

PLASMON'S D-SERIES CD/DVD LIBRARY SYSTEM

SCSI REFERENCE MANUAL

PLASMON IDE

This publication describes the SCSI software interface to Plasmon's family of CD/DVD library systems. It is intended to provide interfacing information to parties wishing to develop software and/or applications programs for these library systems. This document corresponds to Product Revision Level 1.13 or later of the library system firmware.

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Printing History

Revision	Date	Pages	Descriptions
			Original based on Document No. 303985-000 Rev G
01	3/20/01	3 8 10 15 21,25 26 28 39 45 47 50 51 51 52 52 58 69,71	Added flipper to Glossary of terms. Added flipper to Rezero Unit definition. Added number of storage elements with flipper column to element counts table. Added Inv1 and Inv2 bits to Exchange Medium Command Added flip count to Log Select Unit Statistics Page (30H) Count values extend from bytes 32 to 79 Added definition of flip count Added invert bit to Error Log Page (32h) Added rotate to Mode Sense Transport Geometry Params page (1Eh) Added/defined invert bit in Move Medium command Added /defined invert bit in Position To Element cmd Added/defined invert bit in Read Element Status Medium Transport Added invert bit description. Added invert to Storage Element Descriptor Import/Export Element Descriptor Data Transfer Element Descriptor Added/defined Inverted and Inverted2 Request Sense Additional Sense Bytes Added flipper error codes
02	4/11/01	58	Added/defined FlipFull in Request Sense Additional Sense Bytes

		69,71,72	New error 0xB8 (Old flipper protocol) New error 0xB9 (Flipper tray sensor fail) New error 0xBA (Flipper not horizontal) Modified assignment of flipper error codes
03	5/14/01	19	Updated FLASH Firmware Part Number to 755103-000
A	5/21/01	cover all	Initial release with support for flipper Updated to new flipper scsi manual part number Added "Flipper" to footer

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1. Introduction

Plasmon's D-Series family of CD/DVD based robotic library systems are capable of holding from four to six CD or DVD drives and a number of disks in removable magazines. 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-2 Specification. The library system's medium changer device may be on the same SCSI bus as some of the drives within the library system, yet each device has a unique address on the bus and is accessed independently.

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

The import/export element, or I/E, is the operator accessible drawer through which individual disks are added to or removed from the library system.

The storage elements, ST1 - STn, are locations within the library system's medium store used to store disks. These disks are mounted on trays, which are contained within removable magazines. Each magazine can hold up to ten disks. Magazines can be added or removed by opening the magazine access door using a proper sequence of button presses on the library system front panel.

The medium transport elements, MT1 and MT2, are the optical disk transport mechanisms used to remove disks from or return disks to the import/export element, 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 drives.

The medium changer device within the library system responds to commands as defined by and in accordance with the ANSI X3.131-1994 specification Small Computer System Interface-2 (also known as SCSI-2). This standard defines a protocol whereby data is transferred between two devices on the same SCSI bus in a sequence of phases. A request is made by sending a Command Descriptor Block (CDB) during the COMMAND phase. For certain commands, the request is accompanied by a list of parameters sent during the DATA OUT phase. Some commands receive data during the DATA IN phase. This document lists the commands and accompanying parameters for the medium changer device.

The interface to the library system is single-ended. Differential SCSI is also supported as an option. Synchronous data transfer is not supported by the medium changer device; neither is wide nor fast data transfer. However, the library drives may support these options, depending upon the specific drives used.

2. Glossary of Terms Used

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

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

ASC/ASCQ: Additional Sense Code/ Additional Sense Code Qualifier. Bytes 12 and 13 of the Sense Data blocked 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 12 cm 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.

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

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

Drive Control Board (DCB): The PWA controlling power to the drives and controlling their clamping, unclamping, and assignment of SCSI ID.

Drive Service: Unloading a library drive, turning it off (removing drive power), and opening the access door to allow an operator to remove or replace the drive, or install a new drive. If the drive was originally turned on, drive power will be restored when the access door is closed again. Magazines must not be exchanged at this time.

Drive Type: A numeric classification of the type of library drive installed. This value is encoded in the connector to the drive from the library system DCB board.

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.

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), an import/export element (I/E), and data transfer elements (DT's).

(E)PROM: (Erasable) Programmable Read Only Memory. An integrated circuit chip within the library system containing microcode to enable programming of library system's Flash memory via the SCSI bus.

Event History/ Event List: A list of code bytes associated with events occurring within the library system or communication occurring between the library system and an associated host or CD Drive. The particular code bytes logged depends 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 the 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. The microcode must be downloaded from a host while the library system is running from its boot PROM. Programming of the Flash is usually done at the factory.

Flipper: A mechanism to change between side-A and side-B for double sided media. Not all libraries are equipped with a flipper.

Hot Swap: To power down and replace a drive while the library system is on-line.

I/E Drawer: The operator accessible drawer through which individual disks are added to or removed from the library system, the import/export element.

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

Import/Export Element (I/E): The operator accessible drawer through which individual disks are added to or removed from the library system. This is sometimes referred to as the mailslot.

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

LSB: Least significant bit.

Lift: The medium transport elements particularly when moving vertically.

Logical Unit Number (LUN): The number of a specific peripheral device accessible via a designated SCSI ID. The library system supports multiple logical unit numbers for its drives through the use of optional SCSI bus expanders.

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

Magazine: A carrier containing up to ten trays. Magazines may be inserted or removed as a unit when the library system is in magazine exchange mode. A magazine may contain empty trays.

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 access door is closed. This differs from Medium Exchange where a single disk is exchanged for another.

Magazine Board: The PWA mounted vertically beside each column of magazines and containing switches to sense the insertion or removal of those magazines.

Medium Transport Elements (MT's): The optical disk transport mechanisms in the library system. The library system contains two medium transport elements. These are also referred to as the pickers, or jointly as the lift when moving vertically.

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 elements between columns of magazines.

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

SCSI: Small Computer System Interface. A specification defining the transfer of commands and data between two devices such as a host computer and a computer peripheral. The second version of this specification is known as SCSI-2 and is defined in ANSI X3.131-1994.

SCSI Bus Expander: A device which translates SCSI commands addressed to a single SCSI ID and multiple LUN's on its host side, to multiple SCSI ID's and a single LUN (zero) on its device side. It also provides isolation to drives in groups to allow them to be replaced (hot-swapped) while the library system is on-line.

SCSI Bus Expander Group: One of two groups of drives on a single SCSI bus expander. Each group of drives is located on a separate SCSI bus on the device side of the bus expander. When a drive in a group is taken off-line for servicing, the bus expander will return Not Ready status for all media access requests directed any drive in the group.

SCSI ID: A unique address for each device on an SCSI bus. The host and the medium changer device must each have an SCSI ID between zero and 7, inclusive. The drives must each have an SCSI ID between zero and 7, or between zero and 15 or 31 if Wide SCSI is supported. The host generally has a SCSI ID of 7.

Storage Elements (ST's): Locations within the library system's medium store used to store disks. These locations are associated with slots within removable magazines when such magazines are present within the library system.

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 random access storage devices (the drives).

Tray: A carrier for disks. A tray may also be empty (contain no disk).

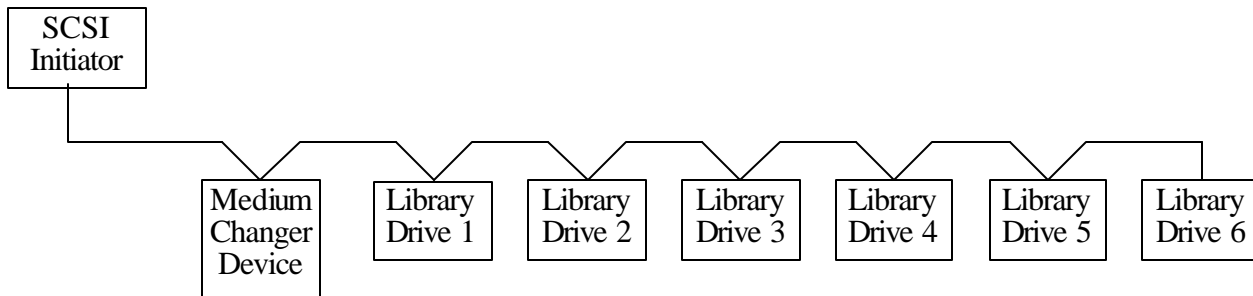
Unload: Unclamping a disk from a drive and moving the disk from the drive.

3. Sample Configurations

The medium changer device and the CD drives in the library system can be connected in a number of different ways. The following are some sample configurations

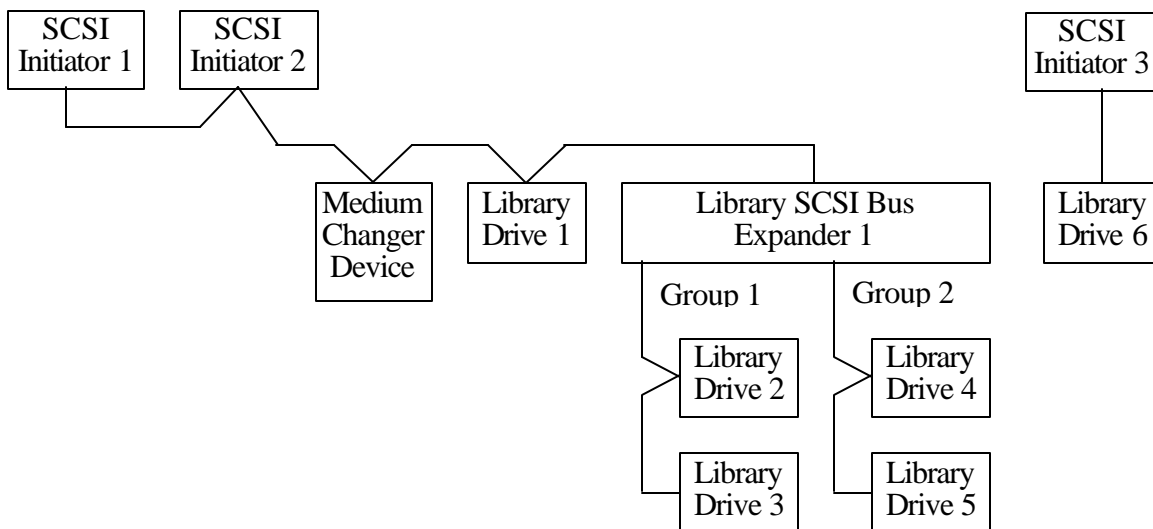
3.1 Simple Configuration

In this example, a single initiator (host) is connected to the library system medium changer device and drives via a single SCSI bus.



3.2 Complex Configuration

In this example, a multiple initiators access the library system medium changer device and drives via a multiple SCSI buses and a SCSI bus expander device. Multiple SCSI buses and SCSI bus expanders are not supported on all library system models.



4. Library System Operating Modes

The library system can operate in one of six modes: online running from EPROM, online running from Flash, magazine exchange, drive service, setup, and maintenance.

4.1 Online Running from EPROM

In this mode, the library system is running from its boot PROM. The library system will run in this mode if it has never received microcode to download to its Flash memory via the Write Buffer command, if it receives a Mode Select command with the BootPROM bit set in Library Mode Parameters Page 2, or if power is applied to the library system while a key is being held down on the front panel. In this mode, only a minimal set of SCSI commands is supported, those necessary to download microcode to the library system Flash memory. Indeed, the library system must be placed in this mode to allow the downloading of microcode via the Write Buffer command. Front panel passwords are not enforced in this mode but may be changed or removed. That is, the library system may be placed in this mode (by holding down a key upon power-up for example) to recover from a lost or forgotten password.

4.2 Online Running from Flash

This is the normal operating mode of the library system. Element statuses are displayed on the front panel of the library system.

4.3 Magazine Exchange Mode

This mode may be invoked from the front panel 'Exchange Magazines' menu selection, or from the Open Access Door command with the SvcDrive bit set to zero. If invoked from the front panel, trays not currently in magazines may or may not (depending upon the DsabTrayRet field of Mode Select Library Mode Parameters Page 1) be returned to their magazines. In either case, the access door will then be opened allowing access to the magazines. When the door is closed after inserting, replacing, or removing magazines, the new or replaced magazines will be automatically checked for the presence of media.

No tray movement commands will be allowed while in magazine exchange mode.

4.4 Drive Service Mode

This mode may be invoked from the front panel 'Service Drive' menu selection, or via the Open Access Door command with the SvcDrive bit set to one. If invoked from the front panel, there will be a 5 second delay before the access door is opened. This allows time for all SCSI initiators to poll the medium changer device and sense that it is entering drive service mode. Sensing this, the initiators should cease SCSI activity to all drives, or all drives on the same SCSI bus expander and in the same group as the drive being serviced. After the delay, the drive being serviced will automatically be unloaded and powered-off before the access door is opened. If the drive is on a SCSI bus expander, subsequent read/write requests to the drive or drives on the same bus expander and in the same group will receive Not Ready status.

