit must also be set for this bit to be effective. The default for this bit is 0 (zero).

SetOptions8 equals 1 if any of the options in byte 8 are to be changed.

EnabAllUA equals 1 if all Unit Attention conditions are to be enabled. If this bit is 0 (zero), only Unit Attention conditions reported in previous D-Series libraries will be enabled. The SetOptions8 bit must also be set for this bit to be effective. The default for this bit is 0 (zero).

10.7.4 Drive Assignments Page (22h)

The Mode Select Drive Assignments Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Page Code (22h)							
1	Parameter Length (3Ch)							
2–5	Drive 1 Assignments Block							
6–9	Drive 2 Assignments Block							
10–13	Drive 3 Assignments Block							
14–17	Drive 4 Assignments Block							
18–21	Drive 5 Assignments Block							
22–25	Drive 6 Assignments Block							
26–29	Drive 7 Assignments Block							
30–33	Drive 8 Assignments Block							
34–37	Drive 9 Assignments Block							
38–41	Drive 10 Assignments Block							
42–45	Drive 11 Assignments Block							
46–49	Drive 12 Assignments Block							
50–61	Reserved (00h)							

Where each assignment block is of the following form.

Bit Byte	7	6	5	4	3	2	1	0
0	Drive On-Line							
1–2	Reserved (00h)							
3	Drive SCSI ID							

Drive On-Line is the on-line designator for the drive. If set to 0 (zero), the drive will be powered down and considered off-line. If set to a non-zero value, the drive will be powered up and considered on-line. This provides a means of taking malfunctioning drives off-line and reinstating them to on-line status, if so desired. Drives may also be taken off-line (turned off) and reinstated to on-line status (turned on) via the front panel ‘Turn Off Drive’ and ‘Turn On Drive’ options. Any attempt to position to an off-line drive will be considered an error.

Drive SCSI ID is the SCSI ID of the drive. Changing this value changes the address of the drive on the SCSI bus. If the drive is currently on-line (turned on), it will be powered down and back up again to effect the change of address. SCSI ID's must be from 0 to 7 and should be unique on the SCSI bus for each drive.

10.7.5 Front Panel Display Mode Page (23h)

The Mode Select Front Panel Display Mode Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (23h)					
1	Parameter Length (52h)							
2	Tone	LightOff	Section1	Reserved (0)			ClrKeys	DispMode
3 – 22	Line 3 Display Text							
23 – 42	Line 4 Display Text							
43	Blink	Rsvd (0)	Section2	Reserved (0)				
44 – 63	Line 1 Display Text							
64 – 83	Line 2 Display Text							

Tone equals 1 if a short alert tone is to be sounded within the library system. This bit is only effective if DispMode is set to 1 and Section1 is set to 0.

LightOff equals 1 if the front panel Active light is to be left in the off state for SCSI bus activity while the DispMode bit is set. This is useful for element status and key polling.

Section1, Section2 indicates equals the section of the display to control if DispMode equals 1.

Section1	Section2	Section to Control
0	0	Entire four lines of display including keypad
0	1	Lines 3 and 4 including keypad
1	0	Lines 1 and 2 (display only - no keypad polling)
1	1	Reserved

ClrKeys equals 1 to clear all front panel key flags in preparation for subsequent key polling with the Mode Sense command. This bit is only effective if DispMode is set to 1 and Section1 is set to 0 (zero).

DispMode equals 1 to gain and maintain control a section of the library system front panel display or 0 (zero) to release control. DispMode will not be effective while the on-line menu is selected at the library front panel interface (see the MenuSeld bit in the Mode Sense front panel display mode page - Section 10.9.8).

Blink equals 1 if the backlight on the display is to repeatedly blink on and off. This can be used to give visual indication of an error or service required condition. This bit is only effective if DispMode is set to 1.

Line 1-4 Display Text is the ASCII representation of text to be displayed on the corresponding line of the library system front panel display.

In addition to the ASCII characters 20h (‘ ’) through 7Dh (‘}’), the following characters are available: FEh=‘[’, 01h=‘]’, 04h=‘▬’, 7Eh=‘✦’, and 7Fh=‘✧’, and A5h=‘▪’.

10.7.6 Magazine Indicator Page (27h)

The Mode Select Magazine Indicator Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Page Code (27h)							
1	Parameter Length (06h)							
2	Reserved (0)							Mag 1 LED
3	Reserved (0)							Mag 2 LED
4	Reserved (0)							Mag 3 LED
5	Reserved (0)							Mag 4 LED
6	Reserved (0)							Mag 5 LED
7	Reserved (0)							IEMag LED

Mag 1-5/IE Mag LED equals 1 if the indicator by corresponding magazine is to be turned on, or 0 (zero) if it is to be placed in a flashing state. Magazines 1 – 5 are mapped to storage elements ST1 – ST50, and the I/E magazine is mapped to import/ export elements IE1 – IE10. The indicator LED's will be turned on or flashed as specified when the magazine access door is opened by the Open Magazine Door command (see Section 10.12). A turned on LED indicates that the magazine is not available for exchange, while a flashing LED indicates that it is available for exchange.

10.8 MODE SELECT (10) Command

The **Mode Select (10)** command provides a means for the initiator to select medium changer device parameters. It performs the same function as the Mode Select (6) command.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (55h)							
1	Reserved (0)			PF (1)	Reserved (0)			SP
2–6	Reserved (00h)							
7–8	(MSB)			Parameter List Length				(LSB)
9	Reserved (00h)							

PF (Page Format) equals 1 indicating that parameters are structured as pages of related parameters.

SP (Save Pages) equals 1 if the target is to save changeable parameters in pages.

Parameter List Length specifies the length in bytes of the Mode Select (10) parameter list.

The Mode Select (10) parameter list consists of a 8 byte header followed by one or more of the medium changer device's supported pages. The header is shown below.

Mode Select (10) Mode Parameter Header

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	Mode Data Length (00h)							
2	Medium Type (00h)							
3	Device-Specific Parameter (00h)							
4 - 5	Reserved (00h)							
6 - 7	Block Descriptor Length (00h)							

See the Mode Select (6) command (Section 10.7) for information about supported mode pages.

10.9 MODE SENSE (6) Command

The **Mode Sense (6)** command provides a means for reporting medium changer device to an initiator.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Reserved (00h)							
2	PC		Page Code					
3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

DBD (Disable Block Descriptor) is ignored.

PC (Page Control) defines the type of parameter values to be returned. Normally, a value of 0 (zero) is used to return the current values.

Page Code defines the parameter page(s) to be returned. A value of 00h, 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, 27h, or 3Fh must be used. If a value of other than 3Fh is used, the corresponding page as described below is returned. If a value of 3Fh is used, all supported pages are returned in this order: page 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, 27h, 00h.

The **Allocation Length** specifies how many bytes of data are to be returned.

The Mode Sense (6) data block consists of a 4 byte header followed by one or more supported pages. The header is shown below followed by the supported pages.

Mode Sense (6) Mode Parameter Header

Bit Byte	7	6	5	4	3	2	1	0
0	Mode Data Length							
1	Medium Type (00h)							
2	Device-Specific Parameter (00h)							
3	Block Descriptor Length (00h)							

Mode Data Length is the length in bytes of the remainder of the Mode Sense (6) return data.

10.9.1 Element Address Assignment Page (1Dh)

The Mode Sense Element Address Assignment Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Rsvd (0)	Page Code (1Dh)					
1	Parameter Length (12h)							
2 - 3	(MSB)	First Medium Transport Element Address						(LSB)
4 - 5	(MSB)	Number of Medium Transport Elements						(LSB)
6 - 7	(MSB)	First Storage Element Address						(LSB)
8 - 9	(MSB)	Number of Storage Elements						(LSB)
10 - 11	(MSB)	First Import/Export Element Address						(LSB)
12 - 13	(MSB)	Number of Import/Export Elements						(LSB)
14 - 15	(MSB)	First Data Transfer Address						(LSB)
16 - 17	(MSB)	Number of Data Transfer Elements						(LSB)
18 - 19	Reserved (00h)							

See the tables in Section 6 for the element addresses and counts returned in this page. It should be noted that the number of data transfer elements is the number of the last installed drive which is turned on. Examine the IDValid bit or the ASC/ASCQ values in the Read Element Status data transfer element descriptors (see Section 10.16.3) to determine if specific drives are present and turned on.

10.9.2 Transport Geometry Parameters Page (1Eh)

The Mode Sense Transport Geometry Parameters Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS(0)	Rsvd (0)	Page Code (1Eh)					
1	Parameter Length (04h)							
2	Reserved (0)						Rotate (1)	
3	Member Number in Transport Element Set (00h)							
4	Reserved (0)						Rotate (1)	
5	Member Number in Transport Element Set (01h)							

Where **Rotate** equals 1 indicating that the medium transport element supports media rotation for handling double-sided media.

10.9.3 Device Capabilities Page (1Fh)

The Mode Sense Device Capabilities Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS(0)	Rsvd (0)	Page Code (1Fh)					
1	Parameter Length (12h)							
2	Reserved (0)			StorD(1)	StorI(1)	StorS(1)	StorM(0)	
3	Reserved (00h)							
4	Reserved (0)			M → D(1)	M → I(1)	M → S(1)	M → M(0)	
5	Reserved (0)			S → D(1)	S → I(1)	S → S(1)	S → M(1)	
6	Reserved (0)			I → D(1)	I → I(1)	I → S(1)	I → M(1)	
7	Reserved (0)			D → D(1)	D → I(1)	D → S(1)	D → M(1)	
8 - 11	Reserved (00h)							
12	Reserved (0)			M ↔ D(0)	M ↔ I(0)	M ↔ S(0)	M ↔ M(0)	
13	Reserved (0)			S ↔ D(1)	S ↔ I(1)	S ↔ S(1)	S ↔ M(0)	
14	Reserved (0)			I ↔ D(1)	I ↔ I(1)	I ↔ S(1)	I ↔ M(0)	
15	Reserved (0)			D ↔ D(1)	D ↔ I(1)	D ↔ S(1)	D ↔ M(0)	
16 - 19	Reserved (00h)							

Where **D** is a data transfer element
I is an import/export element
S is a storage element
M is the medium transport element
Stor indicates storage capability
→ indicates Move Medium capability (first element type is for Source, second element type is for Destination)
↔ indicates Exchange Medium capability (first element type is for Source and Second Destination, second element type is for First Destination)

and the available capabilities are as indicated (1 means yes in all cases and 0 means no in at least some cases).

