

NEO S-Series SCSI Media Changer Command Set

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Introduction

This document describes the SCSI Media Changer Command Set for the NEO S-Series Tape Library media changer.

The media changer processes SCSI commands to move cartridges between various element addresses. These element addresses are divided into four element types:

- The storage elements are the cartridge slots within the magazines.
- The import/export elements are the mailslots.
- The data transfer elements are the tape drives.
- The media transport element is the cartridge-handling robotic subsystem and moves cartridges within a media changer. The media changer logical unit maintains an inventory of the cartridges and the element addresses. The media changer logical unit reports this inventory when requested and identifies the element addresses assigned to different types of elements.

The SCSI media changer commands are based on the following specifications:

Document	T10 Version	ANSI INCITS Version
SMC-2	T10/1383-D rev 7	ANSI INCITS 382-2004
SPC-3	T10/1416-D rev 23	
SAM-2	T10/1157-D rev 24	ANSI INCITS 366-2003

This SCSI command set describes the following NEO Tape Library models running firmware revisions greater than 5.00:

Interface	Tape Drives
LVD SCSI	LTO-2 / LTO-3
SAS / FC	LTO-3 / LTO-4
SAS / FC 4Gb	LTO-3 / LTO-4
SAS 6Gb / FC 8Gb	LTO-5 / LTO-6 / LTO-7 / LTO-8

Media Changer Features

- **Operator Control Panel (OCP)** – This interface, with an LCD display and buttons, allows a user to monitor the media changer operation, move cartridges, and make configuration changes.
- **Remote Management Interface (RMI)** – This web-based interface allows an user to remotely monitor the media changer operation, move cartridges, perform firmware upgrades, and make configuration changes.

- **Mailslots** – These cartridge slots lets an user import or export cartridges without taking the media changer offline. Mailslots are enabled/disabled by the user interfaces. Mailslots are also referred to as import/export elements.
- **Auto Clean** – Provides automatic cleaning of the tape drives when applicable.
- **Partitions** – The media changer can be partitioned into several smaller media changers.
- **Reserved Slots** – The number of storage elements can be modified by changing the number of reserved slots in one of the user interfaces.
- **Sequential Mode** – Sequential mode allows the media changer to operate without use of an client application.
- **Extended Mode** – Two media changers can be merged to create one larger media changer.

Cleaning Cartridge Detection

The media changer automatically recognizes cleaning cartridges by barcode label or once they have been loaded into a data transfer element. After a cleaning cartridge is recognized, the media changer reports its special status in the Medium Type field of the Read Element Status data.

Auto Clean Mode

The media changer supports the Auto Clean feature. The Auto Clean feature is enabled or disabled by means of the ACE bit in the Device Capabilities mode page and by a menu option in the interfaces. When Auto Clean is enabled, the media changer automatically loads and unloads a cleaning cartridge from an inventory slot into the drive without affecting the host application.

Valid cleaning cartridges need to be made available in:

- The same partition (when the media changer is partitioned)
- A shared mailslot
- A reserved slot

Moving Cleaning Cartridges

When the Auto Clean feature is not enabled, application clients may initiate a cleaning operation by moving a cleaning cartridge to the tape drive. When the cleaning operation was successful, the application client should move the cleaning cartridge from the tape drive back to a storage slot. When there is a error with the cleaning cartridge, the MOVE MEDIUM or EXCHANGE MEDIUM command returns a CHECK CONDITON and moves the cleaning cartridge back to its source element address.

Possible sense data on moving cleaning cartridges are:

Sense Key	ASC	ASCQ	Description
3h	30h	07h	MEDIUM ERROR, the cleaning cartridge is expired

User Commanded Cleaning

The media changer can be instructed to clean a tape drive by means of an OCP or RMU command. When the media changer is instructed to clean a drive, the media changer loads a cleaning cartridge into the tape drive and, once the cleaning operation is finished, return this cartridge to its source element address. When no cleaning cartridge is available in the media changer's inventory, then the media changer requests the user to insert a cleaning cartridge. After the cleaning operation is completed, the media changer posts a message regarding the status of the cleaning operation.

Sequential and Random Mode

The media changer operates either in sequential or random mode. The operating mode is configured by means of the OCP or RMU interface. When the media changer is put into sequential mode, the media changer is controlled by internal firmware. In this mode, the media changer automatically replaces an ejected cartridge from the tape drive with another one from the media changers inventory.

When in *sequential* mode, the media changer reports CHECK CONDITION status on all media access commands. The sense data is set to NOT READY, SEQUENTIAL MODE (02/04/8E).

When in *random* mode, the media changer is controlled by SCSI commands from application clients.

Configuration Changes

The RMI and OCP interfaces can be used by a user to make configuration changes. When a change is made to the media changer configuration, the media changer informs the application client by means of a unit attention with the sense data set to MODE PARAMETERS CHANGED (06/2A/00).

Commands Allowed in the Presence of Reservations

The details of which SCSI commands are allowed and which SCSI commands return reservation conflict status while the media changer is reserved are described in next table. The RESERVE and RELEASE commands are used to manage the reservation state of the media changer.

- **Allowed** – Commands received from SCSI initiators not holding the reservation should complete normally.
- **Conflict** – Commands received from SCSI initiators not holding the reservation will terminate the command with a RESERVATION CONFLICT status.

Command	Library Reserved by Another Initiator
EXCHANGE MEDIUM	Conflict
INITIALIZE ELEMENT STATUS	Conflict
INITIALIZE ELEMENT STATUS WITH RANGE	Conflict
INQUIRY	Allowed
LOG SELECT	Conflict
LOG SENSE	Allowed
MODE SELECT (6 & 10)	Conflict
MODE SENSE (6 & 10)	Conflict
MOVE MEDIUM	Conflict
OPEN/CLOSE IMPORT/EXPORT ELEMENT	Conflict
PERSISTENT RESERVE IN	Allowed
PERSISTENT RESERVE OUT	Conflict
POSITION TO ELEMENT	Conflict
PREVENT/ALLOW MEDIUM REMOVAL (PREVENT=0)	Allowed
PREVENT/ALLOW MEDIUM REMOVAL (PREVENT=1)	Conflict
READ BUFFER	Conflict
READ ELEMENT STATUS (CURDATA=0)	Conflict
READ ELEMENT STATUS (CURDATA=1)	Allowed
RECEIVE DIAGNOSTIC RESULTS	Conflict

Command	Library Reserved by Another Initiator
RELEASE (6 & 10)	Allowed
REPORT LUNS	Allowed
REPORT SUPPORTED OPERATION CODES	Conflict
REPORT TIMESTAMP	Allowed
REQUEST SENSE	Allowed
REQUEST VOLUME ELEMENT ADDRESS	Conflict
RESERVE (6 & 10)	Conflict
SET TIMESTAMP	Conflict
SEND DIAGNOSTIC	Conflict
SEND VOLUME TAG	Conflict
TEST UNIT READY	Conflict
WRITE BUFFER	Conflict

NOT READY Handling

When the media changer is unable to accept media access commands, it reports a CHECK CONDITION status on media access commands. The sense data is set to the reason why the media changer is unable to perform the requested media access command. All non-media access commands (see table below) are executed as specified.

The media changer is unable to process media access commands successfully when:

- Its initialization routine is in progress.
- It is in sequential mode.
- It is running diagnostics tests.
- A magazine is removed.

Not Ready Reason	Sense Code During Not Ready Reason	Notes (see below)
Initializing after POR	02/04/01	1, 3
OCP move underway	02/04/01	3
RMU move underway	02/04/01	3
Magazine removed	02/3B/12	
Magazine inserted	02/04/01	2, 3
Sequential Mode	02/04/8E	3
Offline	02/04/12	3

Special Notes:

1. After a power-on or device reset, the media changer initializes automatically.
2. When a magazine is inserted, the media changer re-initializes automatically.
3. When transitioning from not ready to ready, the media changer returns a NOT READY TO READY TRANSITION unit attention (06/28/00) before returning READY status.

The following non-media access commands are processed during the not-ready reason:

Processed Commands During Not Ready Reason
INQUIRY
LOG SENSE
MODE SENSE
PERSISTENT RESERVE IN
PREVENT/ALLOW MEDIUM REMOVAL (PREVENT=0)
READ ELEMENT STATUS (CURDATA = 1)
RELEASE (6 & 10)
REPORT LUNS
REQUEST SENSE
WRITE BUFFER

Partitioning Handling

The media changer supports partitioning. The media changer can be partitioned when it has more than one tape drive. A partitioned media changer behaves identically like the un-partitioned media changer with the following conditions:

- The number of storage slots and data transfer elements are adjusted to match the new configuration.
- The media changer serial number in the INQUIRY data changes to differentiate between the new partitions.
- Command execution time increases. A partitioned media changer can be requested to execute more than one media access command at the same time. Since these commands are executed sequentially, the maximum execution time is multiplied by the number of enabled partitions. SCSI command timeouts are considering a normal scenario without parallel movements.
- Mailslots are shared over partitions. Different partitions use the same physical mailslots for import and export. The partition that moves an imported cartridge from one of the mailslots to its own inventory becomes the owner of that volume. The partition that exports a cartridge to a mailslot, prevents other partitions to use that same slot, until the user has removed the exported cartridge. Whenever a partition modifies the status of a mailslot, the other partitions are notified by means of a unit attention.
- When a partition exports a volume to a shared mailslot, the ACCESS is not set for this volume. Other partitions can see that the slot of the exported volume is occupied, but since the ACCESS bit is cleared, those partitions can not import this volume. This is done to prevent an exported volume from being imported on another partition.
- Mailslot magazines are potentially shared between multiple partitions. Individual slots of such magazines are only assigned to one partition. Nevertheless, mailslot magazines can only be opened completely which affects all owning partitions. If multiple partitions set a media removal prevention to their mailslots, the magazine can only be opened after all removal preventions have been released.

SCSI Abort Handling

A task is aborted when an event or SCSI initiator device action causes termination of the task prior to its successful completion.

The following events cause one or more tasks to be aborted:

- The return of an Execute Command service response of SERVICE DELIVERY OR TARGET FAILURE.
- An I_T nexus loss.
- A logical unit reset.
- A hard reset.
- A power on condition.

On such conditions the system aborts the current SCSI command. However, any mechanical operations still need to be completed. A SCSI initiator can immediately start with new command execution with the new command being executed as soon as possible.

An unit attention condition with an additional sense code set to SCSI BUS RESET OCCURRED is generated.

Mailslot Handling

When a user inserts or removes a cartridge from the mailslot, the FULL bit of the element descriptor describing the mailslot changes. This important event is reported to the application client by means of a unit attention condition (for example, IMPORT/EXPORT ELEMENT ACCESSED). The IMPEX bit of the element descriptor is set if the cartridge in mailslot has been added by a user. If it came from a storage element, the IMPEX bit is not set.

When a cartridge is exported (for example, transport element moved the cartridge to the mailslot), then the ACCESS bit of this cartridge is cleared while the FULL bit is set. This exported cartridge cannot be moved back to a storage slot. When an application client requests to move an exported cartridge, a CHECK CONDITION status is returned with the sense data set to ILLEGAL REQUEST, SOURCE ELEMENT EMPTY.

When an application client requests to move a cartridge to or from the import/export element and the mailslot is open (removed from the lock position), the MOVE MEDIUM command returns a CHECK CONDITION status with the sense data set to ILLEGAL REQUEST, DOOR OPEN (05/04/83).

Whenever a partition has media removal prevented by means of the PREVENT MEDIUM REMOVAL command, opening or closing of the mailslot is prevented for all partitions using mailslots of the same mailslot magazine.

When media removal is prevented by means of the PREVENT MEDIUM REMOVAL command, move commands to or from the import export element are not prevented.

When a user enables or disables the mailslot feature, the assigned element addresses of all storage elements and the number of storage elements changes. This important event is signaled to the application client by means of a unit attention condition (for example, MODE PARAMETERS CHANGED).

If a SCSI command comes in while the mailslot is removed, the robot services that command and then inventories the mailslot magazine if media was inserted during the SCSI command.

Cartridge Generation Handling

The media changer detects and stores LTO generation of each cartridge in its inventory. The media changer is aware what cartridge is supported by which tape drive. The media changer reports a CHECK CONDITION on either a MOVE MEDIUM or EXCHANGE MEDIUM command that causes a media generation conflict between a tape drive and a cartridge (for example, a LTO-6 tape into a LTO-5 drive).

Possible sense data on these media generation conflicts are:

Sense Key	ASC	ASCQ	Description
5h	30h	12h	ILLEGAL REQUEST, the destination tape drive does not support the cartridge generation at the source element address.

Extended Mode

The media changer supports merging of two physical media changers to create one logical media changer. The extended media changer cannot be partitioned. Any drive in the extended media changer can be configured as the LUN master drive. The upper media changer is referred to as master library and the lower is referred to as lower library. The master media changer provides the OCP and the RMU interfaces for the extended media changer. The mailslots of both the master library and the lower library are configurable to be used as storage slots or mailslots. Element addresses count up from the lower media changer. There is one logical transport element. Both lower and master library need to be configured in extended mode.

Supported SCSI Commands

The following table lists the Media Changer SCSI commands in alphabetical order.

NOTE: The command implementation is either **R0** (a launch requirement) or **R1** (a post-launch requirement). This code is used in all the tables.

Command (Operation Code)	Standard Used	NEO Tape Library	Required Implementation
EXCHANGE MEDIUM (A6h)	SMC-2	Supported	R0 (At Launch)
INITIALIZE ELEMENT STATUS (07h)	SMC-2	Supported	R0 (At Launch)
INITIALIZE ELEMENT STATUS WITH RANGE (37h)	SMC-2	Supported	R0 (At Launch)
INQUIRY (12h)	SPC-3	Supported	R0 (At Launch)
INQUIRY: Extender Info Page (D9h)			
INQUIRY: Log Select (4Ch)	SPC-3	Not supported	n/a
LOG SENSE (4Dh)	SPC-3	Supported	R0 (At Launch)
MODE SELECT 10 (55h)	SPC-3	Supported	R0 (At Launch)
MODE SENSE 10 (5Ah)	SPC-3	Supported	R0 (At Launch)
MOVE MEDIUM (A5h)	SMC-2	Supported	R0 (At Launch)
OPEN/CLOSE IMPORT/EXPORT ELEMENT (1Bh)	SMC-3	Not supported	n/a
PERSISTENT RESERVE IN (5Eh)	SPC-3	Supported*	R0 (At Launch)
PERSISTENT RESERVE OUT (5Fh)	SPC-3	Supported*	R0 (At Launch)
POSITION TO ELEMENT (2Bh)	SMC-2	Supported	R0 (At Launch)
PREVENT / ALLOW MEDIA REMOVAL (1Eh)	SPC-3	Supported	R0 (At Launch)
READ BUFFER (3Ch)	SPC-3	Supported	R1 (Post-launch)
READ ELEMENT STATUS (B8h)	SMC-2	Supported	R0 (At Launch)
RECEIVE DIAGNOSTIC RESULTS	SPC-3	Not supported	n/a
RELEASE 6 (17h)	SPC-3	Supported*	R0 (At Launch)

Command (Operation Code)	Standard Used	NEO Tape Library	Required Implementation
RELEASE 10 (57h)	SPC-3	Supported*	RO (At Launch)
REPORT LUNS (A0h)	SPC-3	Supported	RO (At Launch)
REPORT SUPPORTED OPERATION CODES (A3h)	SPC-3	Supported	RO (At Launch)
REPORT TIMESTAMP (A3h)	SPC-3	Supported	R1 (Post-launch)
REQUEST SENSE (03h)	SPC-3	Supported	RO (At Launch)
REQUEST VOLUME ELEMENT ADDRESS (B5h)	SMC-2	Supported	RO (At Launch)
RESERVE 6 (16h)	SPC-3	Supported*	RO (At Launch)
RESERVE 10 (56h)	SPC-3	Supported*	RO (At Launch)
SET TIMESTAMP (A4h)	SPC-3	Supported	R1 (Post-launch)
SEND DIAGNOSTIC (1Dh)	SPC-3	Not supported	n/a
SEND VOLUME TAG (B6h)	SMC-2	Supported	RO (At Launch)
TEST UNIT READY (00h)	SPC-3	Supported	RO (At Launch)
WRITE BUFFER (3Bh)	SPC-3	Supported	RO (At Launch)

*These commands are handled by the LUN drive.

EXCHANGE MEDIUM (A6h)

The EXCHANGE MEDIUM command allows an application client to replace a volume at an element address with another volume. The media changer can exchange cartridges between a mix of Storage Elements, Import/Export Elements, and Data Transfer Elements. The volume in the Source Address element is moved to the First Destination Address element and the volume that previously occupied the First Destination Address element is moved to the Second Destination Address element. The Second Destination Address element may or may not be the same as the Source Address element.

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

Field	Description
Medium Transport Address	This field specifies the media transport element used to execute the Exchange Medium command. This value can be set to either zero (0) or the currently valid Medium Transport Element address.
Source Address	The volume in the Source Address element is moved to the First Destination Address element address. The Source Address can be a Storage Element address, Import/Export Element address or a Data Transfer Element address.

Field	Description
First Destination Address	The volume in the First Destination Address is moved to the Second Destination Address. The First Destination Address can be a Storage Element address, Import/Export Element address or a Data Transfer Element address.
Second Destination Address	The Second Destination Address element may or may not be the same as the Source Address element. The Second Destination Address can be a Storage Element address, Import/Export Element address or a Data Transfer Element address.
Inv1/Inv2	An Invert bit of one (1) specifies that the media should be inverted or rotated prior to placing the media into the destination element. Because the media changer does not support media rotation, this field must be set to zero (0).

INITIALIZE ELEMENT STATUS (07h)

This command directs the media changer to check all existing elements for tape cartridges and any status relevant to that element. This command provides means for an application client to get a quick response from a Read Element Status command that may follow, and is useful if there was a power failure, the tape media has been changed by an operator, or the subsystem configuration has changed. The media changer does not return a GOOD status until the checking of all the elements is complete. The media changer may decide that element status is accurate and return a GOOD status on this command immediately.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (07h)							
1	LUN				Reserved			
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

INITIALIZE ELEMENT STATUS WITH RANGE (37h)

The INITIALIZE ELEMENT STATUS WITH RANGE command directs the media changer to check the specified element range for volume status and any other relevant status. This command enables the application client to get a quick response from a Read Element Status command that may follow, and is useful if there was a power failure, the tape media has been changed by an operator, or the subsystem configuration has changed. The media changer may decide that element status is accurate, and return a GOOD status on this command immediately.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (37h)							
1	LUN				Reserved		Fast	Range
2	(MSB)	Starting Element Address						
3	(LSB)							
4	Reserved							
5	Reserved							
6	(MSB)	Number of Elements						
7	(LSB)							
8	Reserved							
9	Control							

Field	Description
Fast	<ul style="list-style-type: none"> • A Fast bit of one (1) indicates that the specified elements are scanned for media presence only. • A Fast bit of zero (0) indicates that the specified elements are scanned for all relevant statuses.
Range	<ul style="list-style-type: none"> • A Range bit of zero (0) indicates that all element addresses are checked and that the Starting Element Address and Number of Elements fields are ignored. The range checked starts with the Starting Element Address and continues through the last element address on the unit. • A Range bit of one (1) indicates that the series of elements beginning at the specified Starting Element Address for the specified Number of Elements is checked.
Starting Element Address	<ul style="list-style-type: none"> • When the Range bit is set, this field specifies the starting element address of the scan for the Initialize Elements with Range command. • When the Range bit is not set, the information in this field is ignored.
Number of Elements	<ul style="list-style-type: none"> • When the Range bit is set, this field specifies the number of elements to scan during the Initialize Elements with Range command. The number of cartridges to scan should not exceed the maximum number of available storage slots taking in account the starting Element Address field. • When the Range bit is not set, the information in this field is ignored.

