Dell™ PowerVault™ TL2000/TL4000 Tape Library

SCSI Reference

Contents

Chapter 1. Introduction

This document describes the SCSI Media Changer Command Set for the Dell™ PowerVault™ TL2000 Tape Library and TL4000 Tape Library. The host will recognize both a tape drive and a Media Changer on the same SCSI ID. On this SCSI ID logical unit zero is reserved for the tape drive and logical unit one is used for the media changer. The tape drive will pass the received SCSI commands for LUN 1 over to the attached library controller by means of serial communication.

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

A media changer logical unit receives commands to move cartridges between various types in the element address space. The element types are storage, import-export, data transfer, and medium transport. The cartridge handling robotic subsystem, addressed as a medium transport element, moves cartridges within a media changer. The media changer logical unit maintains an inventory of cartridges and the element addresses. The media changer logical unit reports this inventory when requested as well as identifying the element address assigned to different types of elements.

Chapter 2. Library Features

The library includes the following components:

- Operator panel with LCD display and 4 buttons which allows you to monitor the media changer operations, control robotic operation and change configuration settings
- Bar code scanner, the media changer uses the bar code scanner to read the bar codes from the data cartridges and report this information as part of the cartridge inventory
- Ethernet port for connecting to a 10/100Base T Ethernet network. This connection allows remote monitoring of the media changer's operation, performing firmware upgrades and configuring its settings. This port is also called RMU (Remote Management Unit)
- LVD SCSI or Fibre Channel port, through this port the host sends SCSI commands to both the media changer and the tape drive
- Serial monitor port, through this port the media changer can be controlled by a console interface
- Cartridge mover which moves cartridges from one location to the other. This element is also called a medium transfer element
- Storage slots which store cartridges also referred to as storage elements
- Import/Export element allows the user to import or export an cartridge into/from the inventory of the library
- High Speed / High Density tape drive also referred to as data transfer element
- Magazines, these cartridge carriers are used to hold cartridges in the library. Magazines can be removed from the library.

Cleaning Cartridge Detection

The media changer will recognize cleaning cartridges. Once a cleaning cartridge is recognized the media changer will report its special status in the Read Element Status data.

Auto Clean Mode

The media changer supports Auto Clean Mode. Application clients must provide a place within the library to house the cleaning cartridge. Some libraries may have a designated cleaning slot (DCS) where the cleaning cartridge may reside. In the absence of a DCS, the application client must reserve a slot (element address that will not be seen by the host). For details on reserving element addresses, see the Configuration section of your Users Guide. The cleaning cartridge can then be physically moved into that ″reserved″ element address to be available when called for by Auto Clean.

User Commanded Cleaning

The media changer may be instructed to clean a tape drive by means of OCP or RMU commands. When the medium changer is instructed to clean a drive, the media changer will load a cleaning cartridge into the tape drive and return this cartridge to its source element address once the cleaning operation is finished. When no cleaning cartridge is available in the librarys inventory then the media changer will request the user to insert a cleaning cartridge. After the cleaning operation is completed the media changer will post a message to the user about the status of the cleaning operation.

Control Modes

The media changer can receive commands from the following interfaces: SCSI, RMU, OCP and Console. The default interface for receiving media access commands is the SCSI interface. The media changer accepts media access SCSI commands when the media changer is on-line. The media changer is off-line when a user sends a media access command from either the RMU, OCP or Console interface.

Immediately after the user command is finished the media changer switches to on-line mode. Note the media changer is continuous off-line when it is configured into Sequential Mode.

The concept of control modes is introduced to explain the owner of the media changer. If the media changer is on-line then the SCSI bus has control of the loader. When the media changer is in OCP Control mode the OCP has control of the media changer. Described below are the possible control modes of the library:

- **SCSI Control mode (on-line)** , in which the media changer is controlled by a SCSI driver issuing commands to move cartridges between the existing elements. This is the default control mode.
- **Sequential mode (off-line),** in which the media changer is controlled by the media changers internal firmware. In this mode the media changer will automatically replace an ejected cartridge from the tape drive with another one from the media changers inventory. The media changer can be configured into Sequential mode by means of the OCP menu or RMU browser.
- **OCP / RMU / Console Control mode (off-line)** , in which the media changer is controlled by a user. These control modes allow the user to send media access commands like move cartridges between existing elements.

The media changer will return Not Ready status on media access SCSI command when the media changer is off-line. The media changer will accept media access SCSI commands when the media changer is on-line.

About the Not Ready Condition

The media changer reports Not Ready when it is unable to accept medium access commands. During the Not Ready reason the media changer will perform all non-media access commands as specified.

The media changer is Not Ready when:
- Its initialization routine is in progress
- It is in sequential mode
- It is off-line
- A magazine is removed

Not Ready reason	Sense code during	Sense info after Not Ready reason finished
Initializing	02/04/01	06/28/00
Magazine removed	02/3B/12	02/04/01 (see note 1)
Sequential Mode	02/04/8E	06/28/00
Off-line	02/04/12	06/28/00

Note: When a magazine is inserted the media changer will automatically re-initialize. During this process the media changer shall return 02/04/01 status. When initializing is finished the media changer shall return a unit attention 06/28/00 before returning Ready status.

The following non-media access commands are allowed during the Not Ready reason:

Allowed commands during not ready state
INQUIRY
LOG SENSE
MODE SENSE (6)
MODE SENSE (10)
PERSISTENT RESERVE IN

Allowed commands during not ready state
PREVENT/ALLOW MEDIUM REMOVAL (prevent=0)
READ ELEMENT STATUS (curdata=1)
READ ELEMENT STATUS (dvcid=1)
RELEASE (6)
RELEASE (10)
REQUEST SENSE
WRITE BUFFER

Commands Allowed in the Presence of Reservations

The details of which commands are allowed under a reservations are described in next table. The RESERVE and RELEASE commands are used to manage the reservation state of the library.

Next table shows all commands allowed in the presence of reservations.

Command	reserved by another initiator
INITIALIZE ELEMENT STATUS	conflict
INITIALIZE ELEMENT STATUS WITH RANGE	conflict
INQUIRY	allowed
LOG SELECT	conflict
LOG SENSE	allowed
MODE SELECT (6)	conflict
MODE SENSE (6)	allowed
MODE SELECT (10)	conflict
MODE SENSE (10)	allowed
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
READ ELEMENT STATUS (dvcid=1)	allowed
RELEASE (6)	allowed
RELEASE (10)	allowed
REPORT SUPPORTED OPERATION CODES	allowed
REPORT TIMESTAMP	allowed
REQUEST SENSE	allowed
REQUEST VOLUME ELEMENT ADDRESS	conflict

RESERVE (6)	conflict
RESERVE (10)	conflict
SET TIMESTAMP	conflict
SEND DIAGNOSTIC	conflict
SEND VOLUME TAG	conflict
TEST UNIT READY	conflict
WRITE BUFFER	conflict

- **allowed :** Command received from SCSI initiators not holding the reservation should complete normally.
- **conflict :** Commands received from SCSI initiators not holding the reservation shall terminate the command with a RESERVATION CONFLICT status.

RMU Features

The library is equipped with a Remote Management Unit. By means of the RMU interface the media changer can be operated from a web based browser. The RMU interface allows a user to monitor the media changers operation, make configuration changes and perform media access commands. When a user executes a medium access command through the RMU interface the media changer will enter the off-line state. When the media changer is off-line the media changer will report Not Ready on the SCSI bus. For an extensive description of the RMU functions please refer to the RMU specification.

Operator Control Panel Features

The library is equipped with an Operator Control Panel (OCP). By means of the OCP a user can perform simple actions with the media changer. The OCP interface allows a user to monitor the media changer operation, make configuration changes and perform media access commands. When a user executes a medium access command through the OCP interface the media changer will enter the off-line state. When the media changer is off-line the media changer will report Not Ready on the SCSI bus. For an extensive description of the OCP functions please refer to the OCP specification.

Console Features

The library is equipped with a serial port which allows a console interface to control the media changer. The console interface allows a user to monitor the media changer operation, make configuration changes and perform media access commands. When a user executes a medium access command through the console interface the media changer will enter the off-line state. When the media changer is off-line the media changer will report Not Ready on the SCSI bus. For an extensive description of the console functions please refer to the Console specification.

TL2000 Tape Library Element Addressing

Table 2-1. TL2000 Tape Library SCSI Element Types and Element Address Ranges

Element Type	Element Address Range
Media Transport Element (MTE)	1 (0x01)
I/O Station Element (IEE)	16 (0x10)
Data Transfer Element (DTE)	256 (0x100)
Storage Element (STE)	4096 (0x1000) - 4117 (0x1015)

Table 2-2. TL2000 Tape Library SCSI element addresses for I/O Station, storage slots, and drive slot

Left Magazine ⇐ Front of TL2000 Tape Library				Library Rear Panel	Right Magazine Front of TL2000 Tape Library ⇒			
Slot 8 (4103)	Slot 9 (4104)	Slot 10 (4105)	Slot 11 (4106)	Drive 1 256 (0x100)	Slot 23 (4118)	Slot 22 (4117)	Slot 21 (4116)	Slot 20 (4115)
Slot 4 (4099)	Slot 5 (4100)	Slot 6 (4101)	Slot 7 (4102)		Slot 19 (4114)	Slot 18 (4113)	Slot 17 (4112)	Slot 16 (4111)
I/O Station	Slot 1 (4096)	Slot 2 (4097)	Slot 3 (4098)		Slot 15 (4110)	Slot 14 (4109)	Slot 13 (4108)	Slot 12 (4107)

TL4000 Tape Library Element Addressing

Table 2-3. TL4000 Tape Library SCSI Element Types and Element Addresses

Element Type	Element Address Range
Media Transport Element (MTE)	1 (0x01)
I/O Station Element (IEE)	16 (0x10), 17 (0x11), 18 (0x12)
Data Transfer Element (DTE)	256 (0x100), 257 (0x101)
Storage Element (STE)	4096 (0x1000) - 4139 (0x102B)

Table 2-4. TL4000 Tape Library SCSI element addresses for I/O Station, storage slots, and drive slot

Upper Left Magazine ⇐ Front of TL4000 Tape Library				Library Rear Panel	Upper Right Magazine Front of TL4000 Tape Library ⇒			
Slot 17 4112 (0x1010)	Slot 18 4113 (0x1011)	Slot 19 4114 (0x1012)	Slot 20 4115 (0x1013)	Drive 2 257 (0x101)	Slot 44 4139 (0x102B)	Slot 43 4138 (0x102A)	Slot 42 4137 (0x1029)	Slot 41 4136 (0x1028)
Slot 13 4108 (0x100C)	Slot 14 4109 (0x100D)	Slot 15 4110 (0x100E)	Slot 16 4111 (0x100F)		Slot 40 4135 (0x1027)	Slot 39 4134 (0x1026)	Slot 38 4133 (0x1025)	Slot 37 4132 (0x1024)
Slot 9 4104 (0x1008)	Slot 10 4105 (0x1009)	Slot 11 4106 (0x100A)	Slot 12 4107 (0x100B)		Slot 36 4131 (0x1023)	Slot 35 4130 (0x1022)	Slot 34 4129 (0x1021)	Slot 33 4128 (0x1020)
Lower Left Magazine				Drive 1 256 (0x100)				**Lower Right Magazine**
I/O Slot 3 18 (0x12)	Slot 7 4102 (0x1006)	Slot 8 4103 (0x1007)	DCS*		Slot 32 4127 (0x101F)	Slot 31 4126 (0x101E)	Slot 30 4125 (0x101D)	Slot 29 4124 (0x101C
I/O Slot 2 17 (0x11)	Slot 4 4099 (0x1003)	Slot 5 4100 (0x1004)	Slot 6 4101 (0x1005)		Slot 28 4123 (0x101B)	Slot 27 4122 (0x101A)	Slot 26 4121 (0x1019)	Slot 25 4120 (0x1018)
I/O Slot 1 16 (0x10)	Slot 1 4096 (0x1000)	Slot 2 4097 (0x1001)	Slot 3 4098 (0x1002)		Slot 24 4119 (0x1017)	Slot 23 4118 (0x1016)	Slot 22 4117 (0x1015)	Slot 21 4116 (0x1014)
* Dedicated Cleaning Slot								