10.9.4 Library Mode Parameters Page 1 (00h)

The Mode Sense Library Mode Parameters Page 1 is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (00h)					
1	Parameter Length (0Eh)							
2	DsabTrayRet	RetOnPwr	Reserved (0)				DsabLoEj	
3 - 15	Reserved (00h)							

DsabTrayRet, **RetOnPwr**, and **DsabLoEj** are as set by the Mode Select command (see Section 10.7.1).

10.9.5 Library Mode Parameters Page 2 (20h)

The Mode Sense Library Mode Parameters Page 2 is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (20h)					
1	Parameter Length (08h)							
2	NoRepRec	Rsvd (0)	LimitRec	Reserved (0)				
3	Reserved (0)			Event History Type (bits 8 - 12)				
4 - 5	Reserved (00h)							
6	Reserved (0)					Bus Configuration		
7	Reserved (00h)							
8	Element Addressing Scheme (01h)							
9	Event History Type (bits 0 - 7)							

NoRepRec, **LimitRec**, **Bus Configuration**, and **Event History Type** are as set by the Mode Select command (see Section 10.7.2).

10.9.6 Library Mode Parameters Page 3 (21h)

The Mode Sense Library Mode Parameters Page 3 is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (21h)					
1	Parameter Length (08h)							
2	LightOff	Reserved (0)			DsabScanF	DsabScanI	DsabScanS	DsabScanD
3	Reserved (0)			FVerOnWr	WrCaEnab	Rsvd (0)	PwrCycDr	Rsvd (0)
4 - 7	Reserved (00h)							
8	Reserved (0)							EnabAllUA
9	Reserved (00h)							

LightOff, **DsabScanF**, **DsabScanI**, **DsabScanS**, **DsabScanD**, **FVerOnWr**, **WrCaEnab**, **PwrCycDr**, and **EnabAllUA** are as set by the Mode Select command (see Section 10.7.3).

10.9.7 Drive Assignments Page (22h)

The Mode Sense Drive Assignments Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (22h)					
1	Parameter Length (3Ch)							
2 - 5	Drive 1 Assignments Block							
6 - 9	Drive 2 Assignments Block							
10 - 13	Drive 3 Assignments Block							
14 - 17	Drive 4 Assignments Block							
18 - 21	Drive 5 Assignments Block							
22 - 25	Drive 6 Assignments Block							
26 - 29	Drive 7 Assignments Block							
30 - 33	Drive 8 Assignments Block							
34 - 37	Drive 9 Assignments Block							
38 - 41	Drive 10 Assignments Block							
42 - 45	Drive 11 Assignments Block							
46 - 49	Drive 12 Assignments Block							
50 - 61	Reserved (00h)							

Where each assignment block is of the following form.

Bit Byte	7	6	5	4	3	2	1	0
0	Drive Type							
1	Reserved (0)							DrvOff Bus
2	Drive Bus							
3	Drive SCSI ID							

Drive Type are the drive type designators for the drive. If a drive is off-line (turned off), it's drive type will be 0 (zero). Otherwise, it's drive type will be non-zero.

DrvOff Bus equals 0 (zero) if the drive is on the same SCSI bus as the medium changer device, or 1 if it is on a different SCSI bus than the medium changer device.

Drive Bus and **Drive SCSI ID** are the SCSI bus and SCSI ID of the drive (see table in Section 5).

10.9.8 Front Panel Display Mode Page (23h)

The Mode Sense Front Panel Display Mode Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Rsvd (0)	Page Code (23h)					
1	Parameter Length (01h)							
2	Rsvd (0)	LightOff	Rsvd (0)	Key Pressed			MenuSeld	DispMode

LightOff and **DispMode** are as set by the Mode Select command (see Section 10.7.5).

Key Pressed equals 0 if no key was pressed or one of the following:

Key Pressed	Meaning
1	First (left-most) key was pressed
2	Second key was pressed
3	Third key was pressed
4	Fourth (right-most) key was pressed

The Key Pressed field is cleared every time that this page is returned so that each Mode Sense command returns key presses since the last Mode Sense command was issued.

MenuSeld equals 1 if the on-line menu has been selected at the library front panel interface. KeyPressed is not updated if this bit is set.

10.9.9 Magazine Indicator Page (27h)

The Mode Sense Magazine Indicator Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Page Code (27h)							
1	Parameter Length (06h)							
2	Reserved (0)							Mag 1 LED
3	Reserved (0)							Mag 2 LED
4	Reserved (0)							Mag 3 LED
5	Reserved (0)							Mag 4 LED
6	Reserved (0)							Mag 5 LED
7	Reserved (0)							IEMag LED

Mag 1-5/IE Mag LED are as set by the Mode Select command (see Section 10.7.6).

10.10 MODE SENSE (10) Command

The **Mode Sense (10)** command provides a means for reporting medium changer device to an initiator. It performs the same function as the Mode Sense (6) command.

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Operation Code (5Ah)								
1	Reserved (00h)								
2	PC			Page Code					
3-6	Reserved (00h)								
7-8	(MSB)			Allocation Length					(LSB)
9	Reserved (00h)								

DBD (Disable Block Descriptor) is ignored.

PC (Page Control) defines the type of parameter values to be returned. Normally, a value of 0 is used to return the current values.

Page Code defines the parameter page(s) to be returned.

The **Allocation Length** specifies how many bytes of data are to be returned.

The Mode Sense (10) data block consists of a 8 byte header followed by one or more supported pages. The header is shown below.

Mode Sense (10) Mode Parameter Header

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Mode Data Length							(LSB)
2	Medium Type (00h)							
3	Device-Specific Parameter (00h)							
4 - 5	Reserved (00h)							
6 - 7	Block Descriptor Length (00h)							

Mode Data Length is the length in bytes of the remainder of the Mode Sense (10) return data.

See the Mode Sense (6) command (Section 10.9) for information about supported mode pages.

10.11 MOVE MEDIUM Command

The **Move Medium** command instructs the medium changer device to move a tray (empty or full) from the source element to an empty destination element. The command will move a tray at the source element to a vacant destination element. It will also exchange a full tray at the source element with an empty tray at the destination element.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	Reserved (00h)							
2 - 3	(MSB) Medium Transport Address							(LSB)
4 - 5	(MSB) Source Address							(LSB)
6 - 7	(MSB) Destination Address							(LSB)
8 - 9	Reserved (00h)							
10	Reserved (0)							Invert
11	Reserved (00h)							

Medium Transport Address specifies the medium transport element. A value of zero should normally be used. This will move the tray using the first medium transport element. The address of a specific medium transport element may also be used.

Source Address specifies the source element.

Destination Address specifies the destination element.

Invert specifies the medium should be inverted. If the Invert bit is 1, the media is inverted (“flipped”) prior to being deposited into the destination element.

10.12 OPEN MAGAZINE DOOR Command

The **Open Magazine Door** command instructs the medium changer device to open the magazine access door for magazine insertion or removal. This command will fail if the changer device has been placed in the Prevent state by the Prevent/Allow Medium Removal command.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (0Ch)							
1-5	Reserved (00h)							

It may be useful to send a Mode Select command with the Front Panel Display Mode Page (see Section 10.7.5) at the time that the Open Magazine Door command is issued. The display could give the operator instructions about changing magazines based on which magazine LED's are in a flashing state (see Section 10.7.6), and about closing the magazine access door when done. Otherwise, a default message is displayed.

Door closure may be detected by sending Test Unit Ready commands to the medium changer device and testing for a 'Not ready to ready transition' Unit Attention condition (SCSI Sense Key 06h, ASC 28h, ASCQ 00h or 80h - see Section 12.1).

10.13 POSITION TO ELEMENT Command

The **Position to Element** command positions one of the two medium transport elements (MT's) in front of the specified Destination Element so that no further movement of the MT is necessary to execute a subsequent Move Medium or Exchange Medium command. Note that the two medium transport elements are connected so positioning one will also move the other.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (2Bh)							
1	Reserved (00h)							
2-3	(MSB)	Medium Transport Address						(LSB)
4-5	(MSB)	Destination Address						(LSB)
6-7	Reserved (00h)							
8	Reserved (0)							Invert
9	Reserved (00h)							

Medium Transport Address specifies the medium transport element to be positioned. A value of 0 should normally be used. This will position the first medium transport element in front the destination element specified. The address of a specific medium transport element may also be used.

Destination Address specifies the destination element to position in front of.

Invert equals 1 if any disks in a medium transport element are to be inverted ("flipped") before the designated medium transport element is positioned at the destination element.

10.14 PREVENT/ALLOW MEDIUM REMOVAL Command

The **Prevent/Allow Medium Removal** command instructs the medium changer device to either inhibit or permit opening of the magazine access door for magazine insertion or removal. If the library is left in the Allow state, the door can be opened by the Open Magazine Door command or by pressing keys on the front panel. If the library is left in the Prevent state, the door cannot be opened.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Eh)							
1 - 3	Reserved (00h)							
4	Reserved (0)							Prevent
5	Reserved (00h)							

Prevent equals 1 if opening of the magazine access is to be prevented (library placed in Prevent state), or a value of 0 (zero) if the opening of the magazine access door is to be allowed (library placed in Allow state).

