

Plasmon Gx Libraries

UDO/MO Library System

SCSI Reference Manual

Revision H

This publication describes the SCSI software interface to the Plasmon Gx family of ultra density optical and magneto-optical disk library systems. It is intended to provide interfacing information to parties wishing to develop software and/or applications programs for the library system. This document for the most part corresponds to Product Revision Level G03a(for G10-80) and H04a(for G166,G134,174) or later of the library system firmware.

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1. Glossary of Terms Used

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

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

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

Data Transfer Elements (DTs): The data storage devices(MO or UDO) within the library system.

Drive Type: A numeric classification of the type of drive installed.

Element: An addressable location within the library system. The library system contains four types of elements: medium transport elements (MTs), storage elements (STs), import/export element (IEs), and data transfer elements (DTs).

ERP: The action taken by the library firmware to recover from an error event, i.e. an error recovery procedure.

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 drive. The particular code bytes logged depend upon the value of the event history type. This list is used only for error analysis and debugging.

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

Export: Moving a cartridge to the IO station so that the operator may remove it from the library system.

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

Import: Retrieving a cartridge from the IO station so that it may be used in the library system.

Import/Export Element (IE): The externally accessible IO station through which media are added to or removed from the library system.

LSB: Least significant bit.

Lift: The medium transport assembly particularly when moving vertically.

IO station: The operator accessible media slot through which individual cartridges are added to or removed from the library system.

Library (Libraries): The functional device which consists of a robot, controller, and interface that facilitates the moving of media to and from medium storage elements and data transfer elements. The term 'library' and 'media changer' are used interchangeably.

Media Changer: The functional device which consists of a robot, controller, and interface that facilitates the moving of media to and from medium storage elements and data transfer elements. The term 'library' and 'media changer' are used interchangeably. The term 'media changer' is more rigorously used by the SCSI standards documents.

Medium Transport Elements (MTs): The optical disk transport mechanisms in the library system. The library system contains two medium transport elements. They are also referred to as the pickers.

Medium Transport Assembly (MTA): An assembly of medium transport elements within a single housing. All library systems contain a primary MTA and some contain an alternate MTA.

MO: Magneto-Optical. A method of recording data involving the physics of magnetic and optical techniques.

MSB: Most significant bit.

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

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

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

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

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 0 and 7, inclusive. The drives must each have an SCSI ID between 0 and 7, or between 0 and 15 if Wide SCSI is supported.

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

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

Service Panel: The panel behind the front door of the library system through which the library drives may be inserted or removed and the library's printed circuit boards and cables may be accessed.

Storage Elements (STs): Locations within the library system used to store disks.

UDO: Ultra-Density Optical.

2. Introduction

The Plasmon Gx libraries are a family of optical disk robotic library systems capable of holding a number of disk drives and disk cartridges. The primary distinction of the Gx libraries is support of UDO optical media as well as standard MO optical media. The robotic device within each library system is referred to as a medium changer device and it uses the protocols and commands for medium changer devices as defined in the American National Standards Institute SCSI Specification. The Gx library system's medium changer device and the disk drives within the library system are all accessed independently.

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

The import/export element is an externally accessible slots through which disk cartridges are added to or removed from the library system. It is also known as the IO station.

The storage elements, ST1 - STn, are locations within the library system's medium store used to store cartridges.

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

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

The medium changer device within the library system intends to respond to commands as defined by and in accordance with the SCSI 2, ANSI X3.131-1994 standard.

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

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

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

American National Standards Institute, Inc.

11 West 42nd Street, New York, NY 10036

+1-212-642-4900

Internet: www.ansi.com

3. Library System Operating Modes

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

3.1 Normal On-line

This is the normal operating mode of the library system. Element statuses are displayed on the front panel of the library system. A menu may be selected for accessing mail slot, displaying library status values, and entering one of the other two operating modes of the library.

3.2 Library Set Up Mode

This mode may only be invoked from the front panel. It takes the medium changer device completely off-line (the drives remain on-line) for SCSI service requests. For more information refer to the Gx Libraries User Guide and Service Manuals.

3.3 Library Maintenance Mode

This mode may only be invoked from the front panel. It takes the medium changer device completely off-line for SCSI service requests. For more information, refer to the Gx Libraries User Guide and Service Manuals.

4. SCSI Command Overview

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

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

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

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

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

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

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

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

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

The **Move Medium** command instructs the medium changer device to move a unit of media from a source element to a destination element (e.g.: move a cartridge from the IO station to slot ST3). The Invert bit may be specified to flip the cartridge prior to depositing the cartridge into the destination element.

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

*The **Prevent/Allow Medium Removal** command instructs the medium changer device to either inhibit or permit opening of the IO station for cartridge insertion.

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

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

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

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

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

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

***These commands are modified from the previous G Series generation.**

5. SCSI Addresses

The default SCSI IDs for the library system devices are as follows.

Default SCSI IDs

Device	SCSI ID
Library Drive 1	0
Library Drive 2	1
Library Drive 3	2
Library Drive 4	3
Library	6

6. Element Addresses and Counts

The library element address scheme is presented in the following table. ‘n’ depends upon the library model.

Element Addresses

Element Type	Addresses
MT	8001, 8002
ST	1 - n
IE	4001
DT	6001 – 6004

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

Element Counts

Model	Number of Medium Transport Elements	Number of Storage Elements	Number of Import/Export Elements	Number of Data Transfer Elements
Model 10	2	10	1	Maximum of 2
Model 24	2	24	1	Maximum of 2
Model 32	2	32	1	Maximum of 2
Model 72	2	72	1	Maximum of 4
Model 80	2	80	1	Maximum of 2
Model 134	2	134	1	Maximum of 4
Model 166	2	166	1	Maximum of 4
Model 174	2	174	1	Maximum of 2

7. SCSI Communication

7.1 Supported Messages

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

Message Codes

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

7.2 Supported Status Byte Codes

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

Status Byte Codes

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

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

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

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

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

8. Recommended Command Timeouts

The following values are the recommended timeout values for host software to use when issuing commands the medium changer device. The actual command execution times depend upon the various mode settings in effect (see Section 10.6.1), 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 Element, Release Element, Read Element Status, Test Unit Ready, Log Select, Log Sense, Write Buffer (mode 2), Read Buffer	10 sec
Time from power-up to responding to normal initialization commands such as Inquiry and Mode Sense.	5 min
Send Diagnostic, Position to Element, Move Medium, Exchange Medium, Rezero Unit, Write Buffer (mode 7)	10 min
Initialize Element Status (bar code reader enabled)	15 min

9. Special SCSI States/Conditions

9.1 Reset State

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

- All SCSI bus signals (except RST) will be released.
- All I/O processes (commands) will be terminated. The library system will be restored to the state it was in before the reset occurred.
- All device reservations will be released.
- All operating (Mode Select) modes will be restored to default or saved values.
- The library system will be reset to the IO station states—(see Prevent/Allow Medium Removal command).
- A Unit Attention condition will be generated.

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

9.2 Not Ready State

The medium changer device returns CHECK CONDITION status in response to Test Unit Ready command, or any cartridge movement commands, when it is in a state in which it is unable to process such commands. A subsequent Request Sense command issued to the medium changer device yields return data containing a Sense Key of 2h - Not Ready. The device will remain in such a state for a specified period of time or until an action by an operator takes place.

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

- Upon power-up. The medium changer device will be Not Ready while drive power is being restored and the library system is initializing.
- If a drive is turned off because of a drive over-temperature or fan under-speed condition. After an appropriate delay to allow the drives to be unloaded, the medium changer device will be Not Ready for 5 seconds before the drives are turned off and placed in the Service state.
- Selecting ‘Turning Drive Off’ via the front panel menus. The medium changer device will be Not Ready for 5 seconds after this option is selected to allow time for SCSI initiator devices to poll the changer device, sense the Not Ready state, and stop SCSI activity to the drive being turned off.

9.3 Unit Attention Condition

The medium changer device returns CHECK CONDITION status in response to SCSI commands other than Inquiry when one or more conditions indicating a change in state of the library system has occurred. A subsequent Request Sense command issued to the medium changer device yields return data containing a Sense Key of 6h — Unit Attention. This does not indicate a problem with the particular command that was issued but rather a normal or abnormal change in the state of the library system. This change may signal a failure or require that a different sequence of commands be issued to the changer device. 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.
- A change to one or more of the library system settings via the front panel ‘Set Up Library’, ‘Turn Drive Off’, or ‘Turn Drive On’ selections, or a Mode Select command from a host.
- A change to one or more of the log values via the front panel ‘Set Up Library’ selection or a Log Select command from a host.
- A change in the library system Flash firmware via a Write Buffer command.

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

10. SCSI Commands

10.1 EXCHANGE MEDIUM Command (A6h)

The **Exchange Medium** command instructs the medium changer device to exchange a cartridge in a source element with a cartridge in a first destination element and place that cartridge in a second destination element. Using this command instead of Move Medium can significantly decrease cartridge swap times.

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

The cartridge in the source element is moved to the first destination element and the cartridge which previously occupied the first destination element is moved to the second destination element.

Transport Element Address specifies the medium transport element. For the most efficient operation, an address of zero should be used. This will allow the medium changer device to use both medium transport elements to accomplish the cartridge exchange in the least amount of time. A specific medium transport element may also be specified. In this case, however, the second destination element may not be the same as the source element and the Import/Export element may not be involved in the exchange.

Source Element Address specifies the source element.

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

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

10.2 INITIALIZE ELEMENT STATUS Command (07h)

The **Initialize Element Status** command is used to cause the medium changer to test elements for the presence of media. 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 - 4	Reserved (00h)							
5	TypeSel				Reserved (0)			

TypeSel selects the types of elements to test according to the following tables. The **ScanMd** bit set in the Library Special Modes page(21h) determines whether slow or fast mode is used. See Mode Select page 21h for how **ScanMd** is set. The default for **ScanMd** is 0. If a barcode reader is present and enabled, the barcode labels will be read for the specified elements.

TypeSel	Action(ScanMd = 0, Slow)
0	Test all elements. Verify media type(by picking).
1	Test all elements except data transfer elements (drives). Verify media type (by picking).
2	Test all elements except storage elements (slots).
3	Test all elements. Do not verify media type.

TypeSel	Action(ScanMd = 1, Fast)
0	Test all elements. Do not verify media type.
1	Test all elements except data transfer elements (drives). Do not verify media type.
2	Test all elements except storage elements (slots).
3	Test all elements. Verify media type (by picking).

Note that the status of the drives may not be checked if both medium transport elements are full.

The IES (Initialize Element Status) command behaves differently between the Gx80 and the Gx174 models for a particular special case. This case is when the storage elements of each are sensed to be completely empty, i.e. no media. For the Gx80 storage element empty case, an IES will take more time to complete as the medium changer will pick verify every slot to ensure that there is no media. This is a check on the media scan sensor for validity. For the Gx174 empty storage element case, there is a picker calibration feature that can be sensed by the media scan sensor. This verifies validity of the media scan sensor. This precludes the need to pick-check all of the storage slots for the 'good' media scan sensor case. If the Gx174 fails to detect the picker calibration feature (the sensor is broken) during media scan, the unit will pick check each storage slot. This mode of operation for each medium changer model allows the unit to continue to operate with only added time for the IES to complete. **NOTE:** In SCSI specification section 10.2 the usage of the **ScanMd** bit is described. This bit is primarily for making the IES command more efficient if the medium changer is not used in a mixed media environment. Usage of this bit does not change the special cases as described above.

10.3 INQUIRY Command (12h)

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

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

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

Page Code defines the parameter page for vital product to be returned. A value of 00h or 80h 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.

FullSN equals 1 to return a full serial number in the Unit Serial Number page.

The following section details the standard Inquiry Data Format for an Allocation Length of 45.

Standard INQUIRY Data Format

Bit	7	6	5	4	3	2	1	0
Byte								
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	AERC (0)	Reserved (0)			Response Data Format (2)			
4	Additional Length (28h)							
5	Reserved (00h)							
6	Reserved (0)							Addr16 (1)
7	RelAdr (0)	Rsvd (0)	Wbus16 (1)	Sync (0)	Linked (0)	Rsvd (0)	CmdQue(0)	Rsvd (0)
8 – 15	Vendor Identification (“Plasmon ”)							
16 – 31	Product Identification (“Midrange-G ”)							
32 – 35	Product Revision Level (e.g.,”G00a”)							
36 – 43	Manufacturer Id (“Plasmon ”)							
44	Model Identification (see table below)							

Peripheral Qualifier equals 0 indicating connection to a logical unit, or 3h indicating an invalid Logical Unit Number.

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

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

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

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

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

Additional Length equals 28h.

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

RelAdr (Relative Address) equals 0 indicating no support of this feature.

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

Sync (Synchronous Data Transfers) equals 0 indicating that the unit does not support synchronous data transfers.

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

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

Vendor Identification is "Plasmon".

Product Identification is "Midrange-G".

Product Revision Level will indicate the firmware level. The defined format is as follows:

XYYz where:

X = A – Z: base hardware level descriptor where

G = Gx10-80 libraries reserved letter for firmware releases.

H = Gx134, 166, and 174 libraries reserved letter for firmware releases.

T = Engineering test levels of firmware.

Other letters are currently not defined for this product.

YY = 00 – 99: major software level. This would increment with major content additions.

z = a – z: minor software level. This would increment for minor or incremental firmware releases.

Model Identification is based on the following table:

Model	Model Identification
Model 10	107
Model 16	108
Model 24	100
Model 32	101
Model 72	102
Model 80	103
Model 134	106
Model 158	109
Model 166	104
Model 174	105

10.3.1 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 (02h)							
4	1st Supported Page (00h)							
5	2nd Supported Page (80h)							

10.3.2 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 (14h)								
4 - 23	(MSB)			Product Serial Number					(LSB)

Product Serial Number is a twenty-character ASCII representation of the library system's factory serial number. If the FullSN field is not set to 1 in the Inquiry command, then the page length is 6, only 10 bytes are returned, and the least significant digit of the serial number is in byte 9.

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

10.4 LOG SELECT Command (4Ch)

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

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

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

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

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

Parameter List Length specifies the length in bytes of the Log Select parameters list. The Log Select parameter list consists of one or more of the following supported pages.

10.4.1 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)							
2-3	(MSB)			Page Length (18h)			(LSB)	
4-9	Reserved (00)							
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)	
22-27	Reserved (00)							

If any of the **Drive 1-4 Load Count** fields is equal to zero, the load count of the corresponding drive will be set to zero.

10.4.2 Error Statistics Page (31h)

The Log Select Error Statistics Page is as follows.

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

Sending this page will clear all library error statistics information.

10.4.3 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	Reserved (00h)							
2 - 3	(MSB)			Page Length (00h)				(LSB)

Sending this page will clear all library error log information.

10.4.4 Task History Page (33h)

The Log Select TaskHistory Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved		Page Code (33h)					
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (02h)				(LSB)
4 - 5	Reserved (00h)							

Sending this page will clear all task history information.

10.4.5 SCSI Event History Page (34h)

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved		Page Code (34h)					
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (01h)				(LSB)
4	Reserved (00h)							

Sending this page will clear all SCSI event history information.

10.4.6 DSP Event History Page (35h)

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (35h)					
1	Reserved (00h)							
2-3	(MSB)			Page Length (08h)				(LSB)
4-11	Reserved (00h)							

Sending this page will clear all DSP event history information.

10.5 LOG SENSE Command (4Dh)

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

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

PC (Page Control) equals 1 indicating those current cumulative values are to be returned. **Page Code** defines the parameter page to be returned. A value of 00h, 30h, 31h, 32h, 33h, 34h, or 35h must be used. The corresponding page as described below is returned. **Allocation Length** specifies how many bytes of data are to be returned.