INQUIRY (12h)

The INQUIRY command requests that information regarding parameters of the media changer be sent to the initiator. The media changer can provide two categories of data in response to an inquiry command—Standard Inquiry Data and Vital Product Data.

Standard Inquiry Data contains basic data about the media changer and Vital Product Data can comprise several pages of additional data. Each Vital Product Data page requires a separate INQUIRY command from the initiator. An INQUIRY command is not affected by, nor does it clear, a Unit Attention condition.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	LUN			Reserved			Obsolete	EVPD
2	Page Code							
3	(MSB) Allocation Length							
4	(LSB)							
5	Control							

Field	Description
EVPD	<p>Enable Vital Product Data.</p> <ul style="list-style-type: none"> An EVPD bit of zero (0) specifies that the device server returns the optional Vital Product Data specified by the page "00h." An EVPD bit of one (1) specifies that the device server returns the optional Vital Product Data specified by the page code field.
Page Code	<p>This field contains the page number of the vital product data page to be returned for the INQUIRY command, if the EVPD bit is set to one (1). The following pages are supported:</p> <ul style="list-style-type: none"> 00h – Supported vital product pages 80h – Unit serial number page 83h – Device Identification page C0h – Firmware build information page D8h – Lower Library info page D9h – Extender info page
Allocation Length	<p>Specifies the number of bytes of inquiry information the media changer is allowed to return to the initiator during the command's data-in phase. Error status is not returned if the value in this field truncates the requested information.</p>

INQUIRY Standard Page

Standard Inquiry data:

Byte\Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08=Media Changer)				
1	RMB (1)	Reserved						
2	Version (5)							
3	Obsolete	Obsolete	NormACA (0)	HiSup	Response Data Format (2)			
4	Additional Length (45h)							
5	SCCS	ACC	TPGS		3PC	Reserved		Protect
6	BQue	EncServ	Reserved	MultiP	MChngr	Obsolete	Obsolete	Addr16
7	Obsolete	Obsolete	Wbus16	Sync	Linked	Obsolete	CmdQue	Reserved
8 - 15	Vendor Identification (8 ASCII bytes)							
16 - 31	Product Identification (16 ASCII bytes)							
32 - 35	Product Revision Level (4ASCII bytes)							
36 - 54	Reserved							
55	Reserved							BarC
56						Clocking	QAS	IUS
57	Reserved							
58 - 59	Version Descriptor: 005Ch (SAM-2 ANSI INCITS 366-2003)							
60 - 61	Version Descriptor 0B56h (SPI-4 ANSI INCITS 362-2002)							
62 - 63	Version Descriptor: 030Fh (SPC-3 T10/1416-D revision 22)							
64 - 65	Version Descriptor: 02Feh (SMC-2 ANSI INCITS 382-2004)							
66 - 73	Reserved							

Field	Description
Peripheral Qualifier	A return value of zero (0) indicates that the specified LUN is supported in this device. When an unsupported LUN was specified, the Peripheral Qualifier returns "3h," which indicates that specified LUN is not supported.
Peripheral Device Type	Indicates that this is a media changer device and is set to eight (8). When an unsupported LUN was specified, the Peripheral Device Type returns "1Fh," which indicates that specified LUN is not supported.
RMB	Removable Medium Bit. Set to one (1).
Version	The media changer complies to SPC-3. Set to five (5).
NormACA	A NormACA bit set to zero (0) indicates that the device server does not support both a NACA bit set to one (1) in the control byte and the ACA task attribute.
HiSup	A hierarchical support (HISUP) bit set to zero (0) indicates the SCSI target device does not use the hierarchical addressing model to assign LUNs to logical units.
Response Data Format	This Standard Inquiry Data is in SCSI-2 format. Set to two (2).
Additional Length	The media changer uses this field to indicate the number of additional bytes of INQUIRY response data available.
SCCS	The media changer does not contain an embedded storage array controller component. Set to zero (0).
ACC	The ACC bit set to zero (0) indicates that no access controls coordinator can be addressed through this logical unit.
TPGS	The media changer does not support asymmetric logical unit access or supports a form of asymmetric access that is vendor specific. Neither the REPORT TARGET GROUPS nor the SET TARGET GROUPS commands are supported.
3PC	A Third-Party Copy (3PC) bit set to zero (0) indicates that the media changer does not supports third-party copy commands such as the EXTENDED COPY command.
Protect	A PROTECT bit set to zero (0) indicates that the media changer does not support protection information.
BQue	Basic Queuing is not supported. Set to zero (0).
EncServ	An Enclosure Services (ENC SERV) bit set to zero (0) indicates that the media changer does not contain an embedded enclosure services component.
MultiP	<ul style="list-style-type: none"> A Multi-Port (MULTIP) bit set to one (1) indicates that this is a multi-port SCSI target device (with two or more ports) and conforms to the SCSI multi-port device requirements found in the applicable standards (SAM). A MULTIP bit set to zero (0) indicates that this SCSI target device has a single port and does not implement the multi-port requirements.
MChngr	This media changer is not an attached media changer. Set to zero (0).
Addr16	<ul style="list-style-type: none"> When Addr16 is set to one (1), the media changer supports 16-bit wide SCSI addresses. When set to zero (0), it indicates that the media changer does not support 16-bit wide SCSI addresses.

Field	Description																																
Wbus16	<ul style="list-style-type: none"> When Wbus16 is set to one (1), the media changer transfers SCSI data over a 16-bit wide bus. When Wbus16 is not set, data transfers are done over an 8-bit wide bus. 																																
Sync	<ul style="list-style-type: none"> When Sync is set, data transfers are done in synchronous mode. When Sync is not set, data transfers are done in asynchronous mode. 																																
Linked	Linked Commands are not supported. Set to zero (0).																																
CmdQue	The media changer does not support Tagged Command Queuing. Set to zero (0).																																
Vendor Identification	Eight byte ASCII string. This field is set to: <table border="1" style="margin-left: 20px;"> <tr> <td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> </tr> <tr> <td>B</td><td>D</td><td>T</td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	0	1	2	3	4	5	6	7	B	D	T																					
0	1	2	3	4	5	6	7																										
B	D	T																															
Product Identification	Sixteen byte ASCII string. This field depends on the media changer model. This field is set to: <table border="1" style="margin-left: 20px;"> <tr> <td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td> </tr> <tr> <td>F</td><td>l</td><td>e</td><td>x</td><td>S</td><td>t</td><td>o</td><td>r</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	F	l	e	x	S	t	o	r								
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15																		
F	l	e	x	S	t	o	r																										
Product Revision Level	This field contains four (4) bytes of ASCII data that provides the media changer's software revision levels. When a firmware update is performed on the media changer, this part of the revision level changes to reflect that update.																																
BarC	When set this bit indicates that the media changer is equipped with a barcode scanner.																																
IUS	Information Units Supported. Set to zero (0) indicating IUS is not supported.																																
QAS	Quick Arbitrate Supported. Set to zero (0) indicating QAS is not supported.																																
Clocking	Indicates the level of data clocking supported. <ul style="list-style-type: none"> Set to "11b" if the host interface speed has not been set to limit transfers to 80MB/s. Set to "00b" when the host interface speed has been set to limit transfers to 80MB/s. 																																
Version Descriptors	The version descriptors report the identifier of the supported SCSI command sets.																																

INQUIRY: Supported Vital Product Data Page (00h)

The Supported Vital Product Data (VPD) page provides a directory of the Vital Product Data pages supported by the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (8)				
1	Page Code (00h)							
2	Reserved							
3	Page Length (06h)							
4	00h - (this page)							
5	80h - Unit Serial Number Page							
6	83h - Device Identification Page							
7	C0h - Firmware Build Information Page							
8	D8 - Lower Library Info Page							
9	D9 - Extender Info Page							

NOTE: If an unsupported LUN was initially specified, the Peripheral Qualifier returns “3h” and the Peripheral Device Type returns “1Fh.” If Extended mode is not enabled, pages D8 and D9 are not reported.

INQUIRY: Unit Serial Number Page (80h)

The Unit Serial Number VPD page contains 16 bytes of ASCII data representing a unique serial number of the media changer. Length and format of the reported string are independent from being in either partitioned or non-partitioned mode. The original manufacturing serial number is extended by “_LL” and a two-digit extension for the partition number. Non-partitioned libraries report themselves as “Partition 1.”

Byte\Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)				Peripheral Device Type (8)			
1	Page Code (80h)							
2	Reserved							
3	Page Length (0Fh)							
4 - 19	Serial Number (16 ASCII bytes)							

NOTE: If an unsupported LUN was initially specified, the Peripheral Qualifier returns “3h” and the Peripheral Device Type returns “1Fh.”

Field	Description
Serial Number	The 16 byte ASCII Serial Number may contain ASCII numbers and ASCII characters. See the example that follows.

Serial number example (16 bytes):

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	1	3	5	7	a	c	e	x	y	z	_	L	L	0

INQUIRY: Device Identification Page (83h)

The Device Identification VPD page provides the means to retrieve identification descriptors from the media changer. Both FC and SAS devices return the following Device Identification VPD page:

Byte\Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)				Peripheral Device Type (8)			
1	Page Code (83h)							
2	Reserved							
3	Page Length (2Ch)							
4	Reserved						Code Set (2)	
5	Reserved						Identifier Type (1)	
6	Reserved							
7	Identifier Length (28h)							
8 - 15	Vendor Identification (8 ASCII bytes)							
16 - 31	Product Identification (16 ASCII bytes)							
32 - 47	Serial Number (16 ASCII bytes)							

NOTE: If an unsupported LUN was initially specified, the Peripheral Qualifier returns “3h” and the Peripheral Device Type returns “1Fh.”

Field	Description
Peripheral Qualifier	<ul style="list-style-type: none"> A return value of zero (0) indicates that the specified LUN is supported in this device. When a unsupported LUN was specified, the Peripheral Qualifier returns “3h” which indicates that specified LUN is not supported.
Peripheral Device Type	<ul style="list-style-type: none"> Indicates that this is a media changer device. Set to eight (8). When a unsupported LUN was specified the Peripheral Device Type returns “1Fh” which indicates that specified LUN is not supported.
Code Set	This field is set to two 2 indicating that the device identifier is returned as an ASCII string.
Identifier Type	The Identifier Type is set to one (1) indicating that a T10 style identifier is returned.
Vendor Identification	This field returns the 8-byte Vendor ID ASCII string.
Product Identification	This field returns the 16-byte Product ID ASCII string.
Serial Number	This field returns the 16-byte serial number as an ASCII string.

INQUIRY: Firmware Build Information Page (C0h)

The Firmware Build Information VPD page provides information identifying the current operating firmware version.

Byte\Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (8)				
1	Page Code (C0h)							
2	Reserved							
3	Page Length (3Ch)							
4 - 7	Reserved							
8 - 11	Media changer Firmware Checksum in ASCII							
12 - 35	Media changer Firmware Build Date in ASCII (mm-dd-yyyy)							
36 - 63	Reserved							

NOTE: If an unsupported LUN was initially specified, the Peripheral Qualifier returns “3h” and the Peripheral Device Type returns “1Fh.”

INQUIRY: Lower Library Info Page (D8h)

The Lower Library Info VPD page returns information about the lower library. This page is not available when Extended mode is not enabled.

Byte\Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (8)				
1	Page Code (83h)							
2	Reserved						PMatch	DValid
3	Page Length (30h)							
4 - 11	Vendor Identification (8 ASCII bytes)							
12 - 27	Product Identification (16 ASCII bytes)							
28 - 31	Product Revision level (4 ASCII bytes)							
32 - 41	Serial Number (10 ASCII bytes)							
42	Stacking Support level							
43	Library Height							
44	Magazine Count							
45	Slot Count							
46	Sled Count							
47 - 48	Status Flags							
49 - 51	Reserved							

Field	Description
DValid	Data Valid. <ul style="list-style-type: none"> This bit is set to one (1) when the fields below contain valid data. This bit is set to zero (0) when one field does not contain valid data.
PMatch	Personality Match. <ul style="list-style-type: none"> This field is set to one (1) when the Lower Library personality matched with the Master Library personality. This field is set to zero (0) when the personalities do not match.
Vendor ID	This field returns the vendor identifier of the lower library.
Product ID	This field returns the product identifier of the lower library.
Product Revision level	This field returns the firmware revision of the lower library.
Serial Number	This field returns the serial number of the lower library.
Library Height	This field returns the height of the lower library in rack units (U).
Magazine Count	This field returns the number of magazines in the lower library.
Slot Count	This field returns the number of storage slots and mailslots in the lower library.
Sled Count	This field returns the number of drive sleds in the lower library.
Status Flags	This field returns the status flags of the extender connecting the lower library.

INQUIRY: Extender Info Page (D9h)

The Extender Info VPD page returns information about the extender module. This page is not available when Extended mode is not available.

Byte\Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (8)				
1	Page Code (D9h)							
2	Reserved						PMatch	DValid
3	Page Length (10h)							
4 - 7	Product Revision level (4 ASCII bytes)							
8 - 17	Serial Number (10 ASCII bytes)							
18 - 19								

Field	Description
DValid	Data Valid. <ul style="list-style-type: none"> This bit is set to one (1) when the fields below contain valid data. This bit is set to zero (0) when one field does not contain valid data.
PMatch	Personality Match. <ul style="list-style-type: none"> This field is set to one (1) when the extender personality matches with the Master Library personality. This field is set to zero (0) when the personalities do not match.
Product Revision level	This field returns the firmware revision of the extender.
Serial Number	This field returns the serial number of the extender.

INQUIRY: Log Select (4Ch)

The LOG SELECT command provides a means for an application client to clear the event log in the media changer. This event log is maintained in the media changer internal NVRAM and is resistant to power failures. The only method to clear the event log is by means of a LOG SELECT command.

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

Field	Description
PCR	<ul style="list-style-type: none"> When the Parameter Code Reset (PCR) bit is set to one (1), the media changer clears the log parameters as indicated by the PC field. When the PCR bit is not set, no log parameters are cleared.
SP	<p>The Saving Log Parameters bit is ignored.</p> <ul style="list-style-type: none"> 0 - None 1 - Normal trace 2 - Error trace 3 - Both Normal and Error traces
Parameter List Length	The LOG SELECT command does not support additional parameters. This field must be set to zero (0).

LOG SENSE (4Dh)

The LOG SENSE command allows an application client to retrieve statistical information maintained by the media changer. The statistical information is divided over several pages. A LOG SENSE command retrieves one of these pages.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (4Dh)							
1	LUN			Reserved			PPC (0)	SP (0)
2	PC		Page Code					
3	Reserved							
4	Reserved							
5	(MSB)	Parameter Pointer						
6	(LSB)							
7	(MSB)	Allocation Length						
8	(LSB)							
9	Control							

Field	Description
PPC	If Parameter Pointer Control bit is set, the target terminates with a Check Condition status and the sense key set to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.
SP	Saving Log Parameters field is not supported. If the SP bit is set, the command is terminated with a Check Condition status and the sense key set to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.
PC	<p>The Page Control field defines the type of parameter value to be returned. This field should either be set to "00b" (Current Threshold Values) or "01b" (Current Cumulative Values). If not so set, the command is terminated with a Check Condition status and the sense key set to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.</p> <p>The Current Cumulative Values are the values computed since the last reset of the device (either by power-cycling, Bus Device Reset, or SCSI Reset).</p> <p>NOTE: Only the Log Sense Tape Alert page (2Eh) supports the PC to be set to Current Threshold Values.</p>

Field	Description
Page Code	<p>The Page Code field identifies which log page is being requested by the initiator.</p> <p>If the page is not supported then the command terminates with a Check Condition status and the sense key set to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.</p> <p>Supported pages are:</p> <ul style="list-style-type: none"> • 00h - List of Supported Pages page • 07h - Event Log page • 0Dh - Temperature Log page • 2Eh - Tape Alert page • 30h - Statistics Counter page • 33h - Error Log page
Parameter Pointer	The Parameter Pointer field allows the host to specify at which parameter within a Log Page the requested data should begin. This is not supported in any Log Sense page and should be set to zero (0).
Allocation Length	The Allocation Length field is used to inform the target how much space the initiator has allocated for data. The target returns the bytes specified by allocation length.

Log Page Header Format

Each Log Sense page begins with a four-byte header.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserved							
2 - 3	Page Length							

Field	Description
Page Code	The Page Code echoes the page code that was specified in the CDB.
Page Length	The Page Length specifies the total number of bytes contained in this log page, not including the four bytes of the header.

Supported Pages Log Page (00h)

When page zero (0) is requested, the four-byte page header is returned followed by the pages supported in ascending order, one byte for each page.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (00h)					
1	Reserved							
2 - 3	Page Length (4)							
4	00h - Supported Log Pages page							
5	07h - Event Log page							
6	0Dh - Temperature Log page							
7	2Eh - Tape Alert page							
8	30h - Statistics Counter page							
9	34h - Error Log page							

Event Log Page (07h)

In the Event Log the media changer keeps track of different system events. These events result from hardware errors, executed commands, and debug information generated. The events are stored in a FIFO mode, this means that only the n -most recent events are stored. Older events are deleted. This log is stored in non-volatile memory (NVRAM) and is resistant to power failures.

The data returned for the Event Log page does not exceed 64KB. A single LOG SENSE command to the Event Log page may return all events. The Event Log page starts with a header indicating the number of bytes of the total event history, followed by zero or more event structures. Reading the Event Log page does not clear the event data. Clearing the event data is done by means of the LOG SELECT command.

NOTE: The Host may specify what event types need to be logged. This is done with the MODE SELECT command to the vendor-specific Event Filter page.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (07h)					
1	Reserved							
2 - 3	Page Length							
4 - $nnnh$	Event Structures							

Field	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE CDB.
Page Length	The Page Length specifies the total number of bytes contained in this log page, not including the four bytes of the header.
Event Structure	An event structure consists of a header and a variable number of event data bytes. This structure is defined in the next section.

Event Structure

An event structure consists of two parts, a 13-byte event header and optional event data. The event header contains information about the event type, the source module of event, the time of event, the data type, and the event data length. The optional event data can not exceed 114 bytes. When the optional event data field is returned, it contains specific about the event.

