

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

SCSI Software Interface Specification

November, 1996

This publication describes the SCSI software interface to Plasmon Data's *M-Series* family of Optical Disk Library Systems - automated optical disk cartridge changers. It is intended to provide interfacing information to parties wishing to develop software and/or applications programs for the *M-Series* Library Systems. This document corresponds to Product Revision Level 2.01 or later of the *M-Series* firmware.

Information in this document is subject to change without notice and does not represent a commitment on the part of Plasmon Data.

Plasmon has a material and substantial proprietary interest in the design of its controller interface and any information or software it may supply. The supply of this publication does not convey to the recipient any license under Plasmon Data's patent rights or proprietary designs.

At the time of release, the information in this publication was as accurate and current as possible. Plasmon Data assumes no responsibility for any error which may appear herein beyond that of providing corrected information when errors are brought to its attention. Further, Plasmon Data reserves the right to make changes and/or improvements in its products and their interface at any time without notice and without incurring any obligation to incorporate such changes in previously manufactured units.

Technical Support Information

For technical support, contact ...

United States

Plasmon Data, Inc.
9625 West 76th Street
Eden Prairie, MN 55344
Tel: (612) 942-2982
Fax: (612) 946-4132
BBS: (612) 946-4130
Email: support@plasmon.com

European Headquarters:

United Kingdom

Plasmon Data Limited
Whiting Way
Melbourn, Herts. SG8 6EN
Tel: +44(0)1763 262 963
Fax: +44(0)1763 264 444
BBS: +44(0)1763 264 453
Email: techsupport@plasmon.co.uk

You can also visit the Plasmon WWW site at ...

<http://www.plasmon.com>

© Plasmon Data, 1996.

All rights reserved.

Printing History

Revision	Date	Pages	Descriptions
A	12/1/95		Initial Release.
B	1/26/96	17 - 19	Added PS bit to Mode Sense pages.
		18	Changed value of StorD bit to 1 in Mode Sense Device Capabilities Page.
		18	Added OpenAcc bit to Mode Sense Vendor Unique Mode Parameters Page
		37	Added description of Event History Type and Events logged.
C	11/1/96		Updated tech support address information.
		37	Corrected definition of Terse bit.

CONTENTS

1. Introduction	1
2. Command Summary	2
3. Messages, Status Bytes, and Timeouts	3
3.1 Supported Messages.....	3
3.2 Status Bytes	4
3.3 Recommended Command Timeouts.....	4
4. SCSI Commands.....	5
4.1 EXCHANGE MEDIUM Command.....	5
4.2 INITIALIZE ELEMENT STATUS Command	5
4.3 INQUIRY Command	6
4.3.1 Supported Vital Product Data Pages Page (00h).....	7
4.3.2 Unit Serial Number Page (80h).....	7
4.4 LOG SELECT Command.....	8
4.4.1 Unit Statistics Page (30h)	8
4.4.2 Error Statistics Page (31h).....	8
4.4.3 Error Log Page (32h)	9
4.4.4 Event History Page (33h)	9
4.5 LOG SENSE Command.....	9
4.5.1 Supported Log Pages Page (00h).....	10
4.5.2 Unit Statistics Page (30h)	10
4.5.3 Error Statistics Page (31h).....	11
4.5.4 Error Log Page (32h)	11
4.5.5 Event History Page (33h)	12
4.6 MODE SELECT Command	13
4.6.1 Vendor Unique Mode Parameters Page (20h)	13
4.6.2 Vendor Unique Special Modes Page (21h).....	15
4.6.3 Front Panel Display Mode Page (23h).....	15
4.7 MODE SENSE Command	16
4.7.1 Element Address Assignment Page (1Dh)	17
4.7.2 Transport Geometry Parameters Page (1Eh).....	17
4.7.3 Device Capabilities Page (1Fh)	18
4.7.4 Vendor Unique Mode Parameters Page (20h)	18

4.7.5 Vendor Unique Special Modes Page (21h).....	18
4.7.6 Drive Assignments Page (22h).....	19
4.7.7 Front Panel Display Mode Page (23h).....	19
4.8 MOVE MEDIUM Command	20
4.9 OPEN ACCESS DOOR Command	21
4.10 POSITION TO ELEMENT Command.....	21
4.11 PREVENT ALLOW MEDIUM REMOVAL Command.....	22
4.12 READ ELEMENT STATUS Command.....	22
4.12.1 Medium Transport Element Descriptor	24
4.12.2 Storage Element Descriptor	25
4.12.3 Import / Export Element Descriptor.....	25
4.12.4 Data Transfer Element Descriptor.....	26
4.13 RELEASE Command.....	26
4.14 REQUEST SENSE Command	27
4.15 REQUEST VOLUME ELEMENT ADDRESS Command	31
4.16 RESERVE Command.....	32
4.16.1 Reserve Element List Descriptor.....	32
4.17 REZERO UNIT Command.....	33
4.18 SEND DIAGNOSTIC Command	33
4.19 SEND VOLUME TAG Command	34
4.20 TEST UNIT READY Command.....	35
5. Event History Type and Event Description.....	37
6. Error Codes	39
6.1 Medium Changer Device SCSI Sense Codes.....	39
6.2 Log Sense Error Codes	40
6.3 Log Sense Error Locations.....	41

1. Introduction

Plasmon Data Systems' *M-Series* is a family of optical disk based robotic library systems capable of holding two, four, or six optical disk drives and a number of optical disks. The robotic device within each library system is referred to as a **Medium Changer Device** and it uses the protocols and commands for Medium Changer Devices as defined in the American National Standards Institute SCSI-2 Specification. The *M-Series* Library System's Medium Changer Device is on the same SCSI bus as the Optical Disk Drives within the Library System, yet each device has a unique address on the bus and is accessed independently.

There are a number of locations or **Elements** within the Library System which are capable of holding optical disk media. These consist of the Import/Export Element, the Storage Elements, the Medium Transport Elements, and the Data Transfer Elements.

The **Import / Export Element**, or **IEE**, is the operator accessible slot through which optical disk cartridges are added to or removed from the *M-Series* System.

The **Storage Elements**, **SE1 - SE_n**, are internal locations within the *M-Series* System's Medium Store.

The **Medium Transport Elements**, **MTE1** and **MTE2**, are the optical disk transport mechanisms used to remove optical disks from or return optical disks to the Import/Export Element, the Medium Store, or the Read/Write Optical Drives.

The **Data Transfer Elements**, **DTE1 - DTE_n**, are the Read/Write Optical Drives.

The following element addresses have been assigned to the *M-Series* Library System:

Element Addresses

Element Type	<i>M52</i>	<i>M104, M156, and M258</i>
SE	1 - n	1 - n
IEE	200 (0C8h)	4001 (0FA1h)
DTE	240,241 (0F0h,0F1h)	6001-6006 (1771h-1776h)
MTE	8001,8002 (1F41h,1F42h)	8001,8002 (1F41h,1F42h)

Volume Tags have been implemented for the *M-Series* System. Both the Volume Identifier field of 32 bytes and the Volume Sequence Number of two bytes are available for identifying media within the *M-Series's* Medium Store. This information is stored in non-volatile memory.

The following SCSI-2 common commands have been implemented for the *M-Series* Medium Changer Device. The use of these commands is discussed in the following sections.

INQUIRY	MOVE MEDIUM
MODE SELECT	EXCHANGE MEDIUM
MODE SENSE	OPEN ACCESS DOOR
SEND DIAGNOSTIC	PREVENT ALLOW MEDIUM REMOVAL
REZERO UNIT	INITIALIZE ELEMENT STATUS
TEST UNIT READY	SEND VOLUME TAG
REQUEST SENSE	REQUEST VOLUME ELEMENT ADDRESS
RESERVE	READ ELEMENT STATUS
RELEASE	LOG SENSE
POSITION TO ELEMENT	LOG SELECT

2. Command Summary

The **INQUIRY** command requests Medium Changer Device parameters be sent to the initiator.

The **MODE SELECT** command provides a means of selecting Medium Changer Device parameters.

The **MODE SENSE** command provides 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** and **RELEASE** commands are used to reserve the Medium Changer Device or elements within it for multiple initiator applications. Many implementations will not require these commands.