Initiators should poll the medium changer device at least once every 5 seconds to determine whether it is entering drive service mode and whether they need to cease SCSI activity to one or more drives. If a drive not on a SCSI bus expander is physically disconnected from the SCSI bus, even if the drive is powered-off, host communication with the other drives on the same SCSI bus could be adversely effected, so such communication should be stopped at this time. If a drive is on a SCSI bus expander, communication with other drives on the

same bus expander and in the same group should be stopped. In either case, if drive service is initiated at a single host computer rather than from the front panel or other initiators, no polling of the medium changer device is necessary at this point because the host computer can simply stop drive SCSI activity before it invokes drive service mode by sending the Open Access Door command.

After entering drive service mode, the initiator should continue polling the medium changer device until a 'Not ready to ready transition' Unit Attention condition occurs indicating the conclusion of drive service mode. At this point, bus activity to the drives can continue if it was stopped. If drive service mode was invoked from the front panel and the drive was powered-up before servicing, power will automatically be restored to it at the conclusion of drive service mode. If a drive is replaced, the corresponding library system offsets will automatically be recalibrated before leaving drive service mode.

Tray movement commands will be allowed while in drive service mode but no magazines may be inserted or removed. That is, the library system may continue normal operation except for magazine exchange, which is not permitted.

4.5 Setup 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 D-Series User's Guide and Service Manuals.

4.6 Maintenance Mode

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

5. 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 The **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 causes the medium changer device to move all of its motors to their home positions. If control flags allow, media in the picker, drives, import/export drawer, and/or flipper will be returned to their source magazine slots.

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

The **Reserve** and **Release** 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 a data transfer element (a drive) in preparation for a disk eject from the drive. Optionally, this command can also be used to position an MT to a particular storage element location in preparation for a Move Medium or Exchange Medium command.

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 **Exchange Medium** command instructs the medium changer device to exchange the disk in the source element with the disk in a destination element and place that disk in another destination element (e.g., exchange a disk in the first slot of magazine 1 with the disk in drive 1 and place the disk previously in the drive in the second slot of magazine 1).

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

The **Open Close I/E Drawer** command instructs the medium changer device to either extend or retract the import/export drawer for single disk insertion and removal.

The **Prevent Allow Medium Removal** command instructs the medium changer device to either inhibit or permit opening of the access door for magazine insertion or removal, and/or the import/export drawer for single disk insertion or removal.

The **Initialize Element Status** command causes the medium changer device to test all elements for the presence of media (empty or full trays).

The **Read Element Status** command is used to interrogate the status of elements.

The **Read Magazine Status** command is used to interrogate the status of magazines.

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.

The **Write Buffer** command is used to write new firmware to the library system, to change the medium changer device SCSI ID, or to write to a general purpose buffer.

The **Read Buffer** command is used to read from a general purpose buffer.

The library system normally operates from microcode stored in its Flash memory. If this microcode is corrupted or if a Mode Select command is issued with the BootPROM bit set to one, or if a button on the front panel is held down as power is being applied to the library system, the library system will operate from microcode stored in its boot PROM instead. Note that the boot PROM contains only a minimal subset of the normal microcode and is only used to download the normal operating microcode to the library system's Flash memory. See the description of the Write Buffer command for information on downloading microcode and programming the Flash.

The following SCSI-2 commands are available when the library system is running from Flash memory (normal operation).

Inquiry	Move Medium
Mode Select (6)	Exchange Medium
Mode Select (10)	Open Access Door
Mode Sense (6)	Open Close I/E Drawer
Mode Sense (10)	Prevent Allow Medium Removal
Send Diagnostic	Initialize Element Status
Rezero Unit	Read Element Status
Test Unit Ready	Read Magazine Status
Request Sense	Log Sense
Reserve	Log Select
Release	Read Buffer
Position To Element	Write Buffer

When running from the boot PROM rather than from Flash, only the following commands are accepted. Furthermore, not all mode pages are supported by the Mode Select and Mode Sense commands. The Send Diagnostic command has limited functionality in this mode as no robotics are tested.

Inquiry	Test Unit Ready
Mode Select (6) (limited)	Request Sense
Mode Select (10) (limited)	Log Sense
Mode Sense (6) (limited)	Log Select
Mode Sense (10) (limited)	Read Buffer
Send Diagnostic (no robotic tests)	Write Buffer

Finally, when the access door is open for magazine exchange, only the following commands are accepted without error, although the Test Unit Ready command can be used to determine when the access door has been closed again (closing the access door generates a Unit Attention condition - see Section 10).

Inquiry	Open Close I/E Drawer
Mode Select (6)	Prevent Allow Medium Removal (drawer only)
Mode Select (10)	Read Element Status
Mode Sense (6)	Read Magazine Status
Mode Sense (10)	Log Sense
Request Sense	Log Select
Reserve	Read Buffer
Release	Write Buffer

Note: the medium changer device will disconnect from the initiator during a Send Diagnostic, Rezero Unit, Position To Element, Move Medium, Exchange Medium, Open Access Door, Open Close I/E Drawer, Initialize Element Status, and Mode Select (only if a bus expander is effected) command, if disconnection is supported by the initiator. This frees the SCSI bus to allow other I/O processes to occur.

6. SCSI Addresses

The default SCSI ID's for the library system devices are as follows.

Default SCSI ID's

Device	Default SCSI ID
Library Drive 1	1
Library Drive 2	2
Library Drive 3	3
Library Drive 4	4
Library Drive 5	5
Library Drive 6	0
Medium Changer Device	6

7. Element Addresses and Counts

Four different element addressing schemes have been implemented for the library system. The following table lists the element addresses used in the different schemes. Note that the 200h, etc. alternate addresses used in scheme 4 cannot be used for storage elements above ST256. The 500h, etc. addresses will work for all storage elements in this scheme. Scheme 1, however, is the default scheme.

Element Addresses

Element Type	Scheme 1 (default)	Scheme 2	Scheme 3	Scheme 4
MT	8001,8002	8001,8002	16,17	100h,101h
ST	1,2,...	11,12,...	31,32,...	500h,501h,...5FFh,... (or 200h,201h,...2FFh)
I/E	4001	10	10	300h
DT	6001,6002,...	1,2,...	1,2,...	400h,401h,...

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

Element Counts

Model	Number of Transport Elements	Number of Storage Elements No Flipper	Number of Storage Elements With Flipper	Number of Import/Export Elements	Number of Drives Reported
D120	2	120	80	1	4
D240	2	240	200	1	6
D480	2	480	440	1	6

8. SCSI Communication

8.1 Supported Messages

In the course of communication between two SCSI devices, messages are sent in the MESSAGE IN and MESSAGE OUT phases. The following messages are accepted by and 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	Out
0Ch	BUS DEVICE RESET	Out
00h	COMMAND COMPLETE	In
04h	DISCONNECT	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
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		

8.2 Supported Status Bytes

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

Status Byte Code

Bits of status byte								Status
7	6	5	4	3	2	1	0	
R	R	0	0	0	0	0	R	GOOD
R	R	0	0	0	0	1	R	CHECK CONDITION
R	R	0	0	1	0	0	R	BUSY
R	R	0	1	1	0	0	R	RESERVATION CONFLICT
All other codes								Not Returned
Key: R = Reserved bit								

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.

9. 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 11.6.1), 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 Select, Mode Sense, Prevent Allow Medium Removal, Request Sense, Reserve, Release, Read Element Status, Read Magazine Status, Test Unit Ready, Log Select, Log Sense, Write Buffer (mode 2), Read Buffer	10 sec
Send Diagnostic, Position to Element, Move Medium, Exchange Medium, Rezero Unit, Initialize Element Status, Open Access Door, Open Close I/E Drawer	4 min
Write Buffer (mode 7)	15 min

10. Special SCSI States/Conditions

10.1 Reset State

When the RST signal is asserted on the SCSI bus, or a Bus Device Reset message is received from the host, the medium changer device within the library system enters the RESET state (as do all devices on the SCSI bus in which the RST signal being asserted). Because the changer device implements the Hard Reset alternative of the ANSI X3.131-1994 SCSI-2 specification, 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 Door Allow and Drawer Allow states (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.

10.2 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 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, until an appropriate Mode Select command from the host is received, or until an action by an operator (such as closing the access door) takes place.

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

- Entering magazine exchange mode either via the front panel menus or by the Open Access Door command. The medium changer device is Not Ready until the access door is closed again and newly inserted magazines have been scanned for trays and media.
- Entering drive service mode via the front panel menus. The medium changer device will be Not Ready for 5 seconds after 'Service Drive' is selected to allow time for SCSI initiator devices to poll the changer device, sense the Not Ready state, and stop SCSI activity to all drives, or all drives on the same SCSI bus expander and in the same group as the drive being serviced.
- Turning off a drive via the front panel menus. The medium changer device will be Not Ready for 5 seconds after 'Turn Off Drive' 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 (powered down).
- Sending a Mode Select command with the NotReady bit set to one in the Multiple Initiators Page. This bit is used in multiple initiator environments for one initiator to inform other initiators on the same SCSI bus that it will be turning off a drive or causing the unit to enter drive service mode.

10.3 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 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 access door after the insertion, removal, or exchange of magazines.
- The closure of the access door after a drive has been serviced (inserted, removed, replaced).
- A change to one or more of the library system settings via the front panel 'Set Up Library', 'Turn Off Drive', or 'Turn On Drive' functions, or a Mode Select command from a host.
- A change from Not Ready to Ready states via a Mode Select command from a host.
- A change to one or more of the log values via the front panel 'Set Up Library' function or a Log Select command from a host.
- The attainment of a threshold count as a result of a command updating the associated cumulative count value.
- A change in the library system Flash microcode via a Write Buffer command.
- A change to one of the two scratchpad buffers via a Write Buffer command.
- A total or partial reset of the non-volatile SRAM memory in the library system as a result of an abnormal power fluctuation or a shorting of traces on the main microprocessor PWA.

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.

11. SCSI Command Descriptions

11.1 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 can significantly decrease disk swap times. The Exchange Medium command can also be used to import new disks into and export existing disks out of the library system, or replace existing disks in the library system, all via the import/export element.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (A6h)							
1	Logical Unit Number (0)			Reserved (0)				
2-3	Transport Element Address (00h)							
4-5	(MSB)			Source Address				(LSB)
6-7	(MSB)			First Destination Address				(LSB)
8-9	(MSB)			Second Destination Address				
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 the opposite picker may be used as the second destination element.

Transport Element 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. If a flipper mechanism is not installed in the library, these bits are reserved.

One way to import a new disk into the library system is to specify an element with an empty tray as the source element, the (empty) import/export element as the first destination element, and the source element as the second destination element, or an empty storage element (no tray) as the second destination element. The empty tray from the source will be moved to the import/export and the operator will be instructed to insert a disk. The newly filled tray will then be moved to the second destination element.

One way to export an existing disk out of the library system, or have the operator exchange it for a different disk, is to specify the element with the disk to be exported as the source element and the (empty) import/export element as the first destination element. The second destination element can either be set to the original source element or some other empty element. The disk will be moved to the import/export and the operator will be instructed to remove or replace it. When the drawer is closed, the empty or full tray will be moved to the second destination element.

When importing or exporting individual disks in the manner described above, the disk must be inserted or removed from the import/export tray within the time specified in the Mode Select Timeout Parameter Page (See Section 11.6.6) or an Import/Export Timeout error will occur.

The access door will automatically be opened on all moves with the import/export element as the second destination element, unless the LvClosed field of the Library Mode Parameters Page 2 of the Mode Select command (see Section 11.6.2) is set to one.

See the Move Medium command (Section 11.10) for information about other possible errors generated by the Exchange Medium command.

11.2 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	Logical Unit Number (0)			Reserved (0)				
2-5	Reserved (00h)							

Note that the status of the magazines, drives, and import/export drawer 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. The DsabScanI, DsabScanS, and DsabScanD bits in the Mode Select command also effect which elements are checked (see Section 11.6.3). Setting these bits can greatly reduce the amount of time required for Initialize Element Status command to complete, but not all elements will be checked. Note that newly exchanged magazines are automatically scanned for the presence of trays and media upon access door closure apart from this command.

