

Software Interface Guide Software Interface Guide Software Interface Guide

Quantum SuperLoader™ 3

SuperLoader 3

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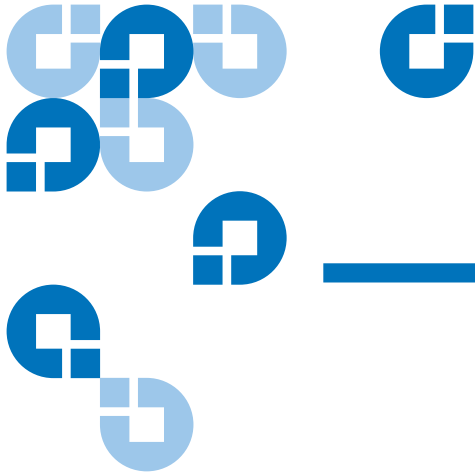
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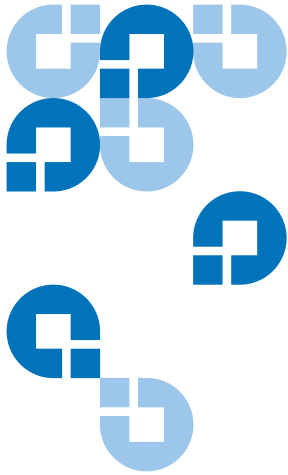
Contents

Preface	xiii
----------------	-------------

Chapter 1	Theory of Operation	1
	SuperLoader 3.....	2
	Medium Changer Elements.....	2
	Medium Transport Element.....	3
	Data Transfer Element.....	3
	Storage Elements.....	3
	Events.....	3
	Power Cycle.....	3
	SuperLoader 3 Offline.....	4
	Magazine Insertion/Removal.....	4
	Maximum Temperature Exceeded.....	4
	Automatic Drive Cleaning.....	5
	Element Status Information.....	6
	Automatic Cleaning Operation.....	6

Chapter 2	Media Changer Commands	7
	Overview of Command and Status Processing	7
	Media Changer Command Descriptions	9
	Initialize Element Status Command (07h)	10
	Inquiry Command (12h).....	11
	Standard Inquiry Data Page	12
	Vital Product Data Page	15
	Command Support Data	19
	Load Unload Command (1Bh)	22
	Log Sense Command (4Dh)	23
	Supported Pages Log Page (00h)	26
	Last n Error Events Page (07h)	27
	TapeAlert Page (2Eh).....	29
	Move Statistics Page (30h)	31
	Hard/Soft Error Statistics Page (31h).....	32
	Device Wellness Page (33h)	34
	Device Status Page (3Eh).....	37
	Mode Select (6) / (10) Command (15h / 55h)	41
	Mode Parameter List	43
	Mode Sense (6) / (10) Command (1Ah/ 5Ah)	48
	Mode Sense Data Headers	50
	Mode Sense Mode Pages.....	52
	TapeAlert Page (1Ch)	53
	Element Address Assignment Page	56
	Transport Geometry Parameters Page.....	58
	Device Capabilities Page	60
	Extended Device Capabilities Page	62
	Move Medium Command (A5h).....	67
	Persistent Reserve In Command (5Eh).....	69
	Persistent Reserve Out Command (5Fh).....	78
	Position to Element Command (2Bh)	92
	Prevent/ Allow Medium Removal (1Eh)	94
	Read Buffer Command (3Ch)	95
	Combined Header and Data Mode (000b)	96
	Data Mode (0010b)	97
	Descriptor Mode (0011b).....	97
	Read Data from Echo Buffer (1010b).....	98
	Echo Buffer Descriptor Mode (1011b)	98