The **POSITION TO ELEMENT** command instructs the Medium Changer Device to position one of the two Medium Transport Elements (MTE's) in front of a Data Transfer Element (Optical Disk Drive) in preparation for a disk cartridge eject from the drive. Optionally, this command can also be used to position an MTE to a particular Media Storage Element location in preparation for a **MOVE MEDIUM** or **EXCHANGE MEDIUM** command.

The **MOVE MEDIUM** command instructs the Medium Changer Device to move a unit of media from a source element to a destination element (e.g.: move a cartridge from the IEE slot to slot SE3). 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 the cartridge in the source element with the cartridge in a destination element and place that cartridge in another destination element. The Invert bit may also be specified.

The **OPEN ACCESS DOOR** command instructs the Medium Changer Device to open the *M-Series* access door thus enabling cartridge insertion or removal.

The **PREVENT ALLOW MEDIUM REMOVAL** command instructs the Medium Changer Device to either inhibit or permit opening of the *M-Series* access door for cartridge insertion or removal.

The **INITIALIZE ELEMENT STATUS** command causes the Medium Changer Device to test all elements for the presence of media.

The **SEND VOLUME TAG**, **REQUEST VOLUME ELEMENT ADDRESS**, and **READ ELEMENT STATUS** commands provide the capability of identifying media at each Medium Changer Device element address.

The **SEND VOLUME TAG** command is used to transfer new volume tag information to a element address (e.g.: the cartridge in SE1 is assigned a volume identifier of "VOLUME_12345678").

The **SEND VOLUME TAG** and **REQUEST VOLUME ELEMENT ADDRESS** commands are used together to determine where a cartridge is located (e.g.: determine where cartridge assigned "VOLUME_12345678" is located).

The **READ ELEMENT STATUS** command is used to determine status of elements and to report Volume Tags (e.g.: make a directory of cartridges in the *M-Series* 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.

3. Messages, Status Bytes, and Timeouts

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

The interface to the Library System is single-ended. Differential SCSI is not supported. Synchronous data transfer is not supported; neither is wide or fast data transfer. The Medium Changer Device will never assert the RST (Reset) line and will follow option b of section 6.1.4.2 of the ANSI X3.131-1994 SCSI-2 specification if the initiator does not respond in the reselection phase.

The Medium Changer Device will disconnect from the initiator during a SEND DIAGNOSTIC, POSITION TO ELEMENT, MOVE MEDIUM, EXCHANGE MEDIUM, OPEN ACCESS DOOR, INITIALIZE ELEMENT STATUS, or REZERO UNIT command (if disconnection is supported by the initiator) thereby freeing the SCSI bus to allow other I/O processes to occur.

3.1 Supported Messages

In the course of communication between two SCSI devices, messages are sent in the MESSAGE IN and MESSAGE OUT phases. The following messages are accepted by and sent by the Medium Changer Device. The direction field indicates the direction of message transfer. The MESSAGE REJECT message is sent for all unaccepted messages.

Message Codes

Code	Message Name	Direction
06h	ABORT	Out
0Ch	BUS DEVICE RESET	Out
00h	COMMAND COMPLETE	In
04h	DISCONNECT	In/Out
80h+	IDENTIFY	In/Out
05h	INITIATOR DETECTED ERROR	Out
09h	MESSAGE PARITY ERROR	Out
07h	MESSAGE REJECT	In/Out
08h	NO OPERATION	Out
Key: In = Target (Medium Changer Device) to Initiator, Out = Initiator to Target (Medium Changer Device)		
80h+ = Codes 80h through FFh are used for IDENTIFY messages		

3.2 Status Bytes

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

Status Byte Code

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

GOOD. The Medium Changer Device has successfully completed the command.

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

BUSY. The Medium Changer Device is busy and cannot accept a command.

RESERVATION CONFLICT. A command has been sent by an initiator to the Medium Changer Device when it is already reserved by another initiator.

3.3 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 4.6.1), the type of optical drives used, and the number of retries performed to successfully complete a command.

Suggested Timeout Values

SCSI Command	Timeout
INQUIRY, MODE SELECT, MODE SENSE, RECEIVE DIAGNOSTIC RESULTS, REQUEST SENSE, RESERVE, RELEASE, SEND VOLUME TAG, REQUEST VOLUME ELEMENT ADDRESS, READ ELEMENT STATUS, LOG SELECT, OPEN ACCESS DOOR, PREVENT ALLOW MEDIUM REMOVAL	10 sec
TEST UNIT READY, LOG SENSE	20 sec
SEND DIAGNOSTIC	90 sec
MOVE MEDIUM, EXCHANGE MEDIUM, REZERO UNIT, INITIALIZE ELEMENT STATUS	5 min

4. SCSI Commands

4.1 EXCHANGE MEDIUM Command

The EXCHANGE MEDIUM command instructs the Medium Changer Device to exchange the cartridge in the source element with the cartridge in a destination element and place that cartridge in another destination element.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A6h)							
1	Logical Unit Number			Reserved				
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					Inv2		Inv1
11	Control Byte							

The medium in the source element is moved to the first destination element and the medium which previously occupied the first destination element is moved to the second destination element. The second destination element may not be the same as the source 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.

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.

4.2 INITIALIZE ELEMENT STATUS Command

The INITIALIZE ELEMENT STATUS command is used to cause the Medium Changer Device to test all elements for the presence of media. The status of each element can then be read using the READ ELEMENT STATUS command. The method by which the Storage Elements are checked is dependent upon the SlowScan bit in the MODE SELECT command (see Section 4.6.1). Note: if the SlowScan bit is set and both Medium Transport Elements are full, no statuses will be checked and the command will return an error. Otherwise, the command will proceed as normal but the empty/full status of the Optical Drives will not be checked if both Medium Transport Elements are full, the ChgrEject bit in the MODE SELECT command is not set, or if disconnects are not supported by the host. The NoScanSE and NoScanDTE bits in the MODE SELECT command also affect which elements are checked (see Section 4.6.2).

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (07h)							
1	Logical Unit Number			Reserved				
2 - 4	Reserved							
5	Control Byte							

4.3 INQUIRY Command

The **INQUIRY** Command is issued by the initiator to request Medium Changer Device information.

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

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

Page Code defines the parameter page for vital product to be returned. A value of zero or 80h must be used. These pages are described following the Standard INQUIRY Data Format.

The **Logical Unit Number**, **Control Byte** and all **Reserved** fields must also be zero.

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

The following page details the standard INQUIRY Data Format for an Allocation Length of 45.

Standard INQUIRY Data Format

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB	Device-Type Qualifier						
2	ISO Version		ECMA Version			ANSI-Approved Version		
3	AENC	TrmIOP	Reserved		Response Data Format			
4	Additional Length							
5	Reserved							
6	Reserved							
7	RelAdr	Wbus32	Wbus16	Sync	Linked	Reserved	CmdQue	SftRe
8 - 15	(MSB)			Vendor Identification				(LSB)
16 - 31	(MSB)			Product Identification				(LSB)
32 - 35	(MSB)			Product Revision Level				(LSB)
36 - 43	(MSB)			Manufacturer Id ('IDEMPLS.')				(LSB)
44	Model Identification							

Peripheral Qualifier equals zero indicating connection.

Peripheral Device Type equals 08h indicating a Changer device.

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

ISO Version equals zero.

ECMA Version equals zero.

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

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

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

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

Additional Length equals 51.

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

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

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

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

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

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

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

Vendor Identification is IDE.

Product Identification is MULTI.

Product Revision Level starts with 200 (2.00).

Model Identification is '1' for the *M52*, '2' for the *M104*, or '3' for the *M156* or *M258*.

4.3.1 Supported Vital Product Data Pages Page (00h)

The Supported Vital Product Data Pages Page is as follows.

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

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

4.3.2 Unit Serial Number Page (80h)

The Unit Serial Number Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (80h)							
2	Reserved							
3	Page Length (6)							
4 - 9	Product Serial Number							

Product Serial Number is a six character ASCII representation of the Library System's Factory Serial Number. 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.