11.3 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	Logical Unit Number (0)			Reserved (0)				EVPD
2	Page Code							
3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

EVPD (Enable Vital Product Data) equals a value of one if the vital product data page as specified by the Page Code field is to be returned or a value of 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 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 (2)		
3	AENC (0)	TrmIOP (0)	Reserved (0)		Response Data Format (2)			
4	Additional Length (29h)							
5 - 6	Reserved (00h)							
7	RelAdr(0)	Wbus32(0)	Wbus16(0)	Sync(0)	Linked(0)	Rsvd(0)	CmdQue(0)	SftRe(0)
8 - 15	Vendor Identification ("PLASMON ")							
16 - 31	Product Identification ("D-SERIES ")							
32 - 35	Product Revision Level (e.g., "100 ")							
36 - 43	Firmware Release Date ("MM/DD/YY")							
44	Manufacturer Identification (01h)							
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 a value of one indicating medium is removable.

ANSI-Approved Version equals 2 indicating compliance with SCSI-2 Specification.

AENC (Asynchronous Event Notification) equals a value of zero indicating no support of this feature.

TrmIOP (Terminate I/O Process) equals a value of zero indicating no support of this feature.

Response Data Format equals 2 indicating compliance with SCSI-2 Specification.

Additional Length equals 29h.

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

WBus32 (Wide Bus - 32 bit) equals zero indicating no support of this feature.

WBus16 (Wide Bus - 16 bit) equals zero indicating no support of this feature.

Sync (Synchronous Data Transfers) equals zero indicating no support of this feature.

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

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

SftRe (Soft Reset) equals zero indicating the device responds to the RESET condition with the hard RESET alternative.

Vendor Identification is "PLASMON "

Product Identification is "D-SERIES ".

Product Revision Level starts with "100 " (1.00).

Manufacturer Identification is 01h.

Model Identification is based on the following table:

Model	Model Identification
unknown	0
D120	4
D240	5
D480	6

11.3.1 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)							

11.3.2 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	Product Serial Number							

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

11.3.3 Additional Unit Information Page (C0h)

The Additional Unit Information 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 (C0h)								
2	Reserved (00h)								
3	Page Length (24h)								
4	Maximum Number of Magazines								
5	Maximum Number of Drives								
6	Number of Magazine and Drive Columns								
7	Reserved (00h)								
8 - 17	Flash Firmware Part Number ("755103-000")								
18 - 19	(MSB)			Flash Firmware Checksum				(LSB)	
20	Library Development Level (2)								
21	Hardware Flags								
22 - 31	EPROM Firmware Part Number ("891000-000")								
32 - 35	EPROM Firmware Version Number (e.g., "100")								
36 - 37	(MSB)			EPROM Firmware Checksum				(LSB)	
38 - 39	Reserved (00h)								

11.4 LOG SELECT Command

The **Log Select** command provides a means of clearing certain unit statistics, error statistics, error log, and event history information.

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

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

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

PC (Page Control) specifies the type of parameter values to be selected.

PC	Values Effected
0	Current Threshold Values (parameter list effects threshold values)
1	Current Cumulative Values (parameter list effects cumulative values)
2	Default Threshold Values (current threshold values set to default values)
3	Default Cumulative Values (no effect – current cumulative values unchanged)

Normally, a value of 1 should be used. If a value of 2 or 3 is used, the Parameter List Length field should be set to zero. A value of 0 or 2 applies to threshold values for counts in the Unit Statistics Page. A value of 1 applies to cumulative values in all pages.

Note: for this field to be effective, the EnabThresh field of the Mode Select Library Mode Parameters Page 2 (Section 11.6.2) must be set to one. If the EnabThresh field is set to zero, then the PC field will be ignored and the current cumulative values will be effected, as if PC were set to a value of 1.

The use of threshold values allows the library to make a comparison whenever one of the count values in the Unit Statistics Page is incremented. If the ETC (Enable Threshold Comparison) bit is set to one in the Unit Statistics Page, and a count value in that page is updated as a result of a subsequent SCSI command, a comparison is made. If the updated value is equal to or greater than (depending upon the TMC field) the current threshold value, a Threshold Condition Met unit attention will be generated in response to the next SCSI command following the one which caused the comparison to be made. This unit attention may be used as an alert for preventative maintenance to be performed on the library, such replacing parts before probable failure.

The default threshold values have not been defined but will be available in a future firmware release. Most defaults will be set to the maximum value possible.

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.

11.4.1 Unit Statistics Page (30h)

The Log Select 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	Reserved (0)			ETC	TMC		Reserved (0)	
3	Page Length (4Ch)							
4 - 6	(MSB)	Power-On Hours Count [rsvd(0) if PC = 1]						(LSB)
7 - 9	(MSB)	Library Cycle Count [rsvd(0) if PC = 1]						(LSB)
10 - 12	(MSB)	Drive 1 Load Count						(LSB)
13 - 15	(MSB)	Drive 2 Load Count						(LSB)
16 - 18	(MSB)	Drive 3 Load Count						(LSB)
19 - 21	(MSB)	Drive 4 Load Count						(LSB)
22 - 24	(MSB)	Drive 5 Load Count						(LSB)
25 - 27	(MSB)	Drive 6 Load Count						(LSB)
28 - 31	Reserved (00h)							
32 - 35	(MSB)	Lift Movement Count [rsvd(0) if PC = 1]						(LSB)
36 - 39	(MSB)	Picker Movement Count - Picker 1 [rsvd(0) if PC = 1]						(LSB)
40 - 43	(MSB)	Picker Movement Count - Picker 2 [rsvd(0) if PC = 1]						(LSB)
44 - 47	(MSB)	Change of Picker In Use Count [rsvd(0) if PC = 1]						(LSB)
48 - 51	(MSB)	Pivot Movement Count [rsvd(0) if PC = 1]						(LSB)
52 - 55	(MSB)	Drawer Movement Count [rsvd(0) if PC = 1]						(LSB)
56 - 59	(MSB)	Door Open Count [rsvd(0) if PC = 1]						(LSB)
60 - 63	(MSB)	Magazine Store Count [rsvd(0) if PC = 1]						(LSB)
64 - 67	(MSB)	Lift Up/Down Distance Count [rsvd(0) if PC = 1]						(LSB)
68 - 71	(MSB)	Picker In/Out Distance Count [rsvd(0) if PC = 1]						(LSB)
72 - 75	(MSB)	Pivot Left/Right Rotation Count [rsvd(0) if PC = 1]						(LSB)
76 - 79	(MSB)	Flip Count [rsvd(0) if PC = 1]						(LSB)

See the Log Sense Unit Statistics page (Section 11.5.2) and the following for a description of these fields.

ETC (Enable Threshold Comparison) equals a value of one if the library is to be configured so that the updating of any cumulative count value in this page as a result of a subsequent SCSI command results in a comparison. If the updated value is equal to or greater than the current threshold value, then a Threshold Condition Met unit attention will be generated in response to the SCSI command following the one which caused the comparison to be made. Whether the count value must become greater than or equal to the threshold value depends upon the TMC field. ETC equals a value of zero if no comparison is to be performed. *The ETC field is ignored if the EnabThresh field of the Mode Select Mode Parameters Page 2 is set to zero.*

TMC (Threshold Met Criteria) must equal a value of 1 or 3 if the ETC field is set to one. If TMC equals 1, a unit attention will be generated when a current count value equals its corresponding threshold value. If TMC equals 3, a unit attention will be generated when a current count value is greater than its corresponding threshold value. *The TMC field is ignored if the EnabThresh field of the Mode Select Mode Parameters Page 2 is set to zero.*

The cumulative **Power-On Hours Count** and **Library Cycle Count** values cannot be altered; however the threshold values for these counts may be altered. The PC field in the Log Select command should be set to 0 or 2 to change the threshold values (PC = 2 will restore default threshold values).

If the PC field in the Log Select command is set to 1, the current cumulative **Drive 1-6 Load Count** values can be selectively set to zero. In this case, if a Drive Load Count field is equal to zero, the load count of the corresponding drive will be set to zero. If any Drive Load Count field is not equal to zero, that load count will not be altered. If the PC field is set to 1, all drive load counts will be set to zero. If the PC field is set to 0 or 2, the threshold values for these counts will be changed (PC = 2 will restore default threshold values).

The cumulative count values in bytes 32-79 cannot be altered by this command. In fact, they can only be reset at the front panel of the library when the library is in Maintenance Mode. The threshold values for these counts may be altered, however. The PC field in the Log Select command should be set to 0 or 2 to change the threshold values (PC = 2 will restore default threshold values).

11.4.2 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)					
1-2	Reserved (00h)							
3	Page Length (64h)							
4-103	Most Frequent Error Parameters (00h)							

Most Frequent Error Parameters must be equal to a block of all zeros resetting all error statistics information.

11.4.3 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)					
1-2	Reserved (00h)							
3	Page Length (A0h)							
4-163	Most Recent Error Parameters (00h)							

Most Recent Error Parameters must be equal to a block of all zeros resetting all error log information.

11.4.4 Event History Page (33h)

The Log Select Event History Page is as follows.

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

Number of Events Recorded must equal zero clearing all event history information.

11.5 LOG SENSE Command

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

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

PPC (Parameter Pointer Control) equals a value of zero indicating that all available log parameters for the specified log page are to be returned.

SP (Save Parameters) equals a value of zero indicating that no log parameters will be saved as a result of the Log Sense command.

PC (Page Control) specifies the type of parameter values to be returned.

PC	Values Returned
0	Threshold Values
1	Cumulative Values
2	Default Threshold Values
3	Default Cumulative Values (equal to current cumulative values)

Normally, a value of 1 should be used. Values 0-3 may be used for the Log Sense Unit Statistics Page below.

Note: for this field to be effective, the EnabThresh field of the Mode Select Library Mode Parameters Page 2 (Section 11.6.2) must be set to one. If the EnabThresh field is set to zero, then the PC field will be ignored and the current cumulative values will be returned, as if PC were set to a value of 1.

The default threshold values have not been defined but will be available in a future firmware release. Most defaults will be set to the maximum value possible. See the Log Select command (Section 11.4) for more information about the use of threshold values.

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

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

11.5.1 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)					
1–2	Reserved (00h)							
3	Page Length (05h)							
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)							

11.5.2 Unit Statistics Page (30h)

The Log Sense 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	Reserved (0)			ETC	TMC		Reserved (0)	
3	Page Length (4Ch)							
4 - 6	(MSB)		Power-On Hours Count					(LSB)
7 - 9	(MSB)		Library Cycle Count					(LSB)
10 - 12	(MSB)		Drive 1 Load Count					(LSB)
13 - 15	(MSB)		Drive 2 Load Count					(LSB)
16 - 18	(MSB)		Drive 3 Load Count					(LSB)
19 - 21	(MSB)		Drive 4 Load Count					(LSB)
22 - 24	(MSB)		Drive 5 Load Count					(LSB)
25 - 27	(MSB)		Drive 6 Load Count					(LSB)
28	Reserved (0)		Cfg Disc	NoTemPwr	DCB Disc	I/E Disc	Main Disc	Lift Disc
29	Reserved (0)		Mag F Disc	Mag E Disc	Mag D Disc	Mag C Disc	Mag B Disc	Mag A Disc
30	Reserved (0)		Drv 6 Disc	Drv 5 Disc	Drv 4 Disc	Drv 3 Disc	Drv 2 Disc	Drv 1 Disc
31	InitReqd	LastMTE		Reserved (0)				
32 - 35	(MSB)		Lift Movement Count					(LSB)
36 - 39	(MSB)		Picker Movement Count - Picker 1					(LSB)
40 - 43	(MSB)		Picker Movement Count - Picker 2					(LSB)
44 - 47	(MSB)		Change of Picker In Use Count					(LSB)
48 - 51	(MSB)		Pivot Movement Count					(LSB)
52 - 55	(MSB)		Drawer Movement Count					(LSB)
56 - 59	(MSB)		Door Open Count					(LSB)
60 - 63	(MSB)		Magazine Store Count					(LSB)
64 - 67	(MSB)		Lift Up/Down Distance Count					(LSB)
68 - 71	(MSB)		Picker In/Out Distance Count					(LSB)
72 - 75	(MSB)		Pivot Left/Right Rotation Count					(LSB)
76 - 79	(MSB)		Flip Count [rsvd(0) if PC = 1]					(LSB)

ETC and **TMC** are as set by the Log Select command.

The **Power-On Hours Count** is incremented every hour that power is applied to the library system.

The **Library Cycle Count** is incremented every time a drive is loaded.

The **Drive 1-6 Load Counts** are incremented every time the corresponding drive is loaded, but may be reset from the front panel or via the Log Select command (see Section 11.4.1) if, for example, a drive is replaced.

Lift Disc equals a value of one if the cable to the lift is faulty or not connected.

Main Disc equals a value of one if the main harness cable is faulty or not connected.

I/E Disc equals a value of one if the i/e harness cable is faulty or not connected.

DCB Disc equals a value of one if the DCB board is not properly connected.

NoTermPwr equals a value of one if SCSI bus terminator power is low.

Cfg Disc equals a value of one if the configuration cable is not properly connected.