The Prevent state remains effective until one of the following conditions occurs:

1. All initiators which have issued the Prevent/Allow Medium Removal command with the Prevent bit set to one reissue the command with the Prevent bit set to zero.
2. The medium changer device receives a TARGET RESET message.
3. The medium changer device receives a hard reset or power is cycled.
4. The medium changer device completes download of new firmware or the SCSI ID of the medium changer device is changed by the Write Buffer command (see Section 10.26).

10.15 READ BUFFER Command

The **Read Buffer** command is used to read the current SCSI ID of the medium changer device, to read a buffer to test the integrity of communication with the medium changer device via the SCSI bus, or to read some library system values.

Bit Byte	7	6	5	4	3	2	1	0	
0	Operation Code (3Ch)								
1	Reserved (0)					Mode (2)			
2	Buffer ID								
3 - 5	(MSB) _____			Buffer Offset				_____ (LSB)	
6 - 8	(MSB) _____			Allocation Length				_____ (LSB)	
9	Reserved (00h)								

Buffer ID select the function to be performed based on the following table.

Buffer ID	Function
0	Read from echo buffer to test SCSI data transfer.
2	Read SCSI ID of medium changer device.
3	Read library IP address.
4	Read library subnet mask.

Buffer Offset is the beginning byte offset within the designated buffer from which data is to be returned.

Allocation Length specifies how many bytes of data are to be returned.

10.15.1 Reading from the Echo Buffer to Test SCSI Communication

A 256 byte echo buffer is supported to test communication with the medium changer device.

To read to the echo buffer, set Buffer ID to 0.

Buffer Offset can be any value between 0 and 255.

Allocation Length can be any value between 1 and 256. The sum of Buffer Offset and Allocation Length cannot exceed 256.

The returned Echo Buffer data is shown below.

Echo Buffer Data

Bit	7	6	5	4	3	2	1	0
Byte								
0 - n	Echo Buffer Data							

The echo buffer should first be written by the Write Buffer command (see Section 10.26.2). After the buffer is read, its contents should be compared with the data originally written.

10.15.2 Reading the Medium Changer Device SCSI ID

To read the SCSI ID of the medium changer device, set Buffer ID to 2, Buffer Offset to 0, and Allocation Length to 1. The return data consists of a single byte containing the current SCSI ID of the medium changer device.

The returned medium changer device SCSI ID data is shown below.

Medium Changer Device SCSI ID Data

Bit	7	6	5	4	3	2	1	0
Byte								
0	Current Medium Changer Device SCSI ID							

10.15.3 Reading the Network IP Address and Subnet Mask

To read the network IP address or subnet mask of the library system, set Buffer ID to 3 for IP address or 4 for subnet mask, Buffer Offset to 0, and Allocation Length to 4. The return data consists of four octets (bytes) of address or mask information.

The returned IP address or subnet mask data is shown below.

Network IP Address or Subnet Mask Parameter Data

Bit Byte	7	6	5	4	3	2	1	0
0	Octet 1							
1	Octet 2							
2	Octet 3							
3	Octet 4							

Octet 1-4 are four bytes of IP address or subnet mask data. For example, an IP address of 101.102.103.104 would be represented as the values 101, 102, 103, and 104.

10.16 READ ELEMENT STATUS Command

The **Read Element Status** command requests the medium changer device report the status of its internal elements to the initiator.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Reserved (0)				Element Type Code			
2-3	(MSB)		Starting Element Address				(LSB)	
4-5	(MSB)		Number of Elements				(LSB)	
6	Reserved (0)					CurData	Rsvd(0)	
7-9	(MSB)		Allocation Length				(LSB)	
10-11	Reserved (00h)							

Element Type Code specifies an element type to be returned as follows.

Code	Element Types Returned
0	All element types
1	Medium transport elements
2	Storage elements
3	Import/export elements
4	Data transfer elements

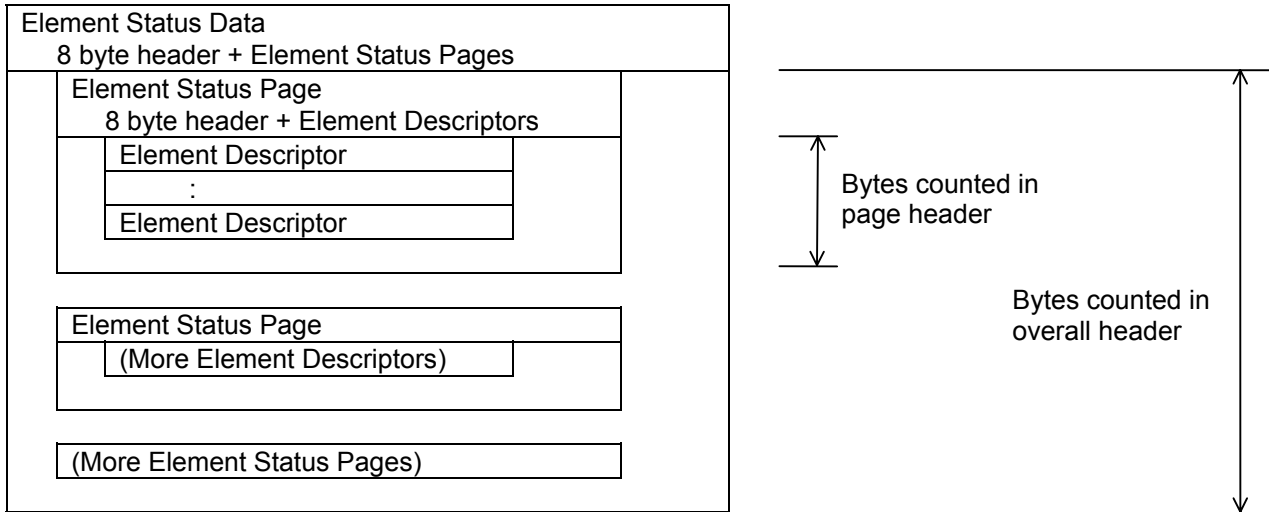
Starting Element Address specifies the minimum element address to report. Only elements with an element type permitted by the Element Type Code and the Starting Element Address are reported.

Number of Elements specifies the maximum number of element descriptor tags to be reported by the medium changer device for this command. The value specified by this field is not the range of element addresses to be considered for reporting but rather the number of elements to report.

CurData (Current Data) specifies that the element status data is to be returned without causing any device motion. This field is ignored as the library system will always return element status data without causing device motion.

Allocation Length specifies the length of the Element Status Data.

The structure of the **Element Status Data** returned is as follows:



The element status data header format is shown following.

Element Status Data

Bit Byte	7	6	5	4	3	2	1	0		
0 - 1	(MSB) _____							First Element Address Reported		_____ (LSB)
2 - 3	(MSB) _____							Number of Elements Reported		_____ (LSB)
4	Reserved (00h)									
5 - 7	(MSB) _____							Byte Count of Report Available (all pages, x - 7)		_____ (LSB)
8 - x	Element Status Page(s)									

The element status page header format is shown following.

Element Status Page Header

Bit Byte	7	6	5	4	3	2	1	0		
0	Element Type Code									
1	Reserved (00h)									
2 - 3	(MSB) _____							Element Descriptor Length (z + 1)		_____ (LSB)
4	Reserved (00h)									
5 - 7	(MSB) _____							Byte Count of Descriptor Data Available (this page, y - 7)		_____ (LSB)
8 - y	Element Descriptor(s)									

The format of the element descriptors follows. Descriptors are returned in element address order.

10.16.1 Medium Transport Element Descriptor

The medium transport element descriptor is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0 - 1	(MSB) _____ Element Address _____ (LSB)								
2	Reserved (0)					Access	Reserved (0)	Full	
3 - 8	Reserved (00h)								
9	Svalid	Invert	Reserved (0)						
10 - 11	(MSB) _____ Source Storage Element Address _____ (LSB)								
12 - 15	Reserved (00h)								
16	Tray	Rsvd (0)	Volatile	Reserved (0)			Fixed Slot	ST Present	Changed
17	Reserved (00h)								

Element Address is the address of this element.

Full equals 1 if this element contains a disk (mounted on a tray).

SValid (Storage Element Valid) equals 1 if the Source Storage Element Address and Invert bits are valid.

Invert equals 1 if the unit of media now in this element was inverted (flipped) since it was last in the Source Storage Element Address.

Source Storage Element Address provides the address of the last storage element this unit of media was moved from.

Tray equals 1 if a tray exists in this element. The tray may or may not have a disk in it.

Volatile equals 1 if the library system is currently performing a front panel function (such as ‘Exchange Magazines’) and the state of this element is therefore subject to change.

LastUsed equals 1 if this medium transport element was the last one used.

10.16.2 Storage Element Descriptor

The storage element descriptor is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) _____ Element Address _____ (LSB)							
2	Reserved (0)				Access	Reserved (0)		Full
3 - 8	Reserved (00h)							
9	Svalid	Invert	Reserved (0)					
10 - 11	(MSB) _____ Source Storage Element Address _____ (LSB)							
12 - 15	Reserved (00h)							
16	Tray	Rsvd (0)	Volatile	Reserved (0)		Fixed Slot	ST Present	Changed
17	Reserved (00h)							

Access equals 1 if element access by the medium transport element is allowed. – that is, if it is a fixed slot which has not been replaced by drives, or it is located within a removable magazine which is currently present. If it is a slot within a removable magazine, the magazine access door must also be closed.

Fixed Slot equals 1 if the storage element is a fixed slot in the library rather than a slot in a removable magazine.

ST Present has the same value as the Access bit.

Changed equals 1 if the magazine at this address has been recently removed, exchanged, or installed. This bit is cleared for each element after the descriptor is returned.

Other fields are the same as for the medium transport element descriptor (see Section 10.16.1).

10.16.3 Import / Export Element Descriptor

The import / export element descriptor is as follows.