4.4 LOG SELECT Command

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

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

PCR (Parameter Code Reset) equals a bit of zero indicating that not all log parameters are to be reset. Certain parameters, such as the total power-on hours and drive load counts, cannot be reset.

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

PC (Page Control) equals a bit of one 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.

4.4.1 Unit Statistics Page (30h)

The Unit Statistics Page for the Log Select command is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved		Page Code (30h)						
1	Reserved								
2 - 3	(MSB)			Page Length (16 for <i>M52</i> or 28 for <i>M104, M156, M258</i>)				(LSB)	
4 - 19 or 31	Reserved								

4.4.2 Error Statistics Page (31h)

The Error Statistics Page for the Log Select command is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved		Page Code (31h)						
1	Reserved								
2 - 3	(MSB)			Page Length (100)				(LSB)	
4 - 103	Most Frequent Error Parameters								

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

4.4.3 Error Log Page (32h)

The Error Log Page for the Log Select command is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved		Page Code (32h)						
1	Reserved								
2 - 3	(MSB)			Page Length (160)				(LSB)	
4 - 163	Most Recent Error Parameters								

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

4.4.4 Event History Page (33h)

The Event History Page for the Log Sense command is as follows.

Bit Byte	7	6	5	4	3	2	1	0	
0	Reserved		Page Code (33h)						
1	Reserved								
2 - 3	(MSB)			Page Length (2050)				(LSB)	
4 - 5	(MSB)			Number of Events Recorded				(LSB)	
6 - 2053	Event List								

Number of Events Recorded and Event List must equal zero and a block of all zeros, respectively, clearing all event history information.

4.5 LOG SENSE Command

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	Logical Unit Number			Reserved			PPC	SP	
2	PC		Page Code						
3 - 4	Reserved								
5 - 6	(MSB)			Parameter Pointer				(LSB)	
7 - 8	(MSB)			Allocation Length				(LSB)	
9	Control Byte								

PPC (Parameter Pointer Control) equals a bit of zero indicating that the target shall return all parameter values for the specified code page.

SP (Save Parameters) equals a bit of zero indicating that the target shall not save any pages.

PC (Page Control) is not used and must be zero.

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

Parameter Pointer equals zero indicating that all parameter values in the specified code page will be returned.

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

4.5.1 Supported Log Pages Page (00h)

The 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 (0)							
2 - 3	(MSB)		Page Length (5)				(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)							

4.5.2 Unit Statistics Page (30h)

The Unit Statistics Page for the Log Sense command is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (30h)					
1	Reserved (0)							
2 - 3	(MSB)		Page Length (16 for <i>M52</i> or 28 for <i>M104,M156,M258</i>)				(LSB)	
4 - 6	(MSB)		Total Power-On Hours				(LSB)	
7 - 9	Reserved							
10 - 12	(MSB)		Drive 1 Load Count				(LSB)	
13 - 15	(MSB)		Drive 2 Load Count				(LSB)	
16 - 18	(MSB)		Drive 3 Load Count (Omit if Page Length = 16)				(LSB)	
19 - 21	(MSB)		Drive 4 Load Count (Omit if Page Length = 16)				(LSB)	
22 - 24	(MSB)		Drive 5 Load Count (Omit if Page Length = 16)				(LSB)	
25 - 27	(MSB)		Drive 6 Load Count (Omit if Page Length = 16)				(LSB)	
16 or 28	Reserved	AuxDrCable	Reserved	TermPwr	PivotCable	SensorCable	LiftCable	Reserved
17-19/29-31	Reserved (0)							

LiftCable equals a bit of one if the cable to the lift is faulty or not connected.

SensorCable equals a bit of one if the cable to the discrete sensors is faulty or not connected.

PivotCable equals a bit of one if the cable to the pivot is faulty or not connected.

AuxDrCable equals a bit of one if the auxiliary drive power interface cable is not connected.

TermPwr equals a bit of one if SCSI bus terminator power is low.

See the M-Series *M52*, *M104*, *M156*, and *M258* Technical Reference Manual for further information.

4.5.3 Error Statistics Page (31h)

The Error Statistics Page for the Log Sense command is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (31h)					
1	Reserved (0)							
2 - 3	(MSB)		Page Length (100)				(LSB)	
4 - 13	First Most Frequent Error Parameters							
14 - 23	Second Most Frequent Error Parameters							
	:							
94 - 103	Tenth Most Frequent Error Parameters							

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

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

The error codes are listed in Section 6.2. Only hardware errors are recorded. The timestamp is the number of power-on hours at occurrence.

4.5.4 Error Log Page (32h)

The Error Log Page for the Log Sense command is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (32h)					
1	Reserved (0)							
2 - 3	(MSB)		Page Length (160)				(LSB)	
4 - 19	First Most Recent Error Parameters							
20 - 35	Second Most Recent Error Parameters							
	:							
148-163	Tenth Most Recent Error Parameters							

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

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

The error codes are listed in Section 6.2. Only hardware errors are recorded. If the same error occurs a number of times in sequence, only information for the most recent error is listed.

Initiating Command is the operation code of the SCSI command which initiated the operation or FFh if the error occurred while in Maintenance Mode or FEh if the error occurred in Setup.

Source Element Address and **Destination Element Address** are the source and destination addresses for the POSITION TO ELEMENT, MOVE MEDIUM and EXCHANGE MEDIUM commands. For the EXCHANGE MEDIUM command, these represent either the Source and First Destination Addresses, the First and Second Destination Address or some other intermediate addresses.

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

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

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

Additional Information contains such information as the value of ASC and ASCQ received from the drive in the event of an eject failure when the ChgrEject mode of operation is enabled or the drive not becoming ready when the WaitLoad mode of operation is enabled (see the Mode Select command). For low-level SCSI errors (error codes F0h and greater) the first byte contains the error number and the second byte contains the error location. The error codes are listed in Section 6.2 and the error locations are listed in Section 6.3.

4.5.5 Event History Page (33h)

The Event History Page for the Log Sense command is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved (0)		Page Code (33h)					
1	Reserved (0)							
2 - 3	(MSB)	Page Length (2050)						(LSB)
4 - 5	(MSB)	Number of Events Recorded						(LSB)
6 - 2053	Event List							

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

Event List is a list of events from most recent to least recent within the Library System. The contents of this list is determined by the Event History Type field of the Vendor Unique Modes Parameters Page of the MODE SELECT command (see Section 4.6.1). For a description of possible events within this list see

Section 5. This list may be helpful to Technical Support personnel in diagnosing problems with the Library System.

4.6 MODE SELECT Command

The **MODE SELECT** command provides a means for the initiator to select Medium Changer Device parameters.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	Logical Unit Number			PF	Reserved			SP
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Control Byte							

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

SP (Save Pages) equals a bit of one if the target is to save changeable parameters in pages.

Parameter List Length specifies the length in bytes of the **MODE SELECT** parameter list.

The **MODE SELECT** 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 Parameter Header

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

The **Mode Data Length**, **Media Type**, **Device-Specific Parameter** and **Block Descriptor Length** fields must all be zero.

4.6.1 Vendor Unique Mode Parameters Page (20h)

The **Vendor Unique Mode Parameters Page** is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved			Page Code (20h)				
1	Parameter Length (8)							
2	ReportRec	SlowScans	LimitRec	ChgrEject	Reserved	WaitLoad	IgnParity	Park
3	Reserved			SetDrive	Loaded	Drive Number		
4 - 7	Reserved							
8	SetType	Reserved						
9	Event History Type							

ReportRec equals a bit of one if the Medium Changer Device is to return CHECK CONDITION status and set REQUEST SENSE data for all recoverable hardware errors, or zero if the device is to return GOOD status for all recoverable hardware errors. If this bit is set and a recoverable error occurs on a subsequent command, then the REQUEST SENSE sense key will be set to RECOVERED ERROR and the ASC and ASCQ fields will be set accordingly. The default for this bit is zero.

LimitRec equals a bit of one 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, the Import/Export Element, or in a drive, it will be left in the a Medium Transport Element. The host software is then responsible for moving the cartridge from this element. Setting this bit also prevents the REZERO UNIT command from unloading all drives. The default for this bit is zero.