Chapter 3. Supported SCSI Commands

The media changer SCSI command set supports the following commands:

Command	Operation Code	Standard	Support Status
INITIALIZE ELEMENT STATUS	07h	SMC-2	supported
INITIALIZE ELEMENT STATUS WITH RANGE	37h	SMC-2	supported
INQUIRY	12h	SPC-3	supported
LOG SELECT	4Ch	SPC-3	supported
LOG SENSE	4Dh	SPC-3	supported
MODE SELECT (6)	15h	SPC-3	supported
MODE SENSE (6)	1Ah	SPC-3	supported
MODE SELECT (10)	55h	SPC-3	supported
MODE SENSE (10)	5Ah	SPC-3	supported
MOVE MEDIUM	A5h	SMC-2	supported
OPEN/CLOSE IMPORT/EXPORT ELEMENT	1Bh	SMC-3	supported
PERSISTENT RESERVE IN	5Eh	SPC-3	supported
PERSISTENT RESERVE OUT	5Fh	SPC-3	supported
POSITION TO ELEMENT	2Bh	SMC-2	supported
PREVENT/ALLOW MEDIUM REMOVAL	1Eh	SPC-3	supported
READ BUFFER	3Ch	SPC-3	supported
READ ELEMENT STATUS	B8h	SMC-2	supported
RECEIVE DIAGNOSTIC RESULTS	1Ch	SPC-3	not supported
RELEASE (6)	17h	SPC-3	supported
RELEASE (10)	57h	SPC-3	supported
REPORT SUPPORTED OPERATION CODES	A3h	SPC-3	supported
REPORT TIMESTAMP	A3h	SPC-3	supported
REQUEST SENSE	03h	SPC-3	supported
REQUEST VOLUME ELEMENT ADDRESS	B5h	SMC-2	supported
RESERVE (6)	16h	SPC-3	supported
RESERVE (10)	56h	SPC-3	supported
SET TIMESTAMP	A4h	SPC-3	supported
SEND DIAGNOSTIC	1Dh	SPC-3	supported
SEND VOLUME TAG	B6h	SMC-2	supported
TEST UNIT READY	00h	SPC-3	supported
WRITE BUFFER	3Bh	SPC-3	supported

INITIALIZE ELEMENT STATUS (07h)

This command directs the medium changer to check all existing elements for tape cartridges and any status relevant to that element. This command enables the initiator to get a quick response from a Read Element Status command that may follow, and is useful after a power failure, if tape medium has been changed by an operator, or if subsystem configuration has changed. The library shall not return GOOD status until checking of all the elements is complete.

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

Field descriptions:

INITIALIZE ELEMENT STATUS WITH RANGE (37h)

The INITIALIZE ELEMENT STATUS WITH RANGE command shall cause the media changer to check the specified elements for volume status and any other relevant status. This command enables the initiator to get a quick response from a Read Element Status command that may follow, and is useful after a power failure, if tape medium has been changed by an operator, or if subsystem configuration has changed.

Bit Byte	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 descriptions:

Range:
> A Range bit of zero indicates that all element addresses shall be checked and that the Starting Element Address and Number of Elements fields are ignored. A Range bit of one indicates that the series of elements beginning at the specified Starting Element Address for the specified Number of Elements shall be checked. If the Number of Elements field is zero, the range checked shall start with the Starting Element Address and continue through the last element address on the unit.

Fast: A Fast bit of one indicates that the specified elements shall be scanned for media presence only. A Fast bit of zero indicates that the specified elements shall be scanned for all relevant status.

Element Address:
> 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:
> 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 medium 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 Medium 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.

Bit Byte	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 descriptions:

EVPD:
> Enable Vital Product Data. An enable vital product data (EVPD) bit of one specifies that the device server shall return the optional vital product data specified by the page code field. Note If the EVPD bit is set to 0, the page code must be 00h.

Page Code:
> 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 1. The following pages are supported:
> - 00h - Supported vital product pages
> - 80h - Unit serial number page
> - 83h - Device Identification page
> - C0h - Firmware build information page
> - D0h - Vendor Specific Page
> - FFh - Vendor Use Only

Allocation Length:
> 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.

Standard Inquiry Data

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08=Medium Changer)				
1	RMB (1)	Reserved						
2	Version (5)							
3	Obsolete	Obsolete	NormACA (0)	HiSup	Response data format (2)			
4	Additional length (43h)							

Bit / Byte	7	6	5	4	3	2	1	0
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 (4 ASCII bytes)							
36 - 37	Plant of manufacturer							
38 - 49	Serial Number (12 ASCII bytes)							
50 - 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: 02FEh (SMC-2 ANSI INCITS 382-2004)							
64 - 65	Version Descriptor: 030Fh (SPC-3 T10/1416-D revision 22)							
66 - 73	Reserved							

Field descriptions:

Peripheral Qualifier:

A return value of 0 indicates that the specified LUN is supported in this device. When a unsupported LUN was specified the Peripheral Qualifier will return 3h which indicates that specified LUN is not supported.

Peripheral Device Type:

Indicates that this is a medium changer device. Set to 8. When a unsupported LUN was specified the Peripheral Device Type will return 1Fh which indicates that specified LUN is not supported.

RMB: Removable Medium Bit. Set to 1.

Version:

The library complies to SPC-3. Set to 5.

NormACA:

A NORMACA bit set to zero indicates that the device server does not support a NACA bit set to one in the control byte and does not support the ACA task attribute.

HiSup:
A hierarchical support (HISUP) bit set to zero 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 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 0.

ACC: The ACC bit set to zero indicates that no access controls coordinator may 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 is supported.

3PC: A Third-Party Copy (3PC) bit set to zero 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 indicates that the media changer does not support protection information.

BQue: Basic Queuing is not supported, set to 0.

EncServ:
An Enclosure Services (ENCSERV) bit set to zero indicates that the media changer does not contain an embedded enclosure services component.

MultiP:
A MULTIP bit set to zero indicates that this SCSI target device has a single port and does not implement the multi-port requirements.

MChanger:
This medium changer is not an attached medium changer. Set to 0.

Addr16:
When Addr16 is set to 1, the media changer does support 16-bit wide SCSI addresses. When set to 0, indicates that the media changer does not support 16-bit wide SCSI addresses.

WBus16:
When WBus16 is set to 1, the media changer transfers SCSI data over an 16-bit wide bus. When WBus16 is not set data transfers are done over an 8-bit wide bus.

Sync: When Sync is set to 1, 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 0.

CmdQue (Command Queuing):
For Fibre Channel, this is returned as 1, indicating command queuing is supported. For SCSI, this is returned as 0, indicating no command queuing is supported.

Vendor Identification:
Eight byte ASCII string. This field is set to:

0	1	2	3	4	5	6	7
I	B	M					

Product Identification:
Sixteen byte ASCII string. This field depends on the library model. This field is set to:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3	5	7	3	-	T	L									

Product Revision Level:
This field contains 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 library is equipped with a bar code scanner.

IUS: Information Units Supported. Set to 0 indicating information units are not supported.

QAS: Quick Arbitrate Supported. Set to 0 indicating QAS is not supported.

Clocking:
Indicates the level of data clocking supported. 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 80 MB/s.

Version Descriptors:
The version descriptors report the identifier of the supported SCSI command sets.

Supported Vital Product Data page (00h)

The Supported Vital Product Data VPD page provides a directory of the Vital Product Data Pages that are supported by the media changer.

Bit Byte	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 (04h)							
4	00h - (this page)							
5	80h - Unit Serial Number Page							
6	83h - Device Identification Page							
7	C0h - Firmware Build Information Page							
8	D0h - Vendor Specific Page							
9	FFh - Vendor Use Only							

Note: If an unsupported LUN was initially specified, the Peripheral Qualifier will return 3h and the Peripheral Device Type will return 1Fh.

Unit Serial Number page (80h)

The Unit Serial Number VPD page contains 12 bytes of ASCII data representing a unique serial number of the media changer.

Bit / Byte	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 (10h)							
4 - 15	Serial Number (12 ACSII bytes)							
16 - 19	Unique Logical Library Identifier							

Note: If an unsupported LUN was initially specified, the Peripheral Qualifier will return 3h and the Peripheral Device Type will return 1Fh.

Field descriptions:

Serial Number:
   The 12 byte ASCII Serial Number may contain ASCII numbers and ASCII characters and is right justified with leading zeros.

Unique Logical Library Identifier:
   Such as the ASCII representation of the logical library name, for example, _LL3.

Device Identification page (83h)

The Device Identification VPD page provides the means to retrieve identification descriptors from the media changer. Both fiber-channel and SCSI devices return the following Device Identification VPD page:

Bit / Byte	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 - 43	Serial Number (12 ASCII bytes)							
44 - 47	Unique Logical Library Identifier							

Note: If an unsupported LUN was initially specified, the Peripheral Qualifier will return 3h and the Peripheral Device Type will return 1Fh.

<u>**Field descriptions:**</u>

Peripheral Qualifier:
A return value of 0 indicates that the specified LUN is supported in this device. When a unsupported LUN was specified the Peripheral Qualifier will return 3h which indicates that specified LUN is not supported.

Peripheral Device Type:
Indicates that this is a medium changer device. Set to 8. When a unsupported LUN was specified the Peripheral Device Type will return 1Fh which indicates that specified LUN is not supported.

Code Set:
This field is set to 2 indicating that the device identifier is returned as an ASCII string.

Identifier Type:
The Identifier Type is set to 1 indicating that the T10 style identifier is returned.

Vendor Identification:
This field returns the eight byte Vendor ID ASCII string.

Product Identification:
This field returns the sixteen byte Product ID ASCII string.

Serial Number:
This field returns the twelve byte serial number ASCII string.

Unique Logical Library Identifier:
Such as the ASCII representation of the logical library name, for example, _LL3.

Firmware Built Information page (C0h)

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

Bit Byte	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 will return 3h and the Peripheral Device Type will return 1Fh.

LOG SELECT (4Ch)

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

Bit Byte	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 descriptions:

PCR: The Parameter Code Reset (PCR) bit is not supported. Must be set to zero.

SP: Saving log Parameters is not supported. Must be set to zero.

Parameter List Length:
        The Log Select parameters are not supported.

LOG SENSE (4Dh)

The LOG SENSE command allows the host to retrieve statistical information maintained by the media changer about its own hardware. The statistical information is divided over several pages. A LOG SENSE command will retrieve one of these pages.

Bit Byte	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 descriptions:

PPC: If Parameter Pointer Control bit is set, the target terminates the command with Check Condition status. The sense key is set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB.

SP: Saving Log Parameters (SP) is not supported. If the SP bit is set, the command is terminated with Check Condition status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB.