Bit	7	6	5	4	3	2	1	0	
Byte									
0 - 1	(MSB) Element Address (LSB)								
2	Reserved (0)	InEnab(1)	ExEnab(1)	Access	Except	Rsvd (0)	Full		
3	Reserved (00h)								
4	Additional Sense Code								
5	Additional Sense Code Qualifier								
6 - 8	Reserved (00h)								
9	Svalid	Invert	Reserved (0)						
10 - 11	(MSB) Source Storage Element Address (LSB)								
12 - 15	Reserved (00h)								
16	Tray	Rsvd (0)	Volatile	Reserved (0)				NoAccess	
17	Reserved (00h)								

InEnab (Import Enable) equals 1 indicating that the import/export element supports movement of media into the scope of the medium changer device.

ExEnab (Export Enable) equals 1 indicating that the import/export element supports movement of media out of the scope of the medium changer device.

Access equals 1 if element access by the medium transport element is allowed. – that is, if the import/export magazine is currently present. The magazine access door must also be closed.

NoAccess has the opposite value than the Access bit.

Other fields are the same as for the medium transport element descriptor (see Section 10.16.1).

10.16.4 Data Transfer Element Descriptor

The data transfer element descriptor is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Element Address (LSB)							
2	Reserved (0)				Access	Except	Rsvd (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	NotBus	Rsvd (0)	IDValid	LUValid	Rsvd (0)	Logical Unit Number (0)		
7	SCSI Bus Address							
8	Reserved (00h)							
9	Svalid	Invert	Reserved (0)					
10 - 11	(MSB) Source Storage Element Address (LSB)							
12 - 15	Reserved (00h)							
16	Tray	Rsvd (0)	Volatile	Reserved (0)				
17	Reserved (00h)							

Except equals 1 if the element is in an abnormal state. In this case, additional information is given in the Additional Sense Code and in the Additional Sense Code Qualifier fields.

Access equals 1 if access to the data transfer element by the medium transport element is allowed (the drive is on-line), or 0 (zero) if access is disallowed (the drive is off-line).

Additional Sense Code (ASC) and **Additional Sense Code Qualifier** for data transfer elements may contain the following values.

ASC	ASCQ	Meaning
80h	41h	Drive operating in overheated cabinet.
80h	42h	Drive being shut down due to overheat condition.
80h	43h	Drive operating with low cabinet fan speed.
80h	44h	Drive being shut down due to low fan speed.
82h	01h	Drive not installed or in service state (off-line).
82h	02h	Drive being placed in service state (5 sec warning).

NotBus equals a 1 if the data transfer element (the drive) is on a different SCSI bus than the medium changer device, or 0 (zero) if it is on the same SCSI bus as the medium changer device.

IDValid equals 1 if the SCSI Bus Address field contains valid information. If the drive is not present or is turned off, this bit will be set to 0 (zero).

LUValid equals 1 if the Logical Unit Number field contains valid information. If the drive is not present or is turned off, this bit will be set to 0 (zero). [This field was retained to maintain backward compatibility with previous D-Series interfaces.]

Logical Unit Number is logical unit number (LUN) used to access the corresponding drive. [This field was retained to maintain backward compatibility with previous D-Series interfaces.]

SCSI Bus Address is the SCSI ID used to access the corresponding drive.

Other fields are the same as for the medium transport element descriptor (see Section 10.16.1).

10.17 READ MAGAZINE STATUS Command

The **Read Magazine Status** command requests the medium changer device report the status of its magazines to the initiator.

[Note: due to internal processor issues, the operation code for this command is not compatible with previous D-Series libraries.]

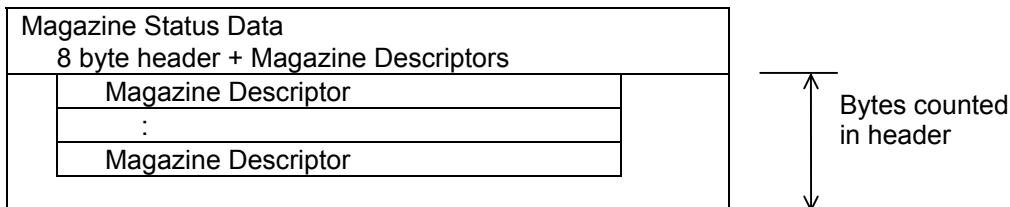
Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (B9h)							
1	Reserved (00h)							
2 - 3	(MSB)		Starting Magazine Number				(LSB)	
4 - 5	(MSB)		Number of Magazines				(LSB)	
6	Reserved (00h)							
7 - 9	(MSB)		Allocation Length				(LSB)	
10 - 11	Reserved (00h)							

Starting Magazine Number specifies the number of the first magazine to report. Magazines 1 – 5 are mapped to storage elements ST1 – ST50, and magazine 6 is mapped to import/ export elements IE1 – IE10.

Number of Magazines specifies the maximum number of magazine descriptors to report.

Allocation Length specifies the length of the Magazine Status Data.

The structure of the **Magazine Status Data** returned is as follows:



The magazine status data header format is shown following.

Magazine Status Data

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) _____ First Magazine Number Reported _____							(LSB)
2 - 3	(MSB) _____ Number of Magazines Reported _____							(LSB)
4	Reserved (00h)							
5 - 7	(MSB) _____ Byte Count of Report Available (x - 7) _____							(LSB)
8 - x	Magazine Descriptor(s)							

The format of the magazine descriptors follows.

10.17.1 Magazine Descriptor

The Magazine Descriptor is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Magazine Number							
1 - 2	(MSB) _____ First Element Address in Magazine _____							(LSB)
3	Reserved (0)	Reserved (0)	Reserved (0)	Reserved (0)	Changed	ImpExp	Full	Full

Magazine Number is the number of this magazine.

First Element Address in Magazine is the address of the first storage element associated with this magazine.

Full equals 1 if the magazine is present.

ImpExp equals 1 if the magazine is mapped to import/export elements rather than storage elements.

Changed equals 1 if this magazine has been recently removed, exchanged, or installed. This bit is cleared after this descriptor is returned.

Volatile equals 1 if the library system is currently performing a front panel function (such as 'Exchange Magazines') and the state of this magazine is therefore subject to change.

10.18 RELEASE ELEMENT Command

The **Release Element** command is used to release reservations on a previously reserved medium changer device or previously reserved elements within it.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (17h)							
1	Reserved (0)							Element
2	Reservation Identification							
3-5	Reserved (00h)							

Element equals bit of 1 if a specific set of elements is to be released or 0 (zero) if the entire medium changer device is to be released.

Reservation Identification is a code byte used to identify a specific element reservation to be released.

Refer to the Reserve Element command (Section 10.20) for more information.

10.19 REQUEST SENSE Command

The **Request Sense** command requests that the medium changer device send Sense Data to the initiator.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (03h)							
1-3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

The Sense Data will be valid for a CHECK CONDITION status returned on the prior command. The Sense Data will be preserved by the medium changer device until retrieved by the Request Sense command or until receipt of any other command.

The Request Sense command shall return a CHECK CONDITION status only to report fatal errors for the Request Sense command. For example:

- 1) The medium changer device detects a non-zero reserve bit in the CDB.
- 2) An unrecoverable parity error occurred on the DATA BUS.
- 3) A medium changer device malfunction prevents return of the sense data.

Any nonfatal error occurring during the execution of the Request Sense command shall return the sense data with GOOD status.

The Sense Data Format is as follows.

Sense Data Format

Bit Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code (70h)						
1	Reserved (00h)							
2	Reserved (0)				Sense Key			
3 - 5	Reserved (00h)							
6	Information							
7	Additional Sense Length (x-7)							
8 - 11	Reserved (00h)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Reserved (00h)							
15	SKSV	Sense-Key Specific						
16 - 17								
18 - x	Additional Sense Bytes							

Sense Key is described below.

Information equals the number of the drive being turned off for a Sense Key of 2 (Not Ready) and an ASC,ASCQ of 04h,81h - 'Not ready, turning off drive'.

Additional Sense Code and **Additional Sense Code Qualifier** indicate detailed information related to an error or exception condition. These error codes are listed in Section 12.2.

SKSV (Sense-Key Specific Valid) equals 1 if the Sense Key Specific field contains valid information.

Sense-Key Specific contains information that is specific to the type of error returned.

Additional Sense Bytes contain additional information about the error returned.

The following Sense Key values are returned by the medium changer device.

Sense Key Descriptions

Sense Key	Description
0h	NO SENSE. Indicates that there is no specific sense key information to be reported. This is the case for a successful command.
1h	RECOVERED ERROR. Indicates that the last command completed successfully with some recovery action performed. Information about the first hardware error encountered is available in the data fields above.
2h	NOT READY. Indicates that the medium changer device cannot be accessed.
4h	HARDWARE ERROR. Indicates that the medium changer device encountered a non-recoverable hardware failure while performing the command or during self test.
5h	ILLEGAL REQUEST. Indicates an illegal parameter in the CDB or in additional parameters supplied as data.
6h	UNIT ATTENTION. Indicates that Mode parameters have been changed or the target has been reset.
Bh	ABORTED COMMAND. Indicates that the medium changer device aborted the command. This is typically due to a SCSI communication error.

If the Sense Key is equal to 5 (Illegal Request) and the SKSV is set to 1, the Sense-Key Specific fields contain the following information.

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

C/D (Command/Data) equals 1 if the illegal parameter is in the command descriptor block or 0 if the illegal parameter is in the data parameters sent.

BPV (Bit Pointer Valid) equals 1 if the value in the Bit Pointer field is valid.

Bit Pointer indicates the left-most (most-significant) bit of the field which is in error.

Field Pointer indicates the byte of the command descriptor block or of the parameter data which in error. When a multiple-byte field is in error, this field contains the first (most-significant) byte of the field which is in error.