Mag A - F Disc equal bits of one if the corresponding magazine board (A - F) is not properly connected.

Drv 1 - 6 Disc equal bits of one if the id cable to the corresponding CD drive is not properly connected.

InitReqd equal a bit of one 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.

LastMTE contains the number of the last medium transport element used — 1 or 2.

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

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

The **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 **Pivot Movement Count** is incremented every time the lift assembly is pivoted to reach another column of magazines or drives, or the import / export drawer.

The **Drawer Movement Count** is incremented every time the import/export drawer is opened or closed.

The **Door Open Count** is incremented every time the access door is opened.

The **Magazine Store Count** is incremented every time a tray is stored in a magazine.

The **Lift Up/Down Distance Count** is incremented by the distance traveled every time the medium transport element is moved vertically (up or down). The count is in units of meters.

The **Picker In/Out Distance Count** is incremented by the distance traveled every time either medium transport element is moved horizontally (in or out). The count is in units of meters.

The **Picker Left/Right Rotation Count** is incremented by the angular distance traveled every time the medium transport element is moved is rotated (left or right). The count is in units of radians.

The **Flip Count** is incremented every time the media is inverted ("flipped").

See the D-Series User's Guide and Service Manuals for further information about the cumulative values of these counts.

11.5.3 Error Statistics Page (31h)

The Log Sense Error Statistics Page is as follows.

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

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	7	6	5	4	3	2	1	0
Byte								
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)		Cycle Count at Last Occurrence				(LSB)	

The error codes are listed in Section 13.2. Only hardware errors, which occurred in response to a SCSI command, are recorded. The **Cycle Count at Last Occurrence** is the library cycle count at the time the error last occurred.

11.5.4 Error Log Page (32h)

The Log Sense Error Log Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (32h)					
1 - 2	Reserved (00h)							
3	Page Length (A0h)							
4 - 19	First Most Recent Error Parameters							
20 - 35	Second Most Recent Error Parameters							
	:							
148 - 163	Tenth Most Recent Error Parameters							

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

Bit	7	6	5	4	3	2	1	0
Byte								
0	Error Code							
1	Initiating Command							
2-3	(MSB)	Source Element Address						(LSB)
4-5	(MSB)	Destination Element Address						(LSB)
6	Medium Transport Element Number							Invert
7-8	(MSB)	Lift Position Element Address						(LSB)
9-10	(MSB)	Recurrence Count						(LSB)
11-13	(MSB)	Cycle Count at Occurrence						(LSB)
14-15	(MSB)	Additional Information						(LSB)

The error codes are listed in Section 13.2. Only hardware errors are recorded. If the same error occurs a number of times in sequence, only information for the most recent error is listed.

Initiating Command is the operation code of the SCSI command which initiated the operation, or zero if the operation was not initiated by a SCSI command.

Source Element Address and **Destination Element 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 the Source and First Destination Addresses, the First and Second Destination Address or some other intermediate addresses.

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

Invert equals a bit of one for the Move Medium and Exchange Medium commands if the medium was to be inverted (“flipped”) prior to being deposited in the destination element.

Lift Position Element Address is the address of the element at which the medium transport element specified by the Medium Transport Element Number was positioned when the error occurred.

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

The **Cycle Count at Occurrence** is the library cycle count at the time the error occurred.

Additional Information contains such information as the value of ASC and ASCQ received from the drive in the event of an eject (unclamp) failure when the DsabLoEj mode of operation is disabled, or a drive not becoming ready failure when the WaitLoad mode of operation is enabled (see the Mode Select command). For low-level SCSI errors (error codes F1h and greater) the first byte contains the error number and the second byte contains the low-level SCSI error location. For non-SCSI errors, the first byte contains an internal location code, which may be useful for Plasmon technical support. The error codes are listed in Section 13.2 and the low-level SCSI error locations are listed in Section 13.3.

11.5.5 Event History Page (33h)

The Log Sense Event History Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (33h)					
1	Reserved (00h)							
2-3	(MSB)		Page Length (804h)				(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 content 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 11.6.2). For a description of possible events within this list see Section 12. This list may be helpful to technical support personnel in diagnosing problems with the library system.

11.6 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	Logical Unit Number (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 a value of one if saveable parameter page data is to be saved in non-volatile memory, or zero if it is not to be saved in non-volatile memory.

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

11.6.1 Library Mode Parameters Page 1 (00h)

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

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

DsabTrayRet equals a value of one if trays (media) not currently in magazines *are not* to be returned to their magazines when the proper key is pressed on the front panel to open the magazine access door, or a value of zero if trays (media) *are* to be returned when the front panel key is pressed. The access door will not open if there are trays in locations other than the magazines. The default for this bit is zero.

RetOnPwr equals a value of one if trays (media) not in already in magazines are to be returned to their magazines when power is first applied to the library system, or a value of zero if trays (media) are not to be returned on power-on. The default for this bit is zero.

DsabLoEj equals a value of one 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 one — 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 zero, the medium changer device *is* to automatically clamp and start or stop and unclamp the drives as part of the Move Medium, Exchange Medium, or Rezero Unit commands which move disks to or from them. The default for this bit is zero.

11.6.2 Library Mode Parameters Page 2 (20h)

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

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (20h)					
1	Parameter Length (08h)							
2	NoRepRec	Rsvd (0)	LimitRec	LvClosed	NoDelay	WaitLoad	IgnParity	Rsvd (0)
3	BootPROM	SetAddr	SetType	Reserved (0)				
4	Reserved (0)						EnabThresh	EmullFJ
5 - 7	Reserved (00h)							
8	Element Addressing Scheme							
9	Event History Type							

NoRepRec equals a value of one if the medium changer device is to return GOOD status for all hardware errors which have been recovered from, or a value of 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 this 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 zero.

LimitRec equals a value of one if the medium changer device is to limit the extent of the error recovery that will perform. Setting this bit to one 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 the import/export element or 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 zero.

LvClosed equals a value of one if the import/export drawer is to left in the closed state after a tray is moved to the import/export element, or a value of zero if the import/export drawer is to be opened after the tray is moved to the import/export element. If, however, a time limit for operation action is in effect as specified by the Timeout Parameter Page (see Section 11.6.9), then the import/export drawer will be opened regardless of the setting of this bit. The default for this bit is zero.

NoDelay equals a value of one if the medium changer device is not to introduce a suitable delay after powering up or down a drive because of a change in the Mode Select Drive Assignments Page (see Section 11.6.4), or a value of zero if the medium changer is to introduce suitable delay. If this bit is set to one, it is the responsibility of the host software to introduce the requisite delays — on the order of 2 seconds after powering off one or more drives and 1/2 second after powering up each drive (drives should be powered up one at a time). If this bit is set to one, drives should be powered down before their SCSI ID's are changed. The default for this bit is zero.

WaitLoad equals a value of one if the medium changer device is to wait for a Ready response from a drive in response to a Move Medium or Exchange Medium command with the drive specified as a destination element. Command completion status is not returned to the host until the host is ready or 30 seconds have elapsed. If a Ready response is not received after 30 seconds, and the PwrCycDr bit is set in Library Mode Parameters Page 3 (see section 11.6.3), drive power is cycled in an attempt to reseal the disk. If the WaitLoad bit is not set, then the host is responsible for waiting until the drive is spun up and ready. To sense Ready status the medium changer will use a hardware Ready signal if the drive is so connected, or will act as an SCSI Initiator and repeatedly issue Test Unit Ready commands to the drive in lieu of a separate hardware signal. For the changer to issue Test Unit Ready commands the drive must be on the same SCSI bus as the medium changer device and the SCSI host adapter used on the host computer must be capable of disconnecting from the SCSI bus. The default for this bit is zero.

IgnParity equals a value of one if parity is to be ignored. This is non-standard for SCSI-2 but may be required for some initiators. The default for this bit is zero.

BootPROM equals a value of one if the medium changer device is to run from its boot PROM rather than from Flash. This bit must be set to one before loading new firmware into the library system with the Write Buffer command. Setting this bit to one will cause the library system to restart running from PROM if it was running from Flash previously. The functionality of the library system is severely limited when running from PROM. The default for this bit is zero.

SetAddr equals a value of one if the Element Addressing Scheme is to be changed.

SetType equals a value of one if the Event History Type is to be changed.

EnabThresh equals a value of one if threshold values are to be enabled or a value of zero if they are to be disabled. Setting this bit enables the Log Sense command to return threshold values for various counts and the Log Select command to set threshold values for these counts. If threshold values are enabled and threshold comparisons are enabled using the Log Select command, then a comparison will be made everytime a cumulative usage count is incremented. If this count meets or exceeds the corresponding threshold value, a Threshold Condition Met unit attention condition is generated. See the Log Select command, Section 11.4, for more information. The default for this bit is zero.

EmulLFJ equals a value of one if the library system is to emulate a Panasonic/MEI LF-JXXX series library system. For true emulation, the Element Addressing Scheme should be set to 4. If this is the case and this bit is set, commands which return element addresses will return addresses in the range 200h to 2FFh for storage

elements ST1 to ST256, and addresses of 600h and above for all other storage elements. Errors specific to library system operation with this bit set are listed in Section 13.1. For more information, refer to the LF-JXXX series documentation. The default for this bit is zero.

Element Addressing Scheme equals 1, 2, 3, or 4 based on the table in Section 7. In order for this field to be effective, the SetAddr bit must be set. The default for this field is 1.

Event History Type specifies the type of event history to collect for diagnostic purposes (see Section 11.5.5). 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 12. The default for this byte is BBh (187).

11.6.3 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
Byte								
0	Reserved (0)		Page Code (21h)					
1	Parameter Length (08h)							
2	LightOff	Reserved (0)			DsabScanI	DsabScanS	DsabScanD	
3	SetOptions	Reserved (0)		FVerOnWr	WrCaEnab	Read512	PwrCycDr	Rsvd (0)
4-9	Reserved (00h)							

LightOff equals a value of one 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 zero reenables the ACTIVE light for SCSI bus activity.

DsabScanI equals a value of one if the import/export element (the drawer) *is not* to be scanned for subsequent Initialize Element Status commands.

DsabScanS equals a value of one if the storage elements (the magazines) *are not* to be scanned for subsequent Initialize Element Status commands.

DsabScanD equals a value of one if the data transfer elements (the drives) *are not* to be scanned for subsequent Initialize Element Status commands.

SetOptions equals a value of one if any of the options in byte 3 are to be changed.

FVerOnWr equals a value of one if the library is to configure all installed DVD-RAM drives to force verify on writes, or a value of zero if the library is to configure all installed DVD-RAM drives not to force verify on writes. The default for this bit is zero.

WrCaEnab equals a value of one if the library is to configure all installed DVD-RAM drives to enable write caching, or a value of 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 default for this bit is zero.

Read512 equals a value of one if the library is to configure all installed CD-ROM drives to read 512 byte sectors, or a value of zero if the library is to configure installed CD-ROM drives to read 2048 byte sectors. This bit has no effect for other types of drives. The default for this bit is zero.

PwrCycDr equals a value of one 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 zero if the AC power *is not* to be cycled. The SetOptions bit must also be set for this bit to be effective. The default for this bit is zero.

11.6.4 Drive Assignments Page (22h)

The Mode Select Drive Assignments Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (22h)					
1	Parameter Length (3Ch)							
2	Drive 1 On-Line							
3	Reserved (0)		Drive 1 Expander Group		Drive 1 Bus Expander		Drv 1 Off Bus	
4	Reserved (0)							
5	Drive 1 SCSI ID							
6	Drive 2 On-Line							
7	Reserved (0)		Drive 2 Expander Group		Drive 2 Bus Expander		Drv 2 Off Bus	
8	Reserved (0)							
9	Drive 2 SCSI ID							
10	Drive 3 On-Line							
11	Reserved (0)		Drive 3 Expander Group		Drive 3 Bus Expander		Drv 3 Off Bus	
12	Reserved (0)							
13	Drive 3 SCSI ID							
14	Drive 4 On-Line							
15	Reserved (0)		Drive 4 Expander Group		Drive 4 Bus Expander		Drv 4 Off Bus	
16	Reserved (0)							
17	Drive 4 SCSI ID							
18	Drive 5 On-Line							
19	Reserved (0)		Drive 5 Expander Group		Drive 5 Bus Expander		Drv 5 Off Bus	
20	Reserved (0)							
21	Drive 5 SCSI ID							
22	Drive 6 On-Line							
23	Reserved (0)		Drive 6 Expander Group		Drive 6 Bus Expander		Drv 6 Off Bus	
24	Reserved (0)							
25	Drive 6 SCSI ID							
26-61	Reserved (0)							

Drive 1-6 On-Line are on-line designators for the drives in the library system. If set to zero, the corresponding drive will be powered down and considered off-line. If set to a non-zero value, the corresponding 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 reinstated to on-line status via the front panel 'Service Drive' option. Any attempt to position to an off-line drive will be considered an error.