SlowScans equals a bit of one if the Medium Changer Device is to use tactile feedback rather than retro-reflective sensors to sense the empty/full status of Storage Elements for the INITIALIZE ELEMENT STATUS command. Setting this bit may be necessary depending upon the type of media used. As an example, some cartridge shells may be difficult to detect with sensors due to variations in color and reflectivity. Setting this bit slows down the element scan appreciably. The default for this bit is zero.

ChgrEject equals a bit of one if the Medium Changer Device is to eject a cartridge from an optical drive in response to a MOVE MEDIUM or EXCHANGE MEDIUM command with the drive specified as the Source Element (or First Destination). 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 LmtErrRec bit is set as described above. To eject a cartridge the Medium Changer will use a hardware Eject signal if the drive is so connected, or it will act as a SCSI Initiator and issue a START STOP UNIT command to the drive if no separate connector cable is installed. For the Changer to issue a START STOP UNIT command the SCSI host adapter used on the host computer must be capable of disconnecting from the SCSI bus. In this case, a command will be sent to spin down the drive before the MTE is positioned to it thus improving overall cartridge exchange performance. The default for this bit is one.

WaitLoad equals a bit of one 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). Command completion status is not returned to the host until the host is ready, or 35 seconds have elapsed. After 35 seconds, drive power is cycled in an attempt to reseal the cartridge. If this bit is not set then the host is responsible for waiting until the cartridge is spun up and ready. To sense ready status the Medium Changer will use a hardware Ready signal if the drive is so connected, or will act as a SCSI Initiator and repeatedly issue TEST UNIT READY commands to the drive if no separate connector cable is installed. For the Changer to issue TEST UNIT READY commands the SCSI host adapter used on the host computer must be capable of disconnecting from the SCSI bus. The default for this bit is zero.

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

Park equals a bit of one 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 default for this bit is zero.

SetDrive equals a bit of one if an optical drive is to be set to the loaded or unloaded state in the Medium Changer Device's NOVRAM. This is generally unnecessary as NOVRAM is updated automatically whenever a drive is loaded or unloaded. The INITIALIZE ELEMENT STATUS command can also be used to update the empty/full status of the optical drives.

Loaded equals a bit of one if the corresponding optical drives are to be set to the loaded state or zero if they are to be set to the unloaded state. The SetDrive bit must also be set.

Drive Number is the number of the drive to be set to the loaded or unloaded state (starting with drive number one).

SetType equals a bit of one if the Event History Type is to be set or a bit of zero if it is to remain unchanged.

Event History Type specifies the type of event history to collect for diagnostic purposes (see Section 4.5.5). No history information will be collected for a value of zero. For a further description of this byte see Section 5. The default for this byte is 3Bh (59).

4.6.2 Vendor Unique Special Modes Page (21h)

The Vendor Unique Special Modes Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (21h)					
1	Parameter Length (8)							
2	LightOff	Reserved			NoScanSE		NoScanDTE	
3	SetOptions	Reserved			NoPwrCyc			
4 - 9	Reserved							

LightOff equals a bit of one if the Medium Changer Device is to leave its front panel ACTIVE light off for future SCSI bus activity. This is useful for element status polling. The ACTIVE light will remain enabled for any motor activity regardless of the setting of this bit. A bit of zero reenables the ACTIVE light for SCSI bus activity.

NoScanSE equals a bit of one if the Storage Elements are not to be scanned for subsequent INITIALIZE ELEMENT STATUS commands.

NoScanDTE equals a bit of one if the Data Transfer Elements (the drives) are not to be scanned for subsequent INITIALIZE ELEMENT STATUS commands.

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

NoPwrCyc equals a bit of one if the AC power to the optical drives is not to be cycled as part of the normal error recovery procedure or a bit of zero if the AC power is to be cycled in an attempt to reseal a badly seated cartridge. The SetOptions bit must also be set for this bit to be effective. Setting this bit reduces the ability of the Library System to recover from drive load failures.

4.6.3 Front Panel Display Mode Page (23h)

The Front Panel Display Mode Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (23h)					
1	Parameter Length (41)							
2	Tone	LightOff	Reserved			ClrKeys		DispMode
3 - 22	Line 1 Display Text							
23 - 42	Line 2 Display Text							

DispMode equals a bit of one to gain and maintain control of the Library System front panel display or a bit of zero to release control.

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

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

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

Line 1 Display Text is the ASCII representation of text to be displayed on the first line of the Library System front panel display.

Line 2 Display Text is the ASCII representation of text to be displayed on the second line of the Library System front panel display.

4.7 MODE SENSE Command

The **MODE SENSE** command provides a means for reporting Medium Changer Device to an initiator.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (1Ah)							
1	Logical Unit Number			Reserved	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Allocation Length							
5	Control Byte							

DBD (Disable Block Descriptor) is ignored. Regardless of the setting of this bit, the Medium Changer Device will not return any block descriptors.

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

Page Code defines the parameter page(s) to be returned. A value of zero, 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, or 3Fh must be used. If a value of zero 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** 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 Parameter Header

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

The returned values are indicated.

4.7.1 Element Address Assignment Page (1Dh)

The Element Address Assignment Page is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0	PS (0)	Reserved	Page Code (1Dh)					
1	Parameter Length (18)							
2 - 3	(MSB)	First Medium Transport Element Address (8001)						(LSB)
4 - 5	(MSB)	Number of Medium Transport Elements (2)						(LSB)
6 - 7	(MSB)	First Storage Element Address (1)						(LSB)
8 - 9	(MSB)	Number of Storage Elements (see table on page 1)						(LSB)
10 - 11	(MSB)	First Import/Export Element Address (see table on page 1)						(LSB)
12 - 13	(MSB)	Number of Import/Export Elements (1)						(LSB)
14 - 15	(MSB)	First Data Transfer Address (see table on page 1)						(LSB)
16 - 17	(MSB)	Number of Data Transfer Elements (see table on page 1)						(LSB)
18	Reserved (0)							
19	Reserved (0)							

The returned values are indicated.

4.7.2 Transport Geometry Parameters Page (1Eh)

The Transport Geometry Parameters Page is as follows.

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

Where **Rotate** equals a bit of one indicating that the Medium Transport Element supports media rotation for handling double-sided media.

4.7.3 Device Capabilities Page (1Fh)

The Device Capabilities Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS(0)	Reserved	Page Code (1Fh)					
1	Parameter Length (18)							
2	Reserved			StorD(1)	StorI(1)	StorS(1)	StorM(0)	
3	Reserved							
4	Reserved			M → D(1)	M → I(0)	M → S(1)	M → M(0)	
5	Reserved			S → D(1)	S → I(1)	S → S(1)	S → M(1)	
6	Reserved			I → D(1)	I → I(0)	I → S(1)	I → M(0)	
7	Reserved			D → D(1)	D → I(1)	D → S(1)	D → M(1)	
8 - 11	Reserved							
12	Reserved			M ↔ D(1)	M ↔ I(0)	M ↔ S(1)	M ↔ M(0)	
13	Reserved			S ↔ D(1)	S ↔ I(1)	S ↔ S(1)	S ↔ M(0)	
14	Reserved			I ↔ D(1)	I ↔ I(0)	I ↔ S(1)	I ↔ M(0)	
15	Reserved			D ↔ D(1)	D ↔ I(1)	D ↔ S(1)	D ↔ M(0)	
16 - 19	Reserved							

Where **D** is a Data Transfer Element
I is the Import / Export Element
S is a Storage Element
M is the Medium Transport Element
Stor indicates storage capability
→ indicates Move Medium capability (first element type is for Source, second element type is for Destination)
↔ indicates Exchange Medium capability (first element type is for Source and Second Destination, second element type is for First Destination)

and the available capabilities are as indicated (a bit of one means yes in all cases and a bit of zero means no in at least some cases).