PC: 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, the command is terminated with Check Condition status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB. 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).

Note: Only Log Sense Tape Alert page (2Eh) supports PC being set to Current Threshold Values.

Page Code:

The Page Code field identifies which log page is being requested by the initiator. If the page is not supported then the command terminates with a Check Condition status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB. Supported pages are:

- 00h -List of Supported Pages Page
- 07h -Event 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 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 4-byte header.

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

Field descriptions:

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 0 is requested, the 4-byte page header is returned followed by the pages supported in ascending order, one byte for each page.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved			Page Code (00h)				
1	Reserved							
2 - 3	Page Length (5)							
4	00h - Supported Log Pages page							
5	07h - Event Log page							
6	2Eh - Tape Alert page							
7	30h - Statistics Counter page							
8	33h - Error Log page							

Event Log Page (07h)

In the Event Log the media changer keeps track of different system events. These events exist out of hardware errors, executed commands, and debug information. 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 therefore resistant to power failures.

The data returned for the Event log page shall not exceed 64KBytes. 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 shall 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.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved			Page Code (07h)				
1	Reserved							
2 - 3	Page Length							
4 - xxxxh	Events Structures							

Field descriptions:

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 event bytes, not including the four bytes for this 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 table.

Event Structure

An event structure consists of two parts: a 13 byte event header and (optional) event data. The event header contains info about event type, source module of event, time of event, data type, and event data length. The optional event data does not exceed 114 bytes. When this field is returned it contains specific information about the event. See next structure:

Bit Byte	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 descriptions:

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 1.

TSD: Target shall determine save method, set to 0.

ETC: No threshold comparison, set to 0.

TMC: No threshold supported, set to 0.

LP: The List Parameter field is set to zero for parameters that are counters and set to one 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 are shown in table below.

Source module ID of event:
This field specifies the module ID that generated the event. Possible source module ID s are listed below in a table.

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 or 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 between 0 up to maximum 114 bytes.

Next table describes the possible Event types.

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

Next table describes the possible Source module ID s which may generate events.

Source module ID of event	Identifier
Main	0001h
Drive	0002h
CDB Interpreter	0004h
Accessor	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

Next table describes the possible Data types of event data.

Data type of event data	Identifier
Binary	00h
ASCII	01h

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 tag number has a standardized meaning. This page will not be 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.

Bit Byte	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 media changer will support the following Tape Alert Flags:

Parameter Code	Flag name	Type	Description
01d	Library Hardware A	C	The media changer mechanism is having difficulty communicating with the drive: • Turn the library OFF then ON • Restart the operation If problem persists, contact Technical Support.
02d	Library Hardware B	W	There is a problem with the media changer mechanism. If the problem persists, contact Technical Support.
03d	Library Hardware C	C	The media changer has a hardware fault: • Make sure the media changer and drives are not being used by any host, then reset the library from the front panel. • If the problem persists, contact Technical Support.

04d	Library Hardware D	C	• Make sure the media changer and drives are not being used by any host, then reset the library from the front panel. • If the problem persists, contact Technical Support.
13d	Library Pick Retry	W	There is a potential problem with the cartridge loader picking a cartridge from a drive or slot. • 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.
14d	Library Place Retry	W	There is a potential problem with the cartridge loader placing a cartridge into a slot. • 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	Drive Load Retry	W	There is a potential problem with the cartridge loader or drive when placing a cartridge into a drive. • 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.
16d	Library Door	W	The operation has failed because the library door is open. • Clear any obstructions from the library door. • Close the library door. • If the problem persists, contact Technical Support. This flag is cleared when the door is closed.
17d	Library I/O Station	C	There is a mechanical problem with the library media I/O Station.
18d	Library Magazine	C	The library cannot operate without the magazine. • 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. Check the applications users manual or the hardware users manual for specific instructions on redoing the library inventory.
25d	Library Illegal Operation	W	A library operation has been attempted that is invalid at this time.
27d	Cooling FAN Failure	W	One or more fans inside the library have failed. This flag is cleared when all fans are working again.
32d	Unreadable Bar Code Labels	I	The library was unable to read the barcode on a cartridge.

- 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.

Tape Alert Flag structure

Bit Byte	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	Reserved	LP(0)
3	Parameter Length (1)							
4	Value of Flag (Set when bit 0 = 1)							

Field descriptions:

Parameter Code:
   The Parameter Code is a 2-byte value that uniquely identifies the parameter within the log. It ranges from 1..64

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 1.

TSD: Target shall determine save method.

ETC: No threshold comparison

TMC: No threshold supported

LP: The List Parameter field is set to zero for parameters that are counters and set to one 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 NV-RAM on power shut-down. This page will not be affected by the LOG SELECT command nor by Firmware updates.

Bit Byte	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 descriptions:

Page Code:
   The Page Code echoes the page code that was specific 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.

Statistic Counter structure

Bit Byte	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	Reserved	LP(0)
3	Parameter Length (4)							
4	(MSB)							
5				Statistic Counter Value				
6								
7								(LSB)

Field descriptions:

Parameter Code :
>   The Parameter Code is a 2-byte value that uniquely identifies the parameter within the log. It ranges from 1..9.

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 1.

TSD: Target shall determine save method, set to 0.

ETC: No threshold comparison, set to 0.

TMC: No threshold supported, set to 0.

LP: The List Parameter field is set to zero for parameters that are counters and set to one 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 will increment.	0	0
2	Number of Power-ups:	This 4 byte unsigned counter specifies the number of times the library 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 Event 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

Bit Byte	7	6	5	4	3	2	1	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)

This page consists out of a Page Header followed by a FIFO containing the last 64 error events. This log data is helpful to determine the error history of the media changer.

Bit Byte	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 descriptions:

Page Code:
> The Page Code echoes the page code that was specific 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 info about event type, source, timestamp, and data length. The event data returns specific info about the error event. Appended to the event data is a error event description of maximum 80 ASCII characters with clear written text about the error event. See description in next structure:

Bit Byte	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(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)							

Bit Byte	7	6	5	4	3	2	1	0
...	Error Event data (*n* bytes)							
13 + (*n*-1)								(LSB)
(13 + *n*	(MSB)							
...	Error Event description (max. 80 ASCII characters)							
96								(LSB)

Field descriptions:

Parameter Code:
> The Parameter Code is a 2-byte value that uniquely identifies the error event structure the log. It ranges between 1 and 64.

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 1.

TSD: Target shall determine save method.

ETC: No threshold comparison

TMC: No threshold supported

LP: The List Parameter field is set to zero for parameters that are counters and set to one for parameters that are not counters.

Parameter Length:
> The parameter length field specifies the length of the whole error event structure 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 page 07h 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.

MODE SELECT 6 (15h)

The MODE SELECT (6) command provides a means for the host 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 is the page is savable to NVRAM.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	LUN			PF (1)	Reserved			SP
2	Reserved							
3	Reserved							
4	Parameter list length							
5	Control							

Field descriptions:

PF: A PF bit of one indicates that the MODE SELECT parameters following the header and block descriptor(s) complies with the SCSI-2 specification. The value must be set to 1.

SP: A Save Pages (SP) bit of zero indicates the media changer shall perform the specified MODE SELECT operation, and shall not save any pages in nonvolatile ram. An SP bit of one indicates that the media changer shall perform the specified MODE SELECT operation, and shall save the current values to a nonvolatile RAM.

When a host has successfully issued the MODE SELECT CDB that changed settings in one of the Mode pages, the media changer will raise a Unit Attention condition to every other host who has not issued this CDB. The sense data for these hosts will be 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 of the following items:

- Parameter List Header
- Mode Select page(s)

Supported Mode Select pages:

Page Code	Subpage Code	Page Name	Page saveable in NVRAM	Page Description
00h	00h	Parity Retry page	Yes	Provides means to select the maximum number 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	Tape Alert page	No	Provides means to select a specific way to report a Tape Alert event .
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 changers 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.

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	Parameter List Header							
4 - *n*	Mode Select page(s)							

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 page(s). The Parameter List Header has the following format:

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

If no Block Descriptor is to be sent to the media changer specify zero 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.

Parity page (00h)

By means of the Parity page the host can enable Parity retries and select the maximum number of retries. Note this page will be stored in non volatile memory when the Host enables the SP bit in the CDB.

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

Field descriptions:

Parity:
>   By means of this field the host can enable parity retires. Parity retries are by factory default enabled by the media changer. When cleared parity retries are disabled.

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 number of parity retries is by factory default set to 4. The maximum value allowed in the parity retry field is 7.

Control Extension page (0Ah)

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

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

Field descriptions:

SPF: The Sub Page Format (SPF) bit is set to one to indicate this is a subpage.

TCMOS:
>   A TCMOS bit set to zero specifies that the timestamp shall not be changed by any method except those defined by this standard.

SCSIP:
>   A SCSI precedence (SCSIP) bit set to one specifies that the timestamp changed using a SET TIMESTAMP command shall take precedence over any other methods.

IALUAE:
>   The implicit asymmetric logical unit access enabled (IALUAE) bit must be set to zero. The media changer does not allow implicit asymmetric logical unit access state changes.

Tape Alert Page (1Ch)

By means of this page the Host can specify the method of reporting Tape Alert events. Currently only the polling method is supported.

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

Field descriptions:

Perf: When this bit is set to 0, this indicates that informational exception operations that can cause delays are acceptable. This bit should be set to zero.

Dexcpt:
> When this bit is set to zero the reporting method indicated by the MRIE field is used. When this bit is set to one this indicates that the media changer shall disable all information exception operations, ignoring the MRIE field (In this mode the initiator must the poll the Tape Alert log page). Currently only MRIE mode 0 is supported, so this bit is ignored.

Test: Test modes are not supported, this field must be set to zero.

LogErr:
> When this bit is set to 0, the media changer shall not log any Tape Alert events. When this bit is set to 1, the media changer shall log Tape Alert events.

MRIE: With this field the initiator can specify the method used by the media changer to report informational exception conditions (Tape Alert events). Currently only mode 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, therefore this field must be set to zero.

Report Count / Test Flag Number:
> Since test modes are not supported, this field reports Report Count only. But the media changer does not report Tape Alert events as Informational Exception conditions, therefore this field must be set to zero.

Element Address Assignment page (1Dh)

The Element Address Assignment Page is used to assign new addresses to the elements of the medium changer (via the Mode Select command) and to report those assignments (Mode Sense). When requested the media changer can store new element addresses in NVRAM. When stored in NVRAM these addresses will automatically become the default addresses after every power up. The format of the element address assignment page is shown in the next table. Note this page will only be stored in non volatile memory when the Host sets the SP bit in the CDB.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved	SPF (0)	Page Code (1Dh)					
1	Additional Page Length (12h)							
2	First Medium Transport Element Address							
3	Number of Medium Transport Elements							
4	First Storage Element Address							
5	Number of Storage Elements							
6	First Import / Export Element Address							
7	Number of Import / Export Elements							
8	First Data Transfer Element Address							
9	Number of Data Transfer Elements							
10	Reserved							
11	Reserved							

Field descriptions:

First Medium Transport Element Address:
By means of this field the host can specify the address of the accessor cartridge handler.

Number of Medium Transport Elements:
By means of this field the host can specify the number of robotic cartridge handlers within the library. If the Number of Medium Transport Elements is greater than the default value returned in the Mode Sense parameter data, the library shall return a Check Condition.

First Storage Element Address:
By means of this field the host can specify the starting address for the cartridge storage locations.