In multiple initiator environments it may be desirable to issue a Mode Select command with a Multiple Initiators Page (see Section 11.6.6) and delay before using this page to power down a drive.

Drv 1-6 Off Bus equals a value of zero if the corresponding drive or its controlling bus expander is to be on the same SCSI bus as the medium changer device, or a value of one if it is to be on a different SCSI bus than the medium changer device. If the drive is on a different SCSI bus than the medium changer device then the changer device cannot send SCSI commands to the drive to clamp and start it, unclamp and stop it, or use it to check the media type of newly imported media.

Drive 1-6 Bus Expander are the numbers of the SCSI bus expanders to which the corresponding drives are connected. If the drive is connected directly to the SCSI bus of the host computer, this number should be set to zero. Otherwise, this number should be greater than or equal to 1 and less than or equal to the number of bus expanders in the library system. Each bus expander may control up to 8 drives, hot-swappable in two groups of up to 4 drives each.

Drive 1-6 Expander Group are the numbers of the SCSI bus expanders groups to which the corresponding drives are connected. Groups 1 and 2 are available for each bus expander in the library system. If the drive is connected directly to the SCSI bus of the host computer, this number should be set to zero. Otherwise, this number identifies a group of drives which will return Not Ready status to media access requests when any drive in the group is taken offline for servicing. Each bus expander group may contain up to 4 drives.

Drive 1-6 SCSI ID are the SCSI ID's of the drives in the library system. Changing these values changes the address of the drives on the SCSI bus. The drives corresponding to the altered SCSI ID's will be automatically 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 host SCSI bus, or on the SCSI bus expander to which the drive is connected. If connected to a bus expander, the drive SCSI ID selected also effects the LUN address by which the drive is accessed by the host. Specifically, the drive will be accessed by sending commands to the SCSI ID of the bus expander and a LUN address equal to the drive SCSI ID set here. The SCSI ID field is only used if the drive is on-line (powered up) and the drive or its controlling bus expander are on the same SCSI bus as the medium changer device.

11.6.5 Front Panel Display Mode Page (23h)

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

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (23h)					
1	Parameter Length (29h)							
2	Tone	LightOff	Reserved (0)			ClrKeys	DispMode	
3 - 22	Line 1 Display Text							
23 - 42	Line 2 Display Text							

Tone equals a value of one if a short alert tone is to be sounded within the library system. This bit is only effective if the DispMode bit is also set.

LightOff equals a value of one 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.

ClrKeys equals a value of one to clear all front panel key flags in preparation for subsequent key polling with the Mode Sense command. This bit is only effective if the DispMode bit is also set.

DispMode equals a value of one to gain and maintain control of the library system front panel display or a value of zero to release control.

Line 1 Display Text is the ASCII representation of text to be displayed on the first line of the library system's front panel display.

Line 2 Display Text is the ASCII representation of text to be displayed on the second line of the library system's front panel display.

In addition to the ASCII characters 20h (' ') through 7Dh ('}'), the following characters are available: FEh='[', 01h=']', 02h='⌘', 03h='·', 04h='⌂', 05h='□', 06h='■', 07h='⌞', 7Eh='⌞', 7Fh='⌞', and A5h='▪'.

11.6.6 Multiple Initiators Page (24h)

The Mode Select Multiple Initiators Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (24h)					
1	Parameter Length (02h)							
2	NotReady	Reserved (0)				Cause		
3	Effected Drive							

NotReady equals a value of one if the medium changer device is to return CHECK CONDITION and Not Ready status for subsequent Test Unit Ready and tray movement commands issued by other initiators. The specific Not Ready error code returned is determined by the Cause field. By setting the NotReady bit prior to turning off a drive via the Mode Select Drive Assignments Page (see Section 11.6.4), or prior to opening the access door for servicing a drive via the Open Access Door command (see Section 11.11), the host may inform other initiators on the same SCSI bus that a change in drive status is imminent and that they should stop read/write activity to that drive, all drives, or all drives on the same SCSI bus expander and in the same group as the drive. The host should then delay for a period to allow time for other initiators to sense the Not Ready status.

All initiators should periodically poll the medium changer device with Test Unit Ready commands to determine whether they should cease drive SCSI activity. To remove Not Ready status this bit should be set to zero. Note that changing a 'Not ready - entering drive service mode' state to a Ready state by setting this bit to zero will generate a 'Not ready to ready transition' Unit Attention condition for other initiators on the same SCSI bus. The use of the NotReady bit and this page is only necessary in multiple initiator systems. Only one initiator can set or clear Not Ready status at a time without receiving an Invalid Request error code.

Cause equals zero if the NotReady bit is set to zero, or one of the following if the NotReady bit is set to one:

- 1 Return status 'Not ready, entering drive service mode' for subsequent Test Unit Ready and tray movement commands issued by other initiators.
- 2 Return status 'Not ready, turning off drive' for subsequent Test Unit Ready and tray movement commands issued by other initiators.

Effected Drive equals the number of the CD drive (starting from drive number 1) being serviced or turned off. This number is reported in the Information field of the Request Sense return data for other initiators received Not Ready status as a result of this page.

11.6.7 Library Offsets Page (25h)

The Mode Select Library Offsets Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (25h)					
1	Parameter Length (24h)							
2 - 37	Values							

Values are the offset values of the library system as obtained from the Mode Sense Library Offsets Page. These bytes also contain checksum values for the contained offset values and the original library system serial number, both of which must match (i.e., the offset values must match the checksum and the serial number must be the same as the original) before the page is accepted and the offset values are changed.

11.6.8 Bus Expander Assignments Page (26h)

The Mode Select Bus Expander Assignments Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)			Page Code (26h)				
1	Parameter Length (10h)							
2	Number of Bus Expanders Installed							
3	Reserved (0)						Exp1Grp2Off	Exp1Grp1Off
4	Bus Expander 1 SCSI ID							
5	Reserved (0)						Exp2Grp2Off	Exp2Grp1Off
6	Bus Expander 2 SCSI ID							
7	Reserved (0)						Exp3Grp2Off	Exp3Grp1Off
8	Bus Expander 3 SCSI ID							
9	Reserved (0)						Exp4Grp2Off	Exp4Grp1Off
10	Bus Expander 4 SCSI ID							
11	Reserved (0)						Exp5Grp2Off	Exp5Grp1Off
12	Bus Expander 5 SCSI ID							
13	Reserved (0)						Exp6Grp2Off	Exp6Grp1Off
14	Bus Expander 6 SCSI ID							
15 - 17	Reserved (0)							

Number of Bus Expanders Installed equals the number of SCSI bus expanders installed in the library system. If this number is decreased, it may be necessary to change Bus Expander values in the Mode Select Drive Assignments Page (see Section 11.6.4).

Exp i Grp j Off equals a value of one if the drives on SCSI bus expander i group j are to be taken off-line to service one or more drives in the group. The drive to be serviced can then be powered down using the Mode Select Drive Assignments Page (see Section 11.6.4). The SCSI bus expander will return standard Inquiry data for all drives in the group and Not Ready status to any media access requests.

Bus Expander 1-6 SCSI ID are SCSI ID's of the SCSI bus expanders in the library system.

11.6.9 Timeout Parameter Page (35h)

The Mode Select Timeout Parameter Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)			Page Code (35h)				
1	Parameter Length (02h)							
2	Unlimited	1 hour	30 mins	10 mins	3 mins	1 min	30 secs	5 secs
3	Reserved (00h)							

Byte 2 specifies the amount of time given to the operator to place a disk in an empty tray or remove a disk from a full tray in the import/export element in response to an Exchange Medium command (with the import/export element specified as the first destination element) before the command terminates abnormally with a timeout error. Only one bit in this byte may be set. Setting the Unlimited bit gives the operator an unlimited amount of time. The default is 30 seconds (bit 1). See the Exchange Medium command (Section 11.1) for more information.

11.7 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	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (55h)							
1	Logical Unit Number (0)			PF (0)	Reserved (0)			SP
2-6	Reserved (00h)							
7-8	Parameter List Length							
9	Reserved (00h)							

PF (Page Format) is ignored.

SP (Save Pages) equals a value of one if saveable parameter page data is to be saved in non-volatile memory, or zero if it is not to be saved in non-volatile memory.

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

The Mode Select (10) parameter list consists of an 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	7	6	5	4	3	2	1	0
Byte								
0-1	(MSB)			Mode Data Length (00h)				(LSB)
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 11.4) for information about supported mode pages.

11.8 MODE SENSE (6) Command

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

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (1Ah)							
1	Logical Unit Number (0)			Rsvd (0)	DBD (0)	Reserved (0)		
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. The possible values for this field are shown in the following table. Normally, a value of zero is used to return the current values.

PC	Values Returned
0	Current Values (current page values are returned)
1	Changeable Values (values containing a 1 in every bit position of page data that can be changed by Mode Select are returned)
2	Default Values (library system default values are returned)
3	Saved Values (values set by Mode Select with the SP bit set are returned)

Page Code defines the parameter page(s) to be returned. A value of 00h, 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, 24h, 25h, 26h, 35h, 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, 24h, 25h, 26h, 35h, 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 Select (6) return data.

11.8.1 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.

11.8.2 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 7 for the element addresses and counts returned in this page.

11.8.3 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 (0/1)	
3	Member Number in Transport Element Set (00h)							
4	Reserved (0)						Rotate (0/1)	
5	Member Number in Transport Element Set (01h)							

The **Rotate** bit is one for both medium transport elements if a flipper mechanism is installed in the library, or zero for both if not.

11.8.4 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 the 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 (a value of one means yes in all cases and a value of zero means no in at least some cases).

11.8.5 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	LvClosed	NoDelay	WaitLoad	IgnParity	Rsvd (0)
3	RunPROM	Reserved (0)						
4	Reserved (0)						EnabThresh	EmullFJ
5	Rsvd (0)	Reserved (Internal Switch Settings)						
6 - 7	Reserved (00h)							
8	Element Addressing Scheme							
9	Event History Type							

NoRepRec, **LimitRec**, **LvClosed**, **NoDelay**, **WaitLoad**, **IgnParity**, **EnabThresh**, **EmullFJ**, **Element Addressing Scheme**, and **Event History Type** are as set by the Mode Select command.

RunPROM equals a value of one if the medium changer device is running from its boot PROM rather than from Flash. The functionality of the library system is severely limited when running from PROM.

11.8.6 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)			DsabScanI	DsabScanS	DsabScanD	
3	Reserved (0)			FVerOnWr	WrCaEnab	Read512	PwrCycDr	Rsvd (0)
4-9	Reserved (00h)							

LightOff, **DsabScanI**, **DsabScanS**, **DsabScanD**, **FVerOnWr**, **WrCaEnab**, **Read512**, and **PwrCycDr** are as set by the Mode Select command.

11.8.7 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	Drive 1 Type							
3	Reserved (0)		Drive 1 Expander Group		Drive 1 Bus Expander		Drv 1 Off Bus	
4	Reserved (0)							
5	Drive 1 SCSI ID							
6	Drive 2 Type							
7	Reserved (0)		Drive 2 Expander Group		Drive 2 Bus Expander		Drv 2 Off Bus	
8	Reserved (0)							
9	Drive 2 SCSI ID							
10	Drive 3 Type							
11	Reserved (0)		Drive 3 Expander Group		Drive 3 Bus Expander		Drv 3 Off Bus	
12	Reserved (0)							
13	Drive 3 SCSI ID							
14	Drive 4 Type							
15	Reserved (0)		Drive 4 Expander Group		Drive 4 Bus Expander		Drv 4 Off Bus	
16	Reserved (0)							
17	Drive 4 SCSI ID							
18	Drive 5 Type							
19	Reserved (0)		Drive 5 Expander Group		Drive 5 Bus Expander		Drv 5 Off Bus	
20	Reserved (0)							
21	Drive 5 SCSI ID							
22	Drive 6 Type							
23	Reserved (0)		Drive 6 Expander Group		Drive 6 Bus Expander		Drv 6 Off Bus	
24	Reserved (0)							
25	Drive 6 SCSI ID							
26-61	Reserved (0)							

Drive 16 Drive Type are the drive type designators for the drives in the library system. If a drive is off-line (turned off), its Drive Type will be zero.

Drv 16 Off Bus equals a value of zero if the corresponding drive is on the same SCSI bus as the medium changer device, or a value of one if it is on a different SCSI bus than the medium changer device.

Drive 16 Bus Expander are the numbers of the SCSI bus expanders to which the corresponding drives are connected. If the drive is connected directly to the SCSI bus of the host computer, this number will be zero.