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Parameter Code							
1	(LSB)							
2	DU(0)	DS(1)	TSD(0)	ETC(0)	TMC(0)	Reserved	Reserved	LP
3	Parameter Length ($n - 3$)							
4	Event type							
5 - 6	Source module ID of event							
7 - 10	Time of event (sec)							
11	Data type of event data							
12	Length of event data							
13 - n	Event data (0...114 bytes)							

Field	Description
Parameter Code	The Parameter Code is a 2-byte value that uniquely identifies the event within the log.
DU	Disable Update is set for any parameter that the Host cannot reset.
DS	Disable Save. The media changer has no support for SP bit. Set to one (1).
TSD	Target determines the save method. Set to zero (0).
ETC	No threshold comparison. Set to zero (0).
TMC	No threshold supported. Set to zero (0).
LP	The List Parameter field is set to zero (0) for parameters that are counters and set to one (1) for parameters that are not counters.
Parameter Length	This field specifies the total length of the event structure, including the additional event data, but without the 4-byte header.
Event type	This field specifies the event type. Possible event types and their identifiers are shown in the table below.
Source module ID of event	This field specifies the module ID that generated the event. Possible source module ID of the event and their identifiers are listed in the table below.
Time of event in sec	This field records the time the event took place.
Data type of event data	This field specifies the format of the additional event data. It is set to "00h" when additional event data contains binary data r set to "01h" when additional event data contains ASCII data.
Length of event data	This field specifies the amount of event data. The length specified in this field ranges between 0 and 114 bytes.
Event data	The Event data field contains detailed information about the event. The amount of event data ranges a minimum of 0 to a maximum of 114 bytes.

Event Type	Identifier
Cmd	01h
Response	02h
Event	04h
Trace Data	08h
Low Level Trace	10h
Customer Events	20h
Recovered Error	40h
Hardware Error	80h

Source Module ID of Event	Identifier
Main	001h
Drive	002h
CDB Interpreter	0004h

Source Module ID of Event	Identifier
Robotic	0008h
Trace	0010h
OCP Input	0020h
OCP Output	0040h
SCSI	0080h
SDCI	0100h
Serial Monitor	0200h
TNT Monitor	0400h
Debug Monitor	0800h
Test	1000h
MN Server	2000h
Network	4000h
RMU	8000h

Data Type of Event Data	Identifier
Binary	00h
ASCII	01h

Event Log Structure

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (07h)					
1	Reserved							
2 - 3	Page Length (n-3)							
Error event log parameters:								
4	Error event log parameters [first]							
...	...							
n	Error event log parameters [last]							

Error Event Log Parameter

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Parameter Code (n)							
1	(LSB)							
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (0)		Reserved	LP (0)
3	Parameter Length (n-3)							
4 - n	Error Event Data							

Field	Description
Parameter Code	The Parameter Code is a 2-byte value that uniquely identifies the event within the log.
DU	Disable Update is set for any parameter that the Host cannot reset.
DS	Disable Save. The media changer has no support for SP bit. Set to one (1).

Field	Description
TSD	Target determines the save method. Set to zero (0).
ETC	No threshold comparison. Set to zero (0).
TMC	No threshold supported. Set to zero (0).
LP	The List Parameter field is set to zero (0) for parameters that are counters and set to one (1) for parameters that are not counters.
Parameter Length	This field specifies the total length of the event structure, including the additional event data, but without the 4-byte header.
Error Event Data	The Error Event Data field contains ASCII detailed information about the event. The amount of event data ranges between 0 and a maximum of 255 bytes.

Temperature Log Page (0Dh)

This page returns the 4-byte page header followed by two Parameter Codes. Parameter Code “0000h” reports the current temperature and Parameter Code “0001h” reports the maximum sensor temperature at which the media changer is capable of operating reliable.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (0Dh)					
1	Reserved							
2 - 3	Page Length (12)							
4 - 5	Parameter Code 0000h (Temperature)							
6	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (xx)		LBIN (1)	LP (1)
7	Parameter Length (02h)							
8	Reserved							
9	Temperature (in degrees Celsius)							
10 - 11	Parameter Code 0001h (Max Temperature)							
12	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (xx)		LBIN (1)	LP (1)
13	Parameter Length (02h)							
14	Reserved							
15	Max Temperature (in degrees Celsius)							

Tape Alert Log Page (2Eh)

This page consists of the Page Header followed by 64 Tape Alert flags. Each Tape Alert flag stands for a pre-determined media changer specific error condition. Tape Alert Flags range from 1 until 64. Every flag number has a standardized meaning. This is not affected by the LOG SELECT command. This page can be retrieved by means of a LOG SENSE command with PC (Page Control) set either to “00b” or “01b.”

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (2Eh)					
1	Reserved							
2	(MSB) Page Length (0140h)							
3	(LSB)							
4 - 323	64 Tape Alert Flag structures (320 bytes)							

The Tape Alert flags supported by the media changer are shown at the end of this document ([Supported Tape Alert Flags on page 81](#)).

Tape Alert Flag Structure

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Parameter Code (<i>n</i>)							
1	(LSB)							
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (0)	Reserved	Reserved	LP (0)
3	Parameter Length (1)							
4	Value of Flag (set when bit 0 = 1)							

Field	Description
Parameter Code	The Parameter Code is a 2-byte value that uniquely identifies the event within the log.
DU	Disable Update is set for any parameter that the Host cannot reset.
DS	Disable Save. The media changer has no support for SP bit. Set to one (1).
TSD	Target determines the save method. Set to zero (0).
ETC	No threshold comparison. Set to zero (0).
TMC	No threshold supported. Set to zero (0).
LP	The List Parameter field is set to zero (0) for parameters that are counters and set to one (1) for parameters that are not counters.

Statistics Counter Page (30h)

This page consists of the Page Header followed three vendor specific counters. The information in this page is stored in NVRAM on power shut-down. This page is not affected by the LOG SELECT command nor by Firmware updates.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (30h)					
1	Reserved							
2	(MSB) Page Length (0048h)							
3	(LSB)							
4 - 51	9 Statistics Counter structures (72 bytes)							

Field	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE CDB.
Page Length	The Page Length specifies the total number of bytes contained in this log page, not including the four bytes of the header.

Statistics Counter Structure

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Parameter Code (<i>n</i>)							
1	(LSB)							
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (0)		Reserved	LP (0)
3	Parameter Length (4)							
4	(MSB)							
5	Statistic Counter Value							
6								
7	(LSB)							

Field	Description
Parameter Code	The Parameter Code is a 2-byte value that uniquely identifies the parameter within the log. It ranges from 1 to 6.
DU	Disable Update is set for any parameter that the Host cannot reset.
DS	Disable Save. The media changer has no support for SP bit. Set to one (1).
TSD	Target determines the save method. Set to zero (0).
ETC	No threshold comparison. Set to zero (0).
TMC	No threshold supported. Set to zero (0).
LP	The List Parameter field is set to zero (0) for parameters that are counters and set to one (1) for parameters that are not counters.

Parameter	Definition	Description	DU	LP
1	Minutes of Operation	This 4-byte unsigned counter specifies the minutes of operation. Every minute the device is turned on, this counter increments.	0	0
2	Number of Power-ups	This 4-byte unsigned counter specifies the number of times the media changer is turned on.	0	0
3	Number of Firmware Updates	This 4-byte unsigned counter specifies the number of times the internal flash code (ROM) has been updated.	0	0
4	Number of Loader Moves	This 4-byte unsigned counter specifies the number of times the media changer performed a successful Move operation.	0	0
5	Number of Event Entries	This 4-byte unsigned counter specifies the number of informational entries in the trace buffer.	0	0
6	Number of Error Entries	This 4-byte unsigned counter specifies the number of Error entries in the trace buffer.	0	0
7	Number of Informational Entries	This 4-byte unsigned counter specifies the number of Informational entries in the trace buffer.	0	0
8	Number of Warning Entries	This 4-byte unsigned counter specifies the number of Warning entries in the trace buffer.	0	0
9	Number of Configuration Change Entries	This 4-byte unsigned counter specifies the number of Configuration Change entries in the trace buffer.	0	0

Error Log Page (33h)

In the Error Log the media changer keeps track of different system errors. The events are stored in a FIFO mode, this means that only the 64 most recent events are stored. Older events are not displayed. This log is stored in non-volatile memory (NVRAM) and is resistant to power failures.

The data returned for the Event Log page does not exceed 64KB. A single LOG SENSE command to the Event Log page may return all events. The Event Log page starts with a header indicating the number of bytes of the total event history, followed by zero or more event structures. Reading the Event Log page does not clear the event data. Clearing the event data is done by means of the LOG SELECT command.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (33h)					
1	Reserved							
2 - 3	Page Length							
4 - 6211	Up to maximum 64 Hardware Error Event Structures (64*97 bytes)							

Field	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE CDB.
Page Length	The Page Length specifies the total number of bytes contained in this log page, not including the four bytes of the header.
Error Event Structures	This field contains a dump of the last error events. Up to 64 error event structures are returned in this page.

Error Event Structure

Every error event structure consists of two parts—a header and its data. The event header contains information about the event type, source, timestamp, and data length. The event data returns specific information about the error event. Appended to the event data is an error event description of no more than 80 ASCII characters with clear written text about the error event. Refer to the descriptions in the next table.

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Parameter Code (n)							
1	(LSB)							
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (0)	Reserved		LP (0)
3	Parameter Length (5Dh)							
4	Event type (80h)							
5 - 6	Source module ID of Error Event							
7 - 10	Timestamp of Error Event							
11	Reserved							
12	Length of Error Event data (n)							
13	(MSB) Error Event data (n bytes)							
13 + (n-1)	(LSB)							
13 + n	(MSB) Error Event description (maximum 80 ASCII characters)							
96	(LSB)							

Field	Description
Parameter Code	The Parameter Code is a 2-byte value that uniquely identifies the event within the log.
DU	Disable Update is set for any parameter that the Host cannot reset.
DS	Disable Save. The media changer has no support for SP bit. Set to one (1).
TSD	Target determines save method. Set to zero (0).
ETC	No threshold comparison. Set to zero (0).
TMC	No threshold supported. Set to zero (0).
LP	The List Parameter field is set to zero (0) for parameters that are counters and set to one (1) for parameters that are not counters.
Parameter Length	This field specifies the total length of the event structure, including the additional event data, but without the 4-byte header.
Event Type	This field specifies the event type. Since this page only returns error events, it is set to "80h," indicating Hard Error event.
Source module ID of Error Event	This field specifies the ID of the source module which generated the error event. See LOG SENSE (4Dh) on page 19 for detailed information about the possible source module IDs.
Time of Event	This field records the time the error event took place.
Length of Error Event Data	This field specifies the length in number of bytes of the error event data field.
Error Event Data	This field returns specific information about the error event.
Error Event Description	This field describes the error event in ASCII text. The returned string is zero-terminated. The maximum string length returned is 80 bytes.

Parity page (00h)

From this page, the host can enable Parity retries and select the maximum number of retries.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (1)	SPF (0)	Page Code (00h)					
1	Additional Page Length (02h)							
2	Reserved		Parity	Reserved				
3	Maximum Parity retries							

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can write this page to non-volatile memory.
Parity	This bit indicates whether parity retries are enabled or disabled. By factory default, parity retries are enabled.
Maximum Parity Retries	This field indicates the maximum number of retries performed on a parity error during data out, data in, and message out phase. The factory default number of parity retries is four (4).

Control Extension page (0Ah)

By means of this page, the host can control SCSI features provided by the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (0)	SPF (1)	Page Code (0Ah)					
1	Subpage Code (01h)							
2	(MSB)	Page Length (1Ch)						
3	(LSB)							
4	Reserved					TCMOS	SCSIP	IALUAE
5	Reserved				Initial Priority			
6 - 31	Reserved							

Field	Description
PS	Parameters Savable. This field is also set to zero (0). The media changer cannot write this page to non-volatile memory.
SPF	The Subpage Format (SPF) bit is set to one (1) to indicate this is a subpage.
TCMOS	A TCMOS bit set to zero (0) specifies that the time stamp is not changed by any method except those defined by this standard.
SCSIP	A SCSI precedence (SCSIP) bit set to one (1) specifies that the time stamp changed using a SET TIMESTAMP command takes precedence over any other methods.
IALUAE	An Implicit Asymmetric Logical Unit Access Enabled (IALUAE) bit set to one (1) specifies that implicit asymmetric logical unit access state changes are allowed.

Informational Exceptions Control Page (1Ch)

By means of this page, the Host can control the reporting and operation of specific informational exception conditions. Currently, only the polling method is supported.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (0)	SPF (0)	Page Code (1Ch)					
1	Additional Page Length (0Ah)							
2	Perf (0)	Reserved			Dexcpt (1)	Test (0)	Reserved	LogErr
3	Reserved				MRIE (0)			
4 - 7	Interval Timer							
8 - 11	Report Count / Test Flag Number							

Field	Description
PS	Parameters Savable. This field is set to zero (0). The media changer cannot write this page to non-volatile memory.
Perf	When this bit is set to zero (0), this indicates that informational exception operations that can cause delays are acceptable. This bit is always set to zero (0).
Dexcpt	<ul style="list-style-type: none"> When this bit is set to zero (0), the reporting method indicated by the MRIE field is used. When this bit is set to one (1), this indicates that the media changer disables all information exception operations, ignoring the MRIE field. (In this mode, the initiator must poll the Tape Alert log page.)

NOTE: Currently, only MRIE mode 0 is supported so this bit is ignored.

Field	Description
Test	Test modes are not supported. This field must be set to zero (0).
LogErr	<ul style="list-style-type: none"> When this bit is set to zero (0), the media changer does not log any Tape Alert events. When this bit is set to one (1), the media changer logs Tape Alert events.
MRIE	This field indicates the method used by the media changer to report informational exception conditions. Currently only mode zero (0) is supported. This means that Tape Alert flags can only be read by polling with the LOG SENSE command to the Tape Alert page.
Interval Timer	The media changer does not report Tape Alert conditions as Informational Exception conditions. This field must be set to zero (0).
Report Count / Test Flag Number	Since test modes are not supported, this field reports Report Count only. But the media changer does not support Informational Exception conditions. This field must be set to zero (0).

Element Address Assignment page (1Dh)

The Element Address Assignment Page is used to assign new addresses to the elements of the media changer (via the Mode Select command) and to report those assignments (via Mode Sense). When requested, the media changer can store new element addresses in NVRAM. When stored in NVRAM these addresses automatically become the default addresses after every power up. The format of the element address assignment page is shown in the next table. This page also defines the number of each type of element present in the subsystem configuration.

NOTE: This page is only stored in NVRAM when the Host sets the SP bit in the CDB.

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

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
First Medium Transport Element Address	This field indicates the address of the robotic cartridge handler (other than the default Medium Transport Element address of zero (0)).
Number Medium Transport Elements	This field indicates the number of robotic cartridge handler within the media changer. If the Number of Medium Transport Elements is greater than the default value returned in the Mode Sense parameter data, the media changer returns a Check Condition. The media changer has one robotic cartridge handler, set to "0001h."

Field	Description
First Storage Element Address	This field specifies the starting address for the cartridge storage locations.
Number of Storage Elements	This field indicates the number of cartridge storage locations. If the Number of Storage Elements is greater than the default value returned in the Mode Sense parameter data, the media changer returns a Check Condition.
First Import/Export Element Address	This field indicates the address of the import/export element.
Number of Import/Export Elements	This field specifies the maximum number of import/export elements contained within the media changer. If the Number of Import/Export Elements is greater than the default value returned in the Mode Sense parameter data, the media changer returns a Check Condition.
First Data Transfer Element	This field indicates the starting address of the installed tape drives.
Number of Data Transfer Elements	This field indicates the number of tape drives installed in the media changer. If the Number of Data Transfer Elements is greater than the default value returned in the Mode Sense parameter data, the media changer returns a Check Condition.

NOTE: The actual number of installed elements cannot be changed by the field values in the Element Address Assignment page. Specifying a value other than the specified number returns a Check Condition status with the Sense Key set to ILLEGAL REQUEST.

Transport Geometry Parameters Page (1Eh)

The Transport Geometry Parameters Page is provided in the SCSI-2 command set to determine whether each media transport element is a member of a set of elements in a robotic subsystem, and if the media transport is capable of media rotation. The initiator cannot change this information.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (1)	SPF (0)	Page Code (1Eh)					
1	Additional Page Length (02h)							
2	Reserved							Rotate (0)
3	Member Number in Transport Element Set (0)							

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
Rotate	Rotation of media is not an implemented feature, so the value returned for this field bit is zero (0).
Member Number in Transport Element Set	This field indicates the specific transport element in the system to which to apply this descriptor. The media changer has only one transport element, so the value returned for this field is zero (0).

Device Capabilities page (1Fh)

The Device Capabilities Page defines the characteristics of the element types used by this media changer. The initiator may use this information to determine which functions are permitted for the Move Medium, Exchange Medium, Read Attribute, and Write Attribute commands.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (0)	SPF (0)	Page Code (1Fh)					
1	Additional Page Length (12h)							
2	Reserved				DT (1)	I/E (1)	ST (1)	MT (0)
3	Reserved				ACE		VTRP	S2C
4	MT→RA (0)	Reserved		MT→DT (1)	MT→I/E (1)	MT→ST (1)	MT→MT (0)	
5	ST→RA (0)	Reserved		ST→DT (1)	ST→I/E (1)	ST→ST (1)	ST→MT (0)	
6	I/E→RA (0)	Reserved		I/E→DT (1)	I/E→I/E (1)	I/E→ST (1)	I/E→MT (0)	
7	DT→RA (0)	Reserved		DT→DT (1)	DT→I/E (1)	DT→ST (1)	DT→MT (0)	
8 - 11	Reserved							
12	MT↔WA (0)	Reserved		MT↔DT (0)	MT↔I/E (0)	MT↔ST (0)	MT↔MT (0)	
13	ST↔WA (0)	Reserved		ST↔DT (1)	ST↔I/E (1)	ST↔ST (1)	ST↔MT (0)	
14	I/E↔WA (0)	Reserved		I/E↔DT (1)	I/E↔I/E (0)	I/E↔ST (1)	I/E↔MT (0)	
15	DT↔WA (0)	Reserved		DT↔DT (1)	DT↔I/E (1)	DT↔ST (1)	DT↔MT (0)	
16 - 19	Reserved							

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
DT	Data Transfer. The value for this field is one (1). Tape drives can store cartridges.
I/E	Import/Export. The value for this field is one (1). The Import/Export element can store cartridges.
ST	Storage. The value reported for this field is one (1). The storage elements can store cartridges.
MT	Medium Transport. The value for this field is zero (0). The media transport element cannot store cartridges.
S2C	SMC-2 Capabilities field is set to one (1). This bit indicates that this page supports the new VRTP, ACE, XX-RA, and XX-WA fields.
VTRP	Volume Tag Reader Present. <ul style="list-style-type: none"> This bit is set to one (1) when the media changer has a barcode reader. It is set to zero (0) when the media changer does not have a barcode reader.

Field	Description
ACE	Auto Clean Enabled. <ul style="list-style-type: none"> When set to one (1), the media changer monitors the cleaning required status of the data transfer element (tape drive) and automatically cleans the data transfer element when needed. When set to zero (0), the media changer does not automatically clean the data transfer element.
XX→YY	(Where XX is a valid source and YY is a valid destination address) If one of these bits is set to one (1), it indicates that the media changer device supports all Move Medium commands for which the source is element type XX and the destination is element type YY on the condition that the element addresses are valid.
XX↔YY	A one (1) in these fields indicates that the media can be exchanged by means of the Exchange Media command between elements of types XX and YY on the condition that the element addresses are valid.
XX→RA	These fields indicate the resources required to support the READ ATTRIBUTE commands for each element type XX. The media changer does not support the READ ATTRIBUTE command. These fields are set to zero (0).
XX→WA	These fields indicate the resources required to support the WRITE ATTRIBUTE commands for each element type XX. The media changer does not support the WRITE ATTRIBUTE command. These fields are set to zero (0).