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

10.5.2 Unit Statistics Page (30h)

The Log Sense Unit Statistics Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (30h)					
1	Reserved (00h)							
2 - 3	(MSB)		Page Length (52h)				(LSB)	
4 - 6	(MSB)		Library Power-On Hours				(LSB)	
7 - 9	(MSB)		Library Swap Count				(LSB)	
10 - 12	(MSB)		Library Recovery Attempts				(LSB)	
13 - 15	(MSB)		Library Recovery Errors				(LSB)	
16 - 18	(MSB)		Drive 1 Load Count				(LSB)	
19 - 21	(MSB)		Drive 2 Load Count				(LSB)	
22 - 24	(MSB)		Drive 3 Load Count				(LSB)	
25 - 27	(MSB)		Drive 4 Load Count				(LSB)	
28	OvrTmp	Rsvd (0)	Rsvd (0)	Rsvd (0)	Rsvd (0)	Rsvd (0)	Rsvd (0)	Rsvd (0)
29	Rsvd (0)		Rsvd (0)	Rsvd (0)	Drv 4 Disc	Drv 3 Disc	Drv 2 Disc	Drv 1 Disc
30	Rsvd (0)		Rsvd (0)	Rsvd (0)	Rsvd (0)	Rsvd (0)	Rsvd (0)	Rsvd (0)
31	Rsvd (0)	LastMT	MTASide	FanR	FanF	PsGood	PsVolt	
32 - 35	(MSB)		Cumulative Lift Movement Count				(LSB)	
36 - 39	(MSB)		Cumulative Picker Movement Count - Picker 1				(LSB)	
40 - 43	(MSB)		Cumulative Picker Movement Count - Picker 2				(LSB)	
44 - 47	(MSB)		Cumulative Change of Picker in Use Count				(LSB)	
48 - 51	(MSB)		Cumulative Pivot Movement Count				(LSB)	
52 - 55	(MSB)		Cumulative IO station Count				(LSB)	
56 - 59	(MSB)		Cumulative Flip Count				(LSB)	
60 - 63	(MSB)		Cumulative Lift Error Recovery Count				(LSB)	

64 – 67	(MSB) _____	Cumulative Picker Error Recovery Count	_____ (LSB)
68 – 71	(MSB) _____	Cumulative Pivot Error Recovery Count	_____ (LSB)
72 – 75	(MSB) _____	Cumulative Flip Error Recovery Count	_____ (LSB)
76		Library Power-On Minutes	
77		Library Power-On Seconds	
78 – 81		Reserved (00h)	

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

Library Swap Count equals the total number of times that a cartridge has been moved in the library.

Library Recovery Attempts equals the total number of times that the library executed an error recovery procedure(ERP).

Library Recovery Errors equals the total number of times that an ERP failed to recover library operation.

Drive 1-4 Load Count equals the number of times the corresponding drive has been loaded.

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

Drv 1-4 Disc equals 1 if the interface cable to the corresponding drive is not properly connected.

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

MTASide contains the side of the MTA currently up - 0 or 1.

FanR equals 0 if the rear fan(s) have a fault. The field is 1 otherwise.

FanF equals 0 if the front fan(s) have a fault. The field is 1 otherwise.

PsGood equals 0 if the POWER_GOOD signal from the power-supply indicates a fault. The field is 1 otherwise. The POWER_GOOD signal indicates that all voltages from the supply are above their minimum requirements.

PsVolt equals 0 if either the 24V or 12V supply is out of tolerance. The field is 1 otherwise.

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

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

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

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

The **Cumulative IO station Open Count** is incremented every time the IO station is opened.

The **Cumulative Flip Count** is incremented every time a cartridge is inverted (“flipped”).

The **Cumulative Lift Error Recovery Count** is incremented each time there is a lift ERP executed in the unit.

The **Cumulative Picker Error Recovery Count** is incremented each time there is a picker ERP executed in the unit.

The **Cumulative Pivot Error Recovery Count** is incremented each time there is a pivot ERP executed in the unit.

The **Cumulative Flip Error Recovery Count** is incremented each time there is a flip ERP executed in the unit.

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

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

See the Gx Series Library System User Guide or Service Manual for further information about these values.

10.5.3 Error Statistics Page (31h)

The Log Sense Error Statistics Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (31h)					
1	Reserved (00h)							
2-3	(MSB)		Page Length (64h)				(LSB)	
4-13	First Most Frequent Error Info							
14-23	Second Most Frequent Error Info							
24-93	:							
94-103	Tenth Most Frequent Error Info							

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

Bit Byte	7	6	5	4	3	2	1	0
0	Error Code							
1-2	(MSB)		Error Count				(LSB)	
3-6	(MSB)		Reserved (00h)				(LSB)	
7-9	(MSB)		Power-On Hours at Last Occurrence				(LSB)	

Error Code is a code for the error which occurred. The error codes are listed in section 11. Only hardware errors are recorded.

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

Power-On Hours at Last Occurrence is equal to the number of library system power-on hours when this error last occurred.

10.5.4 Error Log Page (32h)

The Log Sense Error Log Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved (0)		Page Code (32h)						
1	Reserved (00h)								
2 - 3	(MSB)				Page Length (2000h)				(LSB)
4 - 67	First Most Recent Error Info Block								
68 - 131	Second Most Recent Error Info Block								
	:								
8132-8195	128th Most Recent Error Info Block								

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

The format of each block is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0 - 1	(MSB)				Error Code				(LSB)
2	Severity								
3 - 4	(MSB)				File				(LSB)
5 - 6	(MSB)				Line Number				(LSB)
7 - 8	(MSB)				Instance Number				(LSB)
9 - 10	(MSB)				Firmware Version				(LSB)
11 - 14	(MSB)				Timestamp at First Occurrence				(LSB)
15 - 63	(MSB)				Textual Description of Error				(LSB)

Error Code is a code for the error that occurred. Only hardware errors are recorded.

10.5.5 Task 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 (5DC0h)				_____ (LSB)
4 - 24003	Event List								

Event List is a list of events from most recent to least recent within the library system.

10.5.6 SCSI Event History Page (34h)

The SCSI Event History Page is as follows:

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Reserved (0)		Page Code (34h)						
1	Reserved (00h)								
2 - 3	(MSB) _____				Page Length (4000h)				_____ (LSB)
4 - 16387	Event List								

Event List is a list of SCSI time stamped events from most recent to least recent within the library system. Please note that a data under-run may occur if the event list is not full.

10.5.7 DSP Event History Page (35h)

The DSP Event History Page is as follows:

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Reserved (0)		Page Code (35h)						
1	Reserved (00h)								
2 - 3	(MSB) _____				Page Length (9C40h)				_____ (LSB)
4 - 40003	Event List								

Event List is a list of DSP commands/status from most recent to least recent within the library system. Please note that a data under-run may occur if the event list is not full.

10.5.8 NVRAM Contents Page (36h)

The NVRAM Event History Page is as follows:

Bit	7	6	5	4	3	2	1	0	
Byte									
0	Reserved (0)		Page Code (36h)						
1	Reserved (00h)								
2 - 3	(MSB)				Page Length (4000h)				(LSB)
4 - 16387	Event List								

Event List is a list of defined NVRAM contents within the library system. Please note that a data under-run may occur if the event list is not full.

10.6 MODE SELECT (6) Command (15h)

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

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

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

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

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

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

Mode Select (6) Mode Parameter Header

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

10.6.1 Library Mode Parameters Page (20h)

The Mode Select Library Mode Parameters Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (20h)					
1	Parameter Length (08h)							
2	ReportRec	Rsvd (0)	LimitRec	ChgrEject	Rsvd (0)	WaitLoad	Rsvd (0)	Park
3	Reserved (0)			SetDr1-4 (RW)	Loaded (RW)	Drive Number (RW)		
4	Reserved (00h)							
5	Reserved (00h)							
6	SetDrOpt	Reserved (0)				DASDIrq	FVerOn Wr	WrCa Enab
7	Reserved (00h)							
8	SetType	Event History Type (bits 8 - 11)				Reserved (0)		
9	Event History Type (bits 0 - 7)							

ReportRec is set to 0 if the device is to return GOOD status for all recoverable hardware errors. The default for this bit is 0. This bit is set to 1 if the medium changer device is to return CHECK CONDITION status and set Request Sense data for all recoverable hardware errors. If this bit is set (=1) and a recoverable error occurs on a subsequent command, then the Request Sense key will be set to RECOVERED ERROR and the ASC and ASCQ fields will be set accordingly.

LimitRec equals 1 if the medium changer device is to limit the extent of the error recovery that it will perform. Setting this bit will prevent the changer from performing any transfers on a cartridge that cannot be moved to a destination element or returned to its original source element. Rather than placing the cartridge in its original storage element, it will be left in a medium transport element. The host software is then responsible for moving the cartridge from the medium transport element. Setting this bit also prevents the Rezero Unit command from unloading all drives. The default for this bit is 0.

ChgrEject equals 1 if the medium changer device is to eject a cartridge from a drive in response to a Move Medium or Exchange Medium command with the drive specified as the Source Element, or (First) Destination Element for an Exchange Medium command. If this bit is not set then the host software is responsible for ejecting the cartridge from the optical drive before the Move Medium or Exchange Medium command is issued. Setting this bit will also cause the Rezero Unit command to unload all drives before moving the changer device to its home position, unless the **LimitRec** bit is set as described above. The default for this bit is 1.

WaitLoad equals 1 if the medium changer device is to wait for a Ready response from an optical drive in response to a Move Medium or Exchange Medium command with the drive specified as the Destination Element (or Second Destination). Note that the bit is named *WaitLoad* but really is controlling whether the medium changer waits for a Ready indication from the drive instead of just a medium Loaded indication. Command completion status will not be returned to the host until the drive indicates Ready or a 90 second timeout has lapsed. If this bit is not set (=0) then the host is responsible for waiting until the cartridge is spun up and Ready. The default for this bit is 0. **NOTE:** If this bit is set(=1) and the **NoPwrCyc** bit of the Library Special Mode Parameters page is cleared (=0), then after 45 seconds of the 90 second timeout, the medium changer will cycle the drive power in an attempt to get the drive to come Ready.

Park equals 1 if the Media Transport Element is to be moved to its park position on the next Rezero Unit command issued. This is required in preparation for shipment of the system. The Park field in the Rezero Unit command can also be used for this purpose. The default for this bit is 0.

SetDr1-4 Read/write only. Not implemented

Loaded.-Read/write only. Not implemented

Drive Number Read/write only. Not implemented

SetDrOpt equals 1 if any of the drive options in byte 6 are to be changed or 0 if they are to remain unchanged.

DASDIrq equals a bit of one if all library system drives are to identify themselves as Direct-Access Storage Devices (hard drives) in response to an Inquiry command, or a bit of zero if they are to identify themselves as optical drives. Some operating systems, such as UNIX, may require that the drives identify themselves as DASD devices. The default for this bit is zero.

FVerOnWr For MO drives only. Ignored for UDO. Equals 1 if Force Verify on Write line on all library system drives is to be made active, or 0 if it is to be made inactive. Note that all drives will have to be powered off and then back up before any changes to this option take effect. This can be done by turning the library off and on again or via the Mode Select Drive Assignments Page (see Section 10.6.3). The default for this bit is 1.

WrCaEnab For MO drives only. Ignored for UDO. Equals 1 if Write Cache Enable line on all library system drives is to be made active, or 0 if it is to be made inactive. Note that all drives will have to be powered off and then back up before any changes to this option take effect. This can be done by turning the library off and on again or via the Mode Select Drive Assignments Page (see Section 10.6.3). The default for this bit is 0.

SetType equals 1 if the Event History Type is to be set or 0 if it is to remain unchanged.

Event History Type (bits 0-7, 8-11) indicates the data that is to be logged in the log sense data. The actual format of this field is as follows:

Event History Type bit	Location	Description
11	Byte 8, bit 6	Enable/Disable Task Logging
10	Byte 8, bit 5	Enable/Disable SCSI Logging
9	Byte 8, bit 4	Enable/Disable DSP Logging
Others		Reserved

10.6.2 Library Special Modes Page (21h)

The Mode Select Library Special Modes Page 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)						
3	SetOptions3	Reserved (0)						NoPwrCyc
4	SetOptions4	Reserved (0)			EnabMslot	EnabBCR	Reserved (0)	
5	SetOptions5	ScanMd	Reserved (0)					
6	SetAddr	Element Addressing Scheme						
7	SetBCType	Bar Code Type						
8-9	Reserved (00h)							

LightOff equals 1 if the medium changer device is to leave its front panel ACTIVE light off for future system heart beat activity. This is useful for element status polling. A 0 in this field reenables the ACTIVE light for system heart beat activity.

ScanMd determines the type of scan that the library does based on the TypeSel field of the Initialize Element Status command. This field is provided as a compatibility option with previous G class libraries. See the Initialize Element Status command for a table that shows the affect of the ScanMd state (0=Slow, 1=Fast). The default for this field is 0.

SetOptions3 equals 1 if any of the options in byte 3 are to be changed, or 0 if they are to remain unchanged.

NoPwrCyc equals 1 if the power to the optical drives is not to be cycled as part of a normal drive error recovery procedure. Setting this bit to 0 allows error recovery to cycle drive power. The **SetOptions3** bit must also be set for this bit to be effective. The default for this bit is 1.

SetOptions4 equals 1 if any of the options in byte 4 are to be changed, or 0 if they are to remain unchanged.

EnabMslot equals 1 if the IO station is to be enabled. The default for this bit is 1.

EnabBCR equals 1 if the bar code reader is to be enabled. The default for this bit is 1.

SetAddr equals 1 if the Element Addressing Scheme is to be changed.

Element Addressing Scheme is set according to the table in Section 6. Note that the SetAddr bit must also be set for this change to be effective.

SetBCType equals 1 if the bar code type is to be changed, or 0 if it is to remain unchanged.

Bar Code Type specifies the type of bar code labels used in the library. The default for this field is 2. *The only barcode label supported by the library is type 2 labels.*

10.6.3 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 (0Eh)							
2	Drive 1 On-Line							
3	Drive 1 SCSI ID							
4	Drive 2 On-Line							

Bit Byte	7	6	5	4	3	2	1	0
5	Drive 2 SCSI ID							
6	Drive 3 On-Line							
7	Drive 3 SCSI ID							
8	Drive 4 On-Line							
9	Drive 4 SCSI ID							
10	Reserved (00h)							
11	Reserved (00h)							
12	Reserved (00h)							
13	Reserved (00h)							
14-15	Reserved (00h)							

Drive 1-4 On-Line are the on-line designators for the drives in the library system. If set to zero, the corresponding drive will be powered off and considered off-line. If set to a non-zero value, the corresponding drive will be powered on and considered on-line. This provides a means of taking mal-functioning drives off-line and reinstating them to on-line status, if so desired. Any attempt to position to an off-line drive will be considered an error.

Drive 1-4 SCSI ID are the SCSI IDs of the optical drives in the library system. Changing these values changes the address of the drives on the SCSI bus on which they are located. The drives corresponding to the altered SCSI IDs will be automatically powered off and back up again to effect the change of address. SCSI IDs should be unique for drives on the same SCSI bus. The SCSI ID field is only used if the drive is on-line (powered on).

10.6.4 Front Panel Display Mode Page (23h)

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

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

LightOff equals 1 if the front panel ACTIVE light is to be left in the off state for system heart beat while the DispMode bit is set. This is useful for element status and key polling.

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

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

PowerOff equals 0 to mean power stays on and equals 1 to cause the library to be powered down. If this bit equals 1, the Mode Select command will terminate in a normal manner. However, library will no longer respond to further SCSI commands. Power Down is achieved within 5 seconds after termination of Mode Select command.