Read Element Status Command (B8h)	100
Element Status Data	102
Element Status Page.....	103
Medium Transport Element Descriptor.....	105
Storage Element Descriptor	107
Import/Export Element Descriptor.....	108
Data Transfer Element Descriptor	110
Release Element (10) Command (57h)	113
Release Unit (6) Command (17h)	116
Report Device Identifier Command (A3h)	117
Report LUNS Command (A0h)	120
Request Sense Command (03h)	122
Reserve Element (10) Command (56h)	130
Reserve Element (6) Command (16h)	133
Send Diagnostic Command (1Dh)	135
Set Device Identifier Command (A4h)	137
Test Unit Ready Command (00h)	139
Write Buffer Command (3Bh).....	140
Write Combined Header and Data Mode (0000b).....	141
Write Data Mode (0010b)	141
Download Microcode Mode (0100b).....	141
Download Microcode and Save Mode (0101b).....	142
Write Data to Echo Buffer (1010b)	142



Figures

Figure 1	Initialize Element Status Command	10
Figure 2	Inquiry Command	11
Figure 3	Inquiry Command	12
Figure 4	Standard Inquiry Data	13
Figure 5	Supported Vital Product Data	16
Figure 6	Unit Serial Number Page (80h).....	16
Figure 7	Device Identification Page (83h).....	17
Figure 8	Identifier Descriptor	18
Figure 9	Command Support Data Page	19
Figure 10	Load Unload Command Descriptor Block	22
Figure 11	LOG SENSE Command Descriptor Block.....	23
Figure 12	Supported Pages Page.....	26
Figure 13	Last n Error Events Log Sense Header	27
Figure 14	Format for Last n Error Events Log Sense	28
Figure 15	TapeAlert Log Sense Header Format	29
Figure 16	TapeAlert Page Log Parameters Format	30
Figure 17	Move Statistics Format.....	31
Figure 18	Hard/Soft Move Error Statistics Format.....	33