Drive 1-6 Expander Group are the numbers of the SCSI bus expanders groups to which the corresponding drives are connected. If the drive is connected directly to the SCSI bus of the host computer, this number will be zero.

Drive 1-6 SCSI ID are the SCSI ID's of the drives in the library system. If the drive is connected to a SCSI bus expander, this SCSI ID is also the LUN (using the SCSI ID of the bus expander) by which the drive may be accessed. If a drive is off-line (turned off), its SCSI ID will not be used until the drive is brought back on-line (turned on). Some Setup mode options such as Set Drive Region may temporarily turn on the drive, however.

11.8.8 Front Panel Display Mode Page (23h)

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

Bit	7	6	5	4	3	2	1	0
Byte								
0	PS (0)	Rsvd (0)	Page Code (23h)					
1	Parameter Length (29h)							
2	Rsvd (0)	LightOff	Rsvd (0)	Key Pressed			Rsvd (0)	DispMode
3-42	Reserved (00h)							

LightOff and **DispMode** are as set by the Mode Select command.

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

- 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.

11.8.9 Multiple Initiators Page (24h)

The Mode Sense Multiple Initiators Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	PS (0)	Rsvd (0)	Page Code (24h)					
1	Parameter Length (02h)							
2	NotReady	Reserved (0)			Cause			
3	Effected Drive							

NotReady, **Cause**, and **Effected Drive** are as set by the Mode Select command.

11.8.10 Library Offsets Page (25h)

The Mode Sense Library Offsets Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (25h)					
1	Parameter Length (24h)							
2 - 37	Values							

Values are the offset values of the library along with checksum values for the contained offset values and the library system serial number.

11.8.11 Bus Expander Assignments Page (26h)

The Mode Select Bus Expander Assignments Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (26h)					
1	Parameter Length (10h)							
2	Number of Bus Expanders Installed							
3	Reserved (0)						Exp1Grp2Off	Exp1Grp1Off
4	Bus Expander 1 SCSI ID							
5	Reserved (0)						Exp2Grp2Off	Exp2Grp1Off
6	Bus Expander 2 SCSI ID							
7	Reserved (0)						Exp3Grp2Off	Exp3Grp1Off
8	Bus Expander 3 SCSI ID							
9	Reserved (0)						Exp4Grp2Off	Exp4Grp1Off
10	Bus Expander 4 SCSI ID							
11	Reserved (0)						Exp5Grp2Off	Exp5Grp1Off
12	Bus Expander 5 SCSI ID							
13	Reserved (0)						Exp6Grp2Off	Exp6Grp1Off
14	Bus Expander 6 SCSI ID							
15 - 17	Reserved (0)							

Number of Bus Expanders Installed equals the number of SCSI bus expanders installed in the library system.

Exp i Grp j Off equals a value of one if the drives on SCSI bus expander i group j are off-line to service one or more drives in the group.

Bus Expander 1-6 SCSI ID are SCSI ID's of the SCSI bus expanders in the library system.

11.8.12 Timeout Parameter Page (35h)

The Mode Sense Timeout Parameter Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (35h)					
1	Parameter Length (02h)							
2	Unlimited	1 hour	30 mins	10 mins	3 mins	1 min	30 secs	5 secs
3	Reserved (00h)							

See the Timeout Parameter Page in the Mode Select command (Section 11.6.6) for more information.

11.9 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	Logical Unit Number (0)			Rsvd (0)	DBD (0)	Reserved (0)		
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. . The possible values for this field are shown in the following table. Normally, a value of zero is used to return the current values.

PC	Values Returned
0	Current Values (current page values are returned)
1	Changeable Values (values containing a 1 in every bit position of page data that can be changed by Mode Select are returned)
2	Default Values (library system default values are returned)
3	Saved Values (values set by Mode Select with the SP bit set are returned)

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 an 8 byte header followed by one or more supported pages. The header is shown below.

Mode Sense (10) Mode Parameter Header

Bit	7	6	5	4	3	2	1	0
Byte								
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 11.8) for information about supported mode pages.

11.10 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	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (A5h)							
1	Logical Unit Number (0)				Reserved (0)			
2-3	Transport Element Address (00h)							
4-5	(MSB)		Source Address				(LSB)	
6-7	(MSB)		Destination Address				(LSB)	
8-9	(MSB)		Reserved(00h)				(LSB)	
10	Reserved (0)							Invert
11	Reserved (00h)							

Transport Element Address specifies the medium transport element. A value of zero should be used. This will move the disk using the first medium transport element.

Source Address specifies the source element.

Destination Address specifies the destination element.

Invert specifies the medium should be inverted. If the Invert bit is one, the media is inverted (“flipped”) prior to being deposited into the destination element. If a flipper mechanism is not installed in the library, this bit is reserved. If the source element is empty (containing a tray but no disk), a Medium Source Element Empty error will be generated if moving to a drive. If the destination element is full (containing a full tray), a Destination Element Full error will be generated in all cases. If either of these two conditions occurs unexpectedly (based on the library system’s memory of the empty/full statuses of its elements), a Source Unexpectedly Empty or Destination Unexpectedly Full error will be generated instead. If the source or destination address refers to a storage element and there is no magazine at that address, a No Magazine Present error will be generated. If the source address refers to a storage element and there is no tray at that address, a No Tray Present error will be generated. It will not be considered an error to move an empty tray to or from the import/export element.

The access door will automatically be opened on all moves to the import/export element, unless the LvClosed value of the Library Mode Parameters Page 2 of the Mode Select command (see Section 11.6.2) is set to one.

11.11 OPEN ACCESS DOOR Command

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

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (0Ch)							
1	Logical Unit Number (0)			Reserved (0)				
2-3	Reserved (00h)							
4	Reserved (0)							1
5	Rsvd (0)	SvcDrive	Reserved (00h)					

SvcDrive equals a value of one if the door is to be opened for drive insertion, removal, or replacement. If this bit is set, magazine insertion and removal is not permitted, however subsequent tray movement commands may be issued to the library system. If this bit is not set, subsequent tray movement commands may not be issued to the library system until the access door is closed.

Before sending this command to open the door for drive service, the drive to be serviced should be powered down via the Mode Select Drive Assignments Page (see Section 11.6.4). Additionally, if the drive is on a SCSI bus expander, all drives in the same bus expander group should be taken off-line via the Mode Select Bus Expander Assignments Page (see Section 11.6.8).

In multiple initiator environments it may be desirable to issue a Mode Select command with a Multiple Initiators Page (see Section 11.6.6) and delay before sending this command with the SvcDrive bit set.

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 13.1).

11.12 OPEN CLOSE I/E DRAWER Command

The **Open Close I/E Drawer** command instructs the medium changer device to either extend or retract the import/export drawer for single disk insertion or removal. This command will fail if the changer device has been placed in the Drawer Prevent state by the Prevent Allow Medium Removal command.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (0Dh)							
1	Logical Unit Number (0)			Reserved (0)				
2-3	Reserved (00h)							
4	Reserved (0)							Open
5	Reserved (00h)							

Open equals a value of one if the import/export drawer is to be opened (extended) or a value of zero if it is to be closed (retracted).

11.13 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	Logical Unit Number (0)			Reserved (0)				
2-3	(MSB)			Transport Element Address				(LSB)
4-5	(MSB)			Destination Element Address				(LSB)
6-7	Reserved (00h)							
8	Reserved (0)							Invert
9	Reserved (00h)							

Transport Element Address specifies the medium transport element to be positioned. A value of zero 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 at which to position the designated transport element.

Invert equals a bit of one if the medium transport element is to be inverted (“flipped”) before it is positioned at the destination element. If a flipper mechanism is not installed in the library, this bit is reserved.

11.14 PREVENT ALLOW MEDIUM REMOVAL Command

The **Prevent Allow Medium Removal** command instructs the medium changer device to either inhibit or permit opening of the access door for magazine insertion or removal, and/or opening of the import/export drawer for single disk insertion or removal. If left in the Door Allow state, the door can be opened by the Open Access Door command or by pressing keys on the front panel. If left in the Drawer Allow state, the drawer can be opened by the Open Close I/E Drawer command or by pressing a key on the front panel. The Door Allow and Drawer Allow states are independent of each other.

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

Prevent equals a value of one if opening of the magazine access door or the import/export drawer (depending on the Drawer bit) is to be prevented, or a value of zero if the opening of the magazine access door or import/export drawer is to be allowed.

Drawer equals a value of one if opening of the import/export drawer is to be prevented or allowed, or a value of zero if the opening of the magazine access door is to be prevented or allowed.

The Prevent states remain 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 (and the Drawer bit set to the same value as when the command was originally issued).
2. The medium changer device receives the BUS DEVICE RESET message.
3. The medium changer device receives a hard reset or power is cycled.

11.15 READ BUFFER Command

The **Read Buffer** command is used to read the current SCSI ID of the medium changer device, or from one of the two general purpose host-controlled scratchpad buffers for storing state information and for synchronization and data transfer between multiple initiators.

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

Reading the SCSI ID of the Medium Changer Device

To read the SCSI ID of the medium changer device, set **Mode** to 2, **Buffer ID** to 2, **Buffer Offset** to zero, and **Allocation Length** to one. A single byte specifying the current SCSI ID the changer device will be returned.

Reading from Scratchpad Buffers

Two 256 byte buffers are supported. Set **Buffer ID** to zero or one.

Buffer Offset can be any value between zero and 255.

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

See the Write Buffer command (Section 11.24) for more information.

11.16 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	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (B8h)							
1	Logical Unit Number (0)			Rsvd (0)	Element Type Code			
2-3	(MSB)			Starting Element Address				(LSB)
4-5	(MSB)			Number of Elements				(LSB)
6	Reserved (00h)							
7-9	(MSB)			Allocation Length				(LSB)
10-11	Reserved (00h)							

Element Type Code specifies an element type as follows:

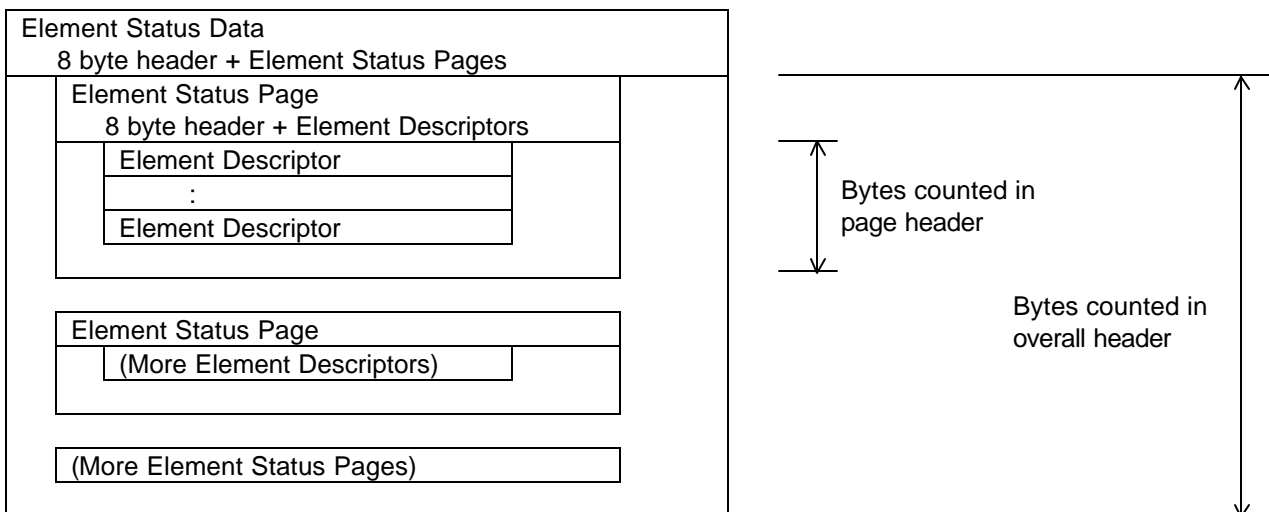
- 0 All element types
- 1 Medium transport elements
- 2 Storage elements
- 3 Import/export elements
- 4 Data transfer elements

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 descriptors to report.

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 (12h)	(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.

11.16.1 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)			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)				LastUsed	
17	Reserved (00h)								

Element Address is the address of this element.

Except equals a value of one if the element was left in an abnormal state. Additional information is given in the Additional Sense Code and in the Additional Sense Code Qualifier fields.

Full equals a value of one if this element contains a disk.

Additional Sense Code and **Additional Sense Code Qualifier** indicate detailed information related to a non-recoverable error condition. These error codes are listed in Section 13.1 and described more fully in the D-Series Service Manual.

SValid (Storage Element Valid) equals bit of one if the Source Storage Element Address and Invert bit are valid.

Invert equals a bit of one if the unit of media now in this element was inverted by Move Medium operation since it was last in the Source Storage Element Address.