Number of Storage Elements:
By means of this field the host can specify 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 library shall return a Check Condition.

First Import/Export Element Address:
By means of this field the host can specify the address of the import/export element.

Number of Import/Export Elements:
By means of this field the host can specify the maximum number of import/export elements. If the Number of Import/Export Elements is greater than the default value returned in the Mode Sense parameter data, the library shall return a Check Condition.

First Data Transfer Element:
By means of this field the host can specify the starting address of the installed tape drives.

Number of Data Transfer Elements:
By means of this field the host can specify the number of tape drives installed. If the Number of Data Transfer Elements is greater than the default value returned in the Mode Sense parameter data, the library shall return 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 medium transport element is a member of a set of elements in a robotic subsystem, and if the medium transport is capable of media rotation. The initiator cannot change this information.

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

Field descriptions:

Rotate:
Rotation of media is not an implemented feature, so the value returned for this field bit is 0.

Member Number in Transport Element Set:
This field indicates the specific transport element in the system to apply this descriptor to. The library has only one transport element , so the value returned for this field is 0.

Device Capabilities page (1Fh)

The Device Capabilities Page defines the characteristics of the element types used by this medium changer. The initiator cannot change this information.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved	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 (0)	ST↔I/E (0)	ST↔ST (0)	ST↔ST (0)
14	I/E→WA (0)	Reserved			I/E↔DT (0)	I/E↔I/E (0)	I/E↔ST (0)	I/E↔ST (0)
15	DT→WA (0)	Reserved			DT↔DT (0)	DT↔I/E (0)	DT↔ST (0)	DT↔ST (0)
16 - 19	Reserved							

Field descriptions:

DT: Data Transfer. The value for this field is 1. Tape drives can store cartridges.

I/E: Import/Export. The value for this field is 1. The Import/Export element can store cartridges.

ST: Storage. The value reported for this field is 1. The storage elements can store cartridges.

MT: Medium Transport. The value for this field is 0. The medium transport element cannot store cartridges.

S2C: SMC-2 Capabilities field is set to 1. This bit indicates that this page supports the new VRTP, ACE, XX-RA, and XX-WA fields.

VTRP: Volume Tag Reader Present. When set this bit indicates that the library does have a bar code reader. When set to zero the library does not have a bar code reader.

ACE: Auto Clean Enabled. When set to one, the library shall automatically clean the data transfer element. When set to zero the library 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 1, it indicates that the medium 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 medium 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 therefore these fields are set to 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 therefore these fields are set to 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 will be stored in the event log.

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

Field descriptions:

Log Mode:

> The Log Mode controls the behavior of the event log system. This mode can be set to the following different modes:

Log Mode	Description	Mode
- Off	Logging is disabled	00h
- Continuous	Logging has no stop condition. Only n events can be traced back. Older events are lost.	01h
- Wait on first error	The first occurred error will lead to a temporary stop of the library.	02h

Seq Mode:

> Sequential Mode, this bit indicates the operating Mode of the loader. This mode is either

Sequential or Random mode. This mode cannot be changed by means of this page, it can only be changed by means of the OCP. Therefore the value set for this bit is ignored.

Event Type Filter:
> The Event Type Filter field determines which event types will be stored in the event log. This field is a 8 bit mask. Every bit in this mask represents a event type. When a mask bit is set all events with the subsequent event type will be stored in the event log. When a mask bit is cleared the event data of the subsequent event type will be discarded.

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 Module Filter:
> The Trace Module Filter field determines which firmware module stores events. This field contains 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 will be discarded. The table below describes what bit belongs to which firmware module.

Source module ID of event	Identifier
Main	0001h
Drive	0002h
CDB Interpreter	0004h
Accessor	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

MODE SELECT 10 (55h)

The MODE SELECT (10) command provides a means for the host 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 is the page is savable to NVRAM. For documentation on the supported Mode Select pages refer to the Mode Select (6) description.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (55h)							
1	LUN			PF (1)	Reserved			SP
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	IMSB)	Parameter list length						
8								(LSB)
9	Control							

Field descriptions:

PF: A PF bit of one indicates that the MODE SELECT parameters following the header and block descriptor(s) complies with the SCSI-2 specification. The value must be set to 1.

SP: A Save Pages (SP) bit of zero indicates the media changer shall perform the specified MODE SELECT operation, and shall not save any pages in non volatile ram. An SP bit of one indicates that the media changer shall perform the specified MODE SELECT operation, and shall save the current values to a non volatile RAM.

MODE SENSE 6 (1Ah)

The MODE SENSE (6) command provides a means for a device server to report parameters to an application client. It is a complementary command to the MODE SELECT (6) command.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	LUN			Reserved	DBD	Reserved		
2	PC		Page Code					
3	Subpage Code							
4	Allocation length							
5	Control							

Field descriptions:

DBD: The Disable Block Descriptors bit specifies if the media changer may return block descriptor after the Parameter List Header. The media changer does not support block descriptors, therefore this bit is ignored.

PC: The Page Control field defines the type of mode parameter values to be returned in the mode pages.

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:

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:

Page Code	Subpage Code	Number bytes	Page Name	Page Description
00h	00	4	Parity Page	Provides a means to read out the setting for 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	Tape Alert Page	Allows the host to see what mechanism 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 library's capabilities.
20h	00h	8	Event Filter Page (Vendor Specific)	Provides a means to read out the current selected event filter settings.

3Fh	00h	68	All pages	Returns all Mode Sense pages in incrementing order.
3Fh	FFh	100	All pages including subpages	Returns all Mode Sense pages including subpages in incrementing order.

Note: 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 shall be returned to the application client. These pages will be returned in ascending order except for Mode Page 00h. Mode Page 00h shall be returned after all other Mode Pages.

Mode Parameter List

Each Mode Sense page begins with a four byte Parameter List Header, and optionally followed by an eight byte Block Descriptor before one or all Mode Sense pages are returned.

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	Mode Parameter Header							
4 - n	Mode Sense Page(s)							

Mode Parameter Header

Each Mode Sense page begins with a four byte Mode Parameter Header. This header has the following structure:

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

Field descriptions:

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 additional Parameter List Header bytes. If a block descriptor was requested this count is also added to the Mode Data Length.

Block Descriptor Length:
> If the DBD bit is cleared in the CDB the media changer may return an eight byte Block Descriptor. When a Block Descriptor is returned the Block Descriptor Length will report 8. When the DBD bit is set the media changer will not return Block Descriptors and therefore the Block Descriptor Length will report 0.

Parity page (00h)

By means of the Parity page the host can enable Parity retries and select the maximum number of retries.

Bit \ Byte	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 descriptions:

PS: Parameters Savable. This field is set to one. 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. By factory default the number of parity retries is set to 4. The maximum value allowed in the parity retry field is 7.

Control Extension page (0Ah)

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

Bit \ Byte	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 descriptions:

PS: Parameters Savable. This field is set to zero. The media changer cannot write this page to non-volatile memory.

SPF: The Sub Page Format (SPF) bit is set to one to indicate this is a subpage.

TCMOS:
A TCMOS bit set to zero specifies that the timestamp shall not be changed by any method except those defined by this standard.

SCSIP:
A SCSI precedence (SCSIP) bit set to one specifies that the timestamp changed using a SET TIMESTAMP command shall take precedence over any other methods.

IALUAE:

An implicit asymmetric logical unit access enabled (IALUAE) bit set to zero. The media changer does not allow implicit asymmetric logical unit access state changes.

Tape Alert page (1Ch)

By means of this page the host can retrieve the tape alerts logging method.

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS (0)	SPF (1)	Page Code (0Ah)					
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 descriptions:

PS: Parameters Savable. This field is set to zero. The media changer cannot write this page to non-volatile memory.

Perf: When this bit is set to 0, this indicates that informational exception operations that can cause delays are acceptable. This bit is always set to zero.

DExcpt: When this bit is set to zero the reporting method indicated by the MRIE field is used. When this bit is set to one this indicates that the media changer shall disable all information exception operations, ignoring the MRIE field (In this mode the initiator must the Tape Alert log page). Currently only MRIE mode 0 is supported, so this bit is ignored.

Test: Test modes are not supported, therefore this field is set to 0.

LogErr: When this bit is set to 0, the media changer shall not log any Tape Alert events. When this bit is set to 1, the media changer shall log Tape Alert events.

MRIE: This field indicates the method used by the media changer to report informational exception conditions. Currently only mode 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 library does not report Tape Alert conditions as Informational Exception conditions, therefore this field is set to zero.

Report Count / Test Flag Number: Since test modes are not supported, this field reports Report Count only. But the library does not support Informational Exception conditions, therefore this field is set to zero.

Element Address Assignment page (1Dh)

The Element Address Assignment Page is used to assign addresses to the elements of the medium 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.

Bit Byte	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 Element							
18	Reserved							
19	Reserved							

Field descriptions:

PS: Parameter Saveable. This field is set to 1. The media changer can save this page to non-volatile memory.

First Medium Transport Element Address:
This field indicates the address of the accessor cartridge handler (other than the default Medium Transport Element address of zero).

Number of Medium Transport Elements:
This field indicates the number of robotic cartridge handler within the library. The library has one accessor 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 medium 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 medium 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 medium changer.

Transport Geometry Parameters page (1Eh)

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

medium transport element is capable of media rotation.

Bit Byte	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 descriptions:

PS: Parameter Saveable. This field is set to 0. The media changer cannot 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 0.

Member Number in Transport Element Set:
This field indicates the specific medium transport element in the system to apply this descriptor to. The library has only one medium transport element, so the value returned for this field is 0.

Device Capabilities page (1Fh)

The Device Capabilities Page defines the characteristics of the element types used by this medium 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.

Bit Byte	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 (0)	ST⇔I/E (0)	ST⇔ST (0)	ST⇔ST (0)

Byte	Bit 7	6	5	4	3	2	1	0
14	I/E→WA (0)	Reserved			I/E↔DT (0)	I/E↔I/E (0)	I/E↔ST (0)	I/E↔ST (0)
15	DT→WA (0)	Reserved			DT↔DT (0)	DT↔I/E (0)	DT↔ST (0)	DT↔ST (0)
16 - 19	Reserved							

Field descriptions:

PS: Parameters Savable. This field is set to zero. the media changer cannot write this page to non-volatile memory.

DT: Data Transfer. The value for this field is 1. Tape drives can store cartridges.

I/E: Import/Export. The value for this field is 1. The Import/Export element can store cartridges.

ST: Storage. The value reported for this field is 1. The storage elements can store cartridges.

MT: Medium Transport. The value for this field is 0. The medium transport element cannot store cartridges.

S2C: SMC-2 Capabilities field is set to 1. This bit indicates that this page supports the new VRTP, ACE, XX-RA, and XX-WA fields.

VTRP: Volume Tag Reader Present. When set to 1 this bit indicates that the library does have a bar code reader. When set to zero the library does not have a bar code reader.

ACE: Auto Clean Enabled. When set to one, the library shall automatically clean the data transfer element. When set to zero the library 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 1, it indicates that the medium 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 medium 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 therefore these fields are set to 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 therefore these fields are set to 0.

Vendor Specific Event Filter page (20h)

By means of this page the host can read out the current selected event logging mode and determine what event types will be stored in the event log.

Bit Byte	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 descriptions:

PS: Parameters Savable. This field is set to one. The media changer can write this page to non-volatile memory.