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

DispMode equals 1 to gain and maintain control a section of the library system front panel display or 0 to release control. DispMode will not be effective while the on-line menu is selected at the library front panel interface (see the MenuSeld bit in the Mode Sense front panel display mode page - Section 10.8.7).

Line 1-4 Display Text is the ASCII representation of text to be displayed on the corresponding line of the library system front panel display. The text by default will be centered. To have text left-justified, the user must append blank characters to the desired text. The front panel lines support 20 characters.

In addition to the ASCII characters 20h (‘ ’) through 7Dh (‘}’), the following characters are available, 80h=‘⌘’, 8Dh=‘⌘’, 81h=‘☐’, 8Ch=‘☐’, 85h=‘☐’, 7Eh=‘☐’, and 7Fh=‘☐’, and A5h=‘▪’.

10.7 MODE SELECT (10) Command (55h)

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	Reserved (0)			PF (1)	Reserved (0)			SP
2-6	Reserved (00h)							
7-8	(MSB) _____							_____ (LSB)
9	Reserved (00h)							

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

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

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

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

Mode Select (10) Mode Parameter Header

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

See the Mode Select (6) command (Section 10.6) for information about supported mode pages.

10.8 MODE SENSE (6) Command (1Ah)

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

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

DBD (Disable Block Descriptor) is ignored. Neither a value of 1 or 0 will result in a Block Descriptor being reported.

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

Page Control	Description
0	Returns current settings.
1	Returns bit-mask of changeable settings.
2	Returns default settings.
3	Returns saved settings.

Page Code defines the parameter page(s) to be returned. A value of 00h, 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, or 3Fh must be used. If a value of 0 is used, no pages are returned. If a value of 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, or 23h is used, the corresponding page as described below is returned. If a value of 3Fh is used, all supported pages are returned. The **Allocation Length** specifies how many bytes of data are to be returned.

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

Mode Sense (6) Mode Parameter Header

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

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

10.8.1 Element Address Assignment Page (1Dh)

The Mode Sense Element Address Assignment Page is as follows.

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

See the tables in Section 6 for the element addresses and counts returned in this page. It should be noted that the number of data transfer elements is the maximum number of drives the library type supports. Examine the IDValid bit or the ASC/ASCQ values in the Read Element Status data transfer element descriptors (see Section 10.14.4) to determine if specific drives are present and turned on.

10.8.2 Transport Geometry Parameters Page (1Eh)

The Mode Sense Transport Geometry Parameters Page is as follows.

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

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

10.8.3 Device Capabilities Page (1Fh)

The Mode Sense Device Capabilities Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS(0)	Rsvd (0)	Page Code (1Fh)					
1	Parameter Length (12h)							
2	Reserved (0)			StorD(1)	StorI(1)	StorS(1)	StorM(0)	
3	Reserved (00h)							
4	Reserved (0)			M → D(1)	M → I(1)	M → S(1)	M → M(0)	
5	Reserved (0)			S → D(1)	S → I(1)	S → S(1)	S → M(1)	
6	Reserved (0)			I → D(1)	I → I(0)	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(0)	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 (1 means yes in all cases and 0 means no in at least some cases).

10.8.4 Library Mode Parameters Page (20h)

The Mode Sense Library Mode Parameters Page 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	ReprtRec	Rsvd (0)	LimitRec	ChgEject	Rsvd (0)	WaitLoad	Rsvd (0)	Park
3	Library Group (0Bh)				Reserved (0)			
4	Reserved (0)				Number of Buses(1)			
5	Internal Cabinet Temperature(8 bit signed number)							
6	Reserved (0)				HRT01	DASDIrq	FVerOnWr	WrCaEnab
7	Model Identification							
8	Rsvd(0)	Event History Type (upper nibble)			NoVTag (0)	CanClose(0)	CanOpen(0)	
9	Event History Type (lower byte)							

ReportRec, LimitRec, ChgrEject, WaitLoad, Park, Number of Buses, DASDIrq, FVerOnWr, WrCaEnab, and Event History Type are as set by the Mode Select command.

Library Group equals 0Bh(decimal 11) for Gx libraries.

Internal Cabinet Temperature equals the temperature inside the library system cabinet in degrees Celsius. The temperature is expressed as an 8 bit signed byte.

HRT01 is a bit that is historically reserved to a value of 1.

Model Identification equals a unique code to indicate the model of library system. See the Inquiry command (Section 10.3) for a table of possible values.

CanOpen equals 0 indicating that the library does not support IO station opening via the Open/Close IO station command.

CanClose equals 0 indicating that the library does not support IO station closure via the Open/Close IO station command.

NoVTag equals 0 indicating that the library does support volume tags. This bit can be used to distinguish this ability of the G Series from other Plasmon libraries which do not support volume tags.

10.8.5 Library Special Modes Page (21h)

The Mode Sense Library Special Modes Page 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)						
3	Reserved (0)							NoPwrCyc
4	Reserved (0)				EnabMslot	EnabBCR	Rsvd (0)	
5	Rsvd (0)	ScanMd	Reserved (0)					
6	Rsvd (0)	Element Addressing Scheme						
7	BCRinstalled	Bar Code Type						
8-9	Reserved (00h)							

LightOff, **ScanMd**, **OpnExport**, **NoPwrCyc**, **EnabMslot**, **EnabBCR**, and **Element Addressing Scheme**, and **Bar Code Type** are as set by the Mode Select command. **BCRinstalled** indicates whether or not the Barcode Reader is installed in the library. A value of one indicates the barcode reader is installed while a value of zero indicates it is not installed. *The only barcode label supported by the library is type 2 labels.*

10.8.6 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 (0Eh)							
2	Drive 1 Type							
3	Drive 1 SCSI ID							
4	Drive 2 Type							
5	Drive 2 SCSI ID							
6	Drive 3 Type							
7	Drive 3 SCSI ID							
8	Drive 4 Type							
9	Drive 4 SCSI ID							
10	Drive 5 Type							
11	Drive 5 SCSI ID							
12	Drive 6 Type							
13	Drive 6 SCSI ID							
14 - 15	Reserved (00h)							

Drive 1-6 Type are the drive type designators for the optical drives in the library system. If a drive is offline (powered off), its drive type will be 0x00. Otherwise, an MO drive will report 0x0E, a UDO1 drive will report 0x1E, and a UDO2 drive will report 0x3C.

Drive 1-6 SCSI ID are the SCSI IDs of the optical drives in the library system. If a drive is off-line (powered off), its SCSI ID will not be used until the drive is brought back on-line (powered on).

10.8.7 Front Panel Display Mode Page (23h)

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

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

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

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

Key Pressed	Meaning
1	First (left-most) key was pressed
2	Second key was pressed
3	Third key was pressed
4	Fourth (right-most) key was pressed
5	Not Valid
6	Not Valid

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. Since the Mode Sense command only returns one key at a time, the key presses are

queued in a FIFO that is four key presses deep. Only the most recent four key presses are saved.

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

10.8.8 Mode Sense Library Four Corners Page (25h)

The Mode Sense Library Four Corners Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Rsvd (0)	Page Code (25h)					
1	Parameter Length (08h)							
2-3	(MSB)			Top Right Corner Slot				(LSB)
4-5	(MSB)			Bottom Right Corner Slot				(LSB)
6-7	(MSB)			Top Left Corner Slot				(LSB)
8-9	(MSB)			Bottom Left Corner Slot				(LSB)

This page describes the slot locations in a given library model that map to the extreme geometrical physical boundaries of the library. This information is useful when used in a host level diagnostic test to verify proper mechanical operation.

For single column models the left top and bottom fields will contain 0FFFFh to indicate they are invalid. The default settings will also be invalid since all models a different.

Note that the right or left locations are from the frame of reference of the rear of the library.

10.9 MODE SENSE (10) Command (5Ah)

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

DBD (Disable Block Descriptor) is ignored. Neither a value of 1 or 0 will result in a Block Descriptor being reported.

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

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

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

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

Mode Sense (10) Mode Parameter Header

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

Mode Data Length is the length in bytes of the remainder of the Mode Sense (10) return data. See the Mode Sense (6) command (Section 10.8) for information about supported mode pages.

10.10 MOVE MEDIUM Command (A5h)

The **Move Medium** command instructs the medium changer device to move a unit of media from a source element to a destination element.

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

Transport Element Address specifies the medium transport element. A value of 0 should normally be used. This will move the cartridge using the first medium transport element. The address of a specific medium transport element may also be used.

Source Element Address specifies the source element.

Destination Address specifies the destination element.

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

10.11 POSITION TO ELEMENT Command (2Bh)

The **Position to Element** command positions one of the two medium transport elements (MTs) 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 Byte	7	6	5	4	3	2	1	0	
0	Operation Code (2Bh)								
1	Reserved (00h)								
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 0 should normally be used. This will position the first medium transport element in front the destination element specified. The address of a specific medium transport element may also be used.

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

Invert equals 1 if the medium transport element is to be inverted (“flipped”) before it is positioned at the destination element.

10.12 PREVENT/ALLOW MEDIUM REMOVAL Command (1Eh)

The **Prevent/Allow Medium Removal** command instructs the medium changer device to either prevent or allow the removal of media (cartridges) from the library system, depending upon the value of the Prevent bit. If the Prevent bit equals 1, cartridge removal is prevented. If the Prevent bit is 0, cartridge removal is allowed.

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

Prevent equals 1 if movement of media to the IO station is prohibited or 0 If movement of media to the IO station is 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 Prevent set to 1 reissue the command with Prevent set to 0 (when applied to the same device and IO station)
2. The medium changer device receives a TARGET RESET message.
3. The medium changer device receives a hard reset or power is cycled.
4. The medium changer device completes download of new firmware or the SCSI ID of the medium changer device is changed by the Write Buffer command (see Section 10.23.2).

10.13 READ BUFFER Command (3Ch)

The **Read Buffer** command is used to read the current SCSI ID of the medium changer device, to read a good / bad status code for each drive, or to read a buffer to test the integrity of communication with the medium changer device via the SCSI bus.

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

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

Mode	Buffer ID	Function	# Of Bytes Returned
2	0	Read SCSI ID of medium changer device.	1
2	1	Read drive status code.	6
2	2	Read from echo buffer to test SCSI data transfer.	256
2	3	Read Flash CRCs	8

Buffer Offset is the beginning byte offset within the designated buffer from which data is to be returned. For buffer ID = 0 and ID = 1, the buffer offset must equal 0.

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

10.13.1 Reading the Medium Changer Device SCSI ID

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

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

Medium Changer Device SCSI ID Data

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

10.13.2 Reading the Drive Good / Bad Status Codes

To read the drive status codes, set Mode to 2, Buffer ID to 1, Buffer Offset to 0, and Allocation Length to 6. The return data consists of an array of bytes containing a status code for each drive. These values are only changed by a corresponding Write Buffer command.

The returned drive status codes data is shown below.

Drive Good / Bad Status Code Data

Bit Byte	7	6	5	4	3	2	1	0
0	Drive 1 Status							
1	Drive 2 Status							
2	Drive 3 Status							
3	Drive 4 Status							

Drive 1-4 Status is a user-defined value to indicate the good / bad status of a drive. For example, a 1 could indicate a good drive while a 2 could indicate a bad drive.

10.13.3 Reading from the Echo Buffer to Test SCSI Communication

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

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

Buffer Offset can be any value between 0 and 255.

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

The returned Echo Buffer data is shown below.

Echo Buffer Data

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

The echo buffer should first be written by the Write Buffer command (Section 10.23.4). After the buffer is read, its contents should be compared with the data originally written. 101.102.103.104 would be represented as the values 101, 102, 103, and 104.

10.13.4 Reading the Firmware Flash CRCs

To read the Flash CRCs, set Mode to 2, Buffer ID to 3, Buffer Offset to 0, and Allocation Length to 8. The returned data contains the Calculated-CRC and the Expected-CRC (stored at the end of each Flash Bank) for the two banks of firmware, as shown below.

Firmware Flash CRCs

Bit	7	6	5	4	3	2	1	0
Byte								
0	Bank0 Calculated-CRC, MSB							
1	Bank0 Calculated-CRC, LSB							
2	Bank0 Expected-CRC, MSB							
3	Bank0 Expected -CRC, LSB							
4	Bank1 Calculated-CRC, MSB							
5	Bank1 Calculated-CRC, LSB							
6	Bank1 Expected-CRC, MSB							
7	Bank1 Expected -CRC, LSB							

Note:

- For a given Bank, if the Calculated-CRC and the Expected-CRC are the same, then this Bank is deemed to contain valid firmware.
- If two Banks contain the same CRCs then they contain the same firmware.

10.14 READ ELEMENT STATUS Command (B8h)

The **Read Element Status** command requests that 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	Reserved (0)			VolTag	Element Type Code			
2-3	(MSB)			Starting Element Address				(LSB)
4-5	(MSB)			Number of Elements				(LSB)
6	Reserved (0)					CurData	Rsvd(0)	
7-9	(MSB)			Allocation Length				(LSB)
10	Reserved (00h)							
11	Rsvd (0)	BarCodes	Reserved (0)					

VolTag equals 1 if the medium changer device is to return bar code information in the form of SCSI volume tags, or 0 if bar codes are to be returned in the condensed format described in this document. Not all media changer models support bar codes.

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

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

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

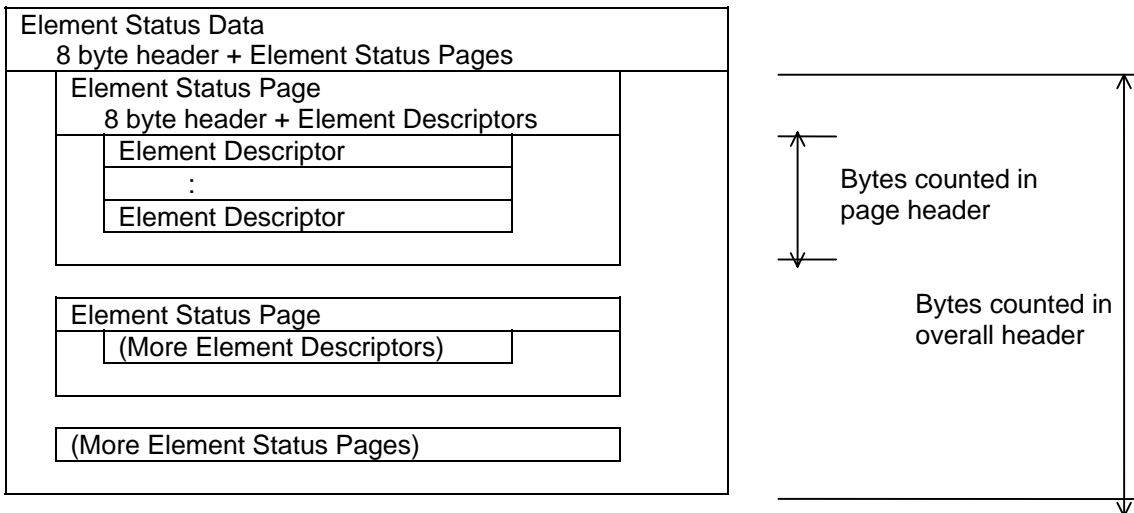
Number of Elements specifies the maximum number of element descriptor tags to be reported by the medium changer device for this command. The value specified by this field is not the range of element addresses to be considered for reporting but rather the number of elements to report.

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

Allocation Length specifies the length of the Element Status Data.

BarCodes equals 1 if the medium changer device is to return bar code information, or 0 if bar code information is not to be returned. *This field is only valid if VolTag equals 0.* If VolTag equals 1 bar code information is always returned. Not all models support bar codes.