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

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

Volatile equals a value of one 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 a value of one if this medium transport element was the last one used.

11.16.2 Storage Element Descriptor

The Storage Element Descriptor is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
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 - 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)			Magazine	Changed
17	Reserved (00h)							

Access equals a value of one if element access by the medium transport element is allowed (i.e., if a tray is present at this address).

Source Storage Element Address provides the address of the last storage element this disk was moved from, or, if another disk was subsequently moved into this storage element, then this field will contain the address of the storage element that disk was moved from.

Magazine equals a value of one if a magazine is present at this address.

Changed equals a value of one if the magazine at this address has been recently removed, exchanged, or installed. This bit is cleared after it is returned.

Other fields are the same as for the medium transport element descriptor.

11.16.3 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 (1)	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)				Open
17	Reserved (00h)							

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

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

Access equals a value of one indicating that access to the import/export element by the medium transport element is always allowed.

Open equals a value of one if import/export drawer is open (extended).

Other fields are the same as for the medium transport element descriptor. Note that if the drawer is open (extended) the Full bit will not be updated until the drawer is closed (retracted).

11.16.4 Data Transfer Element Descriptor

The Data Transfer Element Descriptor is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
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		
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)							

Access a value of one if access to the data transfer element by the medium transport element is allowed (the drive is on-line), or a value of zero if access is disallowed (the drive is off-line).

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

IDValid value of one indicates that the SCSI Bus Address field contains valid information. If the drive is not present or is turned off, this bit will be set to zero.

LUValid value of one indicates that the Logical Unit Number field contains valid information. If the drive is not present or is turned off, this bit will be set to zero.

Logical Unit Number is logical unit number (LUN) used to access the corresponding drive.

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.

11.17 READ MAGAZINE STATUS Command

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

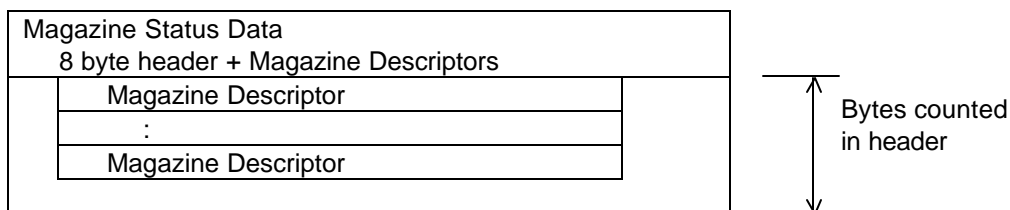
Bit	7	6	5	4	3	2	1	0	
Byte									
0	Operation Code (F8h)								
1	Logical Unit Number (0)				Reserved (0)				
2-3	(MSB)				Starting Magazine Number				(LSB)
4-5	(MSB)				Number of Magazines				(LSB)
6	Reserved (00h)								
7-9	(MSB)				Allocation Length				(LSB)
10-11	Reserved (00h)								

Starting Magazine Number specifies the number of the first magazine to report (starting with magazine number 1).

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	7	6	5	4	3	2	1	0
Byte								
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.

11.17.1 Magazine Descriptor

The Magazine Descriptor is as follows.

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

Magazine Number is the number of this magazine (starting with magazine number 1).

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

Full equals a value of one if the magazine is present.

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

Volatile equals a value of one 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.

11.18 RELEASE Command

The **Release** command is used to release 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	Logical Unit Number (0)			3rdPty	Third Party Device ID			Element
2	Reservation Identification							
3 - 5	Reserved (00h)							

Element equals value of one if a specific set of elements is to be released or a value of zero if the entire medium changer device is to be released.

3rdPty equals a value of one if a reservation made using the 3rdPty option of the Reserve command is to be released.

Third Party Device ID is the SCSI ID of the initiator for whom the reservation was made if the 3rdPty bit is set.

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

11.19 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	Logical Unit Number (0)			Reserved (0)				
2-3	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 Reserved 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 available as shown on the following page for an Allocation Length of 36.

Sense Data Format

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Valid	Error Code (70h)							
1	Reserved (00h)								
2	Reserved (0)				Sense Key				
3-6	(MSB)			Information					(LSB)
7	Additional Sense Length (1Ch)								
8-11	Reserved (00h)								
12	Additional Sense Code								
13	Additional Sense Code Qualifier								
14	Reserved (00h)								
15	SKSV	Sense-Key Specific							
16-17									
18-35	Additional Sense Bytes								

Valid equals a value of one if the Information field contains valid data.

Sense Key is described below.

Information equals the number of the drive being turned off or serviced for a Sense Key of 2 (Not Ready) and an ASC,ASCQ of 04h,80h - 'Not ready, entering drive service mode'; or 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 13.1 and described more fully in the D-Series Service Manual.

SKSV (Sense-Key Specific Valid) equals a value of one 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 was not able to process the command and it was aborted.

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

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

C/D (Command/Data) equals a value of one if the illegal parameter is in the command descriptor block or a value of zero if the illegal parameter is in the data parameters sent during the DATA OUT phase.

BPV (Bit Pointer Valid) equals a value of one if the value in the Bit Pointer field is valid.

Bit Pointer indicates the left-most (most-significant) value 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 one, the Sense-Key Specific fields contain the following information.

Bit Byte	7	6	5	4	3	2	1	0
15	SKSV	Reserved (00h)						
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 contain 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 Element Address						
		(LSB)						
22 - 23	(MSB)	(First) Destination Element Address						
		(LSB)						
24	Info2Valid	Second Source Tray Location			Second Containing Element Number			Inverted2
25 - 26	(MSB)	Second Source Element Address						
		(LSB)						
27 - 28	(MSB)	Second Destination Element Address						
		(LSB)						
29		Medium Transport Element Number						Rsvd (0)
30 - 31	(MSB)	Lift Position Element Address						
		(LSB)						
32 - 33	(MSB)	Additional Information						
		(LSB)						
34 - 35		Reserved (00h)						

ChgrReady equals a value of one if the medium changer device is ready to accept new tray movement commands or a value of zero if the medium changer device is jammed and a Rezero Unit command is required to reinitialize the unit.

Restored equals a value of one if all disks 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 a value of one if disks have been moved and the last command completed successfully.

AllReturned equals a value of one if all disks have been returned to their last storage element locations.

MT1Full equals a value of one if the first medium transport element is full.

MT2Full equals a value of one if the second medium transport element is full.

FlipFull equals a value of one if the flipper mechanism contains media.

FailSecond equals a value of one if the failure occurred on the second move of an Exchange Medium command (from the first destination element to the second destination element) or a value of zero if the failure occurred on the first move (from the source element to the first destination element).

InfoValid equals a value of one 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 a value of one 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 medium transport element (if not the source or destination element) where the MT 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)
- 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.)

(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, if the corresponding Source Location fields contain the numbers 2 or 7, starting with 1 for MT1 or DT1 (drive 1).

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

(First) Source Element and **(First) Destination Element** are the addresses of source and destination Elements of the last movement command, or the source and first destination elements of the last Exchange Medium command.

Second Source Element and **Second Destination Element** are the addresses of first and second destination elements of the last Exchange Medium command.

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

Lift Position Element Address is the address of the element at which the medium transport element specified by the Medium Transport Element Number field was positioned when the error occurred.

Additional Information contains such information as the value of ASC and ASCQ received from the drive in the event of an eject (unclamp) failure when the DsabLoEj mode of operation is disabled, or a drive not becoming ready failure when the WaitLoad mode of operation is enabled (see the Mode Select command). For low-level SCSI errors (error codes F1h and greater) the first byte contains the error number and the second byte contains the low-level SCSI error location. For non-SCSI errors, the first byte contains an internal location code, which may be useful for Plasmon technical support. The error codes are listed in Section 13.2 and the low-level SCSI error locations are listed in Section 13.3.

11.20 RESERVE Command

The **Reserve** command is used to reserve the medium changer device or specific elements within it. Third-party reservation allows one initiator to reserve the medium changer device or specific elements for another initiator.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (16h)							
1	Logical Unit Number (0)			3rdPty	Third Party Device ID			Element
2	Reservation Identification							
3 - 4	(MSB)			Element List Length				(LSB)
5	Reserved (00h)							

Element equals value of one if specific elements are to be reserved or a value of zero if the entire medium changer device is to be reserved.

3rdPty equals a value of one if the reservation is to be made for the initiator specified by the Third Party Device ID field or a value of zero if the reservation is to be made for the initiator issuing the command.

Third Party Device ID is the SCSI ID of the initiator for whom the reservation is to be made if the 3rdPty bit is set.

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

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

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

11.20.1 Reserve Element List Descriptor

The Reserve Element List Descriptor is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
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.

Reservations remain effective until one of the following conditions occurs:

1. The initiator, which made the original reservation, issues another Reserve command to update the reservation.
2. The initiator, which made the reservation, issues a Release command to release the reservation.
3. The medium changer device receives a BUS DEVICE RESET message.
4. The medium changer device receives a hard reset or power is cycled.

11.21 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	Logical Unit Number (0)			Reserved (0)				
2-4	Reserved (00h)							
5	Rsvd (0)	NoTrayRet	Reserved (00h)					

By default, the library system will return all trays not in magazines to their original magazine locations before moving to its home position. If there are trays in drives, and the DsabLoEj bit is set in the Mode Select Library Mode Parameters Page 1 (see Section 11.6.1), 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 a value of one if trays *are not* to be returned to their original magazines locations before moving the library system to its home position.

11.22 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	Logical Unit Number (0)			PF	Rsvd (0)	Selfst	DevOff (0)	UnitOff (0)
2	Reserved (00h)							
3-4	Parameter List Length (00h)							
5	RecalOffs	Park	Reserved (00h)					

PF (Page Format) and **Selfst (Self Test)** are ignored.

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

Park equals a value of one if the library system is to move to its park position in preparation for shipment. If this bit is set, the library system will park and *no other SCSI commands will be accepted*. Library system robotics will not be tested if this bit is set.

RecalOffs equals a value of one if all library system offsets are to be automatically recalibrated. If this bit is set, there must be a magazine in the bottom and top positions of each column of the library system, and a tray in the bottom slots of each of these magazines. Also, the import/export drawer should be closed. Library system robotics will not be tested if this bit is set.

The Send Diagnostic command returns status of GOOD if no errors occur. Otherwise, a CHECK CONDITION will be set. Send a Request Sense command to obtain information about the error encountered.

11.23 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	Logical Unit Number (0)			Reserved (0)				
2-5	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. In other words, if this command passes without error, the medium changer device is ready to accept new tray movement commands.

11.24 WRITE BUFFER Command

The **Write Buffer** command is used to write new firmware to the library system, to change the SCSI ID or the medium changer device, or to write to one of the two host-controlled scratchpad buffers for storing state information and for synchronization and data transfer with multiple initiators.

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

Downloading Firmware

To write new firmware to the library system, set **Mode** equal to 7. **Buffer ID** must equal zero.

The **Buffer Offset** begins at zero 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 Write Buffer parameter list is shown below.

Firmware Download Write Buffer Mode 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							

The BootPROM field of the Mode Select Library Mode Parameters Page 2 (see Section 11.6.2) must be set to one before loading new firmware. After issuing the Mode Select command, host software should poll the library system with the Request Sense command, waiting for GOOD status before sending the Write Buffer command. 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. If the newly loaded firmware code is executing, the RunPROM field of the Mode Sense Library Mode Parameters Page 2 (see Section 11.8.5) will be zero.

Changing the SCSI ID of the Medium Changer Device

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

Writing to Scratchpad Buffers

To write to a scratchpad buffer, set **Mode** to 2.

Two 256 byte buffers are supported. Set **Buffer ID** to zero or one.

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 parameter data in mode 2 is not defined by this specification and may be used in any manner by host software. When a mode 2 Write Buffer command is issued it will generate a Unit Attention condition - 'Buffer 0 has been changed' or 'Buffer 1 has been changed' for all other initiators. All initiators may read the buffer using the Read Buffer command. The contents of the buffers are maintained when the library system is powered-off.

12. 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 11.6.2) determines which values will be recorded in the event list. The format of the Event History Type byte is as follows.

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

Bit	7	6	5	4	3	2	1	0
Byte								
9	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 11.5.5). The default value for this byte is BBh (187).

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.

CmdFilter equals a value of one 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 Buffer, Read Element Status, and Read Magazine Status commands will not be recorded in the Event List. If this bit is 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.

- Cnh Changer is selected by host; n is the host SCSI ID.
- Dnh Drive is selected by changer, or drive has reselected changer; n is the drive SCSI ID.
- F3h Non-zero ASC/ASCQ returned to host. This byte is followed by the ASC and ASCQ bytes.
- F4h Non-zero ASC/ASCQ received from drive. 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 first byte (E3h, E4h, .. - the flag byte) is not recorded if the Terse bit is set to one below.