Seq Mode:
This bit indicates the operational mode of the library. When set to 1, the library is in Sequential Mode. When set to 0, the library is in Random Mode. Note this mode can only be changed by means of the OCP or Web User interfaces.

Log Mode:
The Log Mode determines the selected behavior of the event log system. This mode can be set to the following different modes:

Log Mode	Description	Mode
- Off	Logging is disabled	00h
- Continuous	Logging has no stop condition. Only n events can be traced back. Older events are lost.	01h
- Wait on first error	The first occurred error will lead to a temporary stop of the library.	02h

Event Type Filter:
The Event Type Filter field determines which event types will be 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 will be stored in the event log. When a mask bit is cleared, the event data of the subsequent event type will be discarded.

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 Module Filter:

The Trace Module Filter field determines which firmware module is allowed to store 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 will be discarded.

Source module ID of event	Identifier
Main	0001h
Drive	0002h
CDB Interpreter	0004h
Accessor	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

MODE SENSE 10 (5Ah)

The MODE SENSE (10) command provides a means for a device server to report parameters to an application client. It is a complementary command to the MODE SELECT command. For documentation on the supported Mode Pages refer to the Mode Sense (6) command.

Bit Byte	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 descriptions:

DBD: The Disable Block Descriptors bit specifies if the media changer may return block descriptor after the Parameter List Header. The media changer does not support block descriptors, therefore this bit is ignored.

PC: The Page Control field defines the type of mode parameter values to be returned in the mode pages.

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:
The page code defines which pages should be returned. A Initiator can request one or all mode sense pages. Each response includes four bytes for the Parameter List Header, followed by the specified number of bytes for each page.

Mode Parameter List

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

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	Mode Parameter Header							
8 - *n*	Mode Sense Page(s)							

Mode Parameter Header

The returned data on a Mode Sense (10) command begins with an eight byte Mode Parameter Header. This header has the following structure:

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			Mode Data Length				
1								(LSB)
2				Reserved				
3				Reserved				
4				Reserved				
5				Reserved				
6	(MSB)			Block Descriptor Length				
7								(LSB)

Field descriptions:

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 six additional Mode Parameter Header 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 the media changer may return an eight byte Block Descriptor. When a Block Descriptor is returned the Block Descriptor Length will report 8. When the DBD bit is set the media changer will not return Block Descriptors and the block Descriptor Length will report 0.

MOVE MEDIUM (A5h)

The Move Medium command is used to move tape cartridges from one element address to another specific element address. The library can transfer cartridges between Storage Elements, Import/Export Elements, and Data Transfer Elements.

Bit Byte	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 descriptions:

Medium Transport Address:
> This field specifies the medium transport element used to execute the Move Medium command. This value can be set to either 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 specifies that the medium should be inverted or rotated prior to depositing the medium into the destination element. The library does not support medium rotation. Therefore this field must be set to zero.

PERSISTENT RESERVE IN (5Eh)

The PERSISTENT RESERVE IN command is used to obtain information about persistent reservation keys that are active within a library. 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 descriptions:

Service Action:
>   The following service actions are supported:

Code	Name	Description
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 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)
	...							

Bit Byte	7	6	5	4	3	2	1	0
n - 7	(MSB)			Last reservation key				
n								(LSB)

Field descriptions:

Generation:
See SPC-3 r23.

Additional Length:
See SPC-3 r23.

Reservation Key List:
See 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:

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)			Generation				
3								(LSB)
4	(MSB)			Additional length (n - 7)				
7								(LSB)
8	(MSB)			Reservation Descriptors				
n				(see next table)				(LSB)

Field descriptions:

Generation:
See SPC-3 r23.

Additional Length:
See SPC-3 r23.

Reservation Descriptors:
See SPC-3 r23.

PERSISTENT RESERVE IN Reservation Descriptor

The format for the reservation descriptor is shown below. There shall be 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.

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)			Reservation Key				
1								(LSB)
2	(MSB)			Scope-Specific Address				

Byte \ Bit	7	6	5	4	3	2	1	0
3								(LSB)
4	Reserved							
5	Scope				Type			
6	(MSB)			Obsolete				
7								(LSB)

Field descriptions:

Reservation Key:
See SPC-3 r23.

Scope-Specific Address:
See SPC-3 r23.

Scope:
See SPC-3 r23.

Type: See SPC-3 r23.

PERSISTENT RESERVE OUT (5Fh)

The PERSISTENT RESERVE OUT command is used to request service actions that reserve the whole library 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 shall be used in conjunction with the PERSISTENT RESERVE IN command and shall not be 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.

Bit Byte	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 descriptions:

Service Action:

The following service actions are supported:

Code	Name	Description
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:

Scope:

The value in the Scope field specifies whether a persistent reservation applies to an entire logical unit or to an element.

Code	Description

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:

> The Parameter List Length shall be set to the length of the Persistent Reserve Out Parameter List structure.

PERSISTENT RESERVE OUT Parameter List

The format for the reservation descriptor is shown below. There shall be 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.

Bit Byte	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 descriptions:

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 and 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 shall contain the element address (zero filled in the most significant two bytes).

APTPL:

> The Activate Persist Through power Loss (APTPL) bit shall be valid only for the Register, or the Register and Ignore Existing Key service action. In all other cases the APTPL bit shall be 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 I/O Station. When the action code is set to Open Import/Export Element, the library will open the import/export element. The library will not return a Check Condition status when the import/export element was already open. When media removal is prevented and the I/O Station is full the OPEN/CLOSE IMPORT/EXPORT ELEMENT will return a Check Condition with sense data set to Medium Removal Prevented.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Bh)							
1	LUN			Reserved				
2	(MSB)		Import/Export Element Address					
3								(LSB)
4	Reserved			Action Code				
5	Control							

Field descriptions:

Service Action :

By means of the Action Code the application client specifies the requested action for the I/O Station specified by the Import/Export Element Address.

Action Code	Description
00h	Open the Import / Export element
01h - 1Fh	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 allows the initiator to position the Medium Transport Element to a specific element address position. This destination address can be a Storage Element, Import/Export Element or a Data Transfer Element address.

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

Field descriptions:

Medium Transport Address:
> This field contains either 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 a Data Transfer Element address.

Invert:
> The library does not support medium rotation. This value must be set to 0.

PREVENT / ALLOW MEDIA REMOVAL (1Eh)

The PREVENT / ALLOW MEDIA REMOVAL commands enable or disable removing cartridges from the media changer. A prevent condition inhibits the media changer to remove magazines and open the Import/Export element. A prevent condition of the media changer shall not affect an UNLOAD command issued to the tape drive. Also a prevent condition shall 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 0 (allow cartridge removal). The prevent condition is also cleared after a power on and after a SCSI Bus reset.

Bit / Byte	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 descriptions:

Prevent:

> When this bit is set, opening of the Import/Export element and unlocking of the magazine functions are disabled. When the Prevent bit is cleared opening of the Import/Export element and the unlocking of the magazine functions are enabled.

READ BUFFER (3Ch)

The READ BUFFER command is used in conjunction with Write Buffer as a diagnostic function for testing the media changer's data buffer and the SCSI bus integrity. It is also used to read out Vendor Specific settings.

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 descriptions:

Mode: The Mode field is used to select the mode of operation. The media changer supports the following values within the field.

0001b	Vendor Unique operation
0010b	Data
0011b	Descriptor
1010b	Echo buffer
1011b	Echo Descriptor

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.

Buffer ID:
For all modes only buffer ID zero is supported.

Buffer Offset:
The Buffer Offset field is not supported and must be set to zero. If the Buffer Offset field specifies an unsupported value, the media changer shall return Check Condition status. The sense key will be set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.

Allocation Length:
The Allocation Length 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

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.

Bit / Byte	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 the WRITE BUFFER command.

Descriptor Mode

In this mode, the media changer returns the Buffer Capacity of the specified Buffer ID in Data Mode. If a not supported Buffer ID is specified the media changer will return zero as Buffer Capacity. Next table specifies the Buffer Descriptor which is returned on a READ BUFFER command in Descriptor Mode.

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

Field descriptions:

Offset Boundary:
> The Offset Boundary field defines the byte alignment for the buffer. The media changer only supports byte alignment, so this value will be zero.

Buffer Capacity:
> The Buffer Capacity field returns the size of the specified Buffer ID buffer in bytes. Note that this is the maximum size including the length byte. The Read Buffer command in Data Mode supports Buffer ID zero. Buffer ID zero can store up to 256 bytes. The returned Buffer Capacity for Buffer ID zero is 000100h. The uffer Capacity for all other Buffer ID values is set to 000000h.

Data Mode

In this mode, the library returns the information stored in the specified Buffer ID. This mode is used to test 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.

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

Echo Mode

In this mode, the library returns the same number of bytes of data as received in the prior Echo Mode WRITE BUFFER command from the same host. If a prior Echo Mode WRITE BUFFER command did not complete successfully the Echo Mode READ BUFFER command shall return Check Condition status. The sense key shall be set to ILLEGAL REQUEST and the sense data shall be set to COMMAND SEQUENCE ERROR. If the data in the Echo Buffer has been overwritten by another host the library shall return Check Condition status. The sense key shall be set to ILLEGAL REQUEST and the sense data shall be set to ECHO BUFFER OVERWRITTEN. The maximum length of the Echo Mode buffer is 256 bytes.

Bit Byte	7	6	5	4	3	2	1	0
0 - *n*	(data defined by previous Echo Mode WRITE BUFFER command)							

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.

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

Field descriptions:

EBOS:
> The Echo Buffer Overwritten Support bit is set. The library shall return 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.

READ ELEMENT STATUS (B8h)

The READ ELEMENT STATUS command is sent to a target from the initiator requesting that the target report the status of its internal elements.

Bit Byte	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 descriptions:

VolTag:
> If the VolTag bit is set the media changer shall return volume tag information in the element descriptors. If the VolTag bit is not set the media changer shall not return volume tag information.

Element Type Code:
> This field specifies the element type or types selected to report in response to this command. A value of 0 indicates that status for all element types is to be reported.

0h	Report all element types
1h	Report Medium Transport Elements (Cartridge pickers)
2h	Report Storage Elements (Cartridge Slots)
3h	Report Import / Export Elements (I/O 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 library shall return element status data without causing device motion. If the CurData bit is zero, the library may cause device motion to confirm element status data.

DVCID:

> If the DVCID bit is set the media changer will return device identifiers for the Data Transfer element. A DVCID bit of zero specifies that the device shall 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.

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.

Bit Byte	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							

<u>Field descriptions:</u>

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.

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.

Bit Byte	7	6	5	4	3	2	1	0
0	Element Type Code							
1	PvolTag	AvolTag	Reserved					
2 - 3	Element Descriptor Length							

Byte \ Bit	7	6	5	4	3	2	1	0
4	Reserved							
5 - 7	Byte Count of Descriptor Data Available							

Field descriptions:

Element Type Code:

This field specifies the element type of the next element descriptor(s). The supported element type descriptors are:

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 library does not support dual sided media. Therefore the Alternate Volume Tag label is always set to zero even when the VolTag bit is set in the CDB.

Element Descriptor Length:

This field indicates the number of bytes in each element descriptor.

Byte Count of Descriptor Data Available:

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.

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.

Medium Transport Element Status Page (01h)

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

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							

Bit Byte	7	6	5	4	3	2	1	0
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)							

Field descriptions:

PVolTag:
>   Primary Volume Tag. When set this flag indicates valid information in the Primary Volume Tag Information field. This flag will be set when the VolTag field was set in the CDB.