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

PVolTag (Primary Volume Tag) equals 1 if bar code information in the form of SCSI volume tags will be returned. Bar code information may also be returned in the condensed format (see VolTag field above).

AVolTag (Alternate Volume Tag) equals 1 if bar code information in the form of SCSI volume tags will be returned and the Bar Code Type (see Section 10.6.2) is such that each side of the cartridge has a unique bar code. In this case, the Primary Volume Tag contains the bar code corresponding to the side of the media that is oriented 'up' in the slot, and the Alternate Volume Tag contains the bar code corresponding to the side of the media that is oriented 'down' in the slot. Bar code information may also be returned in the condensed format (see VolTag field above). The format of the element descriptors follows. Descriptors are returned in element address order.

10.14.1 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)							

Format 1. No bar codes requested (VolTag=0, BarCodes=0):

12 - 15	Reserved (00h)		
16	Media Type	MO = 0x00, UDO = 0x01, unknown = 0xFF	

Format 2. Bar codes requested, condensed format (VolTag=0, BarCodes=1):

12 - 15	Reserved (00h)					
16	Reserved (0)		SidIdent	SideB	BCValid	BCScand
17	Bar Code Length (z - 17)					
18 - z	Bar Code					
z + 1	Media Type	MO = 0x00, UDO = 0x01, unknown = 0xFF				

Format 3. Bar codes requested, volume tag format - one bar code per cartridge (VolTag=1, PVolTag=1, AVolTag=0):

12 - 43	Bar Code		
44 - 51	Reserved (00h)		
52	Media Type	MO = 0x00, UDO = 0x01, unknown = 0xFF	

Format 4. Bar codes requested, volume tag format - side unique bar codes (VolTag=1, PVolTag=1, AVolTag=1):

12 - 43	Primary Volume Tag Bar Code
44 - 47	Reserved (00h)
48 - 79	Alternate Volume Tag Bar Code
80 - 87	Reserved (00h)
88	Media Type MO = 0x00, UDO = 0x01, unknown = 0xFF

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

Full equals 1 if the element contains a unit of media.

Additional Sense Code (ASC) and **Additional Sense Code Qualifier** indicate detailed information related to a condition of the element. The following values are used.

ASC	ASCQ	Meaning
83h	00h	Bar code not scanned.
83h	09h	Unable to read bar code.

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

Invert equals 1 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. There tends to be some confusion at times over this fields meaning so the following description is meant to give some examples to clarify the field. The bit literally means exactly what the SCSI standard says in that it indicates whether the media has been flipped(inverted) since coming from the last "Storage Element". The last "Storage Element" is indicated by the "Source Storage Element Address" field. "Storage elements" are slots(bins) but not the picker, drive, or IO station. This field does not track the orientation of the media as it is moved around the library. One example is if media is brought from the IE to a slot. In this case the Svalid field would indicate "invalid" so the invert field is not valid. Then if this media is brought into the picker, flipped, and returned to the same slot, the invert field would indicate "inverted" and the Svalid field would indicate "valid". If this media is then moved to a different slot without a flip, the invert field would indicate "not inverted". If this media is then moved to a drive without a flip, the invert field would indicate "not inverted". If this media is then taken from the drive, flipped, and put in another slot, the invert field would indicate "inverted". If you then pick this piece of media into the picker and then put it back in the same slot without a flip, the invert field would change to "not inverted". These examples do not cover all cases but hopefully give a better idea of how this field works.

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

SideIdent equals 1 if the cartridge side for which the bar code applies has been identified (side unique bar codes), or 0 if the bar code applies to both sides of the cartridge.

SideB equals 1 if the bar code applies to cartridge side B rather than cartridge side A.

BCValid (Bar Code Valid) equals 1 if Bar Code is valid, i.e., if a valid bar code was read.

BCScand (Bar Code Scanned) equals 1 if the bar code was scanned, i.e., if an attempt was made to read it.

Bar Code Length equals the length of the following bar code. The default for this length is 20.

Bar Code contains the bar code of the cartridge if it is known. The bar code will be returned as ASCII characters followed by spaces if a valid bar code was read. Zeros will be returned if the bar code was not scanned or is not valid.

MediaType equals 0 if the media in the element is MO, 1 if the media in the element is UDO and FFh if the element is empty or the media type is unknown. Other values are reserved for future expansion. Media Type only differentiates between MO and UDO media. It **does NOT differentiate** between UDO1 and UDO2 media types. Note, in the data transfer elements, the media type indicates 0 for MO or 1 for UDO regardless of whether the element is empty or full. An MO drive will always have an element type of zero, a UDO drive will always indicate an element type of one.

10.14.2 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 - z	(See Medium Transport Element Descriptor)							

Access equals 1 if element access by the medium transport element is allowed.

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

10.14.3 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	InEnab(1)	ExEnab(1)	Access	Except	ImpExp	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 - z	(See Medium Transport Element Descriptor)							

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

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

Access equals 1 indicating access to the import/export element by the medium transport element is allowed.

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

ImpExp equals 1 if the unit of media in the import/export element was placed there by an operator, or 0 if the unit of media was placed there by the medium transport element.

Additional Sense Code (ASC) and **Additional Sense Code Qualifier** for import/export elements may contain the following values.

ASC	ASCQ	Meaning
83h	00h	Bar code not scanned.
83h	09h	Unable to read bar code.
81h	80h	Utility slot exception.

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

10.14.4 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	Rsvd (0)		IDValid	Reserved (0)				
7	SCSI Bus Address							
8	Reserved (00h)							
9	Svalid	Invert	Reserved (0)					
10 - 11	(MSB) Source Storage Element Address							(LSB)
12 - z	(See Medium Transport Element Descriptor)							

NOTE: Byte 6, bit 7 was historically NotBus for the G models but is not necessary for the Gx models. This bit is not to be re-used for any future functionality.

Access bit of 1 indicates access to the data transfer element by the medium transport element is allowed. Access may require that a SCSI Start Stop Unit command be sent to the corresponding optical drive to effect an eject.

Note: The media type is always reported as UDO (1) if the data transfer element is a UDO drive, and MO (0) if the data transfer element is a Sony MO drive.

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

ASC	ASCQ	Meaning
80h	5Dh	Drive operating in overheated state.
80h	5Eh	Drive being shut down due to overheat condition.
80h	63h	Drive operating with low module fan speed.
80h	5Fh	Drive being shut down due to low module fan speed.
83h	00h	Bar code not scanned.
83h	04h	Drive not installed or turned off (off-line).
83h	09h	Unable to read bar code.
83h	0Ah	Drive being turned off (5 sec warning).
81h	80h	Utility slot exception.

IDValid equals 1 if the SCSI Bus Address field contains valid information. This bit will be set if the drive is installed and turned on.

SCSI Bus Address is the SCSI ID of the corresponding library drive.

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

10.15 RELEASE ELEMENT Command (17h)

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

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

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

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

Refer to the Reserve Element command for more information.

10.16 REQUEST SENSE Command (03h)

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

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

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

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

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

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

The Sense Data Format is as follows.

Sense Data Format

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

Sense Key is described below.

Additional Sense Code and **Additional Sense Code Qualifier** indicate detailed information related to an error or exception condition. .

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

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

Additional Sense Bytes contain additional information about the error returned.

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

Sense Key Descriptions

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

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

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

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

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

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

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

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

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

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

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

Bit Byte	7	6	5	4	3	2	1	0
18	ChgReady	Restord	Completd	AllReturned	MT1Full	MT2Full	FailUtil	Fail Second
19	InfoValid	Reserved (0)			Reserved (0)			Rsvd (0)
20 - 21	(MSB) _____	(First) Source Element Address						(LSB) _____
22 - 23	(MSB) _____	(First) Destination Element Address						(LSB) _____
24	Info2Valid	Reserved (0)			Reserved (0)			Rsvd (0)
25 - 26	(MSB) _____	Second Source Element Address						(LSB) _____
27 - 28	(MSB) _____	Second Destination Element Address						(LSB) _____
29	Error Subcode							
30	Error Type							
31	Error Context							
32	Medium Transport Element Number							
33 - 34	(MSB) _____	Failure Element Address (Drive only)						(LSB) _____
35	Component Number							
36 - 37	Internal Error Location							
38 - 39	(MSB) _____	Put A Offset						(LSB) _____
40 - 41	(MSB) _____	Put B Offset						(LSB) _____
42 - 43	(MSB) _____	Pick A Offset						(LSB) _____
44 - 45	(MSB) _____	Pick B Offset						(LSB) _____
46	Reserved (0)							
47 - 48	(MSB) _____	Pivot Offset						(LSB) _____
49	Reserved (0)							MTA Side
50 - 51	(MSB) _____	Flip Offset						(LSB) _____
52-83	DSP Error Information							
84-127	Reserved for in-house use							

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

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

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

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

MT1Full equals 1 if the first medium transport element (address 8001) is full.

MT2Full equals 1 if the second medium transport element (address 8002) is full.

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

FailUtil equals 1 if the failure occurred on the after moving to a temporary utility location and before moving to the destination location. This is done to accommodate flipping for access to certain slots.

InfoValid equals 1 if bytes 19 to 23 contain valid information about the last cartridge movement command, or the first move of an Exchange Medium command (Source to First Destination Element).

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

(First) Source Element and **(First) Destination Element** are the addresses of Source and Destination Elements of the last cartridge 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.

Error Subcode is a code that provides additional information as to the cause of a fault.

Error Type indicates the front panel error code.

Error Context is the operation code of the SCSI command that had the error.

Medium Transport Element Number is the number of the medium transport element (0, 1, or 2) in use when the error occurred.

Failure Element Address is the address of the element that failed. Currently only failing drive elements are reported.

Component Number is unused.

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

Put A Offset and **Put B Offset** are the step counts for pickers A and B required to put a piece of media into a storage element. These values are from the last calibration that was executed.

Pick A Offset and **Pick B Offset** are the step counts for pickers A and B required to pick a piece of media into a storage element. These values are from the last calibration that was executed.

Pivot Offset is the number of steps required to pivot between columns 1 and 2 from the last calibration that was executed.

MTA Side is the MTA side (0 or 1) up when the error occurred.

Flip Offset is the number of steps required to flip the MTE from side A to side B or from side B to side A. These values are from the last calibration that was executed.

DSP Error Information is information indicating the nature of a DSP error that resulted in a check condition to the host.

10.17 REQUEST VOLUME ELEMENT ADDRESS Command (B5h)

The **Request Volume Element Address** command is used to transfer the results of a Send Volume Tag command. Multiple Request Volume Element Address commands may be used to recover the results of a single Send Volume Tag command.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (B5h)							
1	Reserved (0)			VolTag	Element Type Code			
2-3	(MSB)		Element Address				(LSB)	
4-5	(MSB)		Number of Elements				(LSB)	
6	Reserved (00h)							
7-9	(MSB)		Allocation Length				(LSB)	
10-11	Reserved (00h)							

For each Send Volume Tag command, the medium changer device will report, in element address order, multiple elements that match a volume tag template. Once information for a given element address has been reported, only higher element addresses will be reported by subsequent Request Volume Element Address commands.

VolTag equals 1 if the medium changer device is to report bar code information in the form of volume tags, or 0 if the bar code information in the form of volume tags is not to be reported.

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

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

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

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

Allocation Length specifies the length of the Element Status Data.

The structure of the **Element Status Data** returned is identical to that of the Read Element Status command. See the Read Element Status command (Section 10.14) for the format of the data returned by this command.

10.18 RESERVE ELEMENT Command (16h)

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

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

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

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

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

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

10.18.1 Reserve Element List Descriptor

The Reserve Element List Descriptor is as follows.

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

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

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

10.19 REZERO UNIT Command (01h)

The **Rezero Unit** command reinitializes the medium changer device. The command first unloads the medium transport elements. Then, depending upon the ChgrEjects and LmtErrRec bits in the Mode Select Vendor Unique Mode Parameter Page (see Section 10.6.1), cartridges in data transfer elements (optical drives) may be unloaded. If a cartridge in a data transfer element is to be unloaded, the changer first attempts to place the cartridge into the storage element where it originally came from. If the source storage

element is full, the changer will place the cartridge in the first available slot. If no slots are available for some reason, the changer will report SCSI sense code 04/80/1E which indicates "element unexpectedly full".

If the unit is parked, no SCSI motion commands may be executed until the unit is power cycled. These commands include move medium, exchange medium, position to element, initialize element status, send diagnostic, rezero, as well as mode select since it can affect motor motion.

Note: unless the LmtErrRec bit is set or the ChgrEjects bit is reset in the Mode Select Vendor Unique Mode Parameter Page, the Rezero Unit command will unload all drives.

After unloading the media transport elements and, optionally, the data transfer elements, the Rezero Unit command will reinitialize the changer based on the bits in byte 5.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (01h)							
1 - 4	Reserved (00h)							
5	RecalOffs	Park	ScanU	Reserved (0)				

RecalOffs equals 1 if all library system offsets are to be recalibrated. After this operation, the medium changer device is returned to its home position.

Park equals 1 if the media transport element is to be moved to its park position. This is required in preparation for shipment of the system.

ScanU equals 1 if the utility slots are to be scanned. Set this bit if a previous operation fails by indicating that utility slots are full.

10.20 SEND DIAGNOSTIC Command (1Dh)

The **Send Diagnostic** command instructs the medium changer device to perform a self-diagnostic test on itself.

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

PF (Page Format) is ignored.

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

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

Parameter List Length equals 0.

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

10.21 SEND VOLUME TAG Command (B6h)

The **Send Volume Tag** command transfers a template to be used to search for cartridges with specific bar codes (volume tags). Only this template matching “translate” function of the Send Volume Tag command is supported. The Request Volume Element Address command is used to transfer the results of the template matching operation.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (B6h)							
1	Reserved (0)				Element Type Code			
2 - 3	(MSB)		Element Address				(LSB)	
4	Reserved (00h)							
5	Reserved (0)				Send Action Code			
6 - 7	Reserved (00h)							
8 - 9	(MSB)		Parameter List Length				(LSB)	
10 - 11	Reserved (00h)							

Element Type Code specifies an element type for a translate action as follows.

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

Send Action Code specifies the function to be performed by the command as shown below.

Code	Function
00h or 04h	Translate - search all defined (side A and side B) bar codes of the specified element types.
01h or 05h	Translate - search only primary (side A) bar codes of the specified element types.
02h or 06h	Translate - search only alternate (side B) bar codes of the specified element types.
03h, 07h-1Fh	Reserved

The specified elements are searched for a matching volume identification template. The results are stored and are available for return in the next Request Volume Element Address command (see Section 10.17).

The parameters required for the Send Volume Tag command are as follows.

Send Volume Tag Parameters Format

Bit Byte	7	6	5	4	3	2	1	0
0 - 31	Volume Identification Template							
32 - 33	Reserved (00h)							
34 - 35	Minimum Volume Sequence Number (ignored)							
36 - 37	Reserved (00h)							
38 - 39	Maximum Volume Sequence Number (ignored)							

Volume Identification Template specifies a 32 character template to be used for matching bar codes, although only the first 20 characters are used. The template may contain bar code characters or the wildcard characters '*' and '?'. The '*' will match any string of characters and the '?' will match any single character.

Minimum/Minimum Volume Sequence Number are not used and are ignored.

10.22 TEST UNIT READY Command (00h)

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

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

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

10.23 WRITE BUFFER Command (3Bh)

The **Write Buffer** command is used to write new firmware to the library system, to change the SCSI ID of the medium changer device, to assign a good / bad status code to each drive, or to write to a buffer to test communication with the medium changer device via the SCSI bus.