Figure 19 Device Wellness Log Sense Header35

Figure 20 Device Wellness Log Sense (0000h-000Fh).....35

Figure 21 Log Parameters for Device Wellness Log Sense.....36

Figure 22 Device Status Log Sense Header37

Figure 23 Parameters for Device Status Log Sense Page.....38

Figure 24 Device Status Log Sense Page (0001h).....39

Figure 25 Mode Select (6) Command Descriptor.....41

Figure 26 Mode Select (10) Command Descriptor.....42

Figure 27 Mode Select (6) Mode Parameter List.....43

Figure 28 Mode Select (10) Mode Parameter List.....43

Figure 29 Mode Select (6) Parameter Header.....44

Figure 30 Mode Select (10) Parameter Header.....44

Figure 31 Mode Select Parameter.....46

Figure 32 Mode Select Page Descriptor47

Figure 33 Mode Sense (6) Command Descriptor Block48

Figure 34 Mode Sense (10) Command Descriptor Block.....49

Figure 35 Mode Sense (6) Data Header.....51

Figure 36 Mode Sense (10) Data Header.....51

Figure 37 Mode Sense Page Descriptor.....52

Figure 38 TapeAlert Page Format Descriptor53

Figure 39 Element Address Assignment Page56

Figure 40 Transport Geometry Parameters Page.....59

Figure 41 Transport Geometry Descriptor59

Figure 42 Device Capabilities Page.....60

Figure 43 Extended Device Capabilities Page.....62

Figure 44 Move Medium Descriptor Block67

Figure 45 Persistent Reserve In Descriptor Block.....69

Figure 46 Read Keys Parameters.....71

Figure 47 Read Reservations Parameters.....73

Figure 48 Persistent Reserve In Read Reservations.....74

Figure 49 Persistent Reserve Out Descriptor79

Figure 50 Persistent Reserve Out Command79

Figure 51 Persistent Reserve Out Parameter List88

Figure 52 Position to Element Descriptor92

Figure 53 Prevent/ Allow Medium Removal94

Figure 54 Read Buffer Command Descriptor Block.....95

Figure 55 Read Buffer Header97

Figure 56 Read Buffer Descriptor.....98

Figure 57 Echo Buffer Descriptor.....99

Figure 58 Read Element Status Descriptor100

Figure 59 Element Status Data Header102

Figure 60 Element Status Page103

Figure 61 Data.....104

Figure 62 Medium Transport Element Descriptor105

Figure 63 Storage Element Descriptor.....107

Figure 64 Import/Export Element Descriptor108

Figure 65 Data Transfer Element Descriptor.....110

Figure 66 Release (10) Descriptor Block.....113

Figure 67 Release (10) ID Only Parameter List115

Figure 68 Release Unit (6) Descriptor Block.....116

Figure 69 Report Device Identifier Descriptor.....117

Figure 70 Report Device Identifier.....118

Figure 71 Report LUNS Descriptor.....120

Figure 72 LUN Reporting Parameter List.....121

Figure 73 Request Sense Command Descriptor Block.....122

Figure 74 Request Sense Command Data122

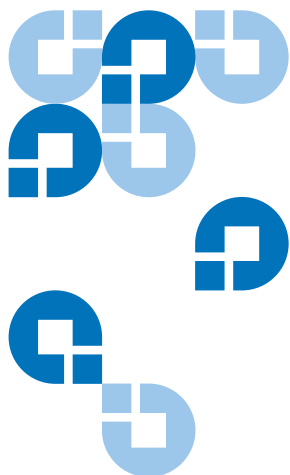
Figure 75 Request Sense123

Figure 76 Reserve Element (10) Descriptor130

Figure 77 Reserve (10) ID Only Parameter List132

Figure 78 Reserve Element (6) Descriptor133

Figure 79 Send Diagnostic Descriptor135
Figure 80 Set Device Identifier Descriptor.....137
Figure 81 Set Device Identifier Parameter List138
Figure 82 Test Unit Ready Descriptor139
Figure 83 Write Buffer Descriptor.....140

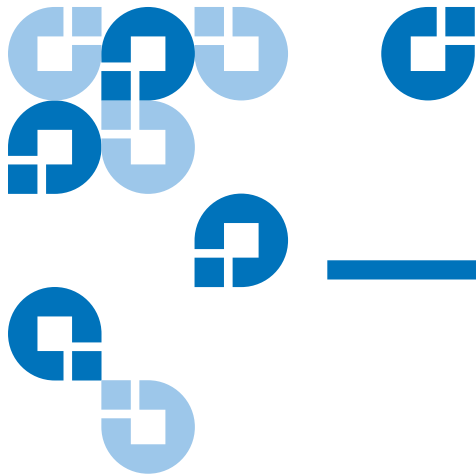


Tables

Table 1	Supported Media Changer Commands	8
Table 2	Standard Inquiry Data	14
Table 3	Unit Serial Number Page Field Descriptions	17
Table 4	Identifier Descriptor Field Descriptions.....	18
Table 5	Supported Identifiers	19
Table 6	Command Support Data Page.....	20
Table 7	Unload Command Descriptor Block	22
Table 8	Log Sense Command Descriptor Block.....	24
Table 9	Last n Error Events Log Sense Header	27
Table 10	Parameters Last n Error Events Log Sense	28
Table 11	TapeAlert Log Sense Header Field Descriptions	29
Table 12	TapeAlert Page Log Parameters.....	30
Table 13	Move Statistics	32
Table 14	Hard/Soft Error	34
Table 15	Device Wellness Log Sense Header	35
Table 16	Device Status Log Sense Header	38
Table 17	Parameters for Device Status Log Sense Page.....	39

Table 18	Device Status Log Sense (0001h).....	40
Table 19	Mode Select (6)/(10) Command Descriptor	42
Table 20	Mode Select Parameter List.....	43
Table 21	Mode Select Parameter Header	45
Table 22	Mode Select Parameter Block.....	46
Table 23	Mode Select Page Descriptor	47
Table 24	Mode Sense Command Descriptor Block.....	49
Table 25	Mode Sense Data Header	52
Table 26	Mode Sense Page Descriptor.....	52
Table 27	TapeAlert Page Format Descriptor	54
Table 28	Element Address Assignment Page.....	58
Table 29	Transport Geometry Parameters Page.....	59
Table 30	Device Capabilities Page.....	61
Table 31	Extended Device Capabilities Page.....	63
Table 32	Move Medium Command.....	68
Table 33	Persistent Reserve In Command	70
Table 34	Read Keys Parameters.....	72
Table 35	Read Reservations Parameters.....	73
Table 36	Persistent Reserve In Read Reservations Descriptor	75
Table 37	Persistent Reservation Type Codes.....	76
Table 38	Persistent Reserve Out Command Service Action.....	82
Table 39	Persistent Reservation Type Codes.....	87
Table 40	Persistent Reserve Out Parameter List	89
Table 41	Device Server Interpretation of Service and Scope Value	91
Table 42	Position to Element Command	93
Table 43	Prevent/Allow Medium Removal Command Descriptor Block.....	94
Table 44	Read Buffer Command Descriptor Block.....	96
Table 45	Read Buffer Header	97