If the Sense Key is equal to 4 (Hardware Error) or 1 (Recovered Error) and the SKSV is set to 1, the Sense-Key Specific fields contain the following information.

Bit	7	6	5	4	3	2	1	0
Byte								
15	SKSV	Reserved (0)						
16 - 17	(MSB)	Actual Retry Count						(LSB)

Actual Retry Count equals the number of retries used in attempting to recover from the error.

Also, for these types of errors, the **Additional Sense Bytes** field contains the following information.

Bit Byte	7	6	5	4	3	2	1	0
18	ChgrReady	Restored	Completed	AllReturned	MT1Full	MT2Full	FlipFull	FailSecond
19	InfoValid	(First) Source Tray Location			(First) Containing Element Number			Inverted
20 - 21	(MSB)	(First) Source Address						(LSB)
22 - 23	(MSB)	(First) Destination Address						(LSB)
24	Info2Valid	Second Source Tray Location			Second Containing Element Number			Inverted2
25 - 26	(MSB)	Second Source Address						(LSB)
27 - 28	(MSB)	Second Destination Address						(LSB)
29	Medium Transport Number							
30 - 31	(MSB)	Failure Address						(LSB)
32	Component Number							
33	Error Subcode							
34	Error Type							
35	Error Context							
36 - 37	Internal Error Location							
38 - 40	Reserved (0)							
41 - 44	(MSB)	Lift Offset						(LSB)
45 - 46	(MSB)	Picker Step Count						(LSB)
47 - 48	(MSB)	Pivot Offset						(LSB)
49 - 53	Reserved (00h)							

ChgrReady equals 1 if the medium changer device is ready to accept new tray movement commands or 0 (zero) if the medium changer device is jammed and a Rezero Unit command is required to reinitialize the unit.

Restored equals 1 if all trays being moved have been returned to their source elements and the medium changer device has been restored to the state in which it was in before the last command was issued.

Completed equals 1 if trays have been moved and the last command completed successfully.

AllReturned equals 1 if all trays have been returned to their last storage element locations.

MT1Full equals 1 if the first medium transport element is full.

MT2Full equals 1 if the second medium transport element is full.

FailSecond equals 1 if the failure occurred on the second move of an Exchange Medium command (from the First Destination Element to the Second Destination Element) or 0 if the failure occurred on the first move (from the Source Element to the First Destination Element). The second move is actually executed first.

InfoValid equals 1 if bytes 18 to 23 contain valid information about the last tray movement command, or the first move of an Exchange Medium command (Source to First Destination Element).

Info2Valid equals 1 if bytes 24 to 28 contain valid information about the second move of an Exchange Medium command (First Destination Element to Second Destination Element).

(First) Source Tray Location and **Second Source Tray Location** contain values indicating the final location of the trays in the first and second source elements, respectively. (The second source element is the First Destination Element of an Exchange Medium command.) These values are as follows:

1	Tray is in source element
2	Tray is in a medium transport element (if not the source or destination element) where the MT number (picker) is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for MT1 or 2 for MT2)
3	Tray is in destination element
4	Tray is in its last occupied storage element (if not the source or destination element)
5	Tray has been lost
6	Tray is in import/export element (if not the source or destination element) where the IE number is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for IE1, 2 for IE2, etc.; or 0 (zero) for IE8-IE10)
7	Tray is in data transfer element (if not the source or destination element) where the DT is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for DT1, 2 for DT2, etc.; or 0 (zero) for DT8-DT12)

(First) Containing Element Number and **Second Containing Element Number** are the numbers of the elements containing the trays originally in the first and second source elements, respectively.

Inverted and **Inverted2** equal bits of 1 if the disks originally in the first and second source elements, respectively, are now inverted from their original states.

(First) Source Address and **(First) Destination Address** are the addresses of Source and Destination Elements of the last tray movement command, or the Source and First Destination Elements of the last Exchange Medium command.

Second Source Address and **Second Destination Address** are the addresses of First and Second Destination Elements of the last Exchange Medium command.

Medium Transport Number is the number of the medium transport element (1 or 2) in use when the error occurred.

Failure Address is the address of the closest element to which the medium transport element specified by the Medium Transport Element Number was positioned when the error occurred.

Error Type indicates the general type of error and the interpretation of the **Component Number** and **Error Subcode** fields. Section 10.6.4 for more information.

Error Context is a code for the context in which the error occurred. The error context codes are listed in Section 12.3.

Internal Error Location is a number which is useful to Plasmon technical support.

Lift Offset is a signed lift encoder count offset from the count associated with the Failure Element Address at the Lift Elevation State above.

Picker Step Count is a signed motor step count for the active picker when the error occurred.

Pivot Offset is a signed pivot step count offset from the count associated with the Failure Element Address in block A.

10.20 RESERVE ELEMENT Command

The **Reserve Element** command is used to reserve the medium changer device or specific elements within it. If the entire medium changer device is reserved, any other SCSI initiator will only be permitted to execute the following commands: Inquiry, Request Sense, Read Element Status, Read Magazine Status, and Release Element (ignored). Any other command will generate RESERVATION CONFLICT status.

Bit Byte	7	6	5	4	3	2	1	0	
0	Operation Code (16h)								
1	Reserved (0)							Element	
2	Reservation Identification								
3-4	(MSB)			Element List Length				(LSB)	
5	Reserved (00h)								

Element equals bit of 1 if specific elements are to be reserved or 0 if the entire medium changer device is to be reserved.

Reservation Identification provides a means for the initiator to identify each element reservation with a specified code byte. It is used in the Release Element command to specify which reservation is to be released and in a superseding Reserve Element command to specify which reservation is to be superseded.

Element List Length specifies the length in bytes of the Reserve Element element list.

The Reserve Element element list consists of zero or more of the following reserve element list descriptors.

10.20.1 Reserve Element Element List Descriptor

The Reserve Element Element List Descriptor is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0-1	Reserved (00h)								
2-3	(MSB)			Number of Elements				(LSB)	
4-5	(MSB)			Element Address				(LSB)	

Element Address is the beginning element address to start assigning reservations for.

Number of Elements is the number of elements to reserve or zero if elements are to be assigned beginning at the specified element address through the last element address on the unit.

10.21 RESTORE DRIVES Command

The **Restore Drives** command restores a pair of drives previously removed (see Service Drives command in Section 10.24) or never inserted. It does this by first electrically isolating the internal SCSI bus to which the drives would be attached and temporarily turning off other drives on this bus to prevent them from being glitched. The specified drive pair may then be manually installed.

This command must be issued twice – once initially with the Isolate bit set to 1, and a second time after the drives are physically installed with the Isolate bit set to 0 (zero). When the command is issued the second time, the drives in the newly installed drive pair will be turned on. Also, any drives which were temporarily turned off will also be turned back on and the internal SCSI bus to which these drives were attached will be no longer be isolated. Thus, these other drives will again be available for use also.

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Operation Code (C1h)								
1	Drive Pair								
2	Isolate	Reserved (0)							
3-5	Reserved (00h)								

Drive Pair is the drive pair to restore (e.g., Drive Pair 1 = drives 1 and 2).

10.22 REZERO UNIT Command

The **Rezero Unit** command causes the library system to attempt to clear all jams and position to its home position. If the library system has not initialized its robotic elements, it will do so at this time

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (01h)							
1-4	Reserved (00h)							
5	Rsvd (0)	NoTrayRet	Reserved (0)					

By default, the library system will return all trays (and disks) in drives to their original storage elements before moving to its home position. If there are trays in drives, and the DsabLoEj bit is set to 1 in the Mode Select Library Mode Parameters Page 1 (see Section 10.7.1), then the command will fail unless the drives were previously stopped and unclamped by Start Stop Unit commands issued by the host to each such drive.

NoTrayRet equals 1 if trays *are not* to be returned to their original storage elements before moving the library system to its home position.

10.23 SEND DIAGNOSTIC Command

The **Send Diagnostic** command instructs the medium changer device to perform self-diagnostic tests on itself. It can also be used to recalibrate library system offsets and to park the library system in preparation for shipping.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (1Dh)							
1	Reserved (0)			PF (0)	Rsvd (0)	Selftest (1)	DevOffl (0)	UnitOffl (0)
2	Reserved (00h)							
3 - 4	(MSB)	Parameter List Length (00h)						(LSB)
5	RecalOffs	Park	Reserved (0)					

PF (Page Format) is ignored.

Selftest (Self Test) equals 1 indicating default self-test.

DevOffl (Device Off-line) and **UnitOffl** (Unit Off-line) both equal bits of 0 (zero) indicating no vendor specific diagnostic that may be visible to other initiators.

Park equals 1 if the library system is to move to its park position in preparation for shipment.

RecalOffs equals 1 if all library system offsets are to be recalibrated.

10.24 SERVICE DRIVES Command

The **Service Drives** command prepares a pair of drives for removal by electrically isolating the internal SCSI bus to which they are attached and turning them off. The LED indicator lights near these drives will also be turned off indicating that the drive pair is available for removal. Other drives on the same SCSI bus as the drive pair will also be temporarily turned off (to prevent them from being glitched), but the LED indicator light near these drives will stay on and begin blinking to indicate that these other drives are not available for removal. The specified drive pair may be manually removed at this time.

This command must be issued twice – once initially with the Isolate bit set to 1, and a second time after the specified drives are physically removed with the Isolate bit set to 0 (zero). When the command is issued the second time, any drives which were temporarily turned off will be turned back on and the internal SCSI bus to which these drives are attached will be no longer be isolated. Thus, these other drives will again be available for use.

The drive pair may be restored to use by the Restore Drives command (see Section 10.21)

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (C0h)							
1	Drive Pair							
2	Isolate	Reserved (0)						
3 - 5	Reserved (00h)							

Drive Pair is the drive pair to service (e.g., Drive Pair 1 = drives 1 and 2).