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

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

Mode	Buffer ID	Function	# Of Bytes Expected
7	0	Download firmware (microcode).	258
2	0	Change SCSI ID of medium changer device.	1
2	1	Assign drive status codes.	6
2	2	Write to echo buffer to test SCSI data transfer.	256

Buffer Offset is the beginning byte offset within the designated buffer to which data is to be written. For buffer ID= 0 and ID=1, the buffer offset must be equal to 0. For buffer ID=2, if the buffer offset and parameter list length fields specify a transfer that would exceed the buffer capacity, a CHECK CONDITION return status is issued and the sense key is set to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

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

10.23.1 Downloading Firmware

To write new firmware to the library system, set Mode to 7 and Buffer ID to 0. The 'Buffer Offset' begins at 0. The 'Parameter List Length' must always be 258 since data is transferred in blocks of 256 bytes with an appended 2 byte checksum. Multiple commands are sent to complete a download. The 'Buffer Offset' for each command is incremented by 258 from the previous command. This is repeated until all the data is sent.

The Firmware Download parameter list is shown below.

Firmware Download Parameter Data

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

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

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

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

10.23.2 Changing the Medium Changer Device SCSI ID

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

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

Medium Changer Device SCSI ID Parameter Data

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

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

10.23.3 Assigning Drive Good / Bad Status Codes

To assign drive status codes, set Mode to 2, Buffer ID to 1, Buffer Offset to 0, and Parameter List Length to 12. The parameter data consists of an array of bytes containing a status code for each drive.

The drive status code parameter data is shown below.

Drive Good / Bad Status Code Parameter Data

Bit	7	6	5	4	3	2	1	0
Byte								
0	Drive 1 Status							
1	Drive 2 Status							
2	Drive 3 Status							
3	Drive 4 Status							

Drive 1-4 Status is a user-defined value to indicate the good / bad status of a drive. For example, a 1 could indicate a good drive while a 2 could indicate a bad drive.

10.23.4 Writing to the Echo Buffer to Test SCSI Communication

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

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

Buffer Offset can be any value between zero and 255.

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

The Echo Buffer parameter list is shown below.

Echo Buffer Parameter Data

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

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

11. Appendix A - Error Codes, Recovery & Subcodes

11.1 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. All values are in hex. The codes are listed in Sense Key order. See the Request Sense command, in the SCSI manual 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.

Recommendations for recovery for a given error are found in the last column when applicable. When multiple recoveries are listed follow the specified order (i.e. recovery 1 followed by recovery 14 if recovery 1 is not successful). The following section details these recovery methods. Note that the Error Type (as seen on the front panel) is also provided in the Log Sense error logs. Not all errors have host recovery procedures. It should be noted that the library system attempts extensive error recovery on its own and many cases has already done some of the suggested recovery items.

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

Sense Key	Sense Code	Qualifier	Error Type	Error Description	Host Corrective Action
00	00	00	00	No Additional Sense No sense information describing an error is relevant. A Request Sense command was sent when no error was outstanding	1
01	80	00	2E	Recovered error The previous move command encountered an event from which the medium changer recovered. This is an informational indication only issued by the medium changer when report recovery mode is set.	2
01	80	4A	23	Bar code reader reset occurred. This error code is currently not used.	na
02	04	01	01	Not Ready, in process of becoming ready The medium changer is in the process of powering up, or recovering from a SCSI reset	3

02	04	82	04	<p>Not Ready, motors are running</p> <p>The medium changer is Not Ready due to robotic motion which is most likely for power-up calibration or another host is moving media.</p>	3
02	04	83	05	<p>Not Ready, library is parked</p> <p>The medium changer is Not Ready due to a robotic park process for shipping. The library must be power cycled to clear this situation.</p>	4
02	04	84	06	<p>Not Ready, programming DSP</p> <p>This error code is currently not used.</p>	na
02	04	86	32	<p>Pickers full and unable to export</p> <p>An indication that the two MTEs have media present and media was also found in utility slot 2 when doing and Initialize Element Scan (IES) operation. This would be an extremely rare fault condition most likely caused by the accidental manual placement of media in the utility slots.</p>	5
02	04	88	3D	<p>Not ready utility slot full</p> <p>A motion operation faulted such that media was left in a utility slot or media was found in a utility slot and could not be exported to the IO station since media is present in the IO station.</p>	6
02	04	89	2F	<p>Not ready, initialization failed</p> <p>A fault occurred such that initialization was not completed successfully at power-up or after a Re-zero with re-calibration was issued.</p>	7
02	80	2C	29	<p>IO station door is open</p> <p>The IO station door indicates media inserted or possibly a hardware malfunction. This fault would be issued if a move operation involving the IO station is issued and the unit has sensor indication that there is media in or partially in the IO station.</p>	8
04	44	00	18	<p>Internal target failure</p> <p>This error indicates a system error has occurred which caused an unknown state.</p>	9
04	52	59	56	<p>Unexpected media type at pick</p> <p>Indicates that a media type was not found as expected upon a move operation.</p>	10
04	80	01	1B	<p>Flash checksum error</p> <p>This fault only occurs when attempting a software download to the unit and indicates a communication or hardware error.</p>	11

04	80	0E	1C	Flash program fail – main controller This fault only occurs when attempting a software download to the unit and indicates a communication or hardware error.	11
04	80	0F	1D	Flash program fail – DSP This fault only occurs when attempting a software download to the unit and indicates a communication or hardware error. This event may cause the library main circuit board to be come unusable.	11
04	80	1D	1F	Element unexpectedly empty An element was found to be empty of media upon attempt of a move operation.	10
04	80	1E	20	Element unexpectedly full An element was found to have media that was expected to be empty upon attempt of a move operation.	10
04	80	20	21	Pick cartridge failure A robotic operation failed to pick a piece of media and was not able to recover with the normal ERP routines.	12
04	80	21	22	Store cartridge failure A robotic operation failed to store a piece of media and was not able to recover with the normal ERP routines.	12
04	80	24	24	Drive load failure A Move Medium or Exchange command involving a drive resulted in the drive not indicating media loaded after a prescribed timeout. A not loaded condition also should indicate that the drive does not come ready.	13
04	80	25	25	Drive unload failure This error code is currently not used. An Eject failure is indicated instead.	na
04	80	26	26	Eject failure A Move Medium or Exchange command involving a drive resulted in the drive not ejecting the media.	14
04	80	29	27	SCSI termination power is low This error code is currently not used.	na
04	80	2F	2A	Pivot failure Robotic motion involving the pivot motion has faulted and was not recoverable.	16

04	80	32	2B	Lift position failure Robotic motion involving the lift motion faulted and was not recoverable.	16
04	80	35	2D	Flip failure Robotic motion involving the flip motion has faulted and was not recoverable.	16
04	80	3C	30	Swap picker failure Robotic motion involving the currently active picker has faulted and was not recoverable	16
04	80	43	33	IO station door is closed This fault would occur if the IO station is the source on a Move Medium or Exchange command and the IO station door is sensed to be closed. This by inference means that a sensor in the IO station is bad. The medium changer could still be used without IO station activity.	47
04	80	49	36	Bar code reader not installed This error code is currently not used.	na
04	80	4A	28	Bar code reader hardware failure This error indicates that a barcode reader is enabled but is not responding which indicates a hardware error.	18
04	80	4B	38	Bar code read fail This error indicates that robotic motion failed while attempting to position and read a barcode label.	16
04	80	4E	39	Drive not responding This error does not occur in functional mode. It is only reported if the library software attempts to send data/command to a drive that is not installed.	19
04	80	52	3A	Cannot load IO station This error code is currently not used.	na
04	80	54	3B	Bad drive type This error code is currently not used.	na
04	80	5D	42	Library overheat condition The library temperature sensor has reached a warning level. This may be due to environmental conditions, improper cooling or airflow by the library fans, or a library hardware problem.	20

04	80	5E	43	<p>Drive shutdown due to temperature</p> <p>All drives in the library are powered off. The library temperature sensor has reached a critical level. This is may be due to environmental conditions, improper cooling or airflow by the library fans, or a library hardware problem.</p>	21
04	80	5F	44	<p>Drive shutdown due to fan failure</p> <p>This error code is currently not used. Instead, individual fan faults are indicated.</p>	na
04	80	62	45	<p>Front fan failure</p> <p>The medium changer has sensed that one or more of the fans in the front of the unit is not working. The front fans are for cooling the main controller board and the drives.</p>	22
04	80	63	46	<p>Rear fan failure</p> <p>The medium changer has sensed that one or more of the fans in the rear of the unit is not working. The rear fans are for cooling the power supply.</p>	22
04	80	64	47	<p>Power supply voltage out of range</p> <p>This fault indicates that the 12V or 24V supply is out of voltage compliance.</p>	43
04	80	65	48	<p>Power supply failure</p> <p>This fault indicates that the PWR GOOD signal from the supply has signaled an error.</p>	43
04	80	70	51	<p>Communications timeout with DSP</p> <p>A timeout condition has occurred on the internal interface between the main CPU and the DSP.</p>	23
04	80	71	53	<p>Drive timeout error</p> <p>A drive failed to respond to a request within a certain amount of time.</p>	24
04	80	82	67	<p>Failed DSP com</p> <p>This could be a number of faults from internal DSP communication.</p>	25
04	80	83	68	<p>DSP driver command abort</p> <p>An internal DSP fault.</p>	25
04	80	90	5B	<p>Flip calibration failure</p> <p>The flip calibration portion of the robotic motion has faulted.</p>	7

04	80	91	5C	Pick calibration failure The picker calibration portion of the robotic motion has faulted.	7
04	80	92	5D	Lift calibration failure The lift calibration portion of the robotic motion has faulted.	7
04	80	93	5E	Pivot calibration failure The pivot calibration portion of the robotic motion has faulted.	7
04	80	94	50	DSP full cal error	7
04	80	96	61	IO station offset failure This error code is currently not used.	na
04	80	97	5F	Alignment calibration failure The alignment portion of the calibration process has faulted.	7
04	80	98	4E	Utility slot detected full Utility slots are for internal robotic use only. This fault indicates that while doing an Initialize Element Status command a utility slot was found to have media. This media is automatically exported to the IO station.	6
04	80	99	4D	Flash CPLD program fail This error code is currently not used.	na
04	80	9B	49	Front panel display not available The op panel is in use by the medium changer when a display request was made by the host.	45
04	80	9C	37	Vertical path block At power-up it was found that the lift is blocked. This could be the lift lock engaged, a piece of media not fully in a slot, or other mechanical issues.	44, 7
04	80	FE	58	Internal Overlapped Command Indicates a command was received and a previous command was still in the process of being executed.	38
04	80	FF	69	SYSTEM SW ERROR Always last entry for error checking and can be a number of possibilities.	9
04	88	01	64	Auto Offset Sensor Failure This fault only occurs during power-up self-test. The Auto Offset Sensor has faulted.	7, 28

04	88	02	41	Picker level error This fault only occurs during power-up self-test. It has been detected that the picker has too much tilt.	7, 28
04	88	03	3F	Flip Sensor Failure This fault only occurs during power-up self-test. It has been detected that the flip sensor has a fault.	7, 28
04	88	04	1E	Pick Flip motor stalled error This fault only occurs during power-up self-test. It has been detected that the pick/flip has stalled.	7, 28
04	88	05	40	Picker 1 or 2 Home Sensor Failure This fault only occurs during power-up self-test. It has been detected that the picker 1 or 2 home sensor has a fault.	7, 28
04	88	06	4C	Lift Encoder Error This fault only occurs during power-up self-test. It has been detected that the lift motor encoder is not working properly.	7, 28
04	88	07	63	I/O Station Home Sensor This fault only occurs during power-up self-test. It has been detected that the IO station home sensor is not in the correct state. This implies that the I/O station is not physically in the home position.	7, 28
04	88	08	34	Incorrect state for the I/O Station Door Sensor and Media Present Sensor. This fault only occurs during power-up self-test. It has been detected that the IO station home and door sensor are not in the correct states with relation to each other. Check to see if a piece of media is partially in the I/O station as this will cause this fault when powering up. If media is partially inserted then either fully insert or remove the media and cycle power on the unit.	7, 28
04	88	09	62	Lift motor type detection failure This fault only occurs during power-up self-test. Power-up self-test could not determine the type of the lift motor installed.	7, 28
04	88	0A	12	Pick Flip Motor or Encoder Failure This fault only occurs during power-up self-test. Power-up self-test has detected that the pick/flip motor has faulted.	7, 28

04	88	0B		Barcode failure during Library Verify test This error only occurs when running the Library Verify test while in Maintenance Mode. This is a hardware check error for maintenance support and should not be seen during normal operation of the unit. This error indicates that the barcode reader was not able to read the test label of the CE cartridge used during Library Verify test.	na
04	88	0C		SCSI failure during Library Verify test This error only occurs when running the Library Verify test while in Maintenance Mode. This is a hardware check error for maintenance support and should not be seen during normal operation of the unit. The error indicates that SCSI communication failed during some portion of the Library Verify test.	na
04	88	0D		Drive failed R/W test during Library Verify test This error only occurs when running the Library Verify test while in Maintenance Mode. This is a hardware check error for maintenance support and should not be seen during normal operation of the unit. The error indicates that one or more drives failed the R/W portion of the Library Verify test.	na
04	88	0E		Media is inserted into the I/O Station, but not detected by the library This error only occurs when running the Library Verify test while in Maintenance Mode. This is a hardware check error for maintenance support and should not be seen during normal operation of the unit. The error indicates that a sensor issue exists with the I/O station.	na
04	88	0F	0E	Drive is not UDO This error only occurs at initial power-up of the medium changer. The error indicates that a drive type was found to be something other than UDO in a medium changer that expects only UDO drives.	28
04	88	10	3E	Drive communication This error only occurs at initial power-up. The error indicates that an expected drive is not responding in the medium changer. The drive interface cable may be at fault or the drive may simply not be installed.	28

04	88	11		Scan Media Sensor Failure This error only occurs when running the Library Verify test while in Maintenance Mode. This is a hardware check error for maintenance support and should not be seen during normal operation of the unit. The error indicates that the scan sensor is not working properly.	na
04	88	88	16	Incorrect alignment of lift cal and pivot home sensor This fault can occur at power-up or during a rezero operation. The mechanics relating to pivot calibration are off such that the lift cal sensors breaks before the pivot home sensor. The MTE/lift mechanics need correction before operation can continue.	7, 28
05	1A	00	07	Parameter list length error This fault indicates that the medium changer detected something incorrect with the Command Block.	29
05	20	00	08	Invalid command operation code This fault indicates that the medium changer detected something incorrect with the Command Block.	29
05	21	01	09	Invalid element address This fault indicates that the medium changer detected something incorrect with the Command Block.	29
05	24	00	0A	Invalid field in CDB This fault indicates that the medium changer detected something incorrect with the Command Block.	29
05	25	00	0B	Logical Unit not supported The medium changer only supports LUN=0.	30
05	26	00	0C	Invalid field in parameter list Error indicates that an invalid value was found in the parameter list field.	31
05	3B	0D	13	Media destination element full A move or exchange has been attempted that involves a destination element that already has media.	10
05	3B	0E	14	Media source element empty A move or exchange has been attempted that involves a source element that does not contain media.	10
05	3D	00	5A	Invalid identify message Fault indicates that invalid bit settings have been found in the identify message fields.	40

05	52	5A	57	Attempt to place MO media in UDO drive A move or exchange command has been attempted that involves putting media that is typed as MO into a UDO drive.	10
05	52	60	60	Attempt to place UDO media in MO drive A move or exchange command has been attempted that involves putting media that is typed as UDO into a MO drive.	10
05	53	02	1A	Media removal prevented The element has media removal set to prevent. This must be cleared prior to removing the media.	32
05	80	4A	4A	Host specified picker for exchange but both are needed Media is in one or both of the pickers at time when an exchange is requested.	33
05	80	55	3C	Drive address conflict	34
05	80	AA	4B	Position element command RAS error A picker has been specified that precludes a particular move or exchange with a RAS element.	35
05	81	03	65	Download checksum error This error is not currently used.	na
05	86	00	66	Transport element full The MTE specified by the command has media already present.	10
06	29	00	0F	Power on, Reset, or Bus Device Reset occurred	39
06	2A	00	10	Log contents changed An indication that a log parameters have changed.	41
06	2A	01	11	Mode Parameters changed An indication that mode parameters have changed	42
06	2F	00	52	Command Aborted by another initiator Not an error, reissue command.	19
06	3F	01	17	Software has changed Not an error, reissue command.	19
06	82	80	31	Picker full at power up and exported This error code is currently not used.	na
0B	43	00	59	Message error	46
0B	45	00	2C	Library unable to reselect the host	38

0B	47	00	55	Parity error	46
0B	48	00	54	Initiator detected error	46
0B	4E	00	19	Overlapped commands	38
0B	83	00	35	Barcode scan abort - media in picker IMPORTANT: If this error is received, it does not mean that element status is in question, only that the barcode information is incorrect because barcodes cannot be read when there is media in the picker. The element empty/full and type information is correct.	33, 10

11.2 Suggested Host Application Error Recovery Actions

The following is a list of possible procedures that a host could use to recover from the SCSI errors listed in section 11.1. In some, if not most cases, no action taken by the host will cause full recovery to take place and the User's Guide or Service Manual should be consulted to determine the ultimate cause or corrective action to be taken to rectify the problem. Some situations call for operator intervention.