Table 46	Echo Buffer Descriptor	99
Table 47	Read Element Status Command Descriptor Block	101
Table 48	Element Status Data	102
Table 49	Medium Transport Element Descriptor	106
Table 50	Storage Element Descriptor.....	108
Table 51	Import / Export Element Descriptor	109
Table 52	Data Transfer Element Descriptor.....	111
Table 53	Release (10) Command	114
Table 54	Report Device Identifier Command Descriptor Block	117
Table 55	Report Device Identifier Parameter Data	118
Table 56	Report LUNS Command Descriptor Block.....	120
Table 57	Request Sense Data.....	124
Table 58	Supported Sense Keys for Request Sense.....	125
Table 59	Supported ASC / ASCQ (Hex) for Request Sense.....	126
Table 60	Reserve Element (10) Command	131
Table 61	Send Diagnostic Command Data	135
Table 62	Set Device Identifier Command Descriptor Block.....	138
Table 63	Set Device Identifier Parameter List	138
Table 64	Write Buffer Command Data	140



Preface

This section outlines the scope and contents of the Quantum SuperLoader™ 3 Software Interface Guide. It contains information about the intended audience, purpose, organization, and document conventions.

Intended Audience

This interface guide is written for the following audiences:

- Original Equipment Manufacturers (OEMs) that integrate the Quantum SuperLoader 3 into a system or subsystem
- System integrators that are responsible for the SCSI interface
- End users that operate and troubleshoot the SuperLoader 3

Purpose

This interface guide describes the procedures and issues involved in the development of software applications and utilities to communicate with the Quantum SuperLoader 3.

- SCSI interfaces
- Media Changer Commands

Organization

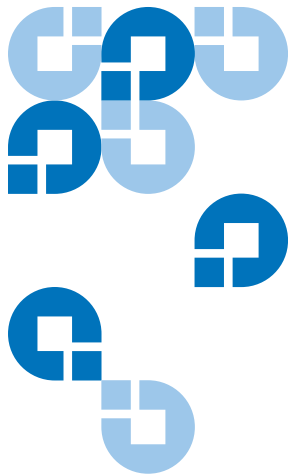
This reference manual is organized as follows:

- [Chapter 1, Theory of Operation](#) describes differences between the SuperLoader 3 models, media changer elements, events, and automatic drive cleaning.
- [Chapter 2, Media Changer Commands](#) describes the SCSI protocol features implemented in the media changer.

Document Conventions

This manual uses the following conventions to designate specific elements:

Element	Convention	Example
Abbreviations	Lowercase, except where standard usage requires uppercase	Mb (megabits) MB (megabytes)
Acronyms	Uppercase	SCSI
Binary Notation	Number followed by lowercase <i>b</i>	101b
Commands	Uppercase (unless case-sensitive)	FORMAT UNIT
Decimal Notation	Number followed without suffix	101
Field	Initial Caps (unless case-sensitive)	Application Data
Hexadecimal Notation	Number followed by <i>h</i>	101h
Sense Key	Uppercase (unless case-sensitive)	ILLEGAL REQUEST



Theory of Operation

The SuperLoader 3 product is an integration of two separate devices, a tape drive and a media changer. The media changer consists of all the mechanics and electronics required to store and move tape cartridges while the tape drive provides the read/write functionality.