10.25 TEST UNIT READY Command

The **Test Unit Ready** command provides a means of checking medium changer device ready status.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (00h)							
1-5	Reserved (00h)							

If the medium changer device is able to accept a medium access command without returning a CHECK CONDITION status, the Test Unit Ready command will return a GOOD status.

10.26 WRITE BUFFER Command

The **Write Buffer** command is used to write new firmware to the library system, to change the SCSI ID of the medium changer device, to write to a buffer to test communication with the medium changer device via the SCSI bus, or to set some library system values.

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Operation Code (3Bh)								
1	Reserved (0)					Mode			
2	Buffer ID								
3-5	(MSB) _____				Buffer Offset				(LSB)
6-8	(MSB) _____				Parameter List Length (n)				(LSB)
9	Reserved (00h)								

Mode and **Buffer ID** select the function to be performed based on the following table.

Mode	Buffer ID	Function
7	0	Download firmware (microcode).
2	0	Write to echo buffer to test SCSI data transfer.
2	2	Change SCSI ID of medium changer device.
2	3	Assign library system IP address.
2	4	Assign library system subnet mask.

Buffer Offset is the beginning byte offset within the designated buffer to which data is to be written.

Parameter List Length specifies the length in bytes of the accompanying parameter list.

10.26.1 Downloading Firmware

To write new firmware to the library system, set Mode to 7 and Buffer ID to 0.

The Buffer Offset begins at 0 but may be incremented as described in the next paragraph.

The required Parameter List Length value can be obtained from the size of the firmware object file, or the first four bytes of the file, or multiple Write Buffer commands can be issued with smaller values of Parameter List Length and increasing values of Buffer Offset (the Buffer Offset for each command is incremented by the Parameter List Length of the previous command). The sum of the Parameter List Lengths of such a group of commands must equal the size of the firmware object file. Each such Write

Buffer transfer may be repeated in the event of receiving a checksum error due to a communication failure. The Parameter List Length must always be a multiple of 258 (since data is transferred in blocks of 256 bytes with 2 byte checksums).

The Firmware Download parameter list is shown below.

Firmware Download Parameter Data

Bit	7	6	5	4	3	2	1	0
Byte								
0 - n	Library System Firmware Object File							

The format of the Library System Firmware Object File is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0 - 3	(MSB)	Size of Library System Firmware Object File (n)						(LSB)
4 - n	Library System Firmware Object Code							

Upon completion of the Write Buffer command, the library system will reboot the library system controller board. Host software should again poll with the Request Sense command, waiting for GOOD status.

10.26.2 Writing to the Echo Buffer to Test SCSI Communication

A 256 byte echo buffer is supported to test communication with the medium changer device.

To write to the echo buffer, set Mode to 2 and Buffer ID to 0.

Buffer Offset can be any value between zero and 255.

Parameter List Length can be any value between one and 256. The sum of Buffer Offset and Parameter List Length cannot exceed 256.

The Echo Buffer parameter list is shown below.

Echo Buffer Parameter Data

Bit	7	6	5	4	3	2	1	0
Byte								
0 - n	Application Supplied Data							

The data transferred is not defined by this specification and may be selected by the application. After the buffer is written, a Read Buffer command should be used to read the buffer and check its contents. The buffer is maintained when the library system is powered off.

10.26.3 Changing the Medium Changer Device SCSI ID

To change the SCSI ID of the medium changer device, set Mode to 2, Buffer ID to 2, Buffer Offset to 0, and Parameter List Length to 1. The parameter data consists of a single byte specifying the new SCSI ID the medium changer device.

The medium changer device SCSI ID parameter list is shown below.

Medium Changer Device SCSI ID Parameter Data

Bit	7	6	5	4	3	2	1	0
Byte								
0	New Medium Changer Device SCSI ID							

After returning good status to this command, the medium changer device will respond to the new SCSI ID for subsequent SCSI commands issued to it.

10.26.4 Assigning Network IP Address and Subnet Mask

To assign a network IP address and subnet mask to the library system, set Mode to 2, Buffer ID to 3 for IP address or 4 for subnet mask, Buffer Offset to 0, and Parameter List Length to 4. The parameter data consists of four octets (bytes) of address or mask information.

The network IP address or subnet mask parameter data is shown below.

Network IP Address or Subnet Mask Parameter Data

Bit	7	6	5	4	3	2	1	0
Byte								
0	Octet 1							
1	Octet 2							
2	Octet 3							
3	Octet 4							

Octet 1-4 are four bytes of IP address or subnet mask parameter data. For example, an IP address of 101.102.103.104 would be represented as the values 101, 102, 103, and 104.

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11. Event History Type and Event Description

The event list is a buffer maintained in the library system's non-volatile memory and used for diagnostic debugging purposes. The Event History Type byte of the Mode Select Library Mode Parameters Page 2 (Section 10.7.2) determines which values will be recorded in the event list. The format of the Event History Type byte is as follows.

Event History Type (see Mode Select Library Mode Parameters Page 2)

Bit	15	14	13	12	11	10	9	8
	N/A			Reserved (0)		DriveCAN	Reserved (0)	

Bit	7	6	5	4	3	2	1	0
	CmdFilter	SCSI Activity		Terse	Src/Dst	MT	Drive Pwr	Front Panel

The host can set this byte (via the Mode Select command) to specify the types of events to be recorded. The event list can then be examined using the Log Sense command Event History Page (Section 10.6.5).

The fields of the Event History Type byte to set and the corresponding bytes recorded in the event list for these settings are provided below. If the Event History Type byte is equal to zero, no further events will be recorded. This provides a means of retaining a previously recorded sequence of event bytes until they can be analyzed.

For a non-zero Event History Type, the following event bytes will always be recorded.

- FFh, 00h Power-on.
- FFh, 01h SCSI bus or device reset.
- F0h Beginning of medium changer command.
- F1h Beginning of library system initialize and recovery sequence, followed by byte values indicating the particular sequence followed.
- F2h End of library system initialize and recovery sequence.

DriveCAN equals 1 if CAN message activity to the drives is to be recorded.

The following bytes will be recorded for each drive CAN message if this bit is set.

- A1h NNh The second byte indicates the type and destination of the CAN message (it is the LSB of the CAN message id). These two bytes are followed by a (command and data) byte count, and the corresponding command and data bytes.

CmdFilter equals 1 if only SCSI commands which effect a change to the library are to be recorded in the Event List. If this bit is set, all Test Unit Ready, Request Sense, Inquiry, Mode Sense, Log Sense, Read Element Status, and Read Magazine Status commands will not be recorded in the Event List. If this bit is 0 (zero), all SCSI commands received will be recorded, subject to the SCSI Activity field and the Terse bit.

SCSI Activity should be set to one of the following:

- 0 No recording of SCSI activity
- 1 Record first byte (byte 0) of command only
- 2 Record all command bytes and all data bytes received by the changer device
- 3 Record first byte of command byte and all message and status bytes

The following bytes will be recorded in the event list for a non-zero SCSI Activity field.

- F3h Non-zero ASC/ASCQ returned to host. This byte is followed by the ASC and ASCQ bytes.

The following bytes will be recorded in the event list, depending upon the setting of the SCSI Activity field. The E5 and E6 values are not recorded if the Terse bit is set to one below.

- E3h One or more message bytes received from host, followed by the message bytes.
- E4h One or more message bytes sent to the host, followed by the message bytes.
- E5h One or more command bytes received from the host, followed only by the first command byte (byte 0).
- E6h One or more command bytes received from the host, followed by a byte count and the command bytes.
- E7h One or more data bytes received from the host, followed by two bytes of byte count (MSB and LSB), and the data bytes.
- E8h A status byte sent to the host, followed by the status byte.

Terse should be set to a bit of one if all bytes specified by the SCSI Activity field are to be recorded except E5 and E6. This bit should only be set for SCSI Activity field settings of 1 or 2. Setting this bit increases the amount of SCSI activity data that may be stored in the list.

Src/Dst equals a bit of one if source and destination element addresses for Position To Element, Move Medium, and Exchange Medium commands; or front panel, Rezero Unit, or power-on tray movement operations; are to be recorded, or a bit of zero if no source and destination element addresses are to be recorded. Source and destination element addresses for front panel, Rezero Unit, or power-on tray movement operations are preceded by an F7h flag byte. Source and destination element addresses for Position To Element, Move Medium, and Exchange Medium commands are also preceded by an F7h flag byte but only if no command byte was recorded (i.e., if the SCSI Activity field is set to zero).

F7h A tray was moved. The source and destination element addresses follow as described below.

For clarity and to save space in the Event List, drives are logged as D1h, D2h, etc.. Medium transport elements are logged as E1h and E2h. Storage elements less than 200 (C8h) are logged as one byte; and storage element numbers greater than or equal to 200 are logged as two bytes - the first (MSB) being OR'd with C0h. Import/export elements are logged as two bytes – FEh and then the magazine slot number (1-10).

For example, the following is the event list of an Exchange Medium from ST3 (a magazine slot) to D1 to ST500 (a fixed slot). Note that 500 decimal is 1F4 in hexadecimal.

F0 A6 03 D1 C1 F4

MT equals a bit of one if the medium transport element used for Position To Element, Move Medium, and Exchange Medium commands is to be recorded, or a bit of zero if the medium transport element is not to be recorded

The MT used is logged as E1h or E2h (for MT1 or MT2, respectively). For the default address of zero used with the Exchange Medium command, E9h is recorded if the exchange begins with MT1 or EAh is recorded if the exchange begins with MT2. The MT used is recorded after the source and destination element bytes if the Src/Dst bit is also set.

DrivePwr equals a bit of one if flag bytes for drive power cycling are to be recorded.

The following flag bytes are recorded for drive power cycling. The two bytes recorded are followed by a byte indicating the number of the drive effected.