Vendor Specific Event Filter Page (20h)

By means of this page, the host can configure the event logging mode and specify what event types are stored in the event log.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (1)	SPF (0)	Page Code (20h)					
1	Additional Page Length (08h)							
2	Reserved							
3	Reserved						Log Mode	
4	Reserved							
5	Reserved						Seq Mode	
6	Reserved							
7	Event Type Filter							
8 - 9	Event Module Filter							

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
Seq Mode	This bit indicates the operational mode of the media changer: <ul style="list-style-type: none"> When set to one (1), the media changer is in Sequential Mode. When set to zero (0), the media changer is in Random Mode. <p>NOTE: Note this mode can only be changed by the OCP or RMU interfaces.</p>

Field	Description																		
Log Mode	<p>The Log Mode controls the behavior of the event log system. This mode can be set to the following different modes:</p> <table border="1"> <thead> <tr> <th>Log Mode</th> <th>Description</th> <th>Mode</th> </tr> </thead> <tbody> <tr> <td>Off</td> <td>Logging is disabled.</td> <td>00h</td> </tr> <tr> <td>Continuous</td> <td>Logging has no stop condition. Only <i>n</i> events can be traced back. Older events are lost.</td> <td>01h</td> </tr> <tr> <td>Wait on first error</td> <td>The first occurred error leads to a temporary stop of the loader.</td> <td>02h</td> </tr> </tbody> </table>	Log Mode	Description	Mode	Off	Logging is disabled.	00h	Continuous	Logging has no stop condition. Only <i>n</i> events can be traced back. Older events are lost.	01h	Wait on first error	The first occurred error leads to a temporary stop of the loader.	02h						
Log Mode	Description	Mode																	
Off	Logging is disabled.	00h																	
Continuous	Logging has no stop condition. Only <i>n</i> events can be traced back. Older events are lost.	01h																	
Wait on first error	The first occurred error leads to a temporary stop of the loader.	02h																	
Event Type Filter	<p>The Event Type Filter field determines which event types are stored in the event log. This field is an 8-bit mask. Every bit in this mask represents an event type. When a mask bit is set, all events with the subsequent event type are stored in the event log. When a mask bit is cleared, the event data of the subsequent event type is discarded.</p> <table border="1"> <thead> <tr> <th>Event Type</th> <th>Mask Bit</th> </tr> </thead> <tbody> <tr> <td>Cmd</td> <td>01h</td> </tr> <tr> <td>Response</td> <td>02h</td> </tr> <tr> <td>Event</td> <td>04h</td> </tr> <tr> <td>Trace Data</td> <td>08h</td> </tr> <tr> <td>Low Level Trace</td> <td>10h</td> </tr> <tr> <td>Customer Events</td> <td>20h</td> </tr> <tr> <td>Recovered Error</td> <td>40h</td> </tr> <tr> <td>Hard Error</td> <td>80h</td> </tr> </tbody> </table>	Event Type	Mask Bit	Cmd	01h	Response	02h	Event	04h	Trace Data	08h	Low Level Trace	10h	Customer Events	20h	Recovered Error	40h	Hard Error	80h
Event Type	Mask Bit																		
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Trace Data	08h																		
Low Level Trace	10h																		
Customer Events	20h																		
Recovered Error	40h																		
Hard Error	80h																		

Field	Description																																		
Event Module Filter	The Trace Module Filter determines which firmware module stores events. This field is a 16-bit mask. Every bit in this mask represents a firmware module. When a mask bit is set, the subsequent module is allowed to store its event data in the event log. When a mask bit is cleared, the event data of the subsequent firmware module is discarded. The table below identifies the bits belonging to different firmware modules.																																		
	<table border="1"> <thead> <tr> <th>Source module ID of event</th> <th>Identifier</th> </tr> </thead> <tbody> <tr> <td>Main</td> <td>0001h</td> </tr> <tr> <td>Drive</td> <td>0002h</td> </tr> <tr> <td>CDB Interpreter</td> <td>0004h</td> </tr> <tr> <td>Robotic</td> <td>0008h</td> </tr> <tr> <td>Trace</td> <td>0010h</td> </tr> <tr> <td>OCP Input</td> <td>0020h</td> </tr> <tr> <td>OCP Output</td> <td>0040h</td> </tr> <tr> <td>SCSI</td> <td>0080h</td> </tr> <tr> <td>SDCI</td> <td>0100h</td> </tr> <tr> <td>Serial Monitor</td> <td>0200h</td> </tr> <tr> <td>TNT Monitor</td> <td>0400h</td> </tr> <tr> <td>Debug Monitor</td> <td>0800h</td> </tr> <tr> <td>Test</td> <td>1000h</td> </tr> <tr> <td>MN Server</td> <td>2000h</td> </tr> <tr> <td>Network</td> <td>4000h</td> </tr> <tr> <td>RMU</td> <td>8000h</td> </tr> </tbody> </table>	Source module ID of event	Identifier	Main	0001h	Drive	0002h	CDB Interpreter	0004h	Robotic	0008h	Trace	0010h	OCP Input	0020h	OCP Output	0040h	SCSI	0080h	SDCI	0100h	Serial Monitor	0200h	TNT Monitor	0400h	Debug Monitor	0800h	Test	1000h	MN Server	2000h	Network	4000h	RMU	8000h
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MODE SELECT 10 (55h)

The MODE SELECT (10) command provides a means for an application client to specify peripheral device parameters to the media changer. Application clients should issue MODE SENSE prior to each MODE SELECT to determine supported pages, page lengths, changeable variables, and to determine if the page is savable to NVRAM.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (55h)							
1	LUN			PF (1)	Reserved			SP
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Control							

Field	Description
PF	A PF bit of one (1) indicates that the MODE SELECT parameters following the header and block descriptors complies with the SCSI-2 specification. The value must be set to one (1).
SP	Save Pages. <ul style="list-style-type: none"> A bit of zero (0) indicates the media changer performs the specified MODE SELECT operation, and does not save any pages in non-volatile ram. A bit of one (1) indicates that the media changer performs the specified MODE SELECT operation, and saves the current values to a non-volatile RAM.

When a host has successfully issued the MODE SELECT CDB that changed settings in one of the Mode pages, the media changer raises a Unit Attention condition to every other host who has not issued this CDB. The sense data for these hosts is set to Mode Parameters Changed (06/2A/01). The host provides the parameters through a parameter list to the media changer.

The parameter list consists out of the following items:

- Parameter List Header
- Mode Select page(s)

Supported Mode Select Pages

Page Code	Subpage Code	Page Name	Page savable in NVRAM	Page Description
00h	00h	Parity Retry page	Yes	Provides means to select the maximum number of retries performed on a parity error
0Ah	01h	Control Extension Page	No	Provides a means to read out the capabilities of the SET TIMESTAMP and REPORT TIMESTAMP commands.
1Ch	00h	Informational Exceptions Control page	No	Provides the means to control the reporting and the operations of specific informational exception conditions
1Dh	00h	Element Address Assignment Page	Yes	Provides a means to change SCSI element address assignments and respective element ranges.
1Eh	00h	Transport Geometry Page	No	Provides a means to set the specifics about the Transport Element (not changeable).
1Fh	00h	Device Capabilities Page	No	Provides a means to set the media changer's capabilities (not changeable).
20h	00h	Event Filter page (Vendor Specific)	Yes	This page provides a means to mask certain error event types from the event logging of the SCSI controller.

Mode Select Parameter List

The Mode Select parameter list shown below, contains a 4-byte header, followed by an optional 8-byte block descriptor after which the Mode Select pages are specified.

Byte\Bit	7	6	5	4	3	2	1	0
0 - 3	Parameter List Header							
4 - n	Mode Select pages							

Parameter List Header

If you send any page(s) using the Mode Select command to the media changer, you must first send the Parameter List Header, followed by the requested Mode Select pages. The Parameter List Header has the following format:

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved							
2	Reserved							
3	Block Descriptor Length (0)							

If no Block Descriptor should be sent to the media changer, specify zero (0) as Block Descriptor Length in the Parameter Header.

After the Parameter List Header the application client can send zero, one, or more Mode Select Pages to the media changer to configure any required parameter.

MODE SENSE 10 (5Ah)

The MODE SENSE (10) command provides a means for an application client to retrieve peripheral device parameters from the media changer. It is a complementary to the MODE SELECT (10) command.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (5Ah)							
1	LUN			Reserved	DBD	Reserved		
2	PC		Page Code					
3	Subpage Code							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)	Allocation Length						
8	(LSB)							
9	Control							

Field	Description
DBD	<p>The Disable Block Descriptors bit specifies if the media changer may return block descriptor after the Parameter List Header.</p> <ul style="list-style-type: none"> • When set to zero (0), the media changer may include an eight-byte block descriptor in the returned data. All bytes of the block descriptor are set to zero (0). • When DBD is set to one (1), the media changer does not return any block descriptor in the returned data.
PC	<p>The Page Control field defines the type of mode parameter values to be returned in the mode pages.</p> <ul style="list-style-type: none"> • 00b – Report Current Values (equal to default values if no pages previously saved) • 01b – Report changeable values • 10b – Report Default Values • 11b – Report Saved Values (equal to default values if no pages previously saved)
Page Code	<p>The page code defines which pages should be returned. See next table. A Initiator can request one or all mode sense pages. Each response includes a four bytes for the Parameter List Header, followed by the specified number of bytes for each page.</p>

Page Code	Subpage Code	Number Bytes*	Page Name	Page Description
00h	00	4	Parity Page	Provides a means to read out the setting for the maximum number retries on parity errors.
0Ah	01h	32	Control Extension Page	Provides a means to read out the capabilities of the SET TIMESTAMP and REPORT TIMESTAMP commands.
1Ch	00h	12	Informational Exception Control page	Allows the host to see what mechanisms is used to report Tape Alert events.
1Dh	00h	20	Element Address Assignment Page	Provides a means to read the SCSI element address assignments and respective element ranges.
1Eh	00h	4	Transport Geometry Page	Provides a means to read the specifics about the Medium Transport Element.
1Fh	00h	20	Device Capabilities Page	Provides a means to read the media changers capabilities.
3Fh	00h	70	All pages	Returns all Mode Sense pages in incrementing order.
3Fh [†]	FFh	102	All pages including subpages	Returns all Mode Sense pages including subpages in incrementing order.

* The Number Bytes column does not include the Parameter List Header and the (optional) Block Descriptor.

† A page code of 3Fh indicates that all mode pages are returned to the application client. These pages are returned in ascending order except for Mode Page 00h. Mode Page 00h is returned after all other Mode Pages.

Mode Parameter List

The returned data on a Mode Sense 10 command begins with an four-byte Mode Parameter Header followed by one or all Mode Sense pages as requested by the Page Code and Subpage Code fields.

Byte\Bit	7	6	5	4	3	2	1	0
0 - 3	Mode Parameter Header							
4 - n	Mode Sense Pages							

Mode Parameter Header

The returned data on a Mode Sense 10 command begins with a four-byte Mode Parameter Header. This header has the following structure:

Byte\Bit	7	6	5	4	3	2	1	0
0	Mode Data Length							
1	Reserved							
2	Reserved							
3	Block Descriptor Length							

Field	Description
Mode Data Length	This field indicates the number of bytes of parameter information the media changer is returning as a result of this command, excluding the Mode Data Length but including the three (3) additional Mode Parameter List bytes. If a block descriptor was requested, this count is also added to the Mode Data Length.
Block Descriptor Length	When the DBD bit is set to zero (0), the media changer may return an eight-byte Block Descriptor. When a Block Descriptor is returned, the Block Descriptor Length be set to "08h." When the DBD bit is set, the media changer does not return Block Descriptors and the Block Descriptor Length is set to "00h."

Control Extension page (0Ah)

By means of this page the host can retrieve SCSI features provided by the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (0)	SPF (1)	Page Code (0Ah)					
1	Subpage Code (01h)							
2	(MSB)	Page Length (1Ch)						
3	(LSB)							
4	Reserved					TCMOS	SCSIP (1)	IALUAE (0)
5	Reserved				Initial Priority			
6 - 31	Reserved							

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
SPF	The Sub Page Format (SPF) bit is set to one (1) to indicate this is a subpage.
TCMOS	A TCMOS bit set to zero (0) specifies that the time stamp is not changed by any method except those defined by this standard.

Field	Description
SCSIP	A SCSI precedence (SCSIP) bit set to one (1) specifies that the time stamp changed using a SET TIMESTAMP command takes precedence over any other methods.
IALUAE	An implicit asymmetric logical unit access enabled (IALUAE) bit set to one (1) specifies that implicit as asymmetric logical unit access state changes are allowed.

Element Address Assignment page (1Dh)

The Element Address Assignment Page is used to assign addresses to the elements of the media changer (via the Mode Select command) and to report those assignments (Mode Sense). This page also defines the number of each type of element present in the subsystem configuration.

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

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
First Medium Transport Element Address	This field indicates the address of the robotic cartridge handler (other than the default Medium Transport Element address of zero (0)).
Number Medium Transport Elements	This field indicates the number of robotic cartridge handler within the media changer. The media changer has one robotic cartridge handler, set to "0001h."
First Storage Element Address	This field indicates the starting address for the cartridge storage locations.
Number of Storage Elements	This field indicates the total number of cartridge storage locations contained within the media changer.
First Import/Export Element Address	This field indicates the starting address of the first import/export element.
Number of Import/Export Elements	This field indicates the total number of import/export elements contained within the media changer.
First Data Transfer Element	This field indicates the starting address of the installed tape drives.
Number of Data Transfer Elements	This field indicates the number of tape drives contained within the media changer.

Transport Geometry Parameters Page (1Eh)

The Transport Geometry Parameters Page is provided in the SCSI-2 command set to determine whether each media transport element is a member of a set of elements in a robotic subsystem, and if the media transport is capable of media rotation.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (0)	SPF (0)	Page Code (1Eh)					
1	Additional Page Length (02h)							
2	Reserved							Rotate (0)
3	Member Number in Transport Element Set (0)							

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
Rotate	Rotation of media is not an implemented feature, so the value returned for this field bit is zero (0).
Member Number in Transport Element Set	This field indicates the specific transport element in the system to which to apply this descriptor. The media changer has only one transport element, so the value returned for this field is zero (0).

Device Capabilities page (1Fh)

The Device Capabilities Page defines the characteristics of the element types used by this media changer. The initiator may use this information to determine which functions are permitted for the Move Medium, Exchange Medium, Read Attribute, and Write Attribute commands.

Byte\Bit	7	6	5	4	3	2	1	0
0	PS (0)	SPF (0)	Page Code (1Fh)					
1	Additional Page Length (12h)							
2	Reserved				DT (1)	I/E (1)	ST (1)	MT (0)
3	Reserved					ACE	VTRP	S2C
4	MT→RA (0)	Reserved		MT→DT (1)	MT→I/E (1)	MT→ST (1)	MT→MT (0)	
5	ST→RA (0)	Reserved		ST→DT (1)	ST→I/E (1)	ST→ST (1)	ST→MT (0)	
6	I/E→RA (0)	Reserved		I/E→DT (1)	I/E→I/E (0)	I/E→ST (1)	I/E→MT (0)	
7	DT→RA (0)	Reserved		DT→DT (1)	DT→I/E (1)	DT→ST (1)	DT→MT (0)	
8 - 11	Reserved							
12	MT↔WA (0)	Reserved		MT↔DT (0)	MT↔I/E (0)	MT↔ST (0)	MT↔MT (0)	
13	ST↔WA (0)	Reserved		ST↔DT (1)	ST↔I/E (1)	ST↔ST (1)	ST↔MT (0)	
14	I/E↔WA (0)	Reserved		I/E↔DT (1)	I/E↔I/E (0)	I/E↔ST (1)	I/E↔MT (0)	
15	DT↔WA (0)	Reserved		DT↔DT (1)	DT↔I/E (1)	DT↔ST (1)	DT↔MT (0)	
16 - 19	Reserved							

Field	Description
PS	Parameters Savable. This field is set to one (1). The media changer can save this page to non-volatile memory.
DT	Data Transfer. The value for this field is one (1). Tape drives can store cartridges.
I/E	Import/Export. The value for this field is one (1). The Import/Export elements can store cartridges.
ST	Storage. The value reported for this field is one (1). The storage elements can store cartridges.
MT	Medium Transport. The value for this field is zero (0). The media transport element cannot store cartridges.
S2C	SMC-2 Capabilities field is set to one (1). This bit indicates that this page supports the new VRTP, ACE, XX-RA, and XX-WA fields.
VTRP	Volume Tag Reader Present. <ul style="list-style-type: none"> • This bit is set to one (1) when the media changer has a barcode reader. • This bit is set to zero (0) when the media changer does not have a barcode reader.
ACE	Auto Clean Enabled is set to one (1) if the media changer is managing the data transfer element cleaning process. The ACE bit is set to zero (0) if the media changer is not managing the cleaning process.
XX→YY	(Where XX is a valid source and YY is a valid destination address) If one of these bits is set to one (1), it indicates that the media changer device supports all Move Medium commands for which the source is element type XX and the destination is element type YY on the condition that the element addresses are valid.
XX↔YY	A one in these fields indicates that the media can be exchanged by means of the Exchange Media command between elements of types XX and YY on the condition that the element addresses are valid.
XX→RA	These fields indicate the resources required to support the READ ATTRIBUTE commands for each element type XX. The media changer does not support the READ ATTRIBUTE command. These fields are set to zero (0).
XX→WA	These fields indicate the resources required to support the WRITE ATTRIBUTE commands for each element type XX. The media changer does not support the WRITE ATTRIBUTE command. These fields are set to zero (0).

MOVE MEDIUM (A5h)

The Move Medium command allows an application client to move tape cartridges from one element address to another specific element address. The media changer is capable to transfer cartridges between Storage Elements, Import/Export Elements, and Data Transfer Elements.

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

Field	Description
Medium Transport Address	This field specifies the media transport element used to execute the Move Medium command. This value can be set to either zero (0) or the currently valid Medium Transport Element address.
Source Address	Element address from which the tape cartridge is being moved. This can be a Storage Element address, Import/Export Element address or a Data Transfer Element address.
Destination Address	Element address to which the tape cartridge is being moved. This can be a Storage Element address, Import/Export Element address or a Data Transfer Element address.
Invert	An Invert bit of one (1) specifies that the media should be inverted or rotated prior to depositing the media into the destination element. The media changer does not support media rotation. This field must be set to zero (0).