AVolTag:
>   Alternate Volume Tag. Always set to 0.

Medium Transport Element Address:
>   This field provides the address of the Medium Transport Element of this changer device whose status is reported by this element descriptor block.

Except:
>   Exception. An exception bit of 0 indicates the medium transport element is in a normal state. If this bit is 1, information on the abnormal state may be available in the Additional Sense Code and Additional Sense Code Qualifier fields.

Full: A full bit value of one indicates that the medium transport element of the changer device contains a tape cartridge. A value of 0 indicates the medium transport element is empty.

Additional Sense Code:
>   This field may provide specific information about an abnormal medium transport state (valid only if the Except bit is 1).

Additional Sense Code Qualifier:
>   This field may provide more detail about an abnormal medium transport state (valid only if the Except bit is 1).

SValid:
>   Source Valid. When set to 1, indicates that the Source Storage Element Address field and the Invert bit information fields are valid. When 0, indicates that the values in these fields are not valid.

Invert:
>   The library uses singe sided media and does not support inverting of the media. The value reported for this field is 0.

ED: An ED bit of one indicates the element is disabled. An ED bit value of zero indicates the element is enabled.

Medium Type:

The Medium Type field provides the type of medium currently present in the Media Transfer Element. The next table describes the values for the Medium Types.

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 1).

Primary Volume Tag Information:

When VolTag in the CDB was set the media changer will return a 36 byte PVolTag Identifier. This identifier will contain the bar code label of the cartridge in the Medium Transport Element.

Next table contains a list of the ASC and ASCQ values that will appear 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.

ASC	ASCQ	Description	Action
30h	03h	Cleaning cartridge	The element contains a cleaning cartridge.
30h	83h	Cleaning cartridge without bar code label	The element contains a cleaning cartridge without a readable bar code label.
83h	00h	Element not yet scanned	The media changer has not scanned this element up to now.
83h	01h	No bar code label	The element contains a cartridge without a readable bar code label.

Storage Element Status Page (02h)

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

Bit / Byte	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	Reserved	Full

Byte \ Bit	7	6	5	4	3	2	1	0
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 descriptions:

PVolTag:
Primary Volume Tag. When set this flag indicates valid information in the Primary Volume Tag Information field. This flag will be set when the VolTag field was set in the CDB.

AVolTag:
Alternate Volume Tag. Always set to 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:
When set to 1 this field indicates that access to the storage element by a medium transport element is allowed. If 0, indicates access to the storage element by a medium transport element is denied.

Except:
Exception. An exception bit of 0 indicates the element is in a normal state. If this bit is 1, information on the abnormal state may be available in the Additional Sense Code and Additional Sense Code Qualifier fields.

Full:
A full bit value of one indicates that the storage element of the changer device contains a tape cartridge. A value of 0 indicates the storage address element 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.

SValid:
Source Valid. When set to 1, indicates that the Source Storage Element Address field and the Invert bit information fields are valid. When 0, indicates that the values in these fields are not valid.

Invert:
The library uses singe sided media and does not support inverting of the media. The value reported for this field is 0.

ED: An ED bit of one indicates the element is disabled (for example, a magazine is not installed or has been logical disabled). An ED bit value of zero indicates the element is enabled.

Medium Type:

The Medium Type field provides the type of medium currently present in the Storage Element. The next table describes the values for the Medium Types.

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 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 will be omitted.

Next table contains a list of the ASC and ASCQ values that will appear 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	ASCQ	Description	Action
30h	03h	Cleaning cartridge	The element contains a cleaning cartridge.
30h	83h	Cleaning cartridge without bar code label	The element contains a cleaning cartridge without a readable bar code label.
3Bh	12h	Magazine removed	Insert magazine.
83h	00h	Element not yet scanned	The media changer has not scanned this element up to now.
83h	01h	No bar code label	The element contains a cartridge without a readable bar code label.

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.

Bit Byte	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							

Bit Byte	7	6	5	4	3	2	1	0
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 descriptions:

PVolTag:
Primary Volume Tag. When set this flag indicates valid information in the Primary Volume Tag Information field. This flag will be set when the VolTag field was set in the CDB.

AVolTag:
Alternate Volume Tag. Always set to 0.

Import/Export Element Address:
This field provides the address of the import/export element of this changer device whose status is reported by this element descriptor block.

Full: A full bit value of 1 indicates that the import/export element address contains a unit of media. A value of 0 indicates the import/export element address is empty.

ImpExp:
An import export bit of one indicates the unit of media in the import/export element was placed there by an operator. An bit of zero indicates the unit of media in the import/export element was placed there by the medium transport element.

Except:
Exception. An exception bit of 0 indicates the element is in a normal state. If this bit is 1, information on the abnormal state may be available in the Additional Sense Code and Additional Sense Code Qualifier fields.

Access:
When set to 1 this field indicates that access to the import/export element by a medium transport element is allowed. If 0, indicates access to the import/export element by a medium transport element is denied.

ExEnab:
An Export Enable bit of one indicates that the import/export element supports movement of media into of the scope of the media changer device.

InEnab:
An InEnab bit of zero indicates that this element does not support import actions. An Import

Enable bit of one indicates that the import/export element supports movement of media out of the scope of the media changer device. An InEnab bit of zero indicates that this element does not support export actions.

CMC: Connected Media Changer bit of one indicates that exports are to a connected media changer. A CMC bit of zero indicates that exports are to the operator and imports are from the operator.

OIR: Operator Intervention Required bit of one indicates operator intervention is required to make the import/export element accessible. The OIR bit shall be set to zero if no operator intervention is required or if the Access bit is set to one.

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.

SValid:
Source Valid. When set to 1, indicates that the Source Storage Element Address field and the Invert bit information fields are valid. When set to 0, indicates that the values in these fields are not valid.

Invert:
The library uses singe sided media and does not support inverting of the media. The value reported for this field is 0.

ED: An ED bit of one indicates the element is disabled (e.g. a magazine is not installed or has been logical disabled). An ED bit value of zero indicates the element is enabled.

Medium Type:
The Medium Type field provides the type of medium currently present in the import/export Element. Next table describes the values for the Medium Types.

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 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 will be omitted.

Next table contains a list of the ASC and ASCQ values that will appear 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	ASCQ	Description	Action
30h	03h	Cleaning cartridge	The element contains a cleaning cartridge.
30h	83h	Cleaning cartridge without bar code label	The element contains a cleaning cartridge without a readable bar code label.
3Bh	12h	Magazine removed	Insert magazine.

83h	00h	Element not yet scanned	The media changer has not scanned this element up to now.
83h	01h	No bar code label	The element contains a cartridge without a readable bar code label.

Data Transfer Element Status Page (04h)

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

Bit / Byte	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 (Omitted if DVCID = 0 in CDB) (LSB)							

Field descriptions:

PVolTag:
> Primary Volume Tag. When set this flag indicates valid information in the Primary Volume Tag Information field. This flag will be set when the VolTag field was set in the CDB.

AVolTag:
> Alternate Volume Tag. The library does not support dual sided media. Therefore the Alternate Volume Tag label is always set to zero 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:
> When 1 indicates that access to the data transfer element by a medium transport element is allowed. If 0 access to the data transfer element by a medium transport element is denied. Note that a value of 1 in this bit may not be sufficient to ensure a successful operation. Access is set to 0 if the drive has an error that would prevent it from being used. For example, if there is a communication failure between the medium changer and the tape drive Access is set to 0.

Except:
> An Except bit of 0 indicates the data transfer element is in a normal state; When set to 1 indicates an abnormal state (information about an abnormal state may be available in the additional sense code and additional sense code qualifier bytes).

Full: A Full bit value of 1 indicates that the data transfer element of the changer device contains a tape cartridge. A value of 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:
> The IDValid bit is set to one, 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. When set to 1, indicates that the Source Storage Element Address field and the Invert bit fields are valid. When 0, indicates that the values in these fields are not valid.

Invert:
> The library uses single sided media and does not support inverting of the media. The value reported for this field is 0.

ED: An ED bit of one indicates the element is disabled (e.g. the tape drive is not installed or has been logical disabled). An ED bit value of zero indicates the element is enabled.

Medium Type:
> The Medium Type field provides the type of medium currently present in the data transfer element. The next table describes the values for the Medium Types :

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 1).

Primary Volume Tag Information:
>   When VolTag in CDB was set the media changer will return a 36 byte PVolTag Identifier. This identifier will contain the bar code label of the cartridge mounted in the tape drive.

0	1	2	3	4	5	6	7
n	n	n	n	n	n	t	t

>   The first six (6) characters are any combination of upper case A-Z or 0-9 (e.g. ABC123) to identify the cartridge volume. The last two (2) characters are determined by the cartridge media type (i.e. L for LTO and 1 for tape cartridge generation or drive manufacturer unique identifier).

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 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 0, the Identifier Type field is set to 0h.

Identifier Length:
>   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. The format is identifier Type 1, which is equivalent to the drive's Inquiry page 83h. If the DVCID bit in the CDB is set to 0, the Identifier field is omitted.

Next table contains a list of the ASC and ASCQ values that will appear 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	ASCQ	Description	Action
30h	03h	Cleaning cartridge	The element contains a cleaning cartridge.
30h	83h	Cleaning cartridge without bar code label	The element contains a cleaning cartridge without a readable bar code label.
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.
83h	00h	Element not yet scanned	The media changer has not scanned this element up to now.
83h	01h	No bar code label	The element contains a cartridge without a readable bar code label.

RELEASE 6 (17h)

The RELEASE command is used to release a previously reserved logical unit.

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

Field descriptions:

RELEASE 10 (57h)

The RELEASE 10 command is used to release a previously reserved logical unit. This library supports Third-Party reservation. Third-Party release allows an application client to release a logical unit that was previously reserved using third party reservation.

Bit Byte	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 descriptions:

LongID:

Device IDs greater than 255 are not supported, therefore setting of LongID will result in a Check Condition status. The Sense Key will be set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.

3rdPty:

If the third party (3rdPty) bit is zero, then a third-party release is not requested. If the 3rdPty bit is zero then the LongID and Parameter List Length field shall be ignored. If the 3rdPty bit is one then the library shall release 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 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.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A3)							
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 descriptions:

Reporting Options :
      The Reporting Options field specifies the information to be returned in the parameter data.

Reporting Option	Description
000b	A list of all operation codes and service actions supported by the logical unit shall be returned in the all_commands parameter data format. The Requested Operation Code Cdb field and Requested Service Action Cdb field shall be ignored.
001b	The command support data for the operation code specified in the Requested Operation Code field shall be returned in the one_command parameter data format. The Requested Service Action Cdb field shall be ignored. If the Requested Operation Code field specifies an operation code that has service actions, then the command shall be 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 shall be 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 shall be 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 that the initiator has allocated for returned data.

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 (i.e., one operation code and service action combination, or one non-service-action operation code). The list of command descriptors shall contain 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)

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	(MSB)	CDB Usage Data						
n								(LSB)

Field descriptions:

Support:

> The Reporting Options field specifies the information to be returned in the parameter data.

Support	Description
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 requests that the library return the value of the logical unit s timestamp.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A3)							
1	LUN			Service Action (0Fh)				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)							
7	Allocation Length							
8								
9								(LSB)
10	Reserved							
11	Control							

Field descriptions:

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

The Timestamp shall not be 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 is shown in next table.

Bit Byte	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 descriptions:

Timestamp parameter data length:
 The Timestamp parameter data length field indicates the number of bytes of parameter data that follow.