4.7.4 Vendor Unique Mode Parameters Page (20h)

The Vendor Unique Mode Parameters Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Reserved	Page Code (20h)					
1	Parameter Length (8)							
2	ReportRec	SlowScans	LimitRec	ChgrEject	Reserved	WaitLoad	IgnParity	Park
3	Model Identification			Reserved				
4 - 7	Reserved							
8	Reserved							OpenAcc
9	Event History Type							

ReportRec, **SlowScans**, **LimitRec**, **ChgrEject**, **WaitLoad**, **IgnParity**, **Park**, and **Event History Type** are as set by the MODE SELECT command.

Model Identification equals 1 for the *M52*, 2 for the *M104*, or 3 for the *M156* or *M258*.

OpenAcc equals a bit of one indicating that the OPEN ACCESS DOOR command is supported.

4.7.5 Vendor Unique Special Modes Page (21h)

The Vendor Unique Special Modes Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Reserved	Page Code (21h)					
1	Parameter Length (8)							
2	LightOff	Reserved			NoScanSE		NoScanDTE	
3	Reserved			NoPwrCyc				
4 - 9	Reserved							

LightOff, NoScanSE, NoScanDTE, and NoPwrCyc are as set by the MODE SELECT command.

4.7.6 Drive Assignments Page (22h)

The Drive Assignments Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (22h)					
1	Parameter Length (14)							
2	Drive 1 Drive Type							
3	Drive 1 SCSI ID							
4	Drive 2 Drive Type							
5	Drive 2 SCSI ID							
6	Drive 3 Drive Type							
7	Drive 3 SCSI ID							
8	Drive 4 Drive Type							
9	Drive 4 SCSI ID							
10	Drive 5 Drive Type							
11	Drive 5 SCSI ID							
12	Drive 6 Drive Type							
13	Drive 6 SCSI ID							
14 - 15	Reserved							

Drive 1-6 Drive Type are the drive type designators for the optical drives in the *M-Series* System as defined by running Configure Drives from the Library System front panel. If a drive is not installed, its Drive Type will be zero.

Drive 1-6 SCSI ID are the SCSI ID's of the optical drives in the *M-Series* System as defined by running Configure Drives from the Library System front panel.

4.7.7 Front Panel Display Mode Page (23h)

The Front Panel Display Mode Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (23h)					
1	Parameter Length (41)							
2	Reserved	LightOff	Reserved	Key Pressed			Reserved	DispMode
3 - 42	Reserved							

LightOff and DispMode are as set by the MODE SELECT command.

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

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

The number of the highest key pressed will always be returned.

4.8 MOVE MEDIUM Command

The **MOVE MEDIUM** command instructs the Medium Changer Device move a unit of media from a source element to a destination element.

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

Transport Element Address specifies the Medium Transport Element. A value of zero 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 one, the media is inverted (“flipped”) prior to being deposited into the destination element.

4.9 OPEN ACCESS DOOR Command

The **OPEN ACCESS DOOR** command instructs the Medium Changer Device to open the *M-Series* access door thus enabling cartridge insertion or removal. This command has no effect if the Changer has been placed in the Prevent state by the PREVENT ALLOW MEDIUM REMOVAL command.

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

4.10 POSITION TO ELEMENT Command

The **POSITION TO ELEMENT** command positions one of the two Medium Transport Elements (MTE's) in front of the specified Destination Element so that no further movement of the MTE 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. If the ChgrEject bit in the Mode Select command is not set, this command *must be used* to ensure that an MTE is positioned in front of an Optical Disk Drive before an eject command can be issued to that drive.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Logical Unit Number			Reserved				
2 - 3	(MSB)			Transport Element Address				(LSB)
4 - 5	(MSB)			Destination Element Address				(LSB)
6 - 7	Reserved							
8	Reserved							Invert
9	Control Byte							

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

Destination Address specifies the Destination Element to position in front of.

Invert equals a bit of one if the Medium Transport Element is to be inverted (“flipped”) before it is positioned at the Destination Element.

4.11 PREVENT ALLOW MEDIUM REMOVAL Command

The **PREVENT ALLOW MEDIUM REMOVAL** command instructs the Medium Changer Device to either inhibit or permit opening of the *M-Series* access door for cartridge insertion or removal. If left in the Allow state, the door can be opened by a button on the front panel or by using the OPEN ACCESS DOOR command.

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

Prevent equals a bit of one if opening of the access door is to be inhibited, or a bit of zero if the opening of the access door is to be allowed

4.12 READ ELEMENT STATUS Command

The **READ ELEMENT STATUS** command requests the Medium Changer Device report the status of its internal elements to the initiator.

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

VolTag (Volume Tag) bit of one indicates that the Medium Changer Device is to report Volume Tag information.

Element Type Code specifies an element type as follows:

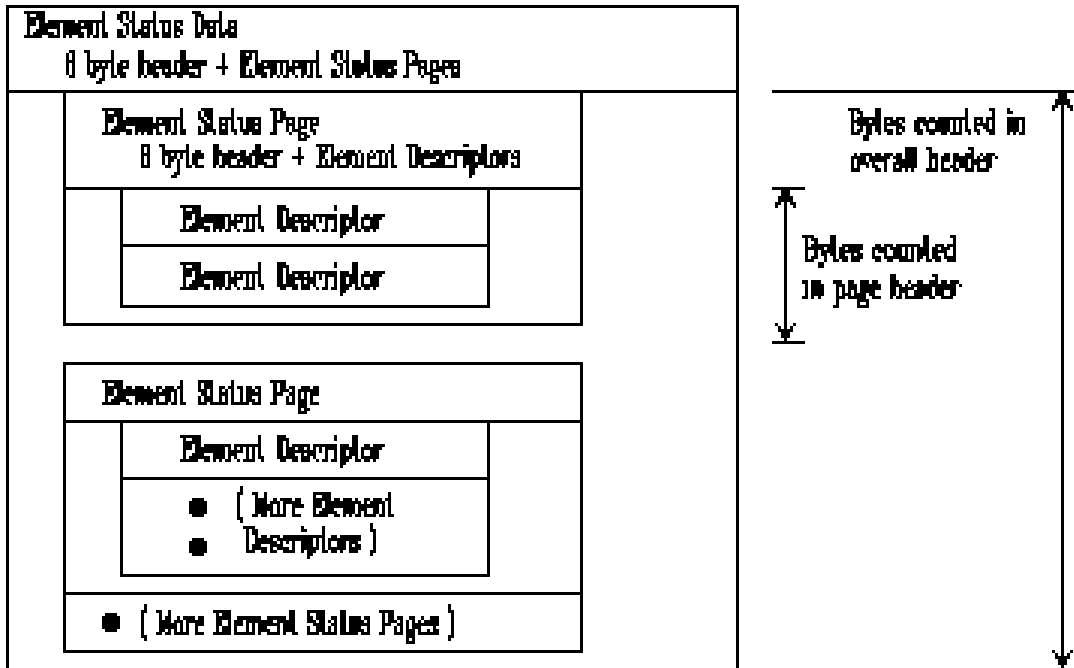
- 0 All element types
- 1 Medium Transport Element
- 2 Storage Element
- 3 Import/Export Element
- 4 Data Transfer Element

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.

Allocation Length specifies the length of the Element Status Data.

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



The Element Status Data Header format is shown following.

Element Status Data

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

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					
2 - 3	(MSB)			Element Descriptor Length (16 if VolTag=0, 88 if VolTag=1)				(LSB)
4	Reserved							
5 - 7	(MSB)			Byte Count of Descriptor Data Available (this page, y - 7)				(LSB)
8 - y	(MSB)			Element Descriptor(s)				(LSB)

PVolTag (Primary Volume Tag) bit of one indicates that Primary Volume Tag information is present.

AVolTag (Alternate Volume Tag) bit of one indicates that Alternate Volume Tag information is present.

The format of the Element Descriptors follows.

4.12.1 Medium Transport Element Descriptor

The Medium Transport Element Descriptor is as follows.

Bit	7	6	5	4	3	2	1	0
Byte								
0 - 1	(MSB)		Element Address				(LSB)	
2	Reserved				Except	Reserved	Full	
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 - 8	Reserved							
9	Svalid	Invert	Reserved					
10 - 11	(MSB)		Source Storage Element Address				(LSB)	
12 - 47	(MSB)		Primary Volume Tag Information (Omit if VolTag = 0)				(LSB)	
48 - 83	(MSB)		Alternate Volume Tag Information (Omit if VolTag = 0)				(LSB)	
12-15 / 84-87	(MSB)		Reserved (0)				(LSB)	

Except bit of one indicates the element is in an abnormal state. Additional information is given in the Additional Sense Code and in the Additional Sense Code Qualifier fields.