Each device has a separate interface for communication to the host. The SCSI command set supported by the tape drive is documented separately. The SCSI command set supported by the media changer device is detailed in [“Media Changer Command Descriptions”](#) on page 9.

The SuperLoader 3 is fully compliant with the mandatory commands for the ANSI SCSI-3 standard for tape drive and media changer devices and implements many optional features.

The SuperLoader 3 does not act as an initiator on the SCSI bus. Therefore, it does not generate unsolicited interrupts to the bus, initiate its own SCSI commands, or assert bus reset.

SuperLoader 3

SuperLoader 3 has one SCSI ID and two logical units (LUN). The tape drive always resides at logical unit 0 and the media changer resides at logical unit 1. Because the drive supports the physical interface, the user needs to reference the drive's documentations for specific support. For example, the sync bit in the Standard Inquiry Data Page (see "[Standard Inquiry Data Page](#)" on page 12) requires the drive hardware to report the proper function.

Medium Changer Elements

The medium changer command set accesses the address space for the set of physical locations and mechanisms within the SuperLoader 3. This guide uses the SCSI-2 term element to refer to one member of the SuperLoader 3 address space. Each element is a discrete physical entity that can hold a single tape cartridge. Each element within a SuperLoader 3 is represented by a unique 16-bit element address. The SuperLoader 3 consists of the following medium changer elements.

- Medium transport element
- Storage elements
- Data transfer elements

You can issue the **Mode Sense** command to determine the SuperLoader 3 configuration. You can also use this command to determine the first address and the number of elements of each type.

Although the SuperLoader 3 does have a mailslot, it is not reported as an Import/Export element for use by the host system. It is strictly to allow users to access tape cartridges using the front panel or On-board Remote Management tool.

Medium Transport Element

This mechanism can hold a single cartridge and is considered a single medium transport element. It is used to move media between elements within the SuperLoader 3.

Data Transfer Element

The SuperLoader 3 is configured with a single tape drive.

Storage Elements

All of the storage elements within the SuperLoader 3 are contained within removable magazines. There are two magazines which hold eight tape cartridges each, for a total of 16 storage elements. The number of storage elements is either 8 or 16 depending on how the magazines are configured via the front panel or the On-board Remote Manager. When a configured magazine is removed, the corresponding storage elements are reported as inaccessible. This is done via the **Read Element Status–“Storage Element Descriptor”** on page 107–byte 2, bit 3.

Events

Events are system conditions created by operator actions or system failures. These events are recorded in sense data for the SCSI host to retrieve via the **Request Sense** command.

Power Cycle

When the SuperLoader 3 is powered-on, it goes through an initialization sequence during which it:

- Resets and initializes all hardware
- Responds to SCSI commands which do not require movement
- Responds to **Test Unit Ready** and all movement type commands with a not ready, initialization in progress check condition (SK=02 ASC=29 ASCQ=02).

When the power on initialization is complete, it:

- Generates a **Power On/Reset Occurred** event (SK=6 ASC=29 ASCQ=02)

- If initialization is successful, it generates a not-ready to ready transition (SK=6 ASC=28 ASCQ=00), otherwise, failure sense data is set accordingly.

SuperLoader 3 Offline

When a user accesses the SuperLoader 3 via the front panel or On-board Remote Management in such a way that would cause conflict with a SCSI command, the SuperLoader 3 is put into an off-line state. If a SCSI command is received while in this off-line state, a not ready check condition is reported (SK=02 ASC=04 ASCQ=07).

Magazine Insertion/ Removal

The SuperLoader 3 must be powered-on with at least one magazine, otherwise a check condition is reported (SK=02 ASC=04 ASCQ=03).

While the system is on-line, the user may remove a magazine blank and replace it with a magazine. The SuperLoader 3 will calibrate the newly installed magazine and check the presence of tape cartridges in each of the storage elements. While this inventory is in progress, the SuperLoader 3 will report a not-ready check condition (SK=02 ASC=04 ASCQ=01). Once the inventory is complete, the SuperLoader 3 reports a unit attention (SK=06 ASC=3B ASCQ=13).