PERSISTENT RESERVE IN (5Eh)

The PERSISTENT RESERVE IN command allows an application client to obtain information about persistent reservation keys that are active within an media changer. This command is used in conjunction with the PERSISTENT RESERVE OUT command.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (5Eh)							
1	LUN			Service Action				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB) Allocation Length							
8	(LSB)							
9	Control							

Field	Description
Service Action	The following service actions are supported: <ul style="list-style-type: none"> • 00h (Read Keys) – Reads all registered Reservation Keys. • 01h (Read Reservation) – Reads the current persistent reservations. • 02H – 1Fh (Reserved) – Reserved.
Allocation Length	By means of the Allocation Length field the application client specifies the how much space has been allocated for the returned parameter list.

PERSISTENT RESERVE IN Parameter Data for Read Keys

The format for the parameter data provided in response to a PERSISTENT RESERVE IN command with the Read Keys service action is shown below:

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Generation							
3	(LSB)							
4	(MSB) Additional Length ($n-7$)							
7	(LSB)							
Reservation Key List:								
8	(MSB) First Reservation Key							
15	(LSB)							
$n-7$	(MSB) Last Reservation Key							
n	(LSB)							

For information regarding the Generation, Additional Length, and Reservation Key List, refer to SPC-3 r23.

PERSISTENT RESERVE IN Parameter Data for Read Reservation

The format for the parameter data provided in response to a PERSISTENT RESERVE IN command with the Read Reservation service action is shown below:

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Generation							
3	(LSB)							
4	(MSB) Additional Length ($n-7$)							
7	(LSB)							
Reservation Descriptors:								
8	(MSB) Reservation Descriptors							
n	(LSB)							

For information regarding the Generation, Additional Length, and Reservation Descriptors, refer to SPC-3 r23.

PERSISTENT RESERVE IN Reservation Descriptor

The format for the reservation descriptor is shown below. There is a reservation descriptor for the persistent reservation, if any, present in the logical unit and a reservation descriptor for each element, if any, having a persistent reservation.

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB) Reservation Key							
7	(LSB)							
8	(MSB) Scope-Specific Address							
11	(LSB)							
12	Reserved							
13	Scope				Type			
14	(MSB) Obsolete							
15	(LSB)							

For information regarding the Reservation Key, Scope-Specific Address, Scope, and Type, refer to SPC-3 r23.

PERSISTENT RESERVE OUT (5Fh)

The PERSISTENT RESERVE OUT command allows an application client to request service actions that reserve the whole media changer or certain elements for the exclusive or shared use of a particular initiator. The command uses other service actions to manage and remove such reservations. The command is used in conjunction with the PERSISTENT RESERVE IN command and is not used with the RESERVE and RELEASE commands.

Initiators performing PERSISTENT RESERVE OUT service actions are identified by a reservation key provided by the application client. An application client may use the PERSISTENT RESERVE IN command to obtain the reservation key for the initiator holding a persistent reservation and may use the PERSISTENT RESERVE OUT command to preempt that reservation.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (5Fh)							
1	LUN				Service Action			
2	Scope				Type			
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB) Parameter List Length							
8	(LSB)							
9	Control							

Field	Description
Service Action	<p>The following service actions are supported:</p> <ul style="list-style-type: none"> • 00h (Register) – Register a reservation key with the device server. • 01h (Reserve) – Creates a persistent reservation having a specified Scope and Type. • 02h (Release) – Releases the selected reservation for the requesting initiator. • 03h (Clear) – Clears all reservation keys and all persistent reservations. • 04h (Preempt) – Preempts persistent reservations from another initiator. • 05h (Preempt and Abort) – Preempts persistent reservations from another initiator and aborts all tasks for all initiators registered with the specified registration key. • 06h (Register and Ignore Existing Key) – Register a reservation key with the device server. • 07h–1Fh (Reserved) – Reserved
Type	<p>The Type field specifies the characteristics of the persistent reservation.</p> <ul style="list-style-type: none"> • 0h – Obsolete • 1h – Write Exclusive • 2h – Obsolete • 3h – Exclusive Access • 4h – Obsolete • 5h – Write Exclusive, registrants only • 6h – Exclusive Access, registrants only • 7h – Write Exclusive, registrants only • 8h – Exclusive Access, registrants only • 9h-Fh – Reserved
Scope	<p>The value in the Scope field specifies whether a persistent reservation applies to an entire logical unit or to an element.</p> <ul style="list-style-type: none"> • 0h – Persistent reservation applies to the full logical unit. • 1h – Obsolete. • 2h – Persistent reservation applies to the specified element. • 3h-Fh – Reserved.
Parameter List Length	<p>The parameter List Length is set to the length of the Persistent Reserve Out Parameter List structure.</p>

PERSISTENT RESERVE OUT Parameter List

The format for the reservation descriptor is shown below. There is a reservation descriptor for the persistent reservation, if any, present in the logical unit and a reservation descriptor for each element, if any, having a persistent reservation.

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB)	Reservation Key						
7	(LSB)							
8	(MSB)	Service Action Reservation Key						
15	(LSB)							
16	(MSB)	Scope-Specific Address						
19	(LSB)							
20		Reserved						APTPL
21		Reserved						
22	(MSB)	Obsolete						
23	(LSB)							

Field	Description
Reservation Key	The Reservation Key field contains a value provided by the application client to the device server to identify the initiator that is the source of the PERSISTENT RESERVE OUT command.
Service Action Reservation Key	For the Register, and Register and Ignore Existing Key service action, the Service Action Reservation Key contains the new registration key to be registered. For the Preempt, and Preempt an Abort service actions, the Service Action Reservation Key field contains the reservation key of the persistent reservations that are being preempted. The Service Action Reservation Key field is ignored for all other service actions.
Scope-Specific Address	If the Scope is an Element Scope reservation, the Scope-Specific Address field contains the element address (zero filled in the most significant two bytes).
APTPL	The Activate Persist Through power Loss (APTPL) bit is valid only for the Register, or the Register and Ignore Existing Key service action. In all other cases the APTPL bit is ignored.

OPEN/CLOSE IMPORT/EXPORT ELEMENT (1Bh)

The OPEN/CLOSE IMPORT/EXPORT ELEMENT command allows an application client to open the Import/Export element, also referred to as mailslot. When the action code is set to Open Import/Export Element, the media changer opens the import/export element. The media changer does not return a CHECK CONDITION when the import/export element was already open. When media removal is prevented by means of the PREVENT MEDIUM REMOVAL command (in any partition) and the mailslot is full, the OPEN/CLOSE IMPORT/EXPORT ELEMENT command returns CHECK CONDITION status with the sense data set to ILLEGAL REQUEST, LIBRARY MEDIUM REMOVAL PREVENTED (05/53/02) on a request to open the mailslot.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (1Bh)							
1	LUN				Service Action			
2	(MSB)	Medium Transport Address						
3	(LSB)							
4	Reserved				Action Code			
5	Control							

Field	Description
Service Action	The Action Code allows the application client to set the requested action for the mailslot specified by the Import/Export Element Address: <ul style="list-style-type: none"> • 00h – Open the Import/Export element. • 01h – 0Fh Reserved
Import/Export Element Address	The Import/Export Element Address field specifies the element address of the Import/Export element.

POSITION TO ELEMENT (2Bh)

The POSITION TO ELEMENT command allows an application client to position the Medium Transport Element to a specific element address. The destination address can be set to any Storage Element, Import/Export Element, or a Data Transfer Element address.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	LUN			Service Action				
2	(MSB)	Medium Transport Address						
3	(LSB)							
4	(MSB)	Destination Address						
5	(LSB)							
6	Reserved							
7	Reserved							
8	Reserved							Invert
9	Control							

Field	Description
Medium Transport Address	This field contains either zero (0) or the currently valid element address of the Medium Transport Element.
Destination Address	This field contains the destination element address for the Position to Element command. This destination address can be a Storage Element, Import/Export Element, or an Data Transfer Element address.
Invert	The does not support media rotation. This value must be set to zero (0).

PREVENT / ALLOW MEDIA REMOVAL (1Eh)

The PREVENT / ALLOW MEDIA REMOVAL command allows an application client to enable or disable the ability to remove magazines from the media changer and enables or disables the ability to open the mailslot. When the media changer is partitioned, the PREVENT / ALLOW MEDIA REMOVAL command controls the magazines related to the partition in which the PREVENT / ALLOW MEDIUM REMOVAL command is received. And when mailslots are shared by different partitions, the PREVENT / ALLOW MEDIA REMOVAL command controls opening of the mailslot for all partitions.

A prevent condition inhibits the media changer to open magazines and the Import/Export element. A prevent condition does not affect the media changer to move cartridges to or from the Import / Export element. A prevent condition does not affect an UNLOAD command issued to the tape drive. Also a prevent condition does not inhibit a front panel LOAD of a cartridge when the tape drive is empty. A prevent condition is cleared when all initiators issue the Prevent Allow Medium Removal command with the Prevent field set to zero (0) to allow cartridge removal. The prevent condition is also cleared after a power on and after a SCSI Bus reset.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (1Eh)							
1	LUN			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							Prevent
5	Control							

Field	Description
Prevent	When this bit is set, unlocking of the magazine and mailslot is disabled. When the Prevent bit is cleared unlocking of the magazine and mailslot is enabled.

READ BUFFER (3Ch)

The READ BUFFER command is used in conjunction with the WRITE BUFFER command. It allows the application client to test the media changer's data buffer and the SCSI bus integrity. It may also be used to read out Vendor Specific settings and debug logs.

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

Field	Description
Mode	<p>The Mode field is used to select the mode of operation. The media changer supports the following values within the field.</p> <ul style="list-style-type: none"> • 0001b - Vendor Unique • 0010b - Data • 0011b - Descriptor • 1010b - Echo Buffer • 1011b - Echo Descriptor <p>If any non-supported value is set, the media changer terminates the command with a Check Condition status and an Illegal Request sense key set.</p>
Buffer ID	For all modes, only buffer ID zero (0) is supported.
Buffer Offset	The Buffer Offset field is not supported and must be set to zero (0). If the Buffer Offset field specifies an unsupported value, the media changer returns Check Condition status. The sense key is set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.
Allocation Length	The Allocation Length field specifies the maximum number of bytes that the initiator has allocated for returned data.

Vendor Unique Mode

A READ BUFFER command with the mode set to Vendor Unique Mode is used to retrieve parameters stored in non-volatile RAM. The Buffer ID specifies the requested page. The Buffer Offset field in the CDB is not supported for this mode.

Buffer ID	Description	Parameter List Length
00h	Variables Setting page	002Eh
90h	DPA	variable (max 96000h)

The following structure specifies the Variables Setting page. A WRITE BUFFER command to this page is used to update the setting variables in NV-RAM.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Additional Page Length (2Ch)							
2	Reserved							
3	Reserved							
4	(MSB)							
...	Current Setting Variables (42 bytes)							
45	(LSB)							

NOTE: For a description of the possible Setting Variables, see the table at WRITE BUFFER command.

The following structure specifies the ASCII trace dump buffer returned with the READ BUFFER command with Mode set to Vendor Unique and Buffer to 90h. No page format is defined for this page.

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB)							
...	Dump All (dpa) ASCII buffer (up to 102400 bytes)							
102400	(LSB)							

Descriptor Mode

In this mode, the media changer returns the Buffer Capacity of the specifies Buffer ID in Data Mode. If a not-supported Buffer ID is specified, the media changer returns zero (0) as Buffer Capacity. The next table specifies the Buffer Descriptor, which is returned on a READ BUFFER command is Descriptor Mode.

Byte\Bit	7	6	5	4	3	2	1	0
0	Offset Boundary (0)							
1	(MSB)							
...	Buffer Capacity							
3	(LSB)							

Field	Description
Offset Boundary	The Offset Boundary field defines the byte alignment for the buffer. The media changer only supports byte alignment, so this value is always set to zero (0).
Buffer Capacity	The Buffer Capacity field returns the maximum size, including the length byte, of the specified Buffer ID buffer in bytes. The Read Buffer command in Data Mode supports Buffer ID of zero (0). Buffer ID “zero” can store up to 256 bytes. The returned Buffer Capacity for Buffer ID “zero” is “000100h.” The Buffer Capacity for all other Buffer Capacity for all other Buffer ID values is set to “000000h.”

Data Mode

In this mode, the media changer returns the information stored in the specified Buffer ID. This mode is used to test the SCSI bus data integrity in conjunction with the WRITE BUFFER command. The Data Mode returns up to 256 bytes from the specified Buffer ID to the host. The value in the Buffer Offset field may not exceed the length of the specified Buffer ID. Only Buffer ID “00h” is supported. Potential Buffer overruns are detected and the command is rejected. By means of a READ BUFFER command in Data Mode, the host can retrieve the information sent by a WRITE BUFFER command in Data Mode. The returned number of bytes is defined by the value stored in the Allocation Length field of the READ BUFFER CDB.

Byte\Bit	7	6	5	4	3	2	1	0
0 – n	(data defined by previous Data Mode WRITE BUFFER command)							

READ ELEMENT STATUS (B8h)

The READ ELEMENT STATUS command allows the application client to obtain the status of the media changer internal elements.

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

Field	Description
VolTag	If the VolTag bit is set the media changer returns volume tag information in the element descriptors. If the VolTag bit is not set the media changer does not return volume tag information.
Element Type Code	This field specifies the element type(s) selected to report in response to this command. A value of zero (0) indicates that status for all element types is to be reported. <ul style="list-style-type: none"> • 0h – Report all element types. • 1h – Report Medium Transport Elements (Cartridge pickers). • 2h – Report Storage Elements (Cartridge Slots). • 3h – Report Import / Export Elements (Mail Slots). • 4h – Report Data Transfer Elements (Tape drives). • 5h-Fh – Reserved.
Starting Element Address	This field indicates the starting element address. Elements greater or equal than the starting address are returned.
Number of Elements	This field specifies the maximum number of element descriptors to return. If the allocation length is not sufficient to transfer all of the element information, the target transfers all the information that can be completely transferred; this is not an error condition.
CurData	If the CurData bit is set the media changer returns element status data without causing device motion. If the CurData bit is zero (0), the media changer may cause device motion to confirm element status data.
DVCID	If the DVCID bit is set the media changer returns device identifiers for the Data Transfer element. A DVCID bit of zero (0) specifies that the device does not return device identifiers.
Allocation Length	This field specifies the number of bytes that the initiator has allocated for returned data. Note that the Read Element Status command can be issued with an Allocation Length specified as 8 bytes (the length of the status page header) to determine the Allocation Length required to transfer all of the element status data that become available as a result of the command. NEO S-Series can only report up to 65536 bytes of data.

Element Status Data

Data returned by the Read Element Status command is described below. The Element Status Data consists of an 8-byte Header followed by one or more status pages (for each element type). The status pages are made up of an 8-byte sub-header and one or more element descriptors (one for each element address).

Header

The data returned on a Read Element Status command always starts with the Header. This Header reports the first element address, the number of elements, and the byte count of the report.

Byte\Bit	7	6	5	4	3	2	1	0
0 - 1	First Element Address Reported							
2 - 3	Number of Elements Available							
4	Reserved							
5 - 7	Byte Count of Report Available							

Field	Description
First Element Address Reported	This field indicates the element address of the element with the smallest element address found to meet the Read Element Status command's request.
Number of Elements Available	This field indicates the number of elements found. The status for these elements is returned if the Allocation Length specified in the Read Element Status command's CDB was sufficient.
Byte Count of Report Available	This field indicates the number of available element status bytes that meet the CDB requirements. This value does not adjust to match the Allocation Length field of the CDB and does not include the 8-byte element status header.

Medium Transport Element Status Page (01h)

The Medium Transport Element is the device that physically moves the tapes around in the media changer. The media changer has one Medium Transport element. This element can be addressed explicitly with the Medium Transport Element address or, implicitly as address zero (0).

Next table contains a list of the ASC and ASCQ values that appears in the Additional Sense Code and Additional Sense Code Qualifier fields of the Medium Transport Element descriptor if the element is in an abnormal state. The Except field of an element descriptor indicates if an element is in an abnormal state.

Byte\Bit	7	6	5	4	3	2	1	0	
Subheader:									
0	Element Type Code (1h = Medium Transport)								
1	PvolTag	AvolTag	Reserved						
2 - 3	Transport Element Descriptor Length								
4	Reserved								
5 - 7	Byte Count of Descriptor Data Available								
Element Descriptor:									
8 - 9	Medium Transport Element Address								
10	Reserved				Except	Reserved	Full		
11	Reserved								
12	Additional Sense Code								
13	Additional Sense Code Qualifier								
14 - 16	Reserved								
17	Svalid	Invert	Reserved		ED	Medium Type			
18 - 19	Source Storage Element Address								
20 - 55	Primary Volume Tag Information (field omitted if PvolTag = 0)								
56 - 59	Reserved (field moved up if Primary Volume Tag Information field is omitted)								

Element Status Page (Sub-header and Element Descriptor)

The Element Status Page includes an 8-byte sub-header and one or more element descriptors. The sub-header includes the element type code, the settings for PvolTag and AvolTag, the length of each descriptor block, and the number of bytes of descriptor information that follow the header for the element.

Field	Description
Element Type Code	The field specifies the element type of the next element descriptor(s). The supported element type descriptors are: <ul style="list-style-type: none"> • 1h – Medium Transport Element • 2h – Storage Element • 3h – Import/Export Element • 4h – Data Transfer Element
PvolTag	Primary Volume Tag. If the PvolTag bit is set, the device returns Primary Volume Tag information in the Storage and Data Transfer Element descriptors.
AvolTag	Alternate Volume Tag. The media changer does not support dual-sided media. The Alternate Volume Tag label is always set to zero (0) even when the VolTag bit is set in CDB.
Element Descriptor Length	This field indicates the number of bytes in each element descriptor.
Byte Count of Descriptor	This field indicates the number of bytes of element descriptor data available for elements of this element type that meet the request in the CDB. The value is not adjusted to match the allocation length available.
Data Available	The element descriptors include the element address and status flags for the elements and may also contain sense code information and/or other information depending on the element type. The following subsections describe each of the possible element descriptors.

Storage Element Status Page (02h)

The Storage Element is the device that physically stores a cartridge in the media changer. The number of available Storage Elements depends on the media changer model. A Storage Element contains a cartridge when the Full bit is set.

Byte\Bit	7	6	5	4	3	2	1	0
Subheader:								
0	Element Type Code (2h = Storage Element)							
1	PvolTag	AvolTag	Reserved					
2 - 3	Storage Element Descriptor Length							
4	Reserved							
5 - 7	Byte Count of Descriptor Data Available							
Element Descriptor:								
8 - 9	Storage Element Address							
10	Reserved				Access	Except	Reserved	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14 - 16	Reserved							
17	Svalid	Invert	Reserved		ED	Medium Type		
18 - 19	Source Storage Element Address							
20 - 55	Primary Volume Tag Information (field omitted if PvolTag = 0)							
56 - 59	Reserved (field moved up if Primary Volume Tag Information field is omitted)							

Field	Description
PvolTag	Primary Volume Tag. When set this flag indicates valid information in the Primary Volume Tag Information field. This flag was set when the VolTag field was set in the CDB.
AvolTag	Alternate Volume Tag. Always set to zero (0).
Storage Element Address	This field provides the address of the storage element of this changer device whose status is reported by this element descriptor block.
Access	<ul style="list-style-type: none"> When set to one (1) this field indicates that access to the storage element by a media transport element is allowed. When set to zero (0), indicates access to the storage element by a media transport element is denied.
Except	Exception. <ul style="list-style-type: none"> When set to zero (0) indicates the element is in a normal state. When set to one (1), indicates an abnormal state (information may be available in the Additional Sense Code and Additional Sense Code Qualifier fields).
Full	<ul style="list-style-type: none"> A value of one (1) indicates that the storage element address contains a unit of media. A value of zero (0) indicates the storage element address is empty.
Additional Sense Code	This field may provide specific information about an abnormal storage element state.
Additional Sense Code Qualifier	This field may provide more detail about an abnormal storage element state.