Full bit of one indicates that the element contains a unit of media.

Additional Sense Code and **Additional Sense Code Qualifier** indicate detailed information related to a non-recoverable error condition. These error codes are listed in Section 6.1 and described more fully in the *M-Series* System Technical Reference Manual.

Svalid (Storage Element Valid) bit of one indicates Source Storage Element Address and Invert bit are valid.

Invert bit of one indicates that the unit of media now in this element was inverted by MOVE MEDIUM operation since it was last in the Source Storage Element Address.

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

Primary Volume Tag information provides for identifying the logical volume that the unit of media residing in this element holds. This identifies the top side of the media - typically the 'A' side.

Alternate Volume Tag information provides for identifying the logical volume that the unit of media residing in this element holds. This identifies the bottom side of the media - typically the 'B' side.

4.12.2 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		InEnab	ExEnab	Access	Except	ImpExp	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 - 8	Reserved							
9	Svalid	Invert	Reserved					
10 - 11	(MSB)		Source Storage Element Address				(LSB)	
12 - 47	(MSB)		Primary Volume Tag Information (Omit if VolTag = 0)				(LSB)	
48 - 83	(MSB)		Alternate Volume Tag Information (Omit if VolTag = 0)				(LSB)	
12-15 / 84-87	(MSB)		Reserved (0)				(LSB)	

Access bit of one indicates element access by the Medium Transport Element is allowed.

Other fields are the same as for the Medium Transport Element descriptor.

4.12.3 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	ExEnab	Access	Except	ImpExp	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 - 8	Reserved							
9	Svalid	Invert	Reserved					
10 - 11	(MSB)		Source Storage Element Address				(LSB)	
12 - 47	(MSB)		Primary Volume Tag Information (Omit if VolTag = 0)				(LSB)	
48 - 83	(MSB)		Alternate Volume Tag Information (Omit if VolTag = 0)				(LSB)	
12-15 / 84-87	(MSB)		Reserved (0)				(LSB)	

InEnab (Import Enable) equals a bit of one indicating Import / Export Element supports movement of media into the scope of the medium changer device.

ExEnab (Export Enable) equals a bit of one indicating Import / Export Element supports movement of media out of the scope of the medium changer device.

Access bit of one indicates access to the Import / Export Element by the Medium Transport Element is allowed (the access door is closed) or a bit of zero if access is not allowed (the access door is open).

ImpExp bit of one indicates the unit of media in the Import / Export Element was placed there by an operator. A bit of zero indicates the unit of media was placed there by the Medium Transport Element.

Other fields are the same as for the Medium Transport Element Descriptor.

4.12.4 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			Access	Except	Reserved	Full	
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	NotBus	Reserved	IDValid	LUValid	Reserved	Logical Unit Number		
7	SCSI Bus Address							
8	Reserved							
9	Svalid	Invert	Reserved					
10 - 11	(MSB)		Source Storage Element Address				(LSB)	
12 - 47	(MSB)		Primary Volume Tag Information (Omit if VolTag = 0)				(LSB)	
48 - 83	(MSB)		Alternate Volume Tag Information (Omit if VolTag = 0)				(LSB)	
12-15 / 84-87	(MSB)		Reserved (0)				(LSB)	

Access bit of one indicates access to the Data Transfer Element by the Medium Transport Element is allowed. Access may require that a SCSI START/STOP command be sent to the corresponding optical drive to effect an eject.

Not Bus equals a bit of zero.

LUValid bit of one indicates that the Logical Unit Number field contains valid information.

IDValid bit of one indicates that the SCSI Bus Address field contains valid information.

Logical Unit Number is always equal to zero.

SCSI Bus Address is the SCSI ID of the corresponding optical drive as defined by running Configure Drives from the Library System front panel.

Other fields are the same as for the Medium Transport Element Descriptor.

4.13 RELEASE Command

The **RELEASE** command is used to release a previously reserved Medium Changer Device or previously reserved elements within it.

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (17h)							
1	Logical Unit Number			3rdPty	Third Party Device ID			Element
2	Reservation Identification							
3 - 4	Reserved							
5	Control Byte							

Element equals bit of one if a specific set of elements is to be released or a bit of zero if the entire Medium Changer Device is to be released.

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

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

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

4.14 REQUEST SENSE Command

The REQUEST SENSE command requests that the Medium Changer Device send Sense Data to the initiator.

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

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 available as shown on the following page for an Allocation Length of 36.

Sense Data Format

Bit Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code						
1	Segment Number							
2	Filemark	EOM	ILI	Reserved	Sense Key			
3 - 6	(MSB)			Information				(LSB)
7	Additional Sense Length							
8 - 11	(MSB)			Command-Specific Information				(LSB)
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Field Replaceable Unit Code							
15	SKSV	Sense-Key Specific						
16 - 17								
18 - 35	Additional Sense Bytes							

Error Code equals 70h indicating current errors.

Segment Number is not used.

FileMark is not used.

EOM is not used.

ILI is not used.

Sense Key is described below.

Information is not used.

Additional Sense Length equals 28.

Command-Specific Information is not used.

Additional Sense Code and **Additional Sense Code Qualifier** indicate detailed information related to an error or exception condition. These error codes are listed in Section 6.1 and described more fully in the *M-Series* System Technical Reference Manual.

Field Replaceable Unit Code is not used.

SKSV (Sense-Key Specific Valid) equals a bit of one if the Sense Key Specific field contains valid information.

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

Additional Sense Bytes contain additional information about the error returned.

The following Sense Key values are returned by the Medium Changer Device.

Sense Key Descriptions

Sense Key	Description
0	NO SENSE. Indicates that there is no specific sense key information to be reported. This is the case for a successful command.
1	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.
2	NOT READY. Indicates that the Medium Changer Device cannot be accessed.
4	HARDWARE ERROR. Indicates that the Medium Changer Device encountered a non-recoverable hardware failure while performing the command or during self test.
5	ILLEGAL REQUEST. Indicates an illegal parameter in the CDB or in additional parameters supplied as data.
6	UNIT ATTENTION. Indicates that Mode parameters have been changed or the target has been reset.

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

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

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

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

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

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

If the **Sense Key** is equal to 4 (**HARDWARE ERROR**) or 1 (**RECOVERED ERROR**) and the **SKSV** is set to one, the **Sense-Key Specific** fields contain the following information.

Bit Byte	7	6	5	4	3	2	1	0
15	SKSV	Reserved						
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 Byte** fields contain the following information.

Bit Byte	7	6	5	4	3	2	1	0
18	ChgrReady	Restored	Completed	AllReturned	MTE1Full	MTE2Full	Reserved	FailSecond
19	InfoValid	(First) Source Cartridge Location			(First) Containing Element Number			Inverted
20 - 21	(MSB)	(First) Source Element Address						(LSB)
22 - 23	(MSB)	(First) Destination Element Address						(LSB)
24	Info2Valid	Second Source Cartridge Location			Second Containing Element Number			Inverted2
25 - 26	(MSB)	Second Source Element Address						(LSB)
27 - 28	(MSB)	Second Destination Element Address						(LSB)
29	Medium Transport Element Number							
30 - 31	(MSB)	Lift Position Element Address						(LSB)
32 - 33	(MSB)	Additional Information						(LSB)
34 - 35	Reserved							

ChgrReady equals a bit of one if the Medium Changer Device is ready to accept new cartridge movement commands or a bit of zero if the Medium Changer Device is jammed and a REZERO UNIT command is required to reinitialize the unit.

Restored equals a bit of one 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 a bit of one if cartridges have been moved and the last command completed successfully.

AllReturned equals a bit of one if all cartridges have been returned to their last Storage Element locations.

MTE1Full equals a bit of one if the first Medium Transport Element (address 8001) is full.

MTE2Full equals a bit of one if the second Medium Transport Element (address 8002) is full.