Procedure	Description
1	If there is no Check Condition, then no action is required; continue with the next command. If there is a Check Condition, send a SCSI Device Reset to the medium changer and retry the last command. If the error persists, log the failure and display a message to call for service.
2	Log the medium changer sense and continue with the next command.
3	Continue to send the last command until the Not Ready condition is no longer reported. If the Not Ready condition persists for more than the timeout value specified in section 8 send a SCSI Device Reset to the medium changer and retry the last command. If the Not Ready persists for an additional timeout value, log the medium changer sense data, mark the medium changer failed, and display a message to call for service.
4	Manual intervention is required. Power the medium changer off and then back on.
5	Issue commands that move any media in the MTE to storage slots. Then issue an Initialize Element Status (IES) command to update element status.
6	Log the medium changer sense. Display a message to remove any media that may be present in the IO station. Issue a Rezero Unit command with the RecalsOffs bit = 1 to cause the library to recalibrate. Then issue an Initialize Element Status (IES) command to update the element status. This IES will automatically invoke error recovery that will export any media in the utility slot to the IO station. An 04-80-98 will be the status of the IES when this occurs. A second IES should then be done which should return with good status. Display a message indicating that a piece of media has been exported to the IO station and that this volume should most likely be re-imported to the medium changer.
7	Log the medium changer sense and issue a Rezero Unit command with the RecalOffs bit = 1 to cause the library to recalibrate. If the unit faults a second time log the medium changer sense, mark the medium changer failed and display a message to call for service.
8	Log the medium changer sense. Issue a Read Element Status command and check for media present in the IO station. If no media is in the IO station then re-issue the last command. If error persists then display a message requesting the operator to check the IO station for the presence of media and remove if appropriate. If media is not present then retry the last command. If the unit continues to fault log the medium changer sense, mark the medium changer failed, and display a message to call for service.
9	Log the medium changer sense. Issue a log sense page 34h and page 35h in that order and save the data. Then retry the command. If the unit continues to fault log the medium changer sense, log sense pages 34h and 35h, mark the medium changer failed, and display a message to call for service.
10	Issue an Initialize Element Status (IES) command to update the element status. Issue Read Element Status commands to re-inventory the medium changer. Retry the last command if appropriate. If the unit continues to fault log the medium changer sense, mark the medium changer failed, and display a message to call for service.
11	These faults only occur when attempting to download a new revision of software to the library. Attempt to re-download Flash firmware to library using Write Buffer commands. If fault continues make sure that the proper download file is being used. NOTE: You may have to power cycle the medium changer first. This may require power disconnection.

Procedure	Description
12	<p>Log the medium changer sense data. Then issue Position to Element command to any storage element with the Invert bit set. This causes the transport element to be placed in the flipped position. Retry the move or exchange command. If this faults, specify a transport element address other than 0 (see note) in the move or exchange command. Use the medium transport element not active at the time that the error occurred. The medium transport element that was active is identified in the Request Sense return data. If fault reoccurs then issue a Rezero Unit command with the RecalOffs bit = 1 to cause the library to recalibrate. Retry the command.</p> <p>NOTE: Specifying a non-zero transport element address in the Exchange Medium command may allow the library to operate but at reduced performance.</p>
13	<p>Log the medium changer sense. Then attempt to reload the drive by issuing a Move Medium command with the drive as the source and destination address. If this does not work, load the drive and then use the Mode Select command, Drive Assignments Page, to first power-off the drive and then, after a few seconds, to power-on the drive again. Wait a few seconds before issuing a Test Unit Ready to the drive to check for ready status. An alternative way to power cycle the drive is to use the Mode Select WaitLoad and NoPwrCyc bits in the Library Mode and Special Mode pages to affect drive power cycling. If the operation continues to fault log the medium changer sense, mark the drive as offline, and move the media to another drive to continue processing. If the media cannot be removed from the drive then also mark the volume out of operation and fail all subsequent requests for that volume. Display a message to call for service.</p>
14	<p>Issue the Initialize Element Status and Read Element Status commands to re-inventory the drives. If the drive is truly full, issue the Mode Select command with the Drive Assignments page to cycle power to the drive and then re-inventory the drive. An alternative method to cycle power to the drive is by using the Mode Select WaitLoad and NoPwrCyc bits in the Library Mode and Special Mode pages to affect drive power cycling. If the operation continues to fault log the medium changer sense and mark the drive as offline. Also mark the volume out of operation and fail all subsequent requests for that volume. Display a message to call for service.</p>
15	<p>No recovery action can be performed. A permanent hardware failure has occurred. Log the medium changer sense data, mark the medium changer failed, and display a message to call for service.</p> <p>NOTE: The power on the medium changer should be cycled just to make sure that the event is not spurious. This requires manual intervention. If the fault persists call for service.</p>
16	<p>Log the medium changer sense. Then issue a Rezero Unit command with the RecalOffs bit = 1 to cause the medium changer to recalibrate. Retry the original command. If the unit continues to fault log the medium changer sense, mark the medium changer failed, and display a message to call for service.</p>
17	<p>Display a message to make sure media is present in the IO station if appropriate.</p>
18	<p>Log the medium changer sense and retry the command. Retry the original command. If the error is persistent then display a message indicating that a hardware failure has occurred and to call for service. If a decision can be made that barcode label information is not necessary for satisfactory operation to continue then the barcode reader can be disabled using the EnabBCR bit of the Library Special Modes page and operation continued till service is able to repair the barcode reader function.</p> <p>NOTE: The power on the medium changer should be cycled just to make sure that the event is not spurious. This requires manual intervention. If the fault persists call for service.</p>
19	<p>No recovery action is required. Log the medium changer sense and retry the command.</p>
20	<p>Log the medium changer sense data. An attempt to decrease the medium changer temperature can be made by decreasing drive read/write activity. This can be done by using the Mode Select command to power-down unused drives. The internal cabinet temperature can be read using the Mode Sense command. If temperature does not decrease then no further recovery action can be performed. Log the medium changer sense data, mark the medium changer failed, and display a message to call for service. The power to the medium changer should be turned off and disconnected.</p>

Procedure	Description
21	The library has sensed a critical temperature. Log the medium changer sense data. The internal cabinet temperature can be read using the Mode Sense command to verify the fault. Mark the medium changer failed, and display a message to call for service. The power to the medium changer should be turned off and disconnected. Alternatively the power could be left on and the cabinet temperature monitored to see if the temperature drops to an acceptable level. Then the drives could be powered back on.
22	Log the medium changer sense data and display a message to call for service. Retry the last command and continue with operation.
23	Log the medium changer sense and retry the command. If the fault repeats then issue a Rezero Unit command with the RecalOfs bit = 1 to cause the medium changer to recalibrate. Retry the original command. If the error is persistent then display a message indicating that a hardware failure has occurred and to call for service.
24	Log the medium changer sense. Use the Mode Select command, Drive Assignments Page, to first power-off the drive and then, after a few seconds, to power-on the drive again. Wait a few seconds before issuing a Test Unit Ready to the drive to check for ready status. Then retry the command. If the error is persistent then display a message indicating that a hardware failure has occurred and to call for service.
25	Issue a Bus Device Reset. This will reset the library main controller. Clear any subsequent Unit Attentions. Then retry the command. If the error is persistent then display a message indicating that a hardware failure has occurred and to call for service.
26	Log the medium changer sense. Issue an Initialize Element Status (IES) command to update the element status. Issue Read Element Status commands to re-inventory the medium changer. Display a message indicating that a piece of media has been exported to the IO station and that this volume should most likely be re-imported to the medium changer.
27	Issue Mode Sense, if desired, to obtain mode parameters changed via front panel or by another host, and then resubmit desired Mode Selection command. Retry command.
28	Power cycling the unit should be tried prior to calling service. If the error repeats then call service.
29	Examine the Command Block for errors. The Sense data identifies offending byte and field. If no error is found then retry command. If the error persists then issue a Bus Device Reset which will reset the library main controller. Clear any subsequent Unit Attentions and then retry the command. If fault persists then log the medium changer sense and display a message to call for service.
30	Examine Command Block or Identify message for a non-zero LUN value. If all is found to be correct then retry the command.
31	Examine the parameter list for errors. The Sense data identifies offending byte and field. If all is found to be correct then retry the command.
32	Issue Prevent/Allow Media Removal to allow media removal. Otherwise, wait for another host to issue Prevent/Allow Media Removal command to allow access to the element. Alternatively, issue a Bus Device Reset to the medium changer and retry the command.
33	Use the Move Media command to move any media from the media transport elements. Retry the original command specifying zero for the picker element.
34	Issue a Mode Sense command with the Drive Assignments page to determine the SCSI IDs of on-line drives. Then issue the Mode Select command with the same page to set the SCSI ID of the drive to be powered-on to a non-conflicting address (also non-conflicting with the media changer device).
35	Retry command specifying the other picker or zero for the available picker to allow positioning correctly to the RAS slot.
36	Re-download software to library using Write Buffer commands and repeat failing command. (Note that this will cause a software reboot.) When using Write Buffer commands to download software, make sure that the software packets as defined by the Buffer Offset and Transfer Length fields are contiguous. If error persists check the download software image file to make sure of type and correctness.
37	Use the Move Media command to move the cartridge out of the MTE. If error persists make sure that both pickers are empty and reissue the command specifying zero for the picker element.
38	Delay a few seconds and then retry command.
39	Determine cause of reset, reselect mode parameters not previously saved, and resubmit command. Note that all reservations and prevents in place are now terminated.
40	Log the sense data and check the identify message for correctness. Retry the command if appropriate.
41	Issue Log Sense, if desired, to obtain log parameters cleared via front panel or by another host. (The cleared log will be zero.)

Procedure	Description
42	Issue Mode Sense, if desired, to obtain mode parameters changed via front panel or by another host, and then resubmit desired Mode Selection command.
43	Log the medium changer sense data and display a message to call for service. The power to the medium changer should be turned off and disconnected.
44	Ensure that the lift lock is disengaged from the lift (manual intervention).
45	Wait a few seconds. Then retry the command. If the unit continues to fault check to ensure that the front panel is at the main screen. Then retry command.
46	Log the sense data and issue a SCSI bus device reset. Clear subsequent unit attentions. Then retry the command. If the unit continues to fault then log the medium changer sense data, mark the medium changer failed, and display a message to call for service.
47	This fault means that a sensor in the IO station is bad. The medium changer could still be used without IO station activity. Service should be called to repair the IO station sensor or sensors.

11.3 Medium Changer Device Sub-codes

The following is a list of error sub-codes that are to further define the type of error returned. These codes help to specify a particular error type. These sub-codes are part of the sense data at byte 29 and can be referenced in section 10.16.

Sub-code	Description	Action
01	Lift Stall	This error can occur when the wrong main circuit board is installed in a model.
02	Lift Timeout	<p>Check that all cartridges are in their slots correctly.</p> <p>Check that the picker moves freely up and down on the shaft.</p> <p>Check that the picker is not binding at the I/O Station, slot or drive.</p>
03	DSP communication error	An internal error for service.
07	Lift position overshoot/servoing error - Lift is having trouble servoing to position at the end of a move	<p>Check that all cartridges are in their slots correctly.</p> <p>Check that the picker moves freely up and down on the shaft.</p> <p>Check that the picker is not binding at the I/O Station, slot, or drive.</p>
09	Lift motor or encoder failure.	<p>A hardware fault needing service for one of the following possible sources:</p> <p>Lift Belt</p> <p>Lift Motor</p> <p>Lift Cable</p> <p>Lift Circuit Board</p> <p>Main Circuit Board</p>

		Lift Cable
0A	Auto Offset Sensor Failure	A hardware fault needing service for one of the following possible sources: Auto Offset Sensor Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable
0B	Picker is not straight, tilt in Picker exceeds specifications	A hardware fault needing service for one of the following possible sources: Picker Assembly (with Lift Body) Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable
0C	Lift motor encoder failure.	This error can occur when the wrong main circuit board is installed in a model. A hardware fault needing service for one of the following possible sources: Lift Belt Lift Motor Lift Cable Lift Circuit Board Main Circuit Board Lift Cable
0D	Auto Offset sensor immediate. A fault where retries could cause mechanical damage, so retries are aborted	A hardware fault needing service for one of the following possible sources: Auto Offset Sensor Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable
10	Number of counts specified for a stepper exceeds maximum limit	A hardware fault needing service for one of the following possible sources: Pick Flip Belt Pick Flip Motor Pivot Motor Lift Circuit Board Main Circuit Board Lift Cable

16	Pick Flip Encoder Error	A hardware fault needing service for one of the following possible sources: Pick Flip Belt Pick Flip Motor Lift Circuit Board Main Circuit Board Lift Cable
18	Stepper motor error	A hardware fault needing service for one of the following possible sources:
19	Stepper homing error	Pick Flip Belt Pick Flip Motor Pivot Motor Lift Circuit Board Main Circuit Board Lift Cable
1A	Stepper servoing error	A hardware fault needing service for one of the following possible sources: Pick Flip Belt Pick Flip Motor Lift Circuit Board Main Circuit Board Lift Cable
1B	Picker 1 or 2 Home Sensor failure	A hardware fault needing service for one of the following possible sources: Picker Assembly (without Lift Body) Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable
1C	Flip Sensor Failure A or B	A hardware fault needing service for one of the following possible sources: Flip Sensor A or B Lift Circuit Board Main Circuit Board Lift Cable
1D	Flip Failure	A hardware fault needing service for one of the following possible sources: Flip Motor Flip Sensor A or B Picker Assembly (without Lift Body) Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable

1E	Pivot Failure	<p>This error can occur when the wrong main circuit board is installed in a model.</p> <p>A hardware fault needing service for one of the following possible sources:</p> <p>Check sector gear teeth at top of lift shaft. Pivot Home Sensor Pivot Motor Main Circuit Board</p>
30	Auto Offset sensor failure	<p>A hardware fault needing service for one of the following possible sources:</p> <p>Auto Offset Sensor Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable</p>
31	Auto Offset sensor and/or pivot home sensor failure	<p>A hardware fault needing service for one of the following possible sources:</p> <p>Auto Offset Sensor Pivot Home Sensor Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable</p>
32	Pick calibration failure	<p>A hardware fault needing service for one of the following possible sources:</p>
33	Flip calibration failure	
35	Alignment calibration failure (picker)	<p>Pick Flip Belt Pick Flip Motor Lift Belt Lift Motor Picker Assembly (without Lift Body) Picker Interface Circuit Board. Lift Circuit Board Main Circuit Board Lift Cable</p>
3D	Auto Offset and Pivot sensors are seen in the wrong order	<p>Check sector gear teeth at top of lift shaft.</p> <p>Check that the picker moves freely up and down on the shaft.</p> <p>A hardware fault needing service for one of the following possible sources:</p> <p>Sector gear Pivot Home Sensor Picker Assembly (with Lift Body).</p>
40	I/O Station error	<p>A hardware fault needing service for one of the following possible sources:</p>

		I/O Station Main Circuit Board
42	Picker 1 and 2 Home Sensor error when attempting to retract I/O Station	Check that the I/O Station is in the correct position and not jamming the cartridge. A hardware fault needing service for one of the following possible sources: Picker Assembly (without Lift Body) Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable
43	I/O Home sensor did not change when I/O station was retracted	A hardware fault needing service for one of the following possible sources: I/O Station Home Sensor I/O Station Main Circuit Board
44	Picker 1 and 2 Home Sensor error when I/O Station is extended	Check that the I/O Station is in the correct position and not jamming the cartridge A hardware fault needing service for one of the following possible sources: Picker Assembly (without Lift Body) Picker Interface Circuit Board Lift Circuit Board Main Circuit Board Lift Cable
45	After extending the I/O Station the I/O Home sensor is not correct	A hardware fault needing service for one of the following possible sources: I/O Station Home Sensor I/O Station
46	Picker empty after picking from I/O Station	Check that the I/O Station is in the correct position and not jamming the cartridge A hardware fault needing service for one of the following possible sources: Picker Assembly (without Lift Body)

47	Picker still has media after putting to I/O Station	<p>Check that the picker moves freely up and down on the shaft.</p> <p>Check that the picker is not binding at the I/O Station, slot, or drive.</p> <p>A hardware fault needing service for one of the following possible sources:</p> <p>I/O Station Picker Assembly (without Lift Body)</p>
50	Media detected in utility slot 1	<p>Media may have been inserted into the Utility slots during manual loading. Utility slots are not available for customer media storage.</p> <p>A failure occurred during operations that use utility slots as a temporary storage element and a cartridge was left in a utility slot.</p> <p>Manually remove media from utility slots and run Scan Elements.</p>
51	Media detected in utility slot 2	
52	Media detected in both utility slots	
53	Media found in utility slot 1 has been exported to the I/O Station	Information Only
54	Media found in utility slot 2 has been exported to the I/O Station	Information Only
57	During a picker calibration, media temporarily stored in the utility slot was not retrievable	<p>Media may have been inserted into the Utility slots during manual loading. Utility slots are not available for customer media storage.</p> <p>A failure occurred during operations that use utility slots as a temporary storage element and a cartridge was left in a utility slot.</p> <p>Manually remove media from utility slots and run Scan Elements.</p>
60	During calibration the picker hung up in the I/O Station	Check that the I/O Station is in the correct position and not jamming the cartridge.
61	During calibration the I/O home sensor showed I/O Station pulled into library	Manually return I/O Station to home position.

62	During calibration an obstruction was detected in the main column	<p>Check that all cartridges are in their slots correctly.</p> <p>Check that the picker moves freely up and down on the shaft.</p> <p>Check that the picker is not binding at the I/O Station, slot, or drive and that the I/O Station is in the home position.</p> <p>A hardware fault needing service for one of the following possible sources:</p> <p>Lift Belt Lift Motor Lift Circuit Board Main Circuit Board Lift Cable.</p>
63	During calibration an obstruction was detected in the offset column	
C0	Scan Media Sensor Failure	<p>A hardware fault needing service for one of the following possible sources:</p> <p>Scan Media Sensor Picker Interface Circuit Board Lift Circuit Board Main Circuit Board</p>
C1		
C2		
C3	SCSI drive test failed, no SCSI Response	Maintenance information
C4	SCSI drive test failed, drive never becomes ready	Maintenance information
C5	Drive test failed, drive returned error code	Maintenance information
C6	Drive test failed, drive stopped communicating mid test	Maintenance information
D0	Drive eject fault after timeout (90 seconds) because host did not or could not eject media	<p>Drive host latency. Host may have failed to issue a drive eject command.</p> <p>A hardware fault needing service for one of the following possible sources:</p> <p>Drive Drive Communications Cable Drive Power Cable Main Circuit Board</p>
D1	Drive 1 failed	Indicates drive 1 failed during Library Verify

D2	Drive 2 failed	Indicates drive 2 failed during Library Verify
D3	Drive 3 failed	Indicates drive 3 failed during Library Verify
D4	Drive 4 failed	Indicates drive 4 failed during Library Verify

12. Appendix B - Host Software Aspects

12.1 Introduction

The Plasmon G-Series Gx is a family of optical disk robotic library systems capable of holding a number of disk drives and disk cartridges. The primary characteristic of the G-Series Gx family is support of UDO optical media as well as standard MO optical media. The robotic device within each library system is referred to as a medium changer device and it uses the protocols and commands for medium changer devices as defined in the American National Standards Institute SCSI Specification. The G-Series Gx library system's medium changer device and the disk drives within the library system are all accessed independently.

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

The import/export element is an externally accessible slot through which disk cartridges are added to or removed from the library system. It is also known as the IO station. The storage elements, ST1 - STn, are locations within the library system's medium store used to store cartridges.

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

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

12.2 Predecessors to the G-Series

The G-Series Gx is the fourth generation of Plasmon optical libraries. The first generation, when Plasmon IDE was known as International Data Engineering, was called the Multi series. These libraries returned an Inquiry Product Revision Level of 1.nn (actually 1nnA, where nn is the revision level and A is a space for release level firmware or a letter for beta firmware). The second generation was called the M-Series and returned an Inquiry Product Revision Level of 2.nn (2nnA). The third generation, the G-Series, returns an Inquiry Product Revision Level of 3.nn (3nnA). The Gx generation will return an Inquiry Product Revision Level of the format XYYz as detailed under the Inquiry command description. The use of the model identification field in the Inquiry data is recommended for distinguishing generations.

The Gx family includes a base model with 32 slots and a maximum of 2 drives. The next highest model adds a second column to reach 72-80 slots with 1-4 drives. A third model

will add more capacity to 174 slots and 4 drives. All models support both UDO and MO media both alone and mixed. There is only one SCSI bus internal to the library.

12.3 Identifying the Library and Model

All previous Plasmon MO libraries return the same Inquiry response, “IDE MULTI,” and so other fields must be used to differentiate the different libraries and library models. Usually, it is not necessary to know the exact library model, but rather the capacities and capabilities of that library model. For example, application code can be written in a more generic manner if information in the following Mode Sense pages is used by the application: Element Address Assignment page (1Dh), Transport Geometry Parameters page (1Eh), Device Capabilities page (1Fh), Library Mode Parameters page (20h), Library Special Modes page (21h), Drive Assignments page (22h), and the Front Panel Display Mode page (23h). Additional library information can be found in the Read Element Status data transfer element descriptors (for the SCSI IDs of the drives). For example, the number and addresses of all element types can be found in the Mode Sense Element Address Assignment page. In this page, the number of data transfer elements is equal to the number of drives installed and powered on. The Drive Assignments page must also be examined to determine which drives types are present and what their SCSI Ids are.

The following table identifies which pages are supported by the various generations of Plasmon optical libraries. A Mode Sense command with a page code of 3Fh can be used to determine which Mode Sense pages are available. An Inquiry command with a vital product data page code of 00h can be used to determine which Inquiry vital product data pages are available.

Library and Model	Mode Sense Pages Supported	Inquiry Vital Product Data Pages Supported
Multi - all	1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h	-
M-Series M20-M258	1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h	-
M-Series M500	1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, 24h	C0h
G-Series - all	1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, 24h	C0h
G-Series Gx	1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h	-

If it is necessary to know the library and model, this can be determined by examining byte 44 in the standard Inquiry return data, or by examining byte 3 bits 4 -7, and byte 7 of the Mode Sense Library Mode Parameters page(20h). This information is summarized in the following table.

Library and Model	Inquiry byte 44	Mode Sense Library Mode Parameters page Byte 3 bits 4-7, Byte 7
Multi	various unique	00h, 00h
M-Series M20	55h	0Ch, 00h
M-Series M32	55h	0Eh, 00h
M-Series M52	31h	02h, 00h
M-Series M104	32h	04h, 00h
M-Series M156	33h	06h, 00h
M-Series M258	33h	06h, 00h
M-Series M500	35h	0Eh, 00h
G-Series G64	01h	0Ah, 01h
G-Series G104	02h	0Ah, 02h
G-Series G164	03h	0Ah, 03h
G-Series G238	04h	0Ah, 04h
G-Series G438	05h	0Ah, 05h
G-Series G638	06h	0Ah, 06h
G-Series MidRange G10	6Bh	0Bh, 6Bh
G-Series MidRange G24	64h	0Bh, 64h
G-Series MidRange G32	65h	0Bh, 65h
G-Series MidRange G72	66h	0Bh, 66h
G-Series MidRange G80	67h	0Bh, 67h
G-Series MidRange G166	68h	0Bh, 68h
G-Series MidRange G174	69h	0Bh, 69h
G-Series MidRange G134	6Ah	0Bh, 6Ah

12.4 Maintaining an Inventory

The medium changer device in the library maintains an inventory of cartridges in the library in its non-volatile memory, but has no knowledge of the contents of the cartridges. For this reason, the host initiator device may wish to maintain its own inventory of library cartridges. To synchronize these two inventories, it may be necessary for the host to issue an Initialize Element Status command followed by a Read Element Status command. Once the position of cartridges are known, the host may wish to load each cartridge into a drive one side at a time, to read content information. Obviously, this is a time-consuming operation so should be done only when necessary. In libraries equipped with a bar code reader, the Read Element Status command will return bar code information, which can be used to identify specific cartridges.

12.5 Using the Library (Moving Cartridges)

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

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

12.6 Examining Errors

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

12.7 Drive Temperature and Low Fan Speed Warnings

If, during normal operation conditions, the cabinet temperature is found to be overheating or system fans have experienced a significant drop in fan speed, a drive warning Unit Attention will be generated. If the host receives this notification, it should stop reading from or writing to any cartridges in those drives and unload those cartridges. If the cabinet continues to overheat or the fan speeds drops further, a drive shutdown Unit Attention condition will be generated. After 90 seconds, the drives will automatically be powered down. At this point, the drives are disconnected from the SCSI bus and a second Unit Attention condition will be generated indicating that drives have been placed

in the power-down state. The drives will have to be powered on via the front panel if required.

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

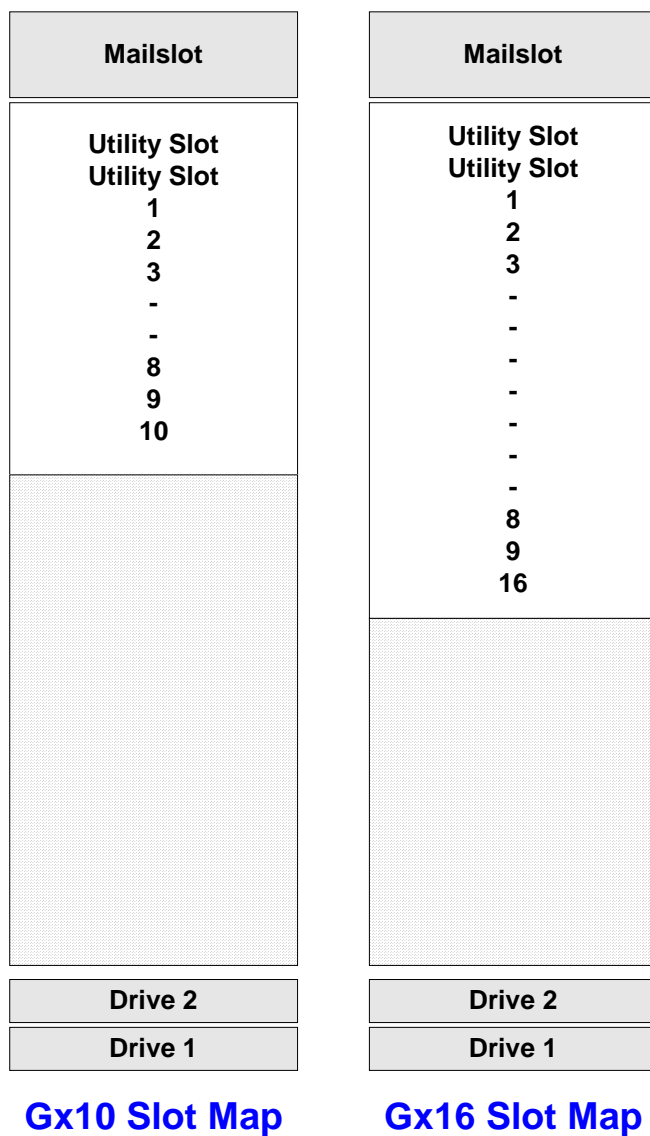
12.8 Mixed Media

The library is capable of handling mixed media of both MO and UDO. There are some aspects of this that the host needs to be aware of. Media type detection is done in the picker. This necessitates that the media be drawn into the picker for an initial identification. This is accomplished when the media is brought in via the IO station and so can be transparent for the most part to the host. Since there is not a door, and media can only enter the library via the media slot, scanning for the media type should rarely have to be performed. However, if there is a conflict detected by the library, then the library will need to be commanded to rescan all the media for type via the Initialize Element Status command. The library will always check the media type when it is drawn into the picker and will thus detect if an incompatible media is being sent to a drive. The host will be informed via SCSI of this and the media will be returned to its source. At any time, the media type is available to the host via the Read Element Status command. The location of this information can be found in the SCSI manual.

12.9 Slot Maps

The following figures depict the physical slot maps for the various library models. Note that the utility slots are for internal use only.