Timestamp Origin :
 The Timestamp origin field indicates the origin of the timestamp.

Code	Description

000b	Timestamp initialized to zero 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 Time Stamp field returns the number of milliseconds that have elapsed since midnight, 1 January 1970 UT.

SEND DIAGNOSTIC (1Dh)

By means of this command the media changer can be requested to perform a self-test operation on itself. During this self-test the serial communication to the tape drive and robotics is tested. Also any pending Hardware Error condition is reported on this command.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	LUN			PF (1)	Reserved	SelfT (1)	DOfl (0)	UOfl (0)
2	Reserved							
3	(MSB)	Parameter List Length (0)						
4								(LSB)
5	Control							

Field descriptions:

PF: Page Format. The value for this bit must be set to 1 to indicate that the SEND DIAGNOSTICS parameters conform to the page structure as specified in SCSI-2.

SelfT: This bit indicates whether the media changer should perform the diagnostic test specified in the parameter list or a standard self-test. The library only supports the self-test and should therefore be set to 1.

DOfl: Device Offline. Since diagnostics tests must be performed when the media changer is online, the value of this bit must be set to 0.

UOfl: Unit Offline. Since the media changer is a single logical unit, the value of this bit must be set to 0.

Parameter List Length:
The media changer does not accept additional parameters for diagnostics test. Must be set to zero.

SEND VOLUME TAG (B6h)

The SEND VOLUME TAG command transfers a volume tag template to be used for a search of existing volume tag information or new volume tag information for one media changer element address. The function of the command is conveyed by the Send Action Code field value. The REQUEST VOLUME ELEMENT ADDRESS command may 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 descriptions:

Element Type Code:
> The Element Type Code field specifies an element type specification as defined in the Read Element Status command. If the Send Action Code field indicates a translate operation, this field indicates the element types to be searched. If the value is zero, all element types are candidates for a translate operation. If the Send Action Code does not indicate a translate, this field shall be treated as reserved.

Element Address:
> The Element Address field gives the media changer element address whose interpretation depends on the Send Action Code field. When the Send Action Code field is a 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:
> The Send Action Code field gives the function to be performed by this command as specified in next table:

Code	Description
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:

      The Parameter List Length field shall be zero when the Send Action Code is an undefine function. The Parameter List Length shall be set to the length of the Send Volume Tag Parameter structure.

Send Volume Tag Parameter structure

Bit Byte	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 descriptions:

Volume Identification Template:

      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. As a search template, this field may contain the wildcard characters ? and *. The ? shall match any single character. The * shall match any string of characters. When it appears in a template the remainder of the template at higher offsets in the field is not used. For assert, replace, or undefined functions, the wildcard characters may not be used.

Minimum Volume Sequence Number:

      The Minimum Volume Sequence Number field specifies the new sequence number for the assert and replace functions. For a translate, this field specifies the least value in the volume sequence number field of the volume tag information that meets the search specification.

Maximum Volume Sequence Number:

      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. This field is ignored for assert, replace, and undefine functions.

SET TIMESTAMP (A4h)

The SET TIMESTAMP command requests the device server to initialize the timestamp in the media changer, if the SCSIP bit is set to one or the TCMOS bit is set to one in the Control Extension mode page. If the SCSIP bit is set to zero, the SET TIMESTAMP command shall be terminated with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN CDB.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A4)							
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 descriptions:

Parameter List Length:

> The PARAMETER LIST LENGTH field specifies the length in bytes of the SET TIMESTAMP parameters that shall be transferred from the application client to the device server. A parameter list length of zero indicates that no data shall be transferred, and that no change shall be made to the timestamp.

The SET TIMESTAMP parameter data format is shown in next table.

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

The TIMESTAMP field shall contain the initial value of the timestamp in the format defined in above table. The Time Stamp field should be the number of milliseconds that have elapsed since midnight, 1 January 1970 UT. If the high order byte in the TIMESTAMP field is greater than F0h, the command shall be terminated with CHECK CONDITION status, with 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 shall generate a unit attention condition for the initiator port associated with every I_T nexus except the I_T nexus on which the SET TIMESTAMP command was received, with the additional sense code set to TIMESTAMP CHANGED.

REQUEST SENSE (03h)

The REQUEST SENSE command tells the library to transfer sense data to the initiator.

Bit Byte	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 descriptions:

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 library 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.

Bit Byte	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 descriptions

Valid: A Valid bit of one indicates that the Information field contains valid information as defined in the SCSI specification. This bit is set to 0.

Response Code:

A value of 70h indicates a current error the report is associated with the most recently received command. Response code value 71h (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.

Filemark:

This bit is only used in sequential access devices. It is always set to zero.

EOM: The End Of Medium bit is for sequential-access and printer devices. This bit is always set to zero.

ILI: An Incorrect Length Indicator indicates that the requested block length did not match the logical of the data on the medium. This bit is always set to zero.

Sense Key, ASC, ASCQ:

Sense Key, Additional Sense Code and Additional Sense Code Qualifier provide a hierarchy of information. The sense key provides generic categories in which error and exception conditions may 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. See Chapter 7, "Sense Keys, ASC, and ASCQ," on page 7-1.

Information:

The contents of the information field is device-type or command specific. These bytes are always zero.

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: When the Sense-Key Specific Valid bit is set to zero the data in the Sense Key Specific field (Bytes 15, 16, and 17) do not contain valid data. When the SKSV bit is set to one bytes 15,16 and 17 contain additional information regarding the error condition.

C/D: A command data (C/D) bit of one indicates that the illegal parameter is in the CDB. A C/D bit of zero indicates that the illegal condition is in the data parameters send by the host.

BPV: A bit pointer valid (BPV) bit of zero indicates that the value in the Bit Pointer field is not valid. A BPV bit of one indicates that the Bit Pointer field specifies which bit of the byte specified in the Field Pointer field is in error.

Field Pointer:

The Field Pointer field indicates which byte of the cdb or parameter data was in error. Bytes are numbered starting from zero, as shown in the tables describing the commands and parameters.

Possible Sense Keys

Sense Key	Name	Description
0h	NO SENSE	Indicates that 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, parity error, etc.) while performing the command or during a self test.

5h	ILLEGAL REQUEST	Indicates that 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 medium 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 chapter 8.

REQUEST VOLUME ELEMENT ADDRESS (B5h)

The REQUEST VOLUME ELEMENT ADDRESS command is used to transfer the results of the SEND VOLUME TAG command. Multiple REQUEST VOLUME ELEMENT ADDRESS commands may be used to retrieve the results of a single SEND VOLUME TAG command with the translate option.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (B5h)							
1	LUN			VolTag	Obsolete			
2	(MSB)			Element Address				
3								(LSB)
4	(MSB)			Number 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 library shall report 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 shall be reported by subsequent Request Volume Element Address commands.

Field descriptions:

VolTag:
> A VolTag bit of one indicates that the library shall report volume tag information. A value of zero indicates that the volume tag information shall not be 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 a 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:
> The Number of Elements to Report field 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 library shall only return those descriptors whose complete contents fit within the allocation length.

Request Volume Element Address header

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)			First Element Address Reported				
1								(LSB)
2	(MSB)			Number of Elements Reported				
3								(LSB)
4	Reserved				Send Action Code			
5	(MSB)							
6	Byte Count of Report Available							
7								(LSB)

Field descriptions:

First Element Address Reported:
    This field indicates the element address of the element with the smallest element address found to meet the Send Volume Tag command s request.

Number of Elements Reported:
    This field indicates the number of elements found. The status for these elements is returned if the Allocation Length specified in the Request Volume Element Address command was sufficient.

Send Action Code:
    The Send Action Code in the Request Volume Element Address Header returns the Send Action code of the last successful Send Volume Tag command.

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 Request Volume Element Address header.

RESERVE 6 (16h)

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

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

Field descriptions:

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 library, only INQUIRY, LOG SENSE, RELEASE, REQUEST SENSE, REPORT LUNS, READ ELEMENT STATUS with CurData set and ALLOW MEDIUM REMOVAL commands are accepted from other initiators. All other commands result in a Reservation Conflict status.

Bit Byte	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 descriptions:

LongID:

Device IDs greater than 255 are not supported, therefore setting of LongID will result in a Check Condition status. The Sense Key will be set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.

3rdPty:

If the third party (3rdPty) bit is zero, then a third-party reservation is not requested. If the 3rdPty bit is zero then the LongID and Parameter List Length field shall be ignored. If the 3rdPty bit is one then the library 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 the same initiator, by a SCSI RESET message, or by a Hard Reset condition, or by a power-on cycle. The library shall ignore 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.

TEST UNIT READY (00h)

TEST UNIT READY checks 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, Check Condition is reported. Due to power cycle, code update, etc., it is possible to get multiple check conditions on TEST UNIT READY commands.

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

Field descriptions:

WRITE BUFFER (3Bh)

Write Buffer is used with Read Buffer 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.

Bit / Byte	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 descriptions:

Mode: The Mode field is used to select the mode of operation. The media changer supports the following values within this field.

0010b	Data
0100b	Download microcode
0101b	Download microcode and save
1010b	Echo buffer

If any non supported value is set, the media changer terminates the command with a Check Condition status. The sense key will be set to ILLEGAL REQUEST and the sense data to INVALID FIELD IN CDB.

Buffer ID:
When the Mode is set to Download micro code or Download micro code and save, the Buffer ID should be set to zero. When the mode is set to Vendor Unique operation, the Buffer ID indicates the requested page to update. 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.

Buffer Offset:
The Buffer Offset is required for the Download micro code (and save) modes and optional for the Vendor Unique and Data modes. In all other modes the Buffer Offset must be set to zero.

Write Data Mode

With this mode, SCSI bus integrity can be tested in conjunction with the READ BUFFER command. The host can by means of 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 will result into a Check Condition the sense key will be set to ILLEGAL REQUEST and the additional sense data to INVALID FIELD IN CDB.

Download microcode and Download microcode and save Mode

In these modes, vendor-specific micro code shall be transferred to the media changer and, if the WRITE BUFFER command is completed successfully, also shall be saved in a non-volatile memory. The downloaded code shall then be 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 send code. After download completion the media changer shall generate a unit attention condition to all initiators. The additional sense code shall be MICROCODE HAS BEEN CHANGED. The Parameter List Length of the firmware image is not defined, it may be set to any size, maximum FFFFh (65535).

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	Library Firmware Image	variable
88h	Library Firmware Image	variable
AAh	Robotics Firmware Image	variable

Mode 4 should be used for all transfers, and the last transfer can be Mode 4 or Mode 5.

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 library 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 may 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 library shall return Check Condition status. The sense key shall be 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)							

Chapter 4. Messages

The message system allows communication between the host and the media changer logical unit for the purpose of physical path management.

Description	Code	Direction
COMMAND COMPLETE	00h	In
EXTENDED MESSAGES	01h	In / Out
SAVE DATA POINTERS	02h	In
RESTORE POINTERS	03h	In
DISCONNECT	04h	In
INITIATOR DETECTED ERROR	05h	Out
ABORT	06h	Out
MESSAGE REJECT	07h	In / Out
NO-OP	08h	Out
MESSAGE PARITY ERROR	09h	Out
BUS DEVICE RESET	0Ch	Out
IDENTIFY	80h / C0h	In / Out

Command Complete

The COMMAND COMPLETE message is sent from a target to an initiator to indicate that the execution of a command completed and a valid status has been sent to the initiator.