- F5h, 01h Drive power cycled because disk did not load into drive
- F5h, 03h Drive power cycled because drive did not become ready after load
- F5h, 04h Drive power cycled because disk could not be unclamped
- F5h, 05h Drive power removed because drive was taken off-line
- F5h, 06h Drive power applied because drive was brought back on-line
- F5h, 07h Drive power cycled because drive SCSI ID was changed

Front Panel equals a bit of one if events related to front panel functions are to be recorded.

The bytes recorded in the event history list related to front panel functions are as follows:

- F6h, 01h Magazine exchange was initiated.
- F6h, 02h Drive service was started. A drive of the selected drive pair is also recorded.
- F7h A tray was moved prior to entering magazine exchange mode, or turning off or servicing a drive. The source and destination addresses of the tray are recorded in the manner described in the Src/Dst field above. The Src/Dst field must be set to one to record these bytes.
- F8h A magazine was removed. The magazine number is also recorded.
- F9h A magazine was inserted. The magazine number is also recorded.

12. Error Codes

12.1 Medium Changer Device SCSI Error Codes

The following is a list of error codes returned by a Request Sense command issued to the medium changer device within the library. The codes are listed in ASC, ASCQ order. See the Request Sense command, Section 10.19, for a description of the Sense Key values. Errors listed here with a Sense Key of 04h, hardware error, may also be returned with a Sense Key of 01h, recovered error. This indicates that the command was successful although the library did have some difficulty in completing the command. Recovered errors indicate a possible problem with the library.

Error codes returned by drives within the library system are not listed — see the appropriate drive manuals for a description of these errors.

Also listed are the internal error codes associated with the SCSI error returned, and the procedures that a host may use to recover when it has received one of the errors listed here. See Section 12.2 for a list of the internal library error codes, and the Enterprise D User's Manual or Service Manual for the cause or corrective action for each code.

Sense Key	ASC	ASCQ	Error Description	Internal Error
(02h)	04h	01h	Not ready, in process of becoming ready	-
(02h)	04h	07h	Not ready, operation in progress	-
(02h)	04h	80h	Not ready, in magazine exchange mode	-
(02h)	04h	81h	Not ready, beginning drive service	-
(02h)	04h	82h	Not ready, turning off a drive	-
(02h)	04h	83h	Not ready, library is parked	-
(02h)	04h	84h	Not ready, programming DSP	-
(05h)	1Ah	00h	Parameter list length error	-
(05h)	20h	00h	Invalid command operation code	-
(05h)	21h	01h	Invalid element address	-
(05h)	21h	81h	Invalid element type	-
(05h)	24h	00h	Invalid field in CDB	-
(05h)	25h	00h	Logical Unit not supported	-
(05h)	26h	00h	Invalid field in parameter list	-
(05h)	26h	81h	Invalid request, entering drive service mode	-
(05h)	26h	82h	Invalid request, turning off drive	-
(06h)	28h	00h	Not ready to ready transition, magazine access door closed	-
(06h)	28h	81h	Not ready to ready transition, rear door closed	-
(06h)	29h	00h	Power-on, Reset, or Bus Device Reset occurred	-
(06h)	2Ah	00h	Log Parameters changed	-
(06h)	2Ah	01h	Mode parameters changed	-
(05h)	2Bh	80h	Cannot disconnect from SCSI bus for Service/Restore Drives	-
(05h)	2Ch	00h	Command sequence error	-
(05h)	3Bh	0Dh	Medium destination element full	85h
(05h)	3Bh	0Eh	Medium source element empty	84h
(05h)	3Bh	81h	Magazine not present	81h
(05h)	3Bh	82h	Tray not present	82h
(05h)	3Dh	00h	Invalid bits in identify message	-
(06h)	3Fh	01h	Microcode has been changed	-
(04h)	40h	00h	Diagnostic failure	-
(0Bh)	43h	00h	Message error	-
(04h)	44h	00h	Internal target failure	-

Sense Key	ASC	ASCQ	Error Description	Internal Error
(0Bh)	45h	00h	Select or Reselect failure	-
(0Bh)	47h	00h	SCSI parity error	-
(0Bh)	48h	00h	Initiator detected error message received	-
(0Bh)	49h	00h	Invalid message error	-
(0Bh)	4Bh	00h	Data Phase error	-
(04h)	80h	11h	DSP not responding	11h
(04h)	80h	12h	Cable connect failure	12h
(04h)	80h	13h	Fuse overload	13h
(04h)	80h	14h	Circuit board failure	14h
(04h)	80h	15h	CAN timeout – drive interface board	15h
(04h)	80h	16h	CAN timeout – magazine interface board	16h
(04h)	80h	17h	Main board SCSI terminator power is low	17h
(04h)	80h	18h	Power supply voltage out of range	18h
(04h)	80h	19h	Power supply failure	19h
(04h)	80h	1Ah	SCSI bus isolation failure	1Ah
(04h)	80h	1Bh	Too few power supplies for number of drives supported	1Bh
(05h)	80h	22h	SCSI bus already isolated	22h
(05h)	80h	23h	SCSI bus not isolated	23h
(05h)	80h	31h	Drive not installed	31h
(04h)	80h	32h	Drive not connected	32h
(04h)	80h	33h	Drive clamp failure	33h
(04h)	80h	34h	Drive unclamp failure	34h
(04h)	80h	35h	Drive load failure	35h
(04h)	80h	36h	Drive unload failure	36h
(05h)	80h	37h	Drive is clamped (and DsabLoEj=1)	37h
(05h)	80h	38h	Drive in service state	38h
(05h)	80h	39h	Drive not in service state	39h
(05h)	80h	3Fh	Drive address conflict	3Fh
(05h)	80h	40h	Not supported by current SCSI bus configuration	40h
(06h)	80h	41h	Drives operating in overheated cabinet	41h
(06h)	80h	42h	Drives being shut down due to overheat condition	42h
(06h)	80h	43h	Drives operating with low cabinet fan speed	43h
(06h)	80h	44h	Drives being shut down due to low fan speed	44h
(04h)	80h	51h	Picker position failure	51h
(04h)	80h	52h	Swap pickers failure	52h
(04h)	80h	54h	Picker misposition	54h
(04h)	80h	55h	Picker not at drive	55h
(04h)	80h	57h	Pick tray failure	57h
(04h)	80h	58h	Store tray failure	58h
(04h)	80h	61h	Lift position failure	61h
(04h)	80h	63h	Lift blocked by projecting tray -	63h
(04h)	80h	69h	Pivot align failure	69h
(04h)	80h	6Ah	Pivot failure	6Ah
(04h)	80h	70h	Door open failure	70h
(02h)	80h	71h	Access door is open	71h
(05h)	80h	72h	Door open is prevented	72h
(02h)	80h	74h	Rear door is open	74h
(05h)	80h	80h	Element not present (slot replaced by drives – Access bit in element descriptor=0)	80h
(04h)	80h	81h	Magazine not present	81h
(04h)	80h	86h	Element unexpectedly empty	86h
(04h)	80h	87h	Element unexpectedly full	87h
(05h)	80h	8Bh	Picker is full	8Bh

Sense Key	ASC	ASCQ	Error Description	Internal Error
(04h)	80h	8Ch	Both pickers are full	8Ch
(05h)	80h	8Dh	No disk to flip	8Dh
(05h)	80h	90h	Tray in drive (illegal for park library)	90h
(04h)	80h	9Ch	Tray's source magazine is known	9Ch
(04h)	80h	B2h	Flip invalid pos.	B2h
(04h)	80h	B3h	Flip station EEPROM write fail	B3h
(04h)	80h	B4h	Missing flipper tray	B4h
(04h)	80h	B5h	Flipper is full	B5h
(04h)	80h	B6h	Flipper com error	B6h
(04h)	80h	B7h	Flipper power was reset	B7h
(04h)	80h	B8h	Old flipper protocol	B8h
(04h)	80h	BAh	Flipper not horizontal	BAh
(04h)	80h	BBh	Flip station EEPROM lock fail	BBh
(04h)	80h	BCh	Flip station EEPROM unlock fail	BCh
(04h)	80h	BDh	Flip station EEPROM read fail	BDh
(04h)	80h	BEh	Flipper status fail	BEh
(04h)	80h	BDh	Flipper timeout	BFh
(04h)	80h	C1h	Pick offset failure	C1h
(04h)	80h	C2h	Lift offset failure	C2h
(04h)	80h	C3h	Pivot offset failure	C3h
(04h)	80h	C4h	Target offset failure	C4h
(04h)	80h	C5h	Reference offset failure	C5h
(05h)	81h	02h	Wrong model firmware	-
(05h)	81h	03h	Download firmware checksum error	-
(05h)	81h	05h	Download offsets checksum error (or serial number mismatch)	-
(06h)	82h	NNh	Cable connect failure (NN=PWA number)	-
(06h)	83h	NNh	Fuse overload (NN=PWA number)	-
(06h)	84h	00h	Power supply failure	-

12.2 Internal Error Codes

The following error codes are stored in the library system error log and error statistics buffers and are returned by the Log Sense command. For more information about the causes and corrective actions for these errors, refer to the Enterprise D User's Guide or Service Manual.