FailSecond equals a bit of one if the failure occurred on the second move of an EXCHANGE MEDIUM command (from the First Destination Element to the Second Destination Element) or a bit of zero if the failure occurred on the first move (from the Source Element to the First Destination Element). The second move is actually executed first.

InfoValid equals a bit of one if bytes 18 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 a bit of one if bytes 24 to 28 contain valid information about the second move of an EXCHANGE MEDIUM command (First Destination Element to Second Destination Element).

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

- 1 Cartridge is in Source Element
- 2 Cartridge is in Medium Transport Element (if MTE is not Source or Destination Element) where the MTE is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for MTE1 or 2 for MTE2)
- 3 Cartridge is in Destination Element
- 4 Cartridge is in its last occupied Storage Element (if SE is not the Source or Destination Element)
- 5 Cartridge has been lost
- 6 Cartridge is in Import/Export Element (if IEE is not Source or Destination Element)
- 7 Cartridge is in Data Transfer Element (if DTE is not Source or Destination Element) where the DTE is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for DTE1, 2 for DTE2, etc.)

(First) Containing Element Number and **Second Containing Element Number** are the numbers of the elements containing the cartridges originally in the first and second source elements, respectively, if the corresponding Source Cartridge Location fields contain the numbers 2 or 7, starting with 1 for MTE1 or DTE1 (optical drive 1).

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

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

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

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

Additional Information contains such information as the value of ASC and ASCQ received from the drive in the event of an eject failure when the ChgrEject mode of operation is enabled or the drive not becoming ready when the WaitLoad mode of operation is enabled (see Section 4.6.1).

4.15 REQUEST VOLUME ELEMENT ADDRESS Command

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 with the translate option.

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

For each **SEND VOLUME TAG** command, the Medium Changer Device will report multiple elements that match a volume tag template in element address order. 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 (Volume Tag) bit of one requests that the Medium Changer Device report Volume Tag information.

Element Type Code specifies an element type as follows:

- 0 All element types
- 1 Medium Transport Element
- 2 Storage Element
- 3 Import/Export Element
- 4 Data Transfer Element

Element Address gives a medium changer element address whose interpretation depends on the **SEND ACTION CODE** received with the last **SEND VOLUME TAG** command. This code is echoed in the volume element address return format transferred by this command. When the last **SEND ACTION CODE** as an element address translate, (code values 0h .. 7h), the element address field gives the minimum element address to be reported by this command. When the **SEND ACTION CODE** is other than Translate (i.e. Assert, Replace and Undefined - code values 8h .. Dh), the element address field gives the particular element whose Volume Tag information was modified.

Number of Elements specifies the maximum number of elements and Volume 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 Volume Element Address Header whose format is shown following.

Volume Element Address Header Format

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			Send Action Code				
5 - 7	(MSB) Byte Count of Report Available (all pages, x - 7)							(LSB)
8 - x	(MSB) Element Status Page(s)							(LSB)

The Element Status Page format is shown under the READ ELEMENT STATUS command (Section 4.12). A description of the returned element descriptors can also be found there.

4.16 RESERVE Command

The RESERVE command is used to reserve the Medium Changer Device or specific elements within it.

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

Element equals bit of one if specific elements are to be reserved or a bit of zero if the entire Medium Changer Device is to be reserved.

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

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

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

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

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

4.16.1 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							
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.

4.17 REZERO UNIT Command

The **REZERO UNIT** command reinitializes the Medium Changer Device. Then, depending upon the ChgrEjects and LmtErrRec bits in the Mode Select Vendor Unique Mode Parameter Page (see Section 4.6.1), cartridges in the Medium Transport Element and loaded Data Transfer Elements (optical drives) may be put back in the Storage Elements from which they originally came. The Medium Changer Device will then go to its HOME position. If the Park bit is set by the MODE SELECT command, the Medium Transport Element will move to its park position and *no other SCSI commands will be accepted*. For the Park option to be effective, all disk cartridges must be first removed from the *M-Series* System as the intent is to prepare the system for shipment.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (01h)							
1	Logical Unit Number			Reserved				
2 - 4	Reserved							
5	Control Byte							

4.18 SEND DIAGNOSTIC Command

The **SEND DIAGNOSTIC** command instructs the Medium Changer Device to perform self-diagnostic tests. Currently, this invokes a checksum comparison on the *M-Series* System firmware.

Bit Byte	7	6	5	4	3	2	1	0	
0	Operation Code (1Dh)								
1	Logical Unit Number			PF	Reserved	Selfst	DevOfL	UnitOfL	
2	Reserved								
3 - 4	(MSB)			Parameter List Length				(LSB)	
5	Control Byte								

PF (Page Format) is ignored.

Selfst (Self Test) equals a bit of one indicating default self-test.

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

Parameter List Length equals zero.

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.

4.19 SEND VOLUME TAG Command

The **SEND VOLUME TAG** command transfers a volume tag template to be searched for or new volume tag information for one of media changer elements. The function of the command is conveyed by the Send Action Code field. The REQUEST VOLUME ELEMENT ADDRESS command is used to transfer the result of a translate search operation.

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

Element Type Code specifies an element type for a Translate action as follows:

- 0 All element types
- 1 Medium Transport Element
- 2 Storage Element
- 3 Import/Export Element
- 4 Data Transfer Element

The **Element Type Code** for Assert, Replace or Undefined actions should be zero.

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

Send Volume Tag Action Codes

Code	Description
00h	Translate - search all defined volume tags.
01h	Translate - search only primary volume tags.
02h	Translate - search only alternate volume tags.
03h	Reserved
04h	Translate - search all defined tags - ignore sequence numbers.
05h	Translate - search primary tags - ignore sequence numbers.
06h	Translate - search alternate tags - ignore sequence numbers.
07h	Reserved
08h	Assert - as the primary volume tag - if tag now undefined.
09h	Assert - as the alternate volume tag - if tag now undefined.
0Ah	Replace - the primary volume tag - current tag ignored.
0Bh	Replace - the alternate volume tag - current tag ignored.
0Ch	Undefined - the primary volume tag - current tag ignored.
0Dh	Undefined - the alternate volume tag - current tag ignored.
0Eh - 1Fh	Reserved

Translate operations request that the target search the volume tag information available to it for elements whose volume tag information matches the template given by the command parameters. The resulting information is reported via the REQUEST VOLUME ELEMENT ADDRESS command.

Assert operations define volume tag information for a single element.

A CHECK CONDITION with ILLEGAL REQUEST is reported if the subject element already has defined volume tag information. The original volume tag information remains unaltered.

Replace operations define volume tag information for a single element. Any previously defined volume tag information is overwritten.

Undefined operations cause previously defined volume tag information for the specified element to be cleared. It is not an error to 'undefined' volume tag information that was not previously defined.

The parameters required for the Send Volume Tag command are as follows. No parameters are required for Undefined operations.

Send Volume Tag Parameters Format

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

Volume Identification Template specifies the 32 byte volume identifier field. For Translate actions, this is the search template for the volume identification and may contain the wildcard characters '*' and '?'. The '*' will match any string of characters and the '?' will match any single character.

Minimum Volume Sequence Number and **Maximum Sequence Number** specify the 2 byte volume sequence number field search range for Translate actions. For Assert and Replace actions, the Minimum Volume Sequence Number specifies a new volume sequence number and the Maximum Volume Sequence Number is unused.

4.20 TEST UNIT READY Command

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	Logical Unit Number			Reserved				
2 - 4	Reserved							
5	Control Byte							

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.

This page intentionally left blank.

5. Event History Type and Event Description

The Event History Type byte of the Vendor Unique Mode Parameters Page (Section 4.6.1) determines which values are recorded in the Event List (Section 4.5.5). The format of the Event History Type byte is as follows.

Event History Type (Vendor Unique Mode Parameters Page)

Bit	7	6	5	4	3	2	1	0
Byte								
9	Reserved	SCSI Activity		Terse	Src/Dst	MTE	DrivePwr	Init/Rec

SCSI Activity equals one of the following:

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

SCSI activity bytes which are recorded in the Event List are preceded in the list by one or more of the following bytes, unless the Terse bit is set.