Extended messages

The library supports two extended messages: Synchronous Data Transfer Request (01h) and Wide Data Transfer Request (03h). All other extended messages are rejected with a Reject message after receiving the entire Extended message. The SDTR is used to negotiate data transfer agreements. If the host wants to transfer data synchronously it must negotiate a synchronous data transfer agreement with the target before transferring data. The media changer does not support synchronous data transfer. When it receives a SDTR from a initiator, it returns a SDTR message with a REQ/ACK offset equal to zero. This indicates that the media changer requires asynchronous data transfer.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Extended Message (01h)							
1	Extended Message Length (03h)							
2	Extended Message Code (01h)							
3	Transfer Period Factor							
4	REQ/ACK Offset							

The Transfer Period Factor field indicated the value for the Transfer Period in 4ns counts. This value is not used, the returned value is 00h. The media changer returns 00h for the REQ/ACK Offset field indicating that the media changer requires asynchronous data transfer.

The Wide Data Transfer Request message is used to negotiate the width of the data path for the data transfers between the media changer and the initiator. The width applies to data phases only. The media changer does not support wide data transfers. When it receives a WDTR message from the initiator, it returns a WDTR message with a transfer width exponent of 0 (8-bit transfer width). The successful exchange of WDTR message implies an agreement to an 8-bit data transfer width.

Bit Byte	7	6	5	4	3	2	1	0
0	Extended Message (01h)							
1	Extended Message Length (02h)							
2	Extended Message Code (03h)							
3	Transfer Width Exponent							

The Transfer Width field determines the width of the data path for data transfers. The media changer will return 00h for this field. This indicates that the media changer supports an 8-bit data transfer width only.

Save Data Pointers

The SAVE DATA POINTERS message is issued before every disconnect message following a data in or data out phase. The message is not sent when disconnecting after a command descriptor block that did not transfer data.

Restore Pointers

The media changer sends the RESTORE POINTERS message to direct the initiator to copy the most recently saved command, data and status pointers of the I/0 process to the corresponding active pointers. The command and status pointers are restored to the value at the beginning of the data area. The media changer sends the Restore Pointers message after a detecting a parity error during the command phase or data out phase. After the media changer successfully sends the Restore Pointers message to the initiator, the media changer restarts the command, data in, data out, or status phase from the beginning.

Disconnect

The DISCONNECT message is sent by a target to inform an initiator that the present data transfer will be suspended. the target will reselect the initiator at a later time to continue the current operation.

Initiator Detected Error

The INITIATOR DETECTED ERROR message is sent from an initiator to inform a target that an error occurred. This allows the target to retry the operation.

Abort

The ABORT message terminates the current I/O process. The target goes directly to the BUS FREE phase after receipt of this message.

Message Reject

The MESSAGE REJECT message is sent from the initiator or target to indicate that the last message received was inappropriate or not implemented.

No Operation

The NO-OP message is sent from an initiator to inform the target that no message is valid in response to the target request for a message. The media changer does not take any action in response to the No Operation message; it accepts this message and continues processing the current command.

Message Parity Error

The MESSAGE PARITY ERROR message is sent from the initiator to the target to indicate that one or more bytes in the last message received contained a parity error.

Bus Device Reset

The BUS DEVICE RESET message is sent from an initiator to clear all commands, data, and status at the target. When the target recognizes this message, it aborts the command currently being executed, proceeds to the BUS FREE state and executes a soft reset.

Identify

The IDENTIFY messages are sent either by the initiator or by the target to establish (or reestablish) the logical connection path between an initiator and target for a particular logical unit.

Bit Byte	7	6	5	4	3	2	1	0
0	Identify	DiscPriv	LUNTAR	Reserved		LUN		

Field Descriptions:

Bit 7 - Identify
>   This bit must be set to 1 to indicate this is the Identify message.

Bit 6 - DiscPriv (Disconnect Privlege)
>   This bit indicates whether the initiator supports the disconnect privelege, as follows:

   - 0 - Disconnect is not allowed
   - 1 - Disconnect is allowed

>   The media changer always sets this bit to 0. Only initiators indicate if they support disconnect.

Bit 5 - LUNTAR (Logical Unit Target)
>   This bit indicates the LUNs that you can access on this device. This bit must be set to 0 to indicate that the Identify message is directed to a logical unit.

Bit 2 ..0 - LUN (Logical Unit Number)
>   The only supported logical unit number for the media changer is 1. If the LUN fiels is set to a other value than 0, the media changer returns Check Condition status to commands other than INQUIRY and REQUEST SENSE, and the sense data is set to indicate that the logical unit is not supported.

Chapter 5. Command Status Byte

The media changer enters the status phase once per command and returns the following status bytes.

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

Chapter 6. Command Timeouts

Next table will list the library media changer commands with the recommended maximum time-out values.

Note: If the library 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.

Op Code	SCSI Command	Command Timeout	Notes
07h	INITIALIZE ELEMENT STATUS	11 minutes	1
37h	INITIALIZE ELEMENT STATUS WITH RANGE with FAST bit set (ignore bar code labels)	11 minutes	2
	INITIALIZE ELEMENT STATUS WITH RANGE with FAST bit cleared (scan bar code labels)	11 minutes	2
12h	INQUIRY	10 seconds	
4Ch	LOG SELECT	30 seconds	
4Dh	LOG SENSE	30 seconds	
15h	MODE SELECT 6	30 seconds	
55h	MODE SELECT 10	30 seconds	
1Ah	MODE SENSE 6	30 seconds	
5Ah	MODE SENSE 10	30 seconds	
A5h	MOVE MEDIUM (slot to slot)	12 minutes	
	MOVE MEDIUM (slot to drive)	25 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	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	
1Bh	OPEN/CLOSE IMPORT/EXPORT ELEMENT	10 minutes	
5Eh	PERSISTENT RESERVE IN	30 seconds	
5Fh	PESISTENT RESERVE OUT	30 seconds	
2Bh	POSITION TO ELEMENT	TBD	
1Eh	PREVENT/ALLOW MEDIUM REMOVAL	30 seconds	
3Ch	READ BUFFER	30 seconds	4
B8h	READ ELEMENT STATUS	30 seconds	
17h	RELEASE 6	30 seconds	
57h	RELEASE 10	30 seconds	
02h	REQUEST SENSE	10 seconds	
16h	RESERVE 6	30 seconds	
56h	RESERVE 10	30 seconds	
A3h	REPORT TIMESTAMP	30 seconds	
A3h	REPORT SUPPORTED OPERATION CODES	30 seconds	
B5h	REQUEST VOLUME ELEMENT ADDRESS	30 seconds	
1Dh	SEND DIAGNOSTICS	30 seconds	

B6h	SEND VOLUME TAG	30 seconds	
A4h	SET TIMESTAMP	30 seconds	
00h	TEST UNIT READY	10 seconds	
3Bh	WRITE BUFFER	3 minutes	5

Notes:

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 will issue an Unload command to the tape drive. Therefore, the time-out value needs to be adjusted fro 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.

Chapter 7. Sense Keys, ASC, and ASCQ

Sense Key	ASC	ASCQ	Description
Recovered Error (01)	0Ah	00h	Error log overflow
	47h	00h	SCSI parity error
Not Ready (02)	00h	17h	Drive cleaning requested
	04h	00h	Cause not reportable
	04h	01h	In progress becoming ready, scanning magazines, etc.
	04h	02h	Initializing command required
	04h	03h	Manual intervention required
	04h	07h	Operation in progress
	04h	12h	Offline
	04h	83h	Door open
	04h	85h	Firmware upgrade in progress
	04h	87h	The drive is not enabled
	04h	88h	The drive is busy
	04h	89h	The drive is not empty
	04h	9Ah	Drive fibre down
	04h	8Eh	The media changer is in sequential mode
	30h	03h	Cleaning in progress
	3Bh	12h	Magazine removed
Medium Error (03)	30h	00h	Incompatible media installed
	30h	03h	Cleaning tape installed
	30h	07h	Cleaning failure

Sense Key	ASC	ASCQ	Description
Hardware Error (04)	81h	80h	Cannot initialize bar code reader
	81h	81h	No response from bar code reader
	81h	82h	No response from EEPROM
	81h	83h	Slave robotic generic problem
	81h	84h	Setting of gripper pic value failed
	81h	85h	Setting of slider pic value failed
	81h	86h	Setting of elevator pic value failed
	81h	87h	Setting of rotation pic value failed
	81h	88h	Setting of sled pic value failed
	81h	89h	Gripper blocked
	81h	8Ah	Slider blocked
	81h	8Bh	Elevator blocked
	81h	8Ch	Rotation blocked
	81h	8Dh	Sled blocked
	81h	8Eh	Cannot find gripper block
	81h	8Fh	Cannot find slider block
	81h	90h	Cannot find elevator block
	81h	91h	Cannot find rotation block
	81h	92h	Cannot find sled block
	81h	93h	Gripper outside range
	81h	94h	Slider outside range
	81h	95h	Elevator outside range
	81h	96h	Rotation outside range
	81h	97h	Sled outside range
	81h	98h	No cartridge present sensor found
	81h	99h	No slider home sensor found
	81h	9Ah	No rotation home sensor found
	81h	9Bh	No sled position sensor found
	81h	9Ch	The range of gripper is wrong
	81h	9Dh	The range of slider is wrong
	81h	9Eh	The range of elevator is wrong
	81h	9Fh	The range of rotation is wrong
	81h	A0h	The range of sled is wrong
	81h	A1h	Open import/export element failed
	81h	B0h	Slave robotic controller response timeout
	81h	B1h	NACK received from slave robotic controller
	81h	B2h	Slave robotic controller communication failed
	81h	B3h	Slave robotic controller urgent stop
	81h	B4h	Cartridge did not transport completely
	81h	B5h	Slave robotic controller does not respond on command

Sense Key	ASC	ASCQ	Description
Hardware Error (04) (continued)	80h	C0h	Network init
	80h	C1h	Telnet interface
	80h	C2h	Webserver
	80h	C3h	EEPROM parameter
	80h	C4h	Cannot init LAN card
	80h	C5h	Write to EEPROM failed
	80h	C6h	Ping command did not reach target
	80h	C7h	Cannot upgrade from USB
	80h	D0h	ROM error
	80h	D1h	RAM error
	80h	D2h	NVRAM error
	80h	D3h	CTC error
	80h	D4h	UART error
	80h	D5h	Display error
	80h	D6h	Memory error
	80h	D7h	Fatal system error
	80h	D8h	dBase error
	80h	D9h	No SCSI IC detected
	80h	DAh	Different bar code labels
	80h	DBh	External cooling fan failure
	80h	DCh	Internal I2C bus error
	82h	F0h	Over temperature problem
	82h	F1h	Drive communication error
	82h	F2h	Drive sled not present
	82h	F3h	Drive broken: needs repair
	82h	F4h	Drive load timeout
	82h	F5h	Drive unload timeout

Sense Key	ASC	ASCQ	Description
Illegal Request (05h)	1Ah	00h	Parameter length error
	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 value invalid
	26h	90h	Wrong firmware image, does not fit boot code
	26h	91h	Wrong personality firmware image
	26h	93h	Wrong firmware image, checksum error
	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	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	83h	Cannot make reservation
	44h	84h	Wrong drive type
	44h	85h	Invalid slave robotic controller request
	44h	86h	Accessor not initialized
Unit Attention (06h)	28h	00h	Not ready to ready transtion
	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

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