Error Code	Error Description
02h	Flash checksum
03h	NVRAM failure
0Ah	Bad element code
0Ch	Operation stack overflow
0Dh	Bad operation stack index
0Eh	Flash program fail
0Fh	Flash program fail - DSP
11h	DSP not responding
12h	Cable connect failure
13h	Fuse overload
14h	Circuit board failure
15h	CAN timeout – drive interface board
16h	CAN timeout – magazine interface board
17h	Main board SCSI terminator power is low
18h	Power supply voltage out of range
19h	Power supply failure
1Ah	SCSI bus isolation failure
1Bh	Too few power supplies for number of drives supported
22h	SCSI bus already isolated
23h	SCSI bus not isolated
31h	Drive not installed
32h	Drive not connected
33h	Drive clamp failure
34h	Drive unclamp failure
35h	Drive load failure
36h	Drive unload failure
37h	Drive is clamped (and DsabLoEj=1)
38h	Drive in service state
39h	Drive not in service state
3Fh	Drive address conflict
40h	Not supported by current SCSI bus configuration
41h	Drives operating in overheated cabinet
42h	Drives being shut down due to overheat condition
43h	Drives operating with low cabinet fan speed
44h	Drives being shut down due to low fan speed
51h	Picker position failure
52h	Swap pickers failure
54h	Picker misposition
55h	Picker not at drive
57h	Pick tray failure
58h	Store tray failure
61h	Lift position failure
63h	Lift blocked by projecting tray
69h	Pivot align failure
6Ah	Pivot failure

Error Code	Error Description
70h	Door open failure
71h	Magazine access door is open
72h	Door open is prevented
74h	Rear door is open
80h	Element not present
81h	Magazine not present
82h	Tray not present
84h	Source is empty
85h	Destination is full
86h	Element unexpectedly empty
87h	Element unexpectedly full
8Bh	Picker is full
8Ch	Both pickers are full
8Dh	No disk to flip
90h	Tray in drive
91h	Tray in picker
94h	Not enough trays for test
95h	Too many trays for test
97h	No drives online
99h	Empty tray not found
9Ah	Full tray not found
9Bh	Empty slot not found
9Ch	Tray's source magazine is unknown
9Dh	Element scan fail
B2h	Flip invalid pos.
B3h	EEPROM write fail
B4h	Missing flipper tray
B5h	Flipper is full
B6h	Flipper communications error
B7h	Flipper power was reset
B8h	Old flipper protocol
BAh	Flipper not horizontal
BBh	Flipper EEPROM lock fail
BCh	Flipper EEPROM unlock fail
BDh	Flipper EEPROM read fail
BEh	Flipper status fail
BFh	Flipper timeout
C1h	Pick offset failure
C2h	Lift offset failure
C3h	Pivot offset failure
C4h	Target offset failure
C5h	Reference offset failure
F7h	SCSI parity error
F9h	Abort message received
FDh	Host communication timeout

12.3 Internal Error Context Codes

The following error context codes are stored in the library system error log and are returned by the Log Sense command.

Context	Description
1	Powering up library and drives

Context	Description
2	Initializing library
3	Positioning to pick from source element
4	Picking from source element
5	Positioning to pick from destination element
6	Picking from destination element
7	Positioning to store to destination element
8	Storing to destination element
9	Positioning to store to destination 2 element
10	Storing to destination 2 element
11	Positioning to element
12	Checking element for media
18	Programming Flash
19	Setting offsets
20	Flipping

13. Developer Notes

13.1 Predecessors to the Enterprise D

The Enterprise D library is the second generation of Plasmon 120mm media libraries. The first generation was the original D-Series libraries. These libraries returned an Inquiry Product Revision Level of 1nn β , where nn was the primary revision level and β was a space for release level firmware or a letter for beta firmware. The Enterprise D libraries return an Inquiry Product Revision Level of the form 2nn β .

13.2 Identifying the Library and Model

All Plasmon CD/DVD libraries begin with the same Inquiry response, "PLASMON D-SERIES", however the Enterprise D libraries also return the model number as part of the Inquiry response. Other commands and fields may be used to differentiate the different libraries and library models. Usually, it is not necessary to know the exact library model, but rather the capacities and capabilities of that library model. For example, application code can be written in a more generic manner if information in the following Mode Sense pages is used by the application: Element Address Assignment page (1Dh), Transport Geometry Parameters page (1Eh), Device Capabilities page (1Fh), Library Mode Parameters page 1-3 (00h, 20h, and 21h), Drive Assignments page (22h), and Front Panel Display Mode page (23h). Additional library information can be found in the Inquiry command Additional Unit Information page (C0h) and the Read Element Status data transfer element descriptors (for example, the SCSI ID's of the drives).

The following table identifies which Mode and Log Sense pages are supported by the various generations of Plasmon CD/DVD libraries. A Mode Sense command with a page code of 3Fh can be used to determine which Mode Sense pages are available. An Log Sense command with a page code of 00h can be used to determine which Log Sense pages are available. Note that the format of Log Sense pages, in particular, may be quite different between the two library generations.

Library Generation	Mode Sense Pages Supported	Log Sense Pages Supported
1. Original D-Series	1Dh, 1Eh, 1Fh, 00h, 20h, 21h, 22h, 23h, 24h, 25h, 26h, 35h	00h, 30h, 31h, 32h, 33h
2. Enterprise D	1Dh, 1Eh, 1Fh, 00h, 20h, 21h, 22h, 23h, 27h	00h, 30h, 31h, 32h, 33h, 34h, 35h, 36h

The library and model can also be determined by examining byte 45 in the standard Inquiry return data. Possible values are listed in the following table.

Library and Model	Inquiry byte 45
D-Series D120	4
D-Series D240	5
D-Series D480	6
D-Series D550	9
D-Series D875	10
D-Series D1525	11
D-Series D2175	12

13.3 Maintaining an Inventory

The medium changer device in the library maintains an inventory of trays and disks in the library in its non-volatile memory, but has no knowledge of the type or contents of any disks. For this reason, the host initiator device may wish to maintain its own inventory of library disks. To synchronize these two inventories, it may be necessary for the host to issue an Initialize Element Status command followed by a Read Element Status command. Once the position of disks are known, the host may wish to load each into a drive one side at a time (assuming double-sided media) to read content information. Obviously, this is a time-consuming operation so should be done only when necessary.

13.4 Using the Library (Moving Trays and Disks)

Although trays (and disks mounted thereon) can be moved by using the Move Medium command and specifying the medium transport elements as source or destination addresses, it is much more efficient to use the Exchange Medium command whenever possible and not to designate specific medium transport elements to be used. For example, the command “Exchange Medium - ST1 to DT1 to ST2” will exchange the trays in storage element 1 with the one in drive 1 and return that one to storage element 2.

Various schemes can be used to optimize the performance of the library. For example, frequently used disks can be placed closer to the drives, or one of the pickers can always be left with a full tray. The latter example would be useful if a number of drive load requests had been queued at the host. The host would use a Move Medium command to load the first n disks into drives and another Move Medium to move the next disk in the queue to a picker. From then on the host would alternate Exchange Medium commands exchange first from the full picker to a loaded drive to the empty picker, and then exchanging the now full picker to the storage slot with the next disk in the queue to the other now empty picker.

13.5 Exchanging Magazines

As with the original D-Series, the first 50 storage elements are slots within removable magazines. In addition, the 10 import/export elements in the Enterprise D library are located within a separate removable magazine. Any of these magazines may be inserted, removed, or replaced via the Exchange Magazines front panel menu selection or the equivalent SCSI Open Magazine Door command. Before the Open Magazine Door command is issued, a Mode Select command should be sent with a Magazine Indicator Page (see Section 10.7.6) to indicate which magazines are to be replaced. Note, however, that once the magazine access door has been opened, there is nothing to prevent the operator from replacing any of the magazines. A warning message will be displayed if a magazine associated with a non-flashing LED is replaced.

13.6 Servicing Drives

Drives may be inserted, removed, or replaced in pairs while the library is in operation. Drives are removed by placing them in a service state. This may be done via the Service Drives front panel menu selection or the equivalent SCSI Service Drives command. The SCSI Service Drives command must be sent twice – once to isolate the SCSI bus on which the drives are located, and once again after the drives are removed to unisolate the SCSI bus. Similarly, drives are inserted and made operational by removing them from the service state. This may be done via the Restore Drives front panel menu selection or the equivalent SCSI Restore Drives command. As with the Service Drives command, the SCSI Restore Drives command must be sent twice – once to isolate the SCSI bus on which the drives will be located, and once again after the drives are inserted to unisolate the SCSI bus.

13.7 Examining Errors

After processing a command, the medium changer device or drive will normally return GOOD completion status or CHECK CONDITION status. If the host receives CHECK CONDITION status, it should issue a Request Sense command. The Sense Key field can then be examined to see if an error occurred and, if so, the severity of the error. The Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) fields provide more information about the error or condition that triggered the CHECK CONDITION. Depending upon the Allocation Length specified in the Request Sense command, more information about the error will also be returned. The error codes listed in this manual are for the medium changer device only. Consult the specific drive manual for information about errors returned by the drives themselves.

13.8 Cabinet Temperature and Low Fan Speed Warnings

If, during normal operation conditions, the cabinet temperature has risen above a minimum threshold temperature or the fan has dropped below a maximum threshold speed, a drive warning Unit Attention will be generated. If the host receives this notification, it should stop reading from or writing to all drives and unload all disks in those drives. If the temperature continue to rise above another temperature threshold or the fan speeds drops below another speed threshold, a drive shutdown Unit Attention condition will be generated. After 60 seconds, all drives will automatically be powered down and disconnected from their internal SCSI buses. At this point, a third Unit Attention condition will be generated indicating that drives have been placed in the service state.

The current state of any drive can be obtained by issuing a Read Element Status using the drive element address. The Additional Sense Code and Additional Sense Code Qualifier fields in the data transfer element descriptor identify the current normal/warning/or shutdown state of the drive. These fields should be examined in every data transfer element descriptor after being notified of any drive-related Unit Attention conditions.

14. Drive Types

This section gives information on the various drive types supported.

Drive ID#	Type	Make and Type	Assembly #	FRU Part #
5	Multi Drive	Panasonic SW-9571		SP97705243
5	Multi Drive	Panasonic SW-9573	97707300-00	SP97707300
6	DVD-R	Panasonic SW-9501 DVD-R		SP97704233
7	DVD-RAM	Hitachi GF-2050 DVD-RAM		SP97704232