- Cnh Changer is selected by host; n is host SCSI ID (logged for SCSI Activity cases 1,2,3 above). This byte is logged even if the Terse bit is set
- Dnh Drive is selected by changer, or drive has reselected changer; n is drive SCSI ID (logged for SCSI Activity cases 1,2,3 above). This byte is logged even if the Terse bit is set
- E0h Message byte received from host in target mode (case 3 above)
- E1h Non-zero message byte sent to host in target mode (case 3 above)
- E2h Command byte(s) received from host in target mode (cases 1,2,3 above)
- E3h Data bytes received from host in target mode (case 2 above)
- E4h Non-zero status byte sent to host in target mode (case 3 above)
- E8h Non-zero message byte sent to drive in initiator mode (case 3 above)
- E9h Message byte received from drive in initiator mode (case 3 above)
- EAh Command byte(s) sent to drive in initiator mode (cases 1,2,3 above)
- EBh Data bytes received from drive in initiator mode (case 2 above)
- ECh Status byte received from drive in initiator mode (case 3 above)
- F0h Non-zero ASC/ASCQ returned to host (cases 1,2,3 above). This byte is logged even if the Terse bit is set
- F1h Non-zero ASC/ASCQ received from drive (cases 1,2,3 above). This byte is logged even if the Terse bit is set

Terse equals a bit of zero if flags bytes (above) indicating the type of SCSI activity are to be recorded, or a bit of one if no flag bytes (other than those indicated) are to be recorded.

Src/Dst equals a bit of one if source and destination element addresses for POSITION, MOVE MEDIUM, and EXCHANGE MEDIUM commands are to be recorded, or a bit of zero if no source and destination element addresses are to be recorded.

For clarity and to save space in the Event List, drives are logged as D1h, D2h, etc.; MTE's are logged as E1h and E2h; the Import/Export is logged as EEh; slot numbers less than 200 are logged as one byte; and slot numbers greater than or equal to 200 are logged as two - the first (MSB) being OR'd with FCh.

For example, the following is the Event List of an EXCHANGE MEDIUM from SE1 to D1 to SE255:

C7 (E2) A6 (...) 01 D1 FC FF

MTE equals a bit of one if the Medium Transport Element used for POSITION, MOVE MEDIUM, and EXCHANGE MEDIUM commands is to be recorded, or a bit of zero if the Medium Transport Element is not to be recorded

The MTE used is logged as E1h or E2h (for MTE1 or MTE2, respectively). If the default address of zero is specified for the EXCHANGE MEDIUM command, then E3h is logged if the exchange begins with MTE1 or E4h is logged if the exchange begins with MTE2. The MTE used is logged after the source and destination element bytes if the Src/Dst bit is set.

DrivePwr equals a bit of one if flag bytes for drive power cycling are to be recorded, or a bit of zero if no flag bytes for drive power cycling are to be recorded.

The following flag bytes are recorded for drive power cycling.

- F2h Drive power cycled because cartridge did not load into drive
- F3h Drive power cycled because cartridge popped out after load
- F4h Drive power cycled because drive did not become ready after load
- F5h Drive power cycled because cartridge could not be ejected
- F6h Drive power cycled because Configure Drives was run from Setup

Init/Rec equals a bit of one if the Library System initialize and recovery sequence is to be recorded, or a bit of zero if the initialize and recovery sequence is not to be recorded.

The initialize and recovery sequence consists of one byte values all of which are less than 100.

Finally, the following bytes are always recorded for a non-zero Event History Type.

- FEh SCSI bus or device reset
- FFh Power-on

6. Error Codes

6.1 Medium Changer Device SCSI Sense Codes

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

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

Sense Key	ASC	ASCQ	Error Description
04h	80h	45h	Element scan fail
05h	1Ah	00h	Parameter list length error
05h	20h	00h	Invalid command operation code
05h	21h	01h	Invalid element address
05h	24h	00h	Invalid field in CDB
05h	25h	00h	Logical Unit not supported
05h	26h	00h	Invalid field in parameter list
05h	28h	01h	Import/Export element accessed
05h	3Bh	0Dh	Medium destination element full
05h	3Bh	0Eh	Medium source element empty
05h	3Dh	00h	Invalid bits in identify message
05h	53h	02h	Medium removal prevented
05h	81h	00h	Volume tag information already defined
05h	84h	00h	Host serial number mismatch
05h	86h	00h	Transport element full
05h	87h	00h	Position with transport full
06h	29h	00h	Power-on, Reset, or Bus Device Reset occurred
06h	2Ah	00h	Log Parameters changed
06h	2Ah	01h	Mode parameters changed
06h	80h	46h	SRAM reset

6.2 Log Sense Error Codes

The following error codes are returned by the Log Sense command. For more information refer to the *M-Series M52, M104, M156, and M258* Technical Reference Manual.

Error Code	Error Description
10h	Unit has not been set up
12h	Park failure
15h	Pivot cable failure
16h	Aux power cable failure
17h	Lift cable failure
18h	Sensor cable failure
1Ah	Drive not installed
1Bh	Source is empty
1Ch	Destination is full
1Dh	Element unexpectedly empty
1Eh	Element unexpectedly full
1Fh	Lift is full
20h	Pick-disk failure
21h	Store-disk failure
23h	Drive not ready
24h	Drive load failure
25h	Drive unload failure
26h	Eject failure
28h	Can't inquiry drive
29h	SCSI terminator power is low
2Ah	Incompatible drive types
2Bh	Cannot export cartridge
2Ch	Import door is open
2Dh	Medium removal is prevented
2Eh	Unit not initialized
2Fh	Pivot failure

Error Code	Error Description
31h	Lift-home failure
32h	Lift-position failure
33h	Cartridge projecting from slot or drive
34h	Pivot not aligned
35h	Flip failure
36h	Flip timeout
37h	Flip-align failure
38h	Flip not aligned
3Ah	Slider-home failure
3Bh	Slider-position failure
3Ch	Swap slider failure
3Dh	Slider-load failure
3Eh	Slider jammed
3Fh	Slider misposition
40h	Pivot align failure
43h	Cannot open access door
44h	MTE not at drive
45h	Element scan fail
46h	SRAM reset
F1h	SCSI bus unavailable
F2h	SCSI selection timeout
F3h	More than 2 ID's on bus
F4h	Undefined SCSI phase
F5h	SCSI phase error
F6h	Bus not terminated
F7h	SCSI parity error
F8h	Unexpected loss of busy
F9h	Abort message received
FAh	Improper message received
FBh	Two devices responding to same selection
FCh	SCSI timeout
FEh	Drive is busy

6.3 Log Sense Error Locations

The following error locations are returned by the Log Sense command. For more information refer to the appropriate *M-Series* Library System Technical Reference Manual.

Location	Description
1	Selection phase (host selecting changer).
2	Receiving the disconnect message (from the host).
3	Checking for reselection by drive or selection by another initiator while busy processing a command (drive-changer or other initiator-changer).
4	Reselection phase (changer reselecting host).
10	Command phase (host-changer nexus).
11	Data out phase (host-changer nexus).
12	Message out phase (host-changer nexus).
13	Status phase (host-changer nexus).
14	Data in phase (host-changer nexus).
15	Message in phase (host-changer nexus).
20	Command phase while disconnected and busy (other initiator-changer nexus).
21	Data out phase while disconnected and busy (other initiator-changer nexus).
22	Message out phase while disconnected and busy (other initiator-changer nexus).
23	Status phase while disconnected and busy (other initiator-changer nexus).

Location	Description
24	Data in phase while disconnected and busy (other initiator-changer nexus).
25	Message in phase while disconnected and busy (other initiator-changer nexus).
30	Arbitration phase (changer arbitrating for bus).
31	Selection phase (changer selecting optical drive).
32	Waiting for new information transfer phase (changer-drive nexus).
40	Command phase (changer-drive nexus).
41	Data out phase (changer-drive nexus).
42	Message out phase (changer-drive nexus).
43	Status phase (changer-drive nexus).
44	Data in phase (changer-drive nexus).
45	Message in phase (changer-drive nexus).

© Copyright 1996 by Plasmon Data.