Field	Description
Svalid	Source Valid. <ul style="list-style-type: none"> When set to one (1), indicates that the Source Storage Element Address field and the Invert bit information fields are valid. When set to zero (0), indicates that the values in these fields are not valid.
Invert	The media changer uses single sided media and does not support inverting of the media. The value reported for this field is zero (0).
ED	<ul style="list-style-type: none"> An ED bit of one (1) indicates the element is disabled (for example a magazine is not installed or has been logically disabled). An ED bit of zero (0) indicates the element is enabled
Medium Type	The Medium Type field provides the type of media currently present in the Storage Element. The values for the Medium Types can be: <ul style="list-style-type: none"> 0h – Unspecified 1h – Data Medium 2h – Cleaning Medium 3h – Diagnostics Medium 4h – WORM Medium 5h-7h – Reserved
Source Storage Element Address	This field provides the address of the last storage element from which the tape cartridge was moved. Valid only if the Svalid bit is one (1).
Primary Volume Tag Information	When VolTag in the CDB is set the Primary Volume Tag Information field provides identifying the unit of media in this element. When VolTag in the CDB is not set, this field is omitted.

Next table contains a list of the ASC and ASCQ values that appears in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. The Except field of an element descriptor indicates if an element is in an abnormal state.

ASC	ADCQ	Description	Action
3Bh	12h	Magazine removed.	Insert magazine.
83h	00h	Element not scanned	The media changer is busy scanning this element for FULL status. This may be completed within the next few seconds.

Import/Export Element Status Page (03h)

Import/Export elements are locations of volumes that are being inserted into or withdrawn from the media changer. A volume in one of these elements is accessible by the Medium Transport Element and by an operator.

Byte\Bit	7	6	5	4	3	2	1	0
Subheader:								
0	Element Type Code (3h = Import Export Element)							
1	PvolTag	AvolTag	Reserved					
2 - 3	Import/Export Element Descriptor Length							
4	Reserved							
5 - 7	Byte Count of Descriptor Data Available							
Element Descriptor:								
8 - 9	Import/Export Element Address							
10	OIR	CMC	InEnab	ExEnab	Access	Except	ImpExp	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14 - 16	Reserved							
17	Svalid	Invert	Reserved		ED	Medium Type		
18 - 19	Source Storage Element Address							
20 - 55	Primary Volume Tag Information (field omitted if PvolTag = 0)							
56 - 59	Reserved (field moved up if Primary Volume Tag Information field is omitted)							

Field	Description
PvolTag	Primary Volume Tag. When set this flag indicates valid information in the Primary Volume Tag Information field. This flag was set when the VolTag field was set in the CDB.
AvolTag	Alternate Volume Tag. Always set to zero (0).
Storage Element Address	This field provides the address of the storage element of this changer device whose status is reported by this element descriptor block.
Full	<ul style="list-style-type: none"> A value of one (1) indicates that the import/export element address contains a unit of media. A value of zero (0) indicates the import/export element address is empty.
Except	Exception. <ul style="list-style-type: none"> When set to zero (0) indicates the element is in a normal state. When set to one (1), indicates an abnormal state (information may be available in the Additional Sense Code and Additional Sense Code Qualifier fields).
Access	<ul style="list-style-type: none"> When set to one (1), indicates that access to the import/export element by a media transport element is allowed. When set to zero (0), indicates access to the import/export element by a media transport element is denied.
Additional Sense Code	This field may provide specific information about an abnormal import/export element state.
Additional Sense Code Qualifier	This field may provide more detail about an abnormal import/export element state.

Field	Description
Svalid	Source Valid. <ul style="list-style-type: none"> When set to one (1), indicates that the Source Storage Element Address field and the Invert bit information fields are valid. When set to zero (0), indicates that the values in these fields are not valid.
Invert	The media changer uses single sided media and does not support inverting of the media. The value reported for this field is zero (0).
ED	<ul style="list-style-type: none"> When set to one (1), indicates the element is disabled (for example a magazine is not installed or has been logically disabled). When set to zero (0), indicates the element is enabled.
Medium Type	The Medium Type field provides the type of media currently present in the Storage Element. Next table describes the values for the Medium Types: <ul style="list-style-type: none"> 0h – Unspecified 1h – Data Medium 2h – Cleaning Medium 3h – Diagnostics Medium 4h – WORM Medium 5h-7h – Reserved
Source Storage Element Address	This field provides the address of the last storage element from which the tape cartridge was moved. Valid only if the Svalid bit is one (1).
Primary Volume Tag Information	When VolTag in the CDB is set the Primary Volume Tag Information field provides identifying the unit of media in this element. When VolTag in the CDB is not set, this field is omitted.

Next table contains a list of the ASC and ASCQ values that appears in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. The Except field of an element descriptor indicates if an element is in an abnormal state.

ASC	ADCQ	Description	Action
3Bh	12h	Magazine removed.	Insert magazine.
83h	00h	Element not scanned.	The media changer is busy scanning this element for FULL status; this may be completed within the next few seconds.

Data Transfer Element Status Page (04h)

The Data Transfer Element is the device that stores user data on the cartridges in the media changer (Tape Drive). A Data Transfer Element contains a cartridge when the Full bit is set.

Byte\Bit	7	6	5	4	3	2	1	0	
Subheader:									
0	Element Type Code (4h = Data Transfer Element)								
1	PvolTag	AvolTag	Reserved						
2 - 3	Data Transfer Element Descriptor Length								
4	Reserved								
5 - 7	Byte Count of Descriptor Data Available								
Element Descriptor:									
8 - 9	Data Transfer Element Address								
10	Reserved			Access		Except	Reserved	Full	
11	Reserved								
12	Additional Sense Code								
13	Additional Sense Code Qualifier								
14	Obsolete	Reserved	IDValid	Obsolete	Reserved	Obsolete			
15	SCSI Bus Address								
16	Reserved								
17	Svalid	Invert	Reserved		ED	Medium Type			
18 - 19	Source Storage Element Address								
20 - 55	Primary Volume Tag Information (field omitted if PvolTag = 0)								
56	Reserved					Code Set			
57	Reserved					Identifier Type			
58	Reserved								
59	Identifier Length								
60 - 93	(MSB)	Identifier						(LSB)	
(Omitted if DVCID = 0 in CDB)									

Field	Description
PvolTag	Primary Volume Tag. When set this flag indicates valid information in the Primary Volume Tag Information field. This flag was set when the VolTag field was set in the CDB.
AvolTag	Alternate Volume Tag. The media changer does not support dual sided media. The Alternate Volume Tag label is always set to zero (0) even when the VolTag bit is set in the CDB.
Data Transfer Element Address	This field provides the address of the data transfer element of this changer device whose status is reported by this element descriptor block.
Access	<ul style="list-style-type: none"> If set to one (1), indicates that access to the data transfer element by a media transport element is allowed. If set to zero (0), access to the data transfer element by a media transport element is denied. <p>NOTE: A value of one (1) in this bit may not be sufficient to ensure a successful operation. Access is set to zero (0) if the drive has an error that would prevent it from being used. For example, if there is a communication failure between the media changer and the tape drive, then Access is set to zero (0).</p>

Field	Description
Except	<ul style="list-style-type: none"> When set to zero (0), indicates the data transfer element is in a normal state. When set to one (1), indicates an abnormal state (information may be available in the Additional Sense Code and Additional Sense Code Qualifier fields).
Full	<ul style="list-style-type: none"> A value of one (1) indicates that the data transfer element of the changer device contains a tape cartridge. A value of zero (0) indicates the data transfer element is empty.
Additional Sense Code	This field may provide specific information about the abnormal data transfer element state.
Additional Sense Code Qualifier	This field may provide more detail about an abnormal data transfer element state.
IDValid	When set to one (1), the SCSI Bus Address field reports the SCSI address of the Data Transfer Element.
SCSI Bus Address	This field returns the SCSI Bus Address of the Data Transfer Element.
Svalid	Source Valid. <ul style="list-style-type: none"> When set to one (1), indicates that the Source Storage Element Address field and the Invert bit fields are valid. When set to zero (0), indicates that the values in these fields are not valid.
Invert	The media changer uses single sided media and does not support inverting of the media. The value reported for this field is zero (0).
ED	<ul style="list-style-type: none"> A value of one (1) indicates the element is disabled (for example the tape drive is not installed or has been logically disabled). A value of zero (0) indicates the element is enabled.
Medium Type	<p>The Medium Type field provides the type of media currently present in the data transfer element. The following describes the values for the Medium Types:</p> <ul style="list-style-type: none"> 0h – Unspecified 1h – Data Medium 2h – Cleaning Medium 3h – Diagnostics Medium 4h – WORM Medium 5h-7h – Reserved
Source Storage Element Address	This field provides the address of the last storage element from which the tape cartridge was moved. Valid only if the Svalid bit is one (1).
Primary Volume Tag Information	<p>When VolTag in CDB was set the media changer returns a 36-byte PvolTag Identifier. This identifier contains the barcode label of the cartridge mounted in the tape drive.</p> <p>The first six (6) characters are any combination of upper case A-Z or 0-9 (such as ABC123) to identify the cartridge volume. The last two (2) characters are determined by the cartridge media type (for example, “L” for LTO and “1” for tape cartridge generation or drive manufacturer unique identifier).</p>
Code Set	If the DVCID bit is set in the CDB, the Code Set field is set to “2h,” indicating that ASCII values are returned. If the DVCID bit in the CDB is set to zero (0), the Code Set is set to “0h.”
Identifier Type	If the DVCID bit is set in the CDB, the Identifier Type is set to “1h.” This indicates that the identifier field contains an eight-byte vendor identifier followed by vendor unique identifier information. If the DVCID bit in the CDB is set to zero (0), the Identifier Type field is set to “0h.”

Field	Description
Identifier Length	If the DVCID bit is set in the CDB the media changer returns a 34-byte structure with information about the tape drive. In this structure, the tape drive Vendor ID, Product ID, and the tape drive serial number are reported. The Identifier Length field contains the length in bytes of the Identifier field. When the DVCID bit is not set in the CDB, the Identifier Length field is set to "00h."
Identifier	If the DVCID bit is set in the CDB, the Identifier field provides the Vendor ID, Product ID, and tape drive serial number. If the DVCID bit in the CDB is set to zero (0), the Identifier field is omitted. The Identifier structure is described below: <ul style="list-style-type: none"> • Bytes 0 to 7 – Vendor Identifier (8 ASCII bytes) • Bytes 8 to 23 – Product Identifier (16 ASCII bytes) • Bytes 24 to 33 – Tape Drive serial number (10 ASCII bytes)

Next table contains a list of the ASC and ASCQ values that appears in the Additional Sense Code and Additional Sense Code Qualifier fields of the Data Transfer Element descriptor if the element is in an abnormal state. The Except field of an element descriptor indicates if an element is in an abnormal state.

ASC	ADCQ	Description	Action
3Bh	12h	Magazine removed.	Insert magazine.
80h	BDh	Drive communication problem.	The media changer has problems communicating with the tape drive. Make sure the tape drive is properly connected.

RELEASE 6 (17h)

The RELEASE 6 command allows an application client to release a previously reserved media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	LUN			Obsolete				
2	Obsolete							
3	Reserved							
4	Reserved							
5	Control							

RELEASE 10 (57h)

The RELEASE 10 command allows an application client to release a previously reserved media changer. Third-Party release allows an application client to release a logical unit that was previously reserved using third party reservation.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (57h)							
1	LUN			3rdPty	Reserved		LongID	Reserved
2	Obsolete							
3	Third-Party Device ID							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)	Parameter List Length						
8	(LSB)							
9	Control							

Field	Description
LongID	Device IDs greater than 255 are not supported. Setting of LongID results in a Check Condition status. The Sense Key is set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.
3rdPty	<ul style="list-style-type: none"> When set to zero (0), then a third-party release is not requested and the LongID and Parameter List Length field is ignored. When set to one (1), then the media changer releases the reservation, but only if the initiator ID and Third-Party Device ID are identical when compared to the RESERVE command that established the reservation.
Third-Party Device ID	This field provides the Device ID for the third party when 3rdPty bit is set.

REPORT LUNS (A0h)

The REPORT LUNS command requests the media changer logical unit inventory be sent to the application client. The returned logical unit inventory includes all the logical units within the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (A0h)							
1	LUN					Reserved		
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)	Allocation Length						
7								
8								
9	(LSB)							
10	Reserved							
11	Control							

Field	Description
Allocation Length	This field specifies the maximum length of parameter list data the hosts is capable to receive.
Select Report	<p>This field specifies the types of Logical Unit Addresses that are reported.</p> <ul style="list-style-type: none"> • 00h – The list contains the logical units accessible to the I_T nexus with addressing methods of either logical unit, peripheral device, or flat space addressing method (see SAM-3). • 01h – The list contains only well-known logical units, is any. If there are no well-known logical units, the LUN List Length field is set to zero (0). • 02h – The list contains all logical units accessible to the I_T nexus. • 03h–FFh – Reserved. <p>If there are no logical units, the LUN List Length field is set to zero (0).</p>

If the allocation length is less than 16 bytes, the media changer returns Check Condition status. The sense key is set to ILLEGAL REQUEST and the sense data is set to INVALID FIELD IN CDB.

This table describes the returned logical unit inventory data:

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB)	LUN List Length (0008h)						
3	(LSB)							
4	(MSB)	Reserved						
7	(LSB)							
8	Address Method (0h)				Bus Identifier (00h)			
9	Single Level LUN (00h)							
10	(MSB)	Null Second Level						
11	(LSB)							
12	(MSB)	Null Third Level						
13	(LSB)							
14	(MSB)	Null Fourth Level						
15	(LSB)							

REPORT SUPPORTED OPERATION CODES (A3h)

The REPORT SUPPORTED OPERATION CODES command requests information on commands the addressed logical unit supports. An application client may request a list of all operation codes and service actions supported by the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (A3h)							
1	LUN				Service Action (0Ch)			
2	Reserved				Reporting Options			
3	Requested Operation Code							
4	(MSB)	Requested Service Action						
5	(LSB)							
6	(MSB)							
7	Allocation Length							
8								
9	(LSB)							
10	Reserved							
11	Control							

Field	Description
Reporting Options	<p>The Reporting Options field specifies the information to be returned in the parameter data.</p> <ul style="list-style-type: none"> • 000b – A list of all operation codes and service actions supported by the logical unit is returned in the All Commands Parameter data format. The Requested Operation Code CDB field and Requested Service Action CDB field is ignored. • 001b – The command support data for the operation code specified in the Requested Operation Code field is returned in the One Command Parameter data format. The Requested Service Action CDB field is ignored. If the Requested Operation Code field specifies an operation code that has service actions, then the command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. • 010b – The command support data for the operation code and service action specified in the Requested Operation Code CDB field and Requested Service Action CDB field is returned in the One Command Parameter data format. If the Requested Operation Code CDB field specifies an operation code that does not have service actions, then the command is terminated with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. • 011b – Reserved.
Requested Operation Code	The Requested Operation Code field specifies the operation code of the command to be returned in the One Command Parameter data format.
Requested Service Action	The Requested Service Action field specifies the service action of the command to be returned in the One Command Parameter data format.
Allocation Length	The Allocation length field specifies the length in bytes of the SET TIMESTAMP parameters that is transferred from the application client to the device server. A parameter list length of zero (0) indicates that no data is transferred, and that no change is made to the time stamp.

The REPORT SUPPORTED OPERATION CODES All Commands Parameter data format begins with a four-byte header that contains the length in bytes of the parameter data followed by a list of supported commands. Each command descriptor contains information about a single-supported command CDB (for example, one operation code and service action combination, or one non-service action operation code). The list of command descriptors contains all commands supported by the logical unit.

The All Commands Parameter data format is shown in next table.

Byte\Bit	7	6	5	4	3	2	1	0
0 - 3	Command Data Length (n-3)							
4 - n	Command Descriptors							

Each Command Descriptor contains information about a single-supported command CDB. The Command Descriptor format is shown in next table:

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code							
1	Reserved							
2	(MSB)	Service Action						
3	(LSB)							
4 - 5	Reserved							
6	(MSB)	CDB Length						
7	(LSB)							

Field	Description
Support	<p>The Reporting Options field specifies the information to be returned in the parameter data.</p> <ul style="list-style-type: none"> • 000b – Data about the requested SCSI command is not currently available. All data after byte 1 is not valid. A subsequent for command support data may be successful. • 001b – The device server does not support the requested command. All data after byte 1 is undefined. • 010b – Reserved. • 011b – The device server supports the requested command in conformance with a SCSI standard. • 100h – Reserved. • 101h – The device server supports the requested command in a vendor specific manner. • 110h – Reserved.

The REPORT SUPPORTED OPERATION CODES One Command Parameter data format contains information about the CDB and a usage map for bits in the CDB for the command specified by the Reporting Options, Requested Operation Code, and Requested Service Action fields in the REPORT SUPPORTED OPERATION CODES CDB.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved						Support	
2	(MSB)	CDB Size ($n-3$)						
3	(LSB)							
4	CDB Usage Data							
n	(LSB)							

Field	Description
Support	<p>The Support field specifies the information to be returned in the parameter data.</p> <ul style="list-style-type: none"> • 000b – Data about the requested SCSI command is not currently available. All data after byte 1 is not valid. A subsequent request for command support data may be successful. • 001b – The device server does not support the requested command. All data after byte 1 is undefined. • 010b – Reserved. • 011b – The device server supports the requested command in conformance with a SCSI standard. • 100h – Reserved. • 101h – The device server supports the requested command in a vendor specific manner. • 110h – Reserved.

REPORT TIMESTAMP (A3h)

The REPORT TIMESTAMP command allows an application client to retrieve the timestamp of the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (A3h)							
1	LUN				Service Action (OFh)			
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)							
7	Allocation Length							
8								
9	(LSB)							
10	Reserved							
11	Control							

Field	Description
Allocation Length	The Allocation Length field specifies the number of bytes the application client has allocated for the returned data.

The Timestamp is not affected by an I_T nexus loss or a logical unit reset. The Timestamp is cleared on a hard reset event.

The REPORT TIMESTAMP parameter data format:

Byte\Bit	7	6	5	4	3	2	1	0
0 - 1	Timestamp Parameter Data Length (0Ah)							
2	Reserved				Timestamp Origin			
3	Reserved							
4 - 9	Timestamp							
10 - 11	Reserved							

Field	Description
Timestamp Parameter Data Length	This field indicates the number of bytes of parameter data that follow.
Timestamp Origin	The Timestamp Origin field indicates the origin of the timestamp. <ul style="list-style-type: none"> • 000b – Timestamp initialized to zero (0) at power-on or as the result of a hard reset. • 001b – Reserved. • 010b – Timestamp initialized by the SET TIMESTAMP command. • 011b – Timestamp initialized by methods outside the scope of this standard.
Timestamp	The Timestamp field contains the current value of the timestamp. The Timestamp field returns the number of milliseconds that have elapsed since midnight, 1 January 1970 UT.