Similarly, while a magazine is in the process of being removed, a not-ready check condition is reported (SK=02 ASC=04 ASCQ=07). Once the operation is complete, by replacing the magazine with a blank a unit attention is reported (SK=06 ASC=3B ASCQ=12).

While one or both of the magazine bays are open, a not ready check condition is reported (SK=02 ASC=04 ASCQ=03).

Maximum Temperature Exceeded

The SuperLoader 3 monitors the ambient temperature within the system. If the temperature exceeds the maximum safe temperature for the media, the SuperLoader 3 will disable all movement until the temperature decreases below a safe threshold. While the temperature remains excessive, SCSI commands that require movement will fail (SK=04 ASC=0B ASCQ=01).

Automatic Drive Cleaning

There are two modes of automatic drive cleaning support available:

- Host-initiated cleaning
- SuperLoader 3 managed cleaning

Both modes provide automatic cleaning of the drive, but the first is managed by the host and the second is managed by the SuperLoader 3. These two modes are configured separately, and only one should be enabled at any given time.

When automatic drive cleaning of the drive is enabled, either the host or the SuperLoader 3 is responsible for all cleaning functions such as:

- Detecting when a drive requires cleaning
- Tracking and selecting cleaning cartridges
- Moving a cleaning cartridge to the drive
- Determining when a cleaning cartridge has used all of its available cleaning cycles

By default, the SuperLoader 3 is configured to allow for host-initiated cleaning. If automatic cleaning is disabled from the host, the SuperLoader 3 can be configured to manage the automatic cleaning of the drive. This is done by enabling the Auto Clean function. Please refer to the *Quantum SuperLoader 3 User's Guide* for information on how this is done.

Note: There is no way for the host and SuperLoader 3 to know how the other is configured with respect to automatic drive cleaning. It is up to the user to make sure only one is enabled.

In host-initiated cleaning mode, the host tracks all cleaning cartridges and their use. When the SuperLoader 3 Auto Clean feature is enabled, a “cleaning slot” is allocated and the cleaning cartridge is stored in this storage element. The SuperLoader 3 assumes that any cartridge stored in this location is a cleaning cartridge and will attempt to use it as such.

The SuperLoader 3 does not keep track of the number of times a cleaning tape is used. Instead, it relies on the tape drive to report when the tape has expired. When this happens, the SuperLoader 3 will notify the user via the front panel. The Auto Clean function is automatically disabled until the user inserts a new cleaning tape and re-enables the feature.

Element Status Information

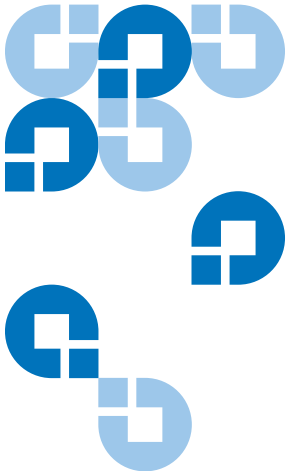
When the SuperLoader 3 Auto Clean feature is enabled, the allocated storage element is reported as inaccessible to the host. This is done by setting the access bit to 0 in the **Read Element Status Storage Element Descriptor** page.

Automatic Cleaning Operation

When the SuperLoader 3 Auto Clean feature is enabled, the SuperLoader 3 checks if the drive needs cleaning after each successful move from the drive. Therefore, each time the drive is unloaded, it is checked.

The movement of the cleaning tape is handled differently depending on the SuperLoader 3 model.

If the move command that unloaded the drive was initiated from SCSI, command complete is returned to the host when the move completes. The cleaning tape is then moved from its storage slot to the drive. The cleaning is performed and once complete, the cleaning tape is returned to its storage location. If a SCSI command is received during this cleaning process, a not ready check condition is reported (SK=-2 ASC=30 ASCQ=03).