- E3h Message byte received from host in target mode, followed by the message byte.
- E4h Non-zero message byte sent to host in target mode, followed by the message byte.
- E5h Command byte(s) received from host in target mode, followed by the command bytes.
- E6h Data bytes received from host in target mode, followed by the data bytes.
- E7h Non-zero status byte sent to host in target mode, followed by the status byte.
- EBh Non-zero message byte sent to drive in initiator mode, followed by the message byte.
- ECh Message byte received from drive in initiator mode, followed by the message byte.
- EDh Command byte(s) sent to drive in initiator mode, followed by the command bytes.
- EEh Data bytes received from drive in initiator mode, followed by the data bytes.
- EFh Status byte received from drive in initiator mode, followed by the status byte.

Terse should be set to a value of one if all bytes specified by the SCSI Activity field are to be recorded except the flag bytes (E3h, E4, etc.). Setting this bit increases the amount of SCSI activity data that may be stored in the list.

Src/Dst equals a value 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 value 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.; MT's are logged as E1h and E2h; the Import/Export is logged as EEh; slot numbers less than 200 (C8h) are logged as one byte; and slot numbers greater than or equal to 200 are logged as two bytes - the first (MSB) being OR'd with FAh.

For example, the following is the event list of an Exchange Medium from ST3 to D1 to ST255:

```
C7 (E2) A6 (..) 03 D1 FA FF
```

MT equals a value of one if the medium transport element used for Position To Element, Move Medium, and Exchange Medium commands is to be recorded, or a value 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 value 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 value 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 mode was entered.

F6h,	02h	Drive Service mode was entered.
F7h		A tray was moved prior to entering magazine exchange mode or turning off 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.
FEh,	01h	The access door was closed by the operator.
FEh,	03h	The import/export drawer was opened by the operator.
FEh,	04h	The import/export drawer was closed by the operator.

13. Error Codes

13.1 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 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 the drives within the library are not listed here. See the appropriate drive manuals for a description of these errors.

Also listed are the internal error codes associated with the SCSI error returned. See Section 13.2 for a list of the internal library error codes, and the D-Series User's Guide 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, entering drive service mode	-
(02h)	04h	82h	Not ready, turning off a drive	-
(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, access door closed for magazine exchange	-
(06h)	28h	80h	Not ready to ready transition, access door closed after servicing a drive	-
(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 for bus expander	-
(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	-
(06h)	3Fh	80h	Buffer 0 has been changed	-
(06h)	3Fh	81h	Buffer 1 has been changed	-
(04h)	40h	00h	Diagnostic failure	-
(0Bh)	43h	00h	Message error	-
(04h)	44h	00h	Internal target failure	-
(0Bh)	45h	00h	Select or Reselect failure	-
(0Bh)	47h	00h	SCSI parity error	-

Sense Key	ASC	ASCQ	Error Description	Internal Error
(0Bh)	48h	00h	Initiator detected error message received	-
(0Bh)	49h	00h	Invalid message error	-
(0Bh)	4Bh	00h	Data Phase error	-
(05h)	53h	02h	Medium removal prevented	7Ch
(06h)	5Bh	01h	Threshold condition met	-
(06h)	80h	10h	Library memory reset	10h
(04h)	80h	11h	Servo CPU failure	11h
(04h)	80h	12h	Lift cable failure	12h
(04h)	80h	13h	Main harness failure	13h
(04h)	80h	14h	I/E harness failure	14h
(04h)	80h	15h	DCB board disconnected	15h
(04h)	80h	16h	Front panel disconnected	16h
(04h)	80h	17h	SCSI terminator power is low	17h
(04h)	80h	18h	Magazine board A disconnected	18h
(04h)	80h	19h	Magazine board B disconnected	19h
(04h)	80h	1Ah	Magazine board C disconnected	1Ah
(04h)	80h	1Bh	Magazine board D disconnected	1Bh
(04h)	80h	1Ch	Magazine board E disconnected	1Ch
(04h)	80h	1Dh	Magazine board F disconnected	1Dh
(04h)	80h	1Eh	Drive interface cable disconnected	1Eh
(04h)	80h	1Fh	Bad drive type - cable	1Fh
(04h)	80h	20h	Drive unclamp bounce	20h
(04h)	80h	21h	Unclamp switch failure	21h
(05h)	80h	30h	Drive is offline	30h
(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
(04h)	80h	37h	Drive won't go ready	37h
(04h)	80h	38h	Can't Inquiry drive	38h
(04h)	80h	39h	Need longer delay between turning drives on or off or changing id's	39h
(04h)	80h	3Ah	Drive won't go ready - SCSI	3Ah
(0Bh)	80h	3Bh	Drive offset not set	3Bh
(04h)	80h	3Ch	Can't reserve drive	3Ch
(04h)	80h	3Dh	Can't release drive	3Dh
(04h)	80h	3Eh	No tray for offset	3Eh
(05h)	80h	3Fh	Drive address conflict	3Fh
(04h)	80h	40h	Bus expander error	40h
(04h)	80h	50h	Picker home failure	50h
(04h)	80h	51h	Picker position failure	51h
(04h)	80h	52h	Swap pickers failure	52h
(04h)	80h	53h	Picker load failure	53h
(04h)	80h	54h	Picker misposition	54h
(04h)	80h	55h	Picker not at drive	55h
(0Bh)	80h	56h	Picker offset not set	56h
(04h)	80h	57h	Tray disengaged	57h
(04h)	80h	60h	Lift home failure	60h
(04h)	80h	61h	Lift position failure	61h
(04h)	80h	62h	Lift blocked by projecting tray - left column	62h
(04h)	80h	63h	Lift blocked by projecting tray - middle column	63h
(04h)	80h	64h	Lift blocked by projecting tray - right column	64h

Sense Key	ASC	ASCQ	Error Description	Internal Error
(04h)	80h	65h	Can't move lift - remove packing foam tube	65h
(04h)	80h	68h	Pivot not aligned	68h
(04h)	80h	69h	Pivot align failure	69h
(04h)	80h	6Ah	Pivot failure	6Ah
(0Bh)	80h	6Bh	Pivot offset not set	6Bh
(04h)	80h	70h	Door open failure	70h
(02h)	80h	71h	Access door is open	71h
(05h)	80h	72h	Door open is prevented	72h
(04h)	80h	78h	Drawer home failure	78h
(04h)	80h	79h	Drawer open failure	79h
(04h)	80h	7Ah	Drawer close failure	7Ah
(02h)	80h	7Bh	I/E drawer is open	7Bh
(0Bh)	80h	7Dh	Import offset not set	7Dh
(04h)	80h	86h	Element unexpectedly empty	86h
(04h)	80h	87h	Element unexpectedly full	87h
(04h)	80h	88h	Unexpectedly tray full	88h
(04h)	80h	89h	Unexpectedly tray empty	89h
(05h)	80h	8Bh	Picker is full	8Bh
(04h)	80h	8Ch	Both pickers are full	8Ch
(0Bh)	80h	98h	Slot offsets not set	98h
(04h)	80h	9Ch	Tray's source magazine is known	9Ch
(04h)	80h	A0h	Illegal magazine change	A0h
(04h)	80h	B0h	Flip fail	B0h
(04h)	80h	B1h	Flip no motion	B1h
(04h)	80h	B2h	Flip invalid pos.	B2h
(04h)	80h	B3h	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	B9h	Flipper tray sensor fail	B9h
(04h)	80h	BAh	Flipper not horizontal	BAh
(05h)	81h	00h	Not running from Boot PROM	-
(05h)	81h	01h	Not running from Flash	-
(05h)	81h	02h	Wrong model firmware	-
(05h)	81h	03h	Download firmware checksum error	-
(05h)	81h	04h	Download firmware EPROM mismatch	-
(05h)	81h	05h	Download offsets checksum error (or serial number mismatch)	-

The following SCSI sense codes are only returned when the EmuLLFJ bit is set in Library Mode Parameters Page 2 of the Mode Select command (see Section 11.6.2).

Sense Key	ASC	ASCQ	Error Description	Internal Error
(04h)	15h	01h	Mechanical positioning error	60h/61h
(04h)	15h	C0h	Front panel door opening error	70h
(04h)	15h	C1h	Medium transfer turn right/left error	6Ah
(0Bh)	53h	00h	Medium load failure	35h
(0Bh)	53h	80h	Medium eject failure	36h
(02h)	5Ah	00h	Operator medium insert requested (door open)	71h

Sense Key	ASC	ASCQ	Error Description	Internal Error
(02h)	5Ah	81h	Operator requested	65h
(04h)	C0h	00h	Medium jut out error	62h-64h

13.2 Internal Error Codes

The following error codes are stored in the library system error log and 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 D-Series User's Guide or Service Manual.

Error Code	Error Description
10h	Library memory reset
11h	Servo CPU failure
12h	Lift cable failure
13h	Main harness failure
14h	I/E harness failure
15h	DCB board disconnected
16h	Front panel disconnected
17h	SCSI terminator power is low
18h	Magazine board A disconnected
19h	Magazine board B disconnected
1Ah	Magazine board C disconnected
1Bh	Magazine board D disconnected
1Ch	Magazine board E disconnected
1Dh	Magazine board F disconnected
1Eh	Drive interface cable disconnected
1Fh	Bad drive type - cable
20h	Drive unclamp bounce
21h	Unclamp switch failure
30h	Drive is offline
31h	Drive already on
32h	Drive already off
33h	Drive clamp failure
34h	Drive unclamp failure
35h	Drive load failure
36h	Drive unload failure
37h	Drive won't go ready
38h	Can't Inquiry drive
39h	Need longer delay between turning drives on or off or changing id's
3Ah	Drive won't go ready-SCSI
3Bh	Drive offset not set
3Ch	Can't reserve drive
3Dh	Can't release drive
3Eh	No tray for offset
3Fh	Drive address conflict
40h	Bus expander error
50h	Picker home failure
51h	Picker position failure
52h	Swap pickers failure
53h	Picker load failure
54h	Picker misposition
55h	Picker not at drive
56h	Picker offset not set
57h	Tray disengaged

Error Code	Error Description
60h	Lift home failure
61h	Lift position failure
62h	Lift blocked by projecting tray - left column
63h	Lift blocked by projecting tray - middle column
64h	Lift blocked by projecting tray - right column
65h	Can't move lift - remove packing foam tube
68h	Pivot not aligned
69h	Pivot align failure
6Ah	Pivot failure
6Bh	Pivot offset not set
70h	Door open failure
71h	Access door is open
72h	Door open is prevented
73h	Access door is in use
78h	Drawer home failure
79h	Drawer open failure
7Ah	Drawer close failure
7Bh	I/E drawer is open
7Ch	Drawer open is prevented
7Dh	Import offset not set
81h	Magazine not present
82h	Tray not present
84h	Source is empty
85h	Destination is full
86h	Element unexpectedly empty
87h	Element unexpectedly full
88h	Unexpected tray full
89h	Unexpected tray empty
8Bh	Picker is full
8Ch	Both pickers are full
90h	Tray in drive
91h	Tray in picker
94h	Not enough trays for test
95h	Too many trays for test
96h	Tray in import/export
97h	No drives online
98h	Slot offsets not set
99h	Empty tray not found
9Ah	Full tray not found
9Bh	Empty slot not found
9Ch	Tray's source magazine is unknown
A0h	Illegal magazine change
A1h	Wrong password
A2h	One or more elements are reserved by host
B0h	Flip fail
B1h	Flip no motion
B2h	Flip invalid pos.
B3h	EEPROM write fail
B4h	Missing flipper tray
B5h	Flipper is full
B6h	Flipper com error
B7h	Flipper power was reset

Error Code	Error Description
B8h	Old flipper protocol
B9h	Flipper tray sensor fail
BAh	Flipper not horizontal
F1h	SCSI bus unavailable
F2h	SCSI selection timeout
F3h	More than 2 ID's on bus
F4h	Undefined SCSI phase
F5h	SCSI phase error
F6h	Bus not terminated
F7h	SCSI parity error
F8h	Unexpected loss of busy
F9h	Abort message received
FAh	Improper message received
FBh	Two devices responding to same selection
FCh	SCSI command timeout
FDh	Host communication timeout
FEh	Drive is busy
FFh	SCSI sense failure

13.3 Error Code F1h-FFh Internal Error Locations

Error codes F1h-FFh are reserved for low-level SCSI communication errors. To assist in isolating the particular SCSI bus phase in which one of these errors occurs, an internal error location is also stored in the Log Sense/Request Sense Additional Information bytes (except for error FEh, in which case the SCSI Status byte is stored instead).

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

Location	Description
43	Status phase (changer-drive nexus).
44	Data in phase (changer-drive nexus).
45	Message in phase (changer-drive nexus).