REQUEST SENSE (03h)

The REQUEST SENSE command allows an application client to retrieve the sense data of the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (03h)							
1	LUN			Reserved				
2	Reserved							
3	Reserved							
4	Allocation Length							
5	Control							

Field	Description
Allocation Length	This field specifies the maximum sense data length the hosts wants to receive.

The sense data is valid for a check condition status returned on the previous command. The sense data bytes are preserved by the media changer until retrieved by the REQUEST SENSE command from the same initiator.

If the media changer receives a REQUEST SENSE command, it returns up to 18 bytes of sense data with the appropriate values in the Sense Key, Additional Sense Code, and Additional Sense Code Qualifier.

Byte\Bit	7	6	5	4	3	2	1	0
0	Valid (0)	Response Code (70h)						
1	Segment Number							
2	Filemark	EOM	ILI	Reserved	Sense Key			
3 - 6	Information							
7	Additional Sense Length (0Ah)							
8 - 11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Reserved							
15	SKSV	C/D	Reserved		BPV	Bit Pointer		
16	(MSB) Field Pointer							
17	(LSB)							

Field	Description
Valid	A Valid bit of one (1) indicates that the Information field contains valid information as defined in the SCSI specification. This bit is set to zero (0).
Response Code	<ul style="list-style-type: none"> A value of "70h" indicates a current error. The report is associated with the most recently received command. A value of "71h" indicates deferred errors not implemented. No other values are returned.
Segment Number	This byte contains the number of the current segment descriptor if the Request Sense command is the response to a Copy, Compare, or Copy and Verify command. It is always zero (0).
Filemark	This bit is only used in sequential access devices. It is always set to zero (0).
EOM	End Of Medium. This bit is for sequential-access and printer devices. This bit is always set to zero (0).
ILI	Incorrect Length Indicator. This indicates that the requested block length did not match the logical of the data on the media. This bit is always set to zero (0).
Sense Key, ASC, ASCQ	<p>Sense Key, Additional Sense Code, and Additional Sense Code Qualifier provide a hierarchy of information.</p> <p>The sense key provides generic categories in which error and exception conditions can be reported. Additional sense code provide further detail describing the sense code. Additional sense code qualifiers add further detail to the additional sense code. These bytes show detailed information about the error and exception conditions.</p>
Information	The contents of the information field is device-type or command specific. These bytes are always zero (0).
Additional Sense Length	This field specifies the number of additional sense bytes to follow. If the allocation length of the command descriptor block is too small to transfer all of the additional sense bytes, the additional sense is not adjusted to reflect the truncation.
SKSV	<p>Sense-Key Specific Valid.</p> <ul style="list-style-type: none"> When set to zero (0), bytes 15, 16, and 17) do not contain valid data. When set to one (1), bytes 15, 16, and 17 contain additional information regarding the error condition.

Field	Description
C/D	Command Data. <ul style="list-style-type: none"> • A value of one (1) indicates that the illegal parameter is in the CDB. • A value of zero (0) indicates that the illegal condition is in the data parameters send by the host.
BPV	Bit Pointer Valid. <ul style="list-style-type: none"> • A value of zero (0) indicates that the value is not valid. • A value of one (1) indicates which bit of the byte specified in the Field Pointer field is in error.
Field Pointer	This indicates which byte of the CDB or parameter data was in error. Bytes are numbered starting from zero (0), as shown in the tables describing the commands and parameters.

Possible Sense Keys

Sense Key	Description
0h – NO SENSE	Indicates there is no specific sense key information to be reported.
1h – RECOVERED ERROR	Indicates that the last command completed successfully with some recovery action performed by the device server.
2h – NOT READY	Indicates that the logical unit addressed cannot be accessed. Operator intervention may be required to correct this condition.
4h – HARDWARE ERROR	Indicates that the device server detected a non-recoverable hardware failure (for example, controller failure, device failure, or parity error) while performing the command or during a self test.
5h – ILLEGAL REQUEST	Indicates there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands.
6h – UNIT ATTENTION	Indicates that the removable media may have been changed or the target has been reset.
Bh – ABORTED COMMAND	Indicates that the device server aborted the command.

NOTE: A list of possible sense keys with supported sense codes (ASC) and additional sense code qualifiers (ASCQ) is available in [Used Sense Keys, ASC, and ASCQ](#) on page 82.

REQUEST VOLUME ELEMENT ADDRESS (B5h)

The REQUEST VOLUME ELEMENT ADDRESS command allows an application client to retrieve the results of the last successful SEND VOLUME TAG command with the Send Action Code field set to a Translate search value. Multiple REQUEST VOLUME ELEMENT ADDRESS commands can be used to retrieve the results of a single SEND VOLUME TAG command.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (B5h)							
1	LUN			VolTag		Obsolete		
2	(MSB) Element Address							
3	(LSB)							
4	(MSB) Number of Elements to Report							
5	(LSB)							
6	Reserved							
7	(MSB)							
8	Allocation Length							
9	(LSB)							
10	Reserved							
11	Control							

For each Send Volume Tag command, the media changer reports, in response to a Request Volume Element Address command, zero or more 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 is reported by subsequent Request Volume Element Address commands.

Field	Description
VolTag	<ul style="list-style-type: none"> A value of one (1) indicates that the media changer reports volume tag information. A value of zero (0) indicates that the volume tag information is not reported.
Element Address	The Element Address field specifies a media changer element address whose interpretation depends on the Send Action Code field of the last successful Send Volume Tag command. When the Send Action Code field was Translate, the Element Address field gives the minimum element address to be reported by this command. When the Send Action Code field is Assert, Replace, or Undefine, the Element Address field gives the particular element whose volume tag information was modified.
Number of Elements to Report	Specifies the maximum number of elements to report of those that match the last Send Volume Tag command translate template.
Allocation Length	If the Allocation Length is not sufficient to transfer all the element descriptors, the media changer only returns those descriptors whose complete contents fit within the allocation length.

RESERVE 6 (16h)

The RESERVE command allows an initiator to reserve the media changer. After reserving the media changer, only INQUIRY, LOG SENSE, RELEASE, REQUEST SENSE, REPORT LUNS, READ ELEMENT STATUS (with CurData set), or ALLOW MEDIUM REMOVAL commands are accepted from other initiators. All other commands result in a Reservation Conflict status.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	LUN			Obsolete				
2	Obsolete							
3	Obsolete							
4								
5	Control							

RESERVE 10 (56h)

The RESERVE and RELEASE commands provide the mechanism for contention resolution in multiple initiator systems. The third-party reservation allows logical units to be reserved for another specified SCSI device. When a initiator reserves the media changer, only INQUIRY, LOG SENSE, RELEASE, REQUEST SENSE, REPORT LUNS, READ ELEMENT STATUS (with CurData set), or ALLOW MEDIUM REMOVAL commands are accepted from other initiators. All other commands result in a Reservation Conflict status.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (56h)							
1	LUN			3rdPty	Reserved		LongID	Reserved
2	Obsolete							
3	Third-Party Device ID							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)	Parameter List Length						
8	(LSB)							
9	Control							

Field	Description
LongID	Device IDs greater than 255 are not supported and results in the setting of LongID results to a Check Condition status with the Sense Key set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.
3rdPty	<ul style="list-style-type: none"> When set to zero (0), a third-party reservation is not requested and the LongID and Parameter List Length field is ignored. When set to one (1), the media changer is reserved by the initiator ID specified in the Third-Party Device ID field. The reservation is preserved until it is superseded by another valid RESERVE command from the initiator that made the reservation or until it is released by either the same initiator, a SCSI RESET message, a Hard Reset condition, or by a power-on cycle. The media changer ignores any attempt to release the reservation made by any other initiator.
Third-Party Device ID	This field provides the Device ID for the third party when 3rdPty bit is set.

SEND DIAGNOSTIC (1Dh)

By means of the SEND DIAGNOSTIC command, an application client can request the media changer to perform a self-test operation. During this self-test, the serial communication to the tape drive and robotics is tested. Also, this command reports any pending Hardware Error condition.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	LUN			PF	Reserved	Self Test	DevOffIn	UnitOffIn
2	Reserved							
3	(MSB)	Parameter List Length (0)						
4	(LSB)							
5	Control							

Field	Description
PF	Page Format. <ul style="list-style-type: none"> When set to one (1), indicated that the SEND DIAGNOSTIC parameters conform to the page structure as specified in SCSI-1. When set to zero (0), this bit is ignored.
SelfTest	When this bit is set and the Parameter List Length field is set to zero (0), the media changer executes the diagnostic self-test. A GOOD status is returned when the self-test passes; an error code returns when the self-test fails.
DevOffIn	Device Offline. The logical unit state in the media changer is not altered by the SEND DIAGNOSTIC command. This bit is ignored.
UnitOffIn	Unit Offline. The SEND DIAGNOSTIC command does not alter the state of the media. This bit is ignored.
Parameter List Length	The media changer does not accept additional parameters for diagnostics test. This field must be set to zero (0).

SEND VOLUME TAG (B6h)

By means of the SEND VOLUME TAG command, an application client can either transfer a volume tag template to be used for a search of existing volume tag information or establish new volume tag information for a volume residing in a media changer element address. The function of the command is conveyed by the Send Action Code field value. The REQUEST VOLUME ELEMENT ADDRESS command can be used to transfer the results of a translate search operation.

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

Field	Description
Element Type Code	<p>The Element Type Code field specifies an element type specification as defined in the Read Element Status command.</p> <ul style="list-style-type: none"> • If the Send Action Code field indicates a translate operation, this field indicates the element types to be searched. • If the value is zero (0), all element types are candidates for a translate operation. <p>If the Send Action Code does not indicate a translate operation, this field is treated as reserved.</p>
Element Address	<p>The Element Address field gives the media changer element address whose interpretation depends on the Send Action Code field.</p> <ul style="list-style-type: none"> • When the Send Action Code field is Translate, the Element Address field gives the starting element to be examined for the search operation. • When the Send Action Code field is Assert, Replace, or Undefined, the Element Address field gives the specific Element Address where the volume tag information for a volume is to be modified.
Send Action Code	<p>The Send Action Code field gives the function to be performed by this command as specified in next table:</p> <ul style="list-style-type: none"> • 0h – Translate—search all defined volume tags. • 1h – Translate—search only primary volume tags. • 4h – Translate—search all defined tags, ignore sequence numbers. • 5h – Translate—search primary tags, ignore sequence numbers. • 8h – Assert—as the primary volume tag, if tag now undefined. • Ah – Replace—the primary volume tag; current tag ignored. • Ch – Undefine—the primary volume tag; current tag ignored.
Parameter List Length	<p>The Parameter List Length field is zero (0) when the Send Action Code is an undefine function. The Parameter List Length is set to the length of the Send Volume Tag Parameter structure.</p>

Send Volume Tag Parameter structure

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

Field	Description
Volume Identification Template	<p>The Volume Identification Template field specifies a search template for translate functions and the value of the new volume identification information for other Send Volume Tag command functions.</p> <p>As a search template, this field may contain the wildcard characters question mark (?) and asterisk (*). The question mark matches any single character while the asterisk matches any string of characters. When it appears in a template, the remainder of the template at higher offsets in the field is not used.</p> <p>NOTE: For Assert, Replace, or Undefined functions, the wildcard characters are not used.</p>
Minimum Volume Sequence Number	<p>The Minimum Volume Sequence Number field specifies the new sequence number for the assert and replace functions. For a Translate function, this field specifies the least value in the volume sequence number field of the volume tag information that meets the search specification.</p>
Maximum Volume Sequence Number	<p>The Maximum Volume Sequence Number field specifies the maximum number value in the volume sequence number field of the volume tag information that meets the search specification.</p> <p>NOTE: This field is ignored for Assert, Replace, and Undefined functions.</p>

SET TIMESTAMP (A4h)

If the SCSIIP bit is set to one (1) or the ATCMOS bit is set to one (1) in the Control Extension mode page, the SET TIMESTAMP command allows an application client to initialize the timestamp in the media changer. If the SCSIIP bit is set to zero (0), the SET TIMESTAMP command is terminated with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

Byte\Bit	7	6	5	4	3	2	1	0
0	Operation Code (A4h)							
1	LUN				Service Action (0Fh)			
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)							
7	Parameter List Length							
8								
9	(LSB)							
10	Reserved							
11	Control							

Field	Description
Parameter List Length	<p>The PARAMETER LIST LENGTH field specifies the length in bytes of the SET TIMESTAMP parameters that are transferred from the application client to the device server. A parameter list length of zero (0) indicates that no data is transferred, and that no change is made to the timestamp.</p>

SET TIMESTAMP Parameter Data Format

Byte\Bit	7	6	5	4	3	2	1	0
0 - 3					Reserved			
4 - 9					Time Stamp			
10 - 11					Reserved			

The **TIMESTAMP** field contains the initial value of the timestamp in the format defined above. The Timestamp field represents the number of milliseconds elapsed since midnight, 1 January 1970 UT. If the high-order byte in the **TIMESTAMP** field is greater than “F0h,” the command is terminated with **CHECK CONDITION** status, the sense key set to **ILLEGAL REQUEST**, and the additional sense code set to **INVALID FIELD IN PARAMETER LIST**.

On successful completion of a **SET TIMESTAMP** command, the device server generates a unit attention condition for the initiator port associated with every **I_T** nexus except the **I_T** set to **TIMESTAMP CHANGED**.

TEST UNIT READY (00h)

The **TEST UNIT READY** command allows an application client to determine if the media changer is ready for commands involving cartridge movement. If the media changer has completed initialization and the magazines are inserted, the command returns **GOOD** status. Otherwise, a **CHECK CONDITION** status is returned.

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

WRITE BUFFER (3Bh)

The **WRITE BUFFER** command is used in conjunction with the **READ BUFFER** command as a diagnostic function for testing the device data buffer, DMA engine, SCSI bus interface hardware, and SCSI bus integrity. Additional modes are provided for downloading and saving micro code and updating Vendor Unique settings.

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

Field	Description
Mode	<p>The Mode field is used to select the mode of operation. The media changer supports the following values within this field.</p> <ul style="list-style-type: none"> • 0001b – Vendor Unique operation • 0010b – Data • 0100b – Download Micro Code • 1000b – Download Micro Code And Save • 1010b – Echo buffer <p>If any non-supported value is set, the media changer terminates the command with a Check Condition status. The sense key is set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.</p>
Buffer ID	<ul style="list-style-type: none"> • When the Mode is set to Download Micro Code or Download Micro Code And Save, the Buffer ID must be set to zero (0). • When the Mode is set to Vendor Unique operation, the Buffer ID indicates the requested page to update. <p>If the value of the Buffer ID is not supported by the specified Mode, the command is rejected. The target detects and rejects commands that would overrun the buffer.</p>
Buffer Offset	<p>The Buffer Offset field specifies the location in the buffer to which the data is written. This field is supported for the Download Micro Code, Download Micro Code And Save, Vendor Unique, and Data modes. In all other modes, the Buffer Offset must be set to zero (0).</p>

Command Elements

Modes

Write Data Mode

Using the Write Data mode, SCSI bus integrity can be tested in conjunction with the READ BUFFER command. The host can use this mode send up to 256 bytes to the media changer. This data can be retrieved by means of the READ BUFFER command. The Buffer Offset specifies the offset within the buffer. Potential buffer overruns are detected and results in a Check Condition being set with the sense key set to ILLEGAL REQUEST and the additional sense data set to INVALID FIELD IN CDB.

Download Micro Code/Download Micro Code And Save Modes

In these modes, vendor-specific micro code is transferred to the media changer and, if the WRITE BUFFER command is completed successfully, it is also saved in non-volatile memory. The downloaded code is effective after each power cycle. The firmware image can be sent in variable length blocks; the buffer offset should be the incremental of the previously sent code. After download is complete, the media changer generates a unit attention condition to all initiators. The additional sense code MICROCODE HAS BEEN CHANGED is set. The Parameter List Length of the firmware image is not defined; it can be set to any size.

The supported Buffer ID field for Mode 4 (Download Micro Code) and Mode 5 (Download Micro Code And Save) are:

Buffer ID	Description	Parameter List Length
00h	Micro Code Image	variable
88h	Micro Code Image	variable

Vendor Unique Operation Mode

A WRITE BUFFER command with the mode set to Vendor Unique Mode is used to modify parameters stored in non-volatile RAM. The Buffer ID specifies the requested page to modify.

Buffer ID	Description	Parameter List Length
00h	Variables Setting page	002Eh
FEh	IEEE EUI-64 Identifier	000Ch
FFh	Media changer Serial Number page	000Eh

The following table specifies the structure of the Variables Setting buffer ID. This buffer ID is used to transfer specific settings to the media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Additional Page Length (2Ch)							
2	Reserved							
3	Reserved							
4 - 45	(MSB)	Variables (42 bytes)						(LSB)

The next table defines the variables' default values and descriptions. Changed values are stored in NVRAM and are recalled after a power on. Current values can be requested by means of the READ BUFFER command.

Byte <i>n</i>	Name	Length	Default Value	Supported	Description
0	Reserved				
1	Barcode Enabled	1	0	No	Enables the barcode reader.
2	Drive SCSI ID	1	4	Yes	Drive 0 SCSI ID is used after next power-on reset.
3 - 5	Reserved				
6	Library SCSI ID	1	0	No	Media changer SCSI ID is used after next power-on reset.
7	Reserved				
8 - 15	Vendor ID	8	BDT	YES	Vendor Identification String
16 - 31	Product ID	16	S-Series	Yes	Product Identification String
32 - 39	Reserved				
40	Operation Mode	1	0	No	Possible settings include: <ul style="list-style-type: none"> • 0 - Random Mode • 1 - Select Sequential Mode • 2 - Sequential Circular Mode
41 - 42	Reserved				

The following table specifies the structure of the IEEE EUI-64 Identifier buffer ID. This buffer ID is used to set the IEEE EUI-64 Identifier in production. This identifier is reported in the Inquiry VPD 83h page and is unique for every media changer.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Additional Page Length (0Ah)							
2	Reserved							
3	Reserved							
4 - 45	(MSB)	IEEE EUI-64 Identifier (8 bytes)						(LSB)

The following table specifies the structure for the media changer serial number buffer ID. This buffer ID is used to set the media changers serial number in production. The serial number can be read back by means of the INQUIRY command.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Additional Page Length (0Ch)							
2	Reserved							
3	Reserved							
4 - 45	(MSB)	Serial Number (10 bytes)						(LSB)

Echo Buffer Mode

In this mode, the host can send data to the echo buffer. The data in the echo buffer is preserved until the media changer is reset, power cycled or overwritten by another host. The Buffer ID and Buffer Offset fields are ignored in this mode. The capacity of the echo buffer can be determined by the Buffer Capacity field in the READ BUFFER echo buffer descriptor. The maximum length of the Echo Mode buffer is 256 bytes. When the parameter list length exceeds the total length of this page, the media changer returns Check Condition status. The sense key is set to ILLEGAL REQUEST and the sense data set to INVALID FIELD IN CDB.