**Utility slots are for library operation only,
not for customer media storage.**



**Utility slots are for library operation only,
not for customer media storage.**

Mailslot
Utility Slot
Utility Slot
1
2
3
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
22
23
24
Drive 2
Drive 1

Gx24 Slot Map

Mailslot
Utility Slot
Utility Slot
1
2
3
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
30
31
32
Drive 2
Drive 1

Gx32 Slot Map

**Utility slots are for library operation only,
not for customer media storage.**

72	Mailslot
71	
70	
-	Utility Slot
-	Utility Slot
-	1
-	2
-	3
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	22
-	23
-	24
-	
-	Drive 4
-	
-	Drive 3
27	
26	Drive 2
25	Drive 1

**Gx80(4 Drive)
Slot Map**

72	Mailslot
71	
70	
-	Utility Slot
-	Utility Slot
-	1
-	2
-	3
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	22
-	23
-	24
-	
-	73
-	-
-	80
27	
26	Drive 2
25	Drive 1

**Gx80(2 Drive)
Slot Map**

**Utility slots are for library operation only,
not for customer media storage.**

158	
157	Mailslot
156	
155	Utility Slot
-	Utility Slot
-	1
-	2
-	3
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	60
-	61
-	62
-	
-	159
-	-
-	166
-	
-	Drive 4
-	
66	Drive 3
65	
64	Drive 2
63	
	Drive 1

**Gx174(4 Drive)
Slot Map**

158	
157	Mailslot
156	
155	Utility Slot
-	Utility Slot
-	1
-	2
-	3
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	60
-	61
-	62
-	
-	159
-	-
-	-
-	-
-	-
-	174
66	
65	Drive 2
64	
63	Drive 1

**Gx174(2 Drive)
Slot Map**

13. Appendix C – Gx, G Enterprise, and G SCSI Differences

Diff. = Difference area

Sect. = Standard G-series SCSI specification section number

#	Diff.	Sect	G-Series	MidRange	Notes
1.	SCSI bus	5	Supports up to 3 LVD buses	Supports only one LVD bus	SE to LVD bus segments will be used for MO drives HVD support will also be supported
2.	Element address schemes	6	Supports 1-4	Supports only 1 & 4	4 now maps to 2
3.	Element counts	6	Supports 64,104,164,238,438,638 slots; up to 11 I/E; up to 12 drives	Supports 10, 24, 32, 72, 80, 134, 166, and 174 slots; 1 I/E; up to 4 drives	
4.	Doors	NA	Two doors supported – one for service and one for media access	One door only for service	
5.	Initialize Element Status Command	10.2	As defined	The TypeSel field does not support the identical scans as the G-Ent. See the section.	The section defines the operation. There is a ScanMd bit added to the special modes page(21h) that provides for compatible function between the Gx and G. The default mode is not the same as the G-Ent.
6.	Initialize Single Element	10.3	Supported	Not Supported	Due to the relatively small number of max slots
7.	Inquiry	10.4	Standard data page Vendor ID is "IDE"	Standard data page Vendor ID is "Plasmon"	Note required spaces
8.	Inquiry	10.4	Standard data page product ID is "MULTI"	Standard data page product ID is "Midrange-G"	Note required spaces
9.	Inquiry	10.4	Standard data page product revision level is "3xy"	Standard data page product revision level is "XYZZ"	Note required spaces. "3" applies to production level only. Note new format
10.	Inquiry	10.4	Standard data page manufacturer ID is "IDEMPLS"	Standard data page manufacturer ID is "Plasmon"	Note required spaces
11.	Inquiry	10.4	Standard data page model ID is 0-6	Standard data page model ID is 0, 100-10x	All G-series types will have unique model numbers. Model numbers should be used for ID purposes as opposed to the production level
12.	Inquiry	10.4.1 10.4.3	Additional Unit Information page supported	Additional Unit Information page NOT supported	Information in this page is redundant or irrelevant

13.	Log Select Unit Statistics	10.5.1	Supports drives 1 – 12	Supports drives 1 - 6	
14.	Log Select Micro-ops	10.5.5	Supported	Not Supported	Not used outside of engineering
15.	Log Select Time Page	10.5.6	Supported	Not Supported	No hardware support
16.	Log Sense Supported Log Pages	10.6.1	Supports pages 34 and 35	Does not support pages 34 and 35	See below
17.	Log Sense Unit Statistics	10.6.2	Supports drive load counts for 1-12	Supports drive load counts for 1-6	
18.	Log Sense Unit Statistics	10.6.2	Byte 46, bit 6 - SCC cable	Byte 46, bit 6 – reserved 0	No hardware support Note byte renumbering
19.	Log Sense Unit Statistics	10.6.2	Byte 46, bit 5 –Intlck cable	Byte 28, bit 5 – reserved 0	No hardware support Note byte renumbering
20.	Log Sense Unit Statistics	10.6.2	Byte 46, bit 4 –Term power	Byte 28, bit 4 – reserved 0	No hardware support Note byte renumbering
21.	Log Sense Unit Statistics	10.6.2	Byte 46, bit 3 –Pivot cable	Byte 28, bit 3 – reserved 0	No hardware support Note byte renumbering
22.	Log Sense Unit Statistics	10.6.2	Byte 46, bit 2 –VPSE cable	Byte 28, bit 2 – reserved 0	No hardware support Note byte renumbering
23.	Log Sense Unit Statistics	10.6.2	Supports drive disconnect for 1-12	Supports drive disconnect for 1-6	
24.	Log Sense Unit Statistics	10.6.2	Byte 49, bit 3 –Alt MTA	Byte 28, bit 3 – reserved 0	No alternate MTA support
25.	Log Sense Unit Statistics	10.6.2	Byte 49, bit 2 –Power Supply 3	Byte 31, bit 2 – reserved 0	Max of 2 power supplies
26.	Log Sense Unit Statistics	10.6.2	Bytes 100-103 – magazine release count	Not supported	No magazine support
27.	Log Sense Unit Statistics	10.6.2	Bytes 104-131 – alternate MTA counts	Not supported	No alternate MTA support
28.	Log Sense Unit Statistics	10.6.2	Bytes 132-139 – pass through counts	Not supported	No pass through support
29.	Log Sense Error Log	10.6.4	See defined format	May alter page format while preserving current length	Unsupported elements such as time and pass through entries will be replaced

30.	Log Sense Event History	10.6.5	See defined format	May alter page format while preserving current length	Unsupportable elements such as time and pass through entries will be replaced
31.	Log Sense Micro-ops	10.6.6	Supports micro-ops page	Not supported	Not used
32.	Log Sense Library Time	10.6.7	Supports time page	Not supported	Not supported in hardware
33.	Mode Select Library Mode Parameter	10.7.1	Byte 3, bit 4 – Set drive 1-6	Byte 3, bit 4 – Ignored	Redundant See description
34.	Mode Select Library Mode Parameter	10.7.1	Byte 3, bit 3 – drive loaded	Byte 3, bit 3 – Ignored	Redundant See description
35.	Mode Select Library Mode Parameter	10.7.1	Byte 3, bit 2-0 – drive number	Byte 3, bit 2-0 – Ignored	Redundant See description
36.	Mode Select Library Mode Parameter	10.7.1	Byte 4, bit 7 – set number of buses	Byte 4, bit 7 – reserved 0	Single bus support only
37.	Mode Select Library Mode Parameter	10.7.1	Byte 4, bit 4 – Set drive 6-12	Byte 4, bit 4 – reserved 0	
38.	Mode Select Library Mode Parameter	10.7.1	Byte 4, bit 2-0 – number of buses	Byte 4, bit 2-0 – reserved 0	Single bus support only
39.	Front Panel LEDs	NA	Indicates SCSI or motor activity	One LED indicates online/offline and the other indicates library activity.	Physically different but similar meanings as stated.
40.	Mode Select Library Special	10.7.2	Byte 2, bit 1 – No scan ST	Byte 2, bit 1 – reserved 0	No M-series emulation

	Mode				
41.	Mode Select Library Special Mode	10.7.2	Byte 2, bit 0 – No scan DT	Byte 2, bit 0 – reserved 0	No M-series emulation
42.	Mode Select Library Special Mode	10.7.2	Byte 3, bit 5 – log info	Byte 3, bit 5 – reserved 0	No M-series emulation
43.	Mode Select Library Special Mode	10.7.2	Byte 3, bit 1 – open on export	Byte 3, bit 1 – reserved 0	No mailbox door
44.	Mode Select Library Special Mode	10.7.2	Byte 4, bit 4 – enable magazine	Byte 4, bit 4 – reserved 0	No magazine
45.	Mode Select Library Special Mode	10.7.2	Byte 4, bit 1 – enable AMS	Byte 4, bit 1 – reserved 0	No alternate MTA
46.	Mode Select Library Special Mode	10.7.2	Byte 5 – emulation enable and mode	Byte 5 – reserved 0	No emulation support
47.	Mode Select Drive Assign	10.7.3	Bytes 14-25 – drives 6-12	Bytes 14-25 – reserved 0	
48.	Mode Select Front Panel	10.7.4	Byte 2, bit 7 – Tone	Byte 2, bit 7 – reserved 0	No hardware support
49.	Mode Sense Device Capability	10.9.3	Supports I/E to I/E capability	No support	Single I/E
50.	Mode Sense Mode Parameter	10.9.4	Byte 3, bit 7-6 – library group = 5	Byte 3 bit 7-5 – library group = 11	Note increased field length
51.	Mode Sense Mode Parameter	10.9.4	Byte 4, bit 2-0 – number of buses	Byte 4, bit 2-0 – number of buses RETURNS 1	Single bus only

52.	Mode Sense Special Mode	10.9.5	Byte 2, bit 1 – No scan ST	Byte 2, bit 1 – reserved 0	No M-series emulation
53.	Mode Sense Special Mode	10.9.5	Byte 2, bit 0 – No scan DT	Byte 2, bit 0 – reserved 0	No M-series emulation
54.	Mode Sense Special Mode	10.9.5	Byte 3, bit 5 – log info	Byte 3, bit 5 – reserved 0	No M-series emulation
55.	Mode Sense Special Mode	10.9.5	Byte 4, bit 4 – enable magazine	Byte 4, bit 4 – reserved 0	No magazine
56.	Mode Sense Special Mode	10.9.5	Byte 4, bit 1 – enable AMS	Byte 4, bit 1 – reserved 0	No alternate MTA
57.	Mode Sense Special Mode	10.9.5	Byte 5 – emulation enable and mode	Byte 5 – reserved 0	No emulation support
58.	Mode Sense Drive Assign	10.9.6	Bytes 2,4,6,8,10,12	Always 0	Now 0 or 1 for MO or UDO
59.	Mode Sense Drive Assign	10.9.6	Bytes 14-25 – drives 6-12	Bytes 14-25 – reserved 0	
60.	Mode Sense Drive Layout	10.9.8	Supported	NOT supported	Not needed based on number of columns and drives supported
61.	Move Medium	10.11	Byte 11, bit 7-6 - IE Option	Byte 11, bit 7-6 - reserved 0	No door on the mail slot
62.	Open or Close IO station	10.12	Supported	NOT supported	No door on the mail slot
63.	Prevent or Allow	10.14	Byte 5, bit 7-6 – PA option	Byte 5, bit 7-6 – reserved 0	No door on the mail slot and no magazine
64.	Read Buffer	10.15.2	Bytes 6-11 – drive status 6-12	Bytes 6-11 – not supported	
65.	Read Element Status	10.16.1	Byte 2, bit 7-6 – reserved 0	Byte 2, bit 7-6 – Media type	Used to distinguish MO from UDO media
66.	Read Element Status	10.16.2	Byte 2, bit 7-6 – reserved 0	Byte 2, bit 7-6 – Media type	Used to distinguish MO from UDO media
67.	Read		Byte 2, bit 7-6 –	Byte 2, bit 7-6 – Media type	Used to distinguish MO

	Element Status	10.16.3	reserved 0		from UDO media
68.	Read Element Status	10.16.4	Byte 6, bit 7 – NotBus	Byte 6, bit 7 – reserved 0	Single bus only
69.	Read Magazine Status	10.17	Supported	Not supported	No magazine
70.	Release Magazine Status	10.19	Supported	Not supported	No magazine
71.	Request Sense	10.20	Byte 18, bit 1 – reserved 0	Byte 18, bit 1 – FailUtil	Indicates a failure associated with the utility slot
72.	Request Sense	10.20	Byte 49, bit 1 – MTA	Byte 49, bit 1 – reserved 0	No alternate MTA support
73.	Request Sense	10.20	Byte 52-53 – IO station or pass through count	Byte 52-53 – reserved 0	No hardware support
74.	Restore Drive Pair	10.23	Supported	Not supported	No hardware support
75.	Service Drive Pair	10.27	Supported	Not supported	No hardware support
76.	Swap Transport Assembly	10.28	Supported	Not supported	No hardware support
77.	Write Buffer	10.30.3	Bytes 6-11 – drive status 6-12	Bytes 6-11 – not supported	
78.	Event History Format	11	As defined	TBD - May modify format while retaining overall length	Will replace irrelevant fields such as CAN, pass through, alternate MTA
79.	Error Codes	12	As defined	Will now map all internal error codes into the ASCQ	
80.	Recovery procedure	12.2	As defined	TBD	These may change due to differences in system mechanics and electronics architecture
81.	Internal Error Codes	12.3	As defined	Replaced by ASCQ	See table in 12.1
82.	Error Context Codes	12.4	As defined	TBD	These may change due to differences in system mechanics and electronics architecture
83.					

14. Appendix D – UDO2 Integration

14.1 Introduction

The purpose of this section is to outline recommendations for implementing support for UDO2 drives and media when they become available. The Plasmon libraries support a field upgrade to UDO2 drives and media. Additionally, a mix of UDO1 and UDO2 are supported by the Plasmon Gx libraries. Plasmon software connectivity partners (i.e. ISVs) will want to give consideration to whether they will support upgraded configurations with a mix of UDO1 and UDO2 drives and media.

The following table defines the compatibility between UDO1 and UDO2 media and drives:

UDO Media and Drive Compatibility Table

Generation	<i>UDO1 Media</i>			<i>UDO2 Media</i>		
Media Type	RW	WO	CW	RW	WO	CW
UDO1 Drive	R-W	R-W	R-W-S	NS	NS	NS
UDO2 Drive	R	R	R-S	R-W	R-W	R-W-S

Legend: RW-Rewriteable WO-WriteOnce CW-Compliant WriteOnce
R-Read, W-Write, S-Shred NS-Not Supported

Customers who currently have UDO1 drives may not have filled all their UDO1 media when they upgrade to UDO2 drives. Hence, supporting a mixed drive environment where UDO1 media can be written by UDO1 drives is desirable. Once all UDO1 media is filled, a decision can be made to switch all drives to UDO2.

14.2 Suggested Implementation

When UDO2 drives are introduced, the Gx libraries will accept UDO2 drives. UDO1 and UDO2 media must be loaded into drives to detect whether it is UDO1 or UDO2 media. Once established, it is recommended that the ISV software maintain information on the drive types and media types for future use. Then, based on the above UDO Media and Drive Compatibility Table the appropriate drive can be selected to provide the appropriate functionality required for the Media generation.

The following is the recommended processes for managing a mixed UDO1 and UDO2 drive and media environment:

Establishing Drive Type (UDO1 or UDO2)

1. Detect the drive type of each drive by issuing a SCSI Mode Sense Command Drive Assignment Page (22h) to the library. The drive type field for each drive will report UDO1 or UDO2. A drive type value of 0x1E will indicate UDO1 and a drive type value of 0x3C will indicate UDO2.

Establishing Media Generation (UDO1 or UDO2)

1. All media introduced to the system with an unknown media generation should be placed in an available UDO2 drive to establish whether it is UDO1 or UDO2 media.
2. Detect the media generation by issuing a SCSI Mode Sense Command to the UDO2 drive while the media is loaded into a UDO2 drive. The Density Code, byte 0, of the Mode Sense Block Descriptor will be 0 for UDO1 media and 1 for UDO2 media.
3. If UDO2 media is loaded into a UDO1 drive, media access commands will return an error: Incompatible cartridge (0x3/0x30/0x0), The ID hole locations of the cartridge are invalid.

Process for Managing Mixed Drive and Media

The ISV software maintains the drive type in some type of tracking system (e.g. database) and establishes/verifies each time the system is restarted to insure the drive type has not changed. See “Establishing Drive Type”.

Media introduced to the library via the mailbox will have its drive generation set by initially loading it into a UDO2 drive. The media generation will be stored in a tracking system (e.g. database) for future reference when media must be accessed. See “Establishing Media Generation”.

All UDO1 media that can be written (either RW or WORM that is not filled) will be loaded into UDO1 drives to accommodate either reading or writing. Any UDO1 media which is read-only or shred-able, can be loaded into either UDO1 or UDO2 drives.

UDO2 media should only be loaded into UDO2 drives. The inadvertent insertion of UDO2 media into a UDO1 drive will illicit a drive check condition (0x03-0x30-0x00, Incompatible Cartridge (Medium Error)). The ISV application should as contingency implement a recovery process in case this event occurs.

It should also be noted that the issuance of a RES (Read Element Status) command will only return a media type as either UDO or MO, *i.e.* both UDO1 and UDO2 media are considered UDO type media.

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