Byte\Bit	7	6	5	4	3	2	1	0
0 - n	(Echo Mode WRITE BUFFER data)							

Echo Buffer Descriptor Mode

In this mode, the media changer returns the descriptor information for the Echo Buffer. The Buffer Offset field is reserved in this mode. The Buffer ID field is ignored in this mode. Next table specifies the Buffer Descriptor, which is returned on a READ BUFFER command in Echo Buffer Descriptor Mode.

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							EBOS
1	Reserved							
2	Reserved			(MSB)	Buffer Capacity			
3	(LSB)							

Field	Description
EBOS	The Echo Buffer Overwritten Support bit is set. The media changer returns ECHO_BUFFER_OVERWRITEN sense data when the buffer is overwritten by another initiator.
Buffer Capacity	The Buffer Capacity field returns the maximum size of the Echo Buffer in bytes. The Echo Buffer can store up to 256 bytes.

Command Status Byte

The media changer enters the status phase once for each received command. The supported status bytes are shown in next table:

Status	Value	Description
Good	00h	This status indicates, that the media changer successfully completed the command.
Check condition	02h	An error condition occurred during command processing. The REQUEST SENSE command responds with detailed error information.
Busy	08h	The target is busy. This status is returned when the device is unable to accept a command from an otherwise acceptable initiator. The initiator should reissue the command at later time.
Reservation conflict	18h	This status is returned by the media changer when a SCSI initiator attempts to access the media changer after it is reserved by another initiator with the RESERVE command.

Command Timeouts

The table below lists the media changer commands with the recommended nominal and maximum time-out values for a single (non-extended) library and an extended library. The extended library command timeouts are longer due to the extra handling required to transport the media through the extender.

NOTE: If the media changer is working in a multi host environment, the time-out values should be adjusted for the worst case time-out value from a pending motion command from another host. If the media changer is partitioned, the time-out values should be adjusted for the worst case time-out value due to a pending motion command in another partition.

Op Code	SCSI Command	Command Timeout – Nominal	Command Timeout – Maximum	Note No.
A6h	EXCHANGE MEDIUM (between slot and slot)	36 minutes	62 minutes	
	EXCHANGE MEDIUM (implicit between drive and slot) The media changer initiates the unload of the cartridge from the drive. The EXCHANGE MEDIUM command timeout has been adjusted to account for maximum unload time).	50 minutes	76 minutes	3
	EXCHANGE MEDIUM (explicit between drive and slot) The host has issued an UNLOAD command to the tape drive prior to issuing the EXCHANGE MEDIUM command.	38 minutes	64 minutes	
07h	INITIALIZE ELEMENT STATUS	11 minutes	20 minutes	1

Op Code	SCSI Command	Command Timeout – Nominal	Command Timeout – Maximum	Note No.
37h	INITIALIZE ELEMENT STATUS WITH RANGE with FAST bit set (ignore barcode labels)	11 minutes	20 minutes	2
	INITIALIZE ELEMENT STATUS WITH RANGE with FAST bit cleared (scan barcode labels)	11 minutes	20 minutes	2
12h	INQUIRY	10 seconds	10 seconds	
4Dh	LOG SENSE	30 seconds	30 seconds	
15h	MODE SELECT 6	30 seconds	30 seconds	
55h	MODE SELECT 10	30 seconds	30 seconds	
1Ah	MODE SENSE 6	30 seconds	30 seconds	
5Ah	MODE SENSE 10	30 seconds	30 seconds	
A5h	MOVE MEDIUM (slot to slot)	12 minute	25 minutes	
	MOVE MEDIUM (slot to drive)	25 minutes	38 minutes	
	MOVE MEDIUM (implicit drive to slot) The media changer initiates the unload of the cartridge from the drive. The MODE MEDIUM command timeout has been adjusted to account for maximum unload time.	25 minutes	38 minutes	3
	MOVE MEDIUM (explicit drive to slot) The host has issued an UNLOAD command to the tape drive prior to issuing the MOVE MEDIUM command.	13 minutes	26 minutes	
1Bh	OPEN/CLOSE IMPORT/EXPORT ELEMENT	10 minutes	10 minutes	
5Eh	PERSISTENT RESERVE IN	30 seconds	30 seconds	
5Fh	PESISTENT RESERVE OUT	30 seconds	30 seconds	
2Bh	POSITION TO ELEMENT	10 minute	10 minutes	
1Eh	PREVENT/ALLOW MEDIUM REMOVAL	30 seconds	30 seconds	
3Ch	READ BUFFER	30 seconds	30 seconds	4
B8h	READ ELEMENT STATUS (curdata = 1)	30 seconds	30 seconds	
B8h	READ ELEMENT STATUS (curdata = 0)	11 minutes	11 minutes	
17h	RELEASE 6	30 seconds	30 seconds	
57h	RELEASE 10	30 seconds	30 seconds	
02h	REQUEST SENSE	10 seconds	10 seconds	
16h	RESERVE 6	30 seconds	30 seconds	
56h	RESERVE 10	30 seconds	30 seconds	
A0h	REPORT LUNS	10 seconds	10 seconds	
A3h	REPORT TIMESTAMP	30 seconds	30 seconds	
A3h	REPORT SUPPORTED OPERATION CODES	30 seconds	30 seconds	
B5h	REQUEST VOLUME ELEMENT ADDRESS	30 seconds	30 seconds	
1Dh	SEND DIAGNOSTICS	11 minutes	11 minutes	
B6h	SEND VOLUME TAG	30 seconds	30 seconds	
A4h	SET TIMESTAMP	30 seconds	30 seconds	
00h	TEST UNIT READY	10 seconds	10 seconds	
3Bh	WRITE BUFFER	3 minutes	3 minutes	5

Notes (from table):

1. The Initialize Element Status time-out assumes a fully populated unit.
2. The Initialize Element Status With Range time-out assumes a fully populated unit.
3. The Move Medium command assumes a move from one storage element to the data transfer element or vice versa. If the cartridge has not been unloaded by a host command to the tape drive, prior to receiving the Move Medium command, the media changer issues an Unload command to the tape drive. The time-out value needs to be adjusted for the maximum time a data transfer element takes to rewind and unload the cartridge.
4. The Read Buffer time-out is based on a 16K-data-chunk request. Adjust the time-out value if larger data chunks are requested.
5. The Write Buffer time-out is based on a 16K-data-chunk request. Adjust the time-out value if larger data chunks are sent.

Supported Tape Alert Flags

The following Tape Alert Flags are supported in the media changer:

Parameter Code	Flag Name	Type	Description
01d	Library Hardware A	C	The library mechanism is having difficulty communicating with the drive: <ul style="list-style-type: none"> • Turn the media changer OFF then ON. • Restart the operation. • If problem persists, contact Technical Support.
02d	Library Hardware B	W	There is a problem with the library mechanism. If the problem persists, contact Technical Support.
04d	Library Hardware D	C	The library has a hardware fault that is not mechanically related or requires a power cycle to recover: <ul style="list-style-type: none"> • Turn the media changer OFF then ON. • Restart the operation. • If the problem persists, contact Technical Support.
05d	Library Diagnostics Required	W	The library mechanism may have a hardware fault. Run extended diagnostics to verify and diagnose the problem. Check the library users manual for device specific instructions on running extended diagnostic tests.
13d	Library Pick Retry	W	There is a potential problem with the drive ejecting cartridges or with the library picking cartridges from a slot. <ul style="list-style-type: none"> • No action needs to be taken at this time. • If the problem persists, contact Technical Support.
14d	Library Place Retry	W	There is a potential problem with the library mechanism placing a cartridge into a slot. <ul style="list-style-type: none"> • No action needs to be taken at this time. • If the problem persists, contact Technical Support. This flag is cleared when the next move command is received.
15d	Library Load Retry	W	There is a potential problem with the drive or the library mechanism loading cartridges, or an incompatible cartridge. This flag is cleared when the next move command is received.

Parameter Code	Flag Name	Type	Description
17d	Library Mailslot	C	There is a mechanical problem with the library media import/export mailslot.
18d	Library Magazine	C	The library cannot operate without the magazine. <ul style="list-style-type: none"> • Insert the magazine into the library. • Restart the operation.
19d	Library Security	W	Library security has been compromised. The door was opened then closed during operation.
21d	Library Offline	I	The library has been manually turned offline and is unavailable for use.
22d	Library Drive Offline	I	A drive inside the library has been taken offline. This is for information purposes only. No action is required.
24d	Library Inventory	C	The library has detected an inconsistency in its inventory. - Redo the library inventory to correct inconsistency. - Restart the operation.
25d	Library Illegal Operation	W	A library operation has been attempted that is invalid at this time.
27d	Cooling Fan Failure	W	A library cooling fan has failed. This flag is cleared when all fans are working again.
33d	Library Capacity Exceeded	C	The total number of volumes exceeds the available number of storage elements. Remove a cartridge from the inventory to recover.

Types (from table):

I = Informational suggestion to user.

W = Warning. Remedial action is advised. Performance of data may be at risk.

C = Critical. Immediate remedial action is required.

Used Sense Keys, ASC, and ASCQ

NEO S-Series Sense keys.

Sense Key	ASC	ASCQ	Description
Recovered Error (01)	0Ah	00h	Error log overflow
	47h	00h	SCSI parity error

Sense Key	ASC	ASCQ	Description
Not ready (02h)	00h	17h	Not ready, drive cleaning requested.
Media error (03h)	04h	00h	Not ready, cause not reportable.
	04h	01h	Not ready, in progress becoming ready, scanning magazines, etc.
	04h	03h	Not ready, manual intervention required.
	04h	12h	Not ready, offline.
	04h	87h	Not ready, the drive is not enabled.
	04h	88h	Not ready, the drive is busy.
	04h	89h	Not ready, the drive is not empty.
	04h	8Ah	Not ready, drive fiber down.
	04h	8Eh	Not ready, the media changer is in sequential mode.
	04h	8Fh	Not ready, no free slots.
	08h	00h	Not ready, communication problem between master and lower library.
	30h	03h	Not ready, cleaning in progress.
	3Bh	11h	Not ready, invalid magazine detected.
	3Bh	12h	Not ready, magazine removed.
	30h	00h	Media error.
	Medium Error	30h	00h
30h		03h	Cleaning tape installed.
30h		07h	Cleaning failure.
Hardware Error (04h)	81h	80h	Hardware error, cannot initialize barcode reader.
	81h	81h	Hardware error, no response from barcode reader.
	81h	82h	Hardware error, no response from EEPROM.
	81h	83h	Hardware error, robotic generic problem, invalid code.
	81h	84h	Hardware error, gripper pick control failure.
	81h	85h	Hardware error, slider pick control failure.
	81h	86h	Hardware error, elevator pick control failure.
	81h	87h	Hardware error, rotation pick control failure.
	81h	88h	Hardware error, sled pick control failure.
	81h	89h	Hardware error, gripper blocked.
	81h	8Ah	Hardware error, slider blocked.
	81h	8Bh	Hardware error, elevator blocked.
	81h	8Ch	Hardware error, rotation blocked.
	81h	8Dh	Hardware error, sled blocked.
	Hardware Error (04h)	81h	8Eh
81h		8Fh	Hardware error, cannot find slider block.
81h		90h	Hardware error, cannot find elevator block.
81h		91h	Hardware error, cannot find rotation block.
81h		92h	Hardware error, cannot find sled block.

Sense Key	ASC	ASCQ	Description
	81h	93h	Hardware error, gripper outside range.
	81h	94h	Hardware error, slider outside range.
	81h	95h	Hardware error, elevator outside range.
	81h	96h	Hardware error, rotation outside range.
	81h	97h	Hardware error, sled outside range.
	81h	98h	Hardware error, cartridge detection failed.
	81h	99h	Hardware error, slider home not found.
	81h	9Ah	Hardware error, rotation home not found.
	81h	9B8h	Hardware error, sled home not found
	81h	9Ch	Hardware error, invalid gripper range.
	81h	9Dh	Hardware error, invalid slider range.
	81h	9Eh	Hardware error, invalid elevator range.
	81h	9Fh	Hardware error, invalid rotation range.
	81h	A0h	Hardware error, invalid sled range.
	81h	A1h	Hardware error open import/export element failed.
	81h	A2h	Hardware error, elevator locking failed.
	81h	A3h	Hardware error, sled II blocked.
	81h	A4h	Hardware error, cannot find sled II block.
	81h	45h	Hardware error, sled II home not found.
	81h	A6h	Hardware error, elevator home not found.
	81h	B0h	Hardware error, robotic controller response timeout.
	81h	B1h	Hardware error, NACK received from robotic controller.
	81h	B2h	Hardware error, robotic controller communication failed.
	81h	B3h	Hardware error, robotic controller emergency stop.
	81h	B4h	Hardware error, cartridge movement failed.
	81h	B5h	Hardware error, robotic cartridge does not respond.
	81h	B8h	Hardware error, extender missing.
	81h	B9h	Hardware error, extender communication error.
	81h	BAh	Hardware error, extended library communication error.
	81h	BBh	Hardware error, extended link not enabled.
	81h	BCh	Hardware error, lower library power not seen in time.
	81h	BDh	Hardware error, extender reported error.
	81h	BEh	Hardware error, extender or lower library incompatibility.
	80h	C0h	Hardware error, network init.
Hardware Error (04h)	80h	C1h	Hardware error, telnet interface.
	80h	C2h	Hardware error, webserver.
	80h	C3h	Hardware error, EEPROM parameter.
	80h	C4h	Hardware error, cannot init LAN.
	80h	C5h	Hardware error, write to EEPROM failed.
	80h	C6h	Hardware error, ping command did not reach target.

Sense Key	ASC	ASCQ	Description
	80h	C7h	Hardware error, cannot upgrade from USB.
	80h	C8h	Hardware error, cannot upgrade from FTP.
	80h	C9h	Hardware error, cannot upgrade Robotic firmware.
	80h	D0h	Hardware error, ROM error.
	80h	D1h	Hardware error, RAM error.
	80h	D2h	Hardware error, NVRAM error.
	80h	D3h	Hardware error, CTC error.
	80h	D4h	Hardware error, UART error.
	80h	D5h	Hardware error, display error.
	80h	D6h	Hardware error, memory error.
	80h	D7h	Hardware error, fatal system error.
	80h	D8h	Hardware error, dBase error.
	80h	D9h	Hardware error, no SCSI IC detected.
	80h	DAh	Hardware error, different barcode labels.
	80h	DBh	Hardware error, cooling fan failure.
	80h	DCh	Hardware error, internal I2C bus error.
	80h	DDh	Hardware error, power supply cooling fan failure.
	80h	DEh	Hardware error, power supply failure.
	80h	DFh	Hardware error, power supply has failed.
	80h	E0h	Hardware error, incompatible magazine detected.
	80h	E2h	Hardware error, detected new hardware, new library firmware required
	82h	F0h	Hardware error, drive over-temperature problem.
	82h	F1h	Hardware error, drive communication error.
	82h	F2h	Hardware error, drive sled not present.
	82h	F3h	Hardware error, drive broken and needs repair.
	82h	F4h	Hardware error, drive load timeout.
	82h	F5h	Hardware error, drive unload timeout.
	82h	F8h	Hardware error, drive invalid command.
	82h	F9h	Hardware error, drive invalid parameter.
	82h	FAh	Hardware error, SFCL microcode error.
	82h	FBh	Hardware error, drive logged out.
	82h	FCh	Hardware error, internal drive command failed with Check Condition.
Hardware Error (04h)	82h	FDh	Hardware error, internal drive command timeout.
Illegal Request (05h)	04h	02h	Initializing command required.
	04h	07h	Operation in progress.
	04h	83h	Not ready, door open.
	04h	85h	Not ready, firmware upgrade in progress.
	1Ah	00h	Parameter length error.

Sense Key	ASC	ASCQ	Description
	20h	00h	Invalid command operation code.
	21h	01h	Invalid element address.
	24h	00h	Invalid field CDB.
	3Dh	00h	SCSI invalid ID message.
	25h	00h	Invalid LUN
	2Ch	00h	Command sequence error
	26h	00h	Invalid field in parameter list
	26h	01h	Parameter list error; parameter not supported.
	26h	02h	Parameter valid invalid.
	26h	90h	Wrong firmware image, does not fit boot code.
	26h	91h	Wrong personality firmware image.
	26h	93h	Wrong firmware image, checksum error.
	26h	98h	Invalid license key.
	30h	12h	Incompatible media.
	39h	00h	Saving parameters not supported.
	3Bh	0Dh	Medium destination element full.
	3Bh	0Eh	Medium source element empty.
	3Bh	11h	Medium magazine not accessible.
	3Bh	81h	Cartridge belongs to another partition.
	3Bh	A0h	Medium transfer element full.
	53h	02h	Library media removal prevented state set.
	53h	03h	Drive media removal prevented state set.
	44h	80h	Bad status library controller.
	44h	81h	Source not ready.
	44h	82h	Destination not ready.
	44h	83	Cannot make reservation.
	44h	84h	Wrong drive type.
	44h	85h	Invalid robotic controller request.
	44h	86h	Robotic not initialized.
Unit Attention (06h)	28h	00h	Not ready to ready transition
	28h	01h	Import/export element accessed
	29h	01h	Power on occurred
	29h	02h	SCSI Bus reset occurred
	29h	05h	Bus type changed to Single Ended (SE)
	29h	06h	Bus type changed to Low Voltage Differential (LVD)
	2Ah	01h	Mode parameters changed
	2Ah	10h	Time stamp changed
	3Bh	13h	Medium magazine inserted
	3Fh	01h	Microcode has changed
	53h	02h	Media removal prevented

Sense Key	ASC	ASCQ	Description
Command Aborted (0Bh)	3Fh	0Fh	ECHO buffer overwritten
	43h	00h	SCSI message error
	47h	00h	SCSI parity error
	49h	00h	SCSI invalid message
	4Eh	00h	Overlapped command attempt

Abbreviations

Term	Definition
ASC	Additional Sense Code
ASCQ	Additional Sense Code Qualifier
CDB	Command Descriptor Block
Console	Serial connector at the back of the media changer provides serial communication interface to the media changer
DMA	Direct Memory Access
DTE	Data Transfer Element (tape drive)
Extended Mode	Two media changers merged to create one larger media changer
Extender	Robotics module that connects master library with lower library
HVD	High Voltage Differential
LUN	Logical Unit Number
Lower Library	Bottom media changer of extended media changer
LVD	Low Voltage Differential
Master Library	Upper media changer of extended media changer
MTE	Medium Transfer Element (tape mover)
NVRAM	Non Volatile Random Access Memory; this memory stores information also when power is shut off.
OCP	Operator Control Panel
Online	Control Mode: Application-client has control of the media changer
Offline	Control Mode: User has control of the media changer
POS	Power On Self Test
Random Mode	Mode of Operation: SCSI commands control the media changer
RMU	Remote Management Unit
SCSI	Small Computer Systems Interface
Sequential Mode	Mode of operation: Internal firmware controls the media changer
SMC-2	SCSI Media Changer Commands – 2 specifications
STE	Storage Element (slot)
TBD	To Be Defined