Media Changer Commands

This chapter describes the Media Changer SCSI protocol features implemented by the Media Changer device of the SuperLoader 3 system. Note that the sections included in this chapter do not fully reiterate every ANSI SCSI option and/or command code specification; the sections do describe the supported commands and options.

Note: The original SCSI specification allowed users to specify the LUN (Logical Unit Number) in bits 7 - 5 in byte 1. These legacy reserved bits are ignored by the autoloader, but will not be rejected if set.

Overview of Command and Status Processing

The SuperLoader 3 supports all mandatory SCSI-3 commands and the Media Changer commands listed in [table 1](#).

Table 1 Supported Media
 Changer Commands

Command	Operation Code
Initialize Element Status Command (07h)	07h
"Inquiry Command (12h)" on page 11	12h
"Load Unload Command (1Bh)" on page 22	1Bh
"Log Sense Command (4Dh)" on page 23	4Dh
"Mode Select (6) / (10) Command (15h / 55h)" on page 41	15h / 55h
"Mode Sense (6) / (10) Command (1Ah / 5Ah)" on page 48	1Ah / 5Ah
"Move Medium Command (A5h)" on page 67	A5h
"Persistent Reserve In Command (5Eh)" on page 69 (SCSI-3)	5Eh
"Persistent Reserve Out Command (5Fh)" on page 78 (SCSI-3)	5Fh
"Position to Element Command (2Bh)" on page 92	2Bh
"Prevent/Allow Medium Removal (1Eh)" on page 94	1Eh
"Read Buffer Command (3Ch)" on page 95	3Ch
"Read Element Status Command (B8h)" on page 100	B8h
"Release Element (10) Command (57h)" on page 113	57h
"Release Unit (6) Command (17h)" on page 116	17h
"Report Device Identifier Command (A3h)" on page 117	A3h
"Report LUNS Command (A0h)" on page 120	A0h
"Request Sense Command (03h)" on page 122	03h
"Reserve Element (10) Command (56h)" on page 130 (SCSI-3)	56h
"Reserve Element (6) Command (16h)" on page 133	16h
"Send Diagnostic Command (1Dh)" on page 135	1Dh
"Set Device Identifier Command (A4h)" on page 137 (SCSI-3)	A4h
"Test Unit Ready Command (00h)" on page 139	00h

Command	Operation Code
"Write Buffer Command (3Bh)" on page 140	3Bh

Media Changer Command Descriptions

The Media Changer commands are presented in alphabetical order. Because information about a particular command may span multiple pages, the command name is repeated at the top of every page that concerns that command.

Throughout this manual, multiple bytes containing information about specific command parameters are portrayed as shown in the following example of the Parameter List Length field (bytes 7 and 8) of the **MODE SELECT** command:

Bit Byte	7	6	5	4	3	2	1	0	
(Bytes 0 - 6)									
7 - 8	(MSB) Parameter List Length							(LSB)	

As shown, this sample indicates that the most significant bit (MSB) of the field is bit 7 of byte 7; the least significant bit is bit 0 of byte 8.

Initialize Element Status Command (07h)

The **INITIALIZE ELEMENT STATUS** command allows the media changer to check all assigned element addresses for volume and any other status relevant to that element address. The intent of this command is to enable the Initiator to get a quick response from a subsequent **READ ELEMENT STATUS** command. It may be useful to issue this command after a power failure, if a volume has been changed by an operator, or if configurations have been changed.

Figure 1 Initialize Element Status Command

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

Inquiry Command (12h)

The **INQUIRY** command allows the initiator to determine the kind of SCSI devices attached to its SCSI BUS. It causes a device that is attached to a SCSI BUS to return information about itself. The SuperLoader 3 identifies itself as a media changer that implements the SCSI-3 protocol.

The media changer can provide three categories of data in response to an **INQUIRY** command: **Standard Inquiry Data**, **Vital Product Data**, and **Command Support Data**. **Standard Inquiry Data** contains basic data about the device. **Vital Product Data** comprises several pages of additional data. Each **Vital Product Data** page requires a separate **INQUIRY** command from the initiator. **Command Support Data** indicates the fields in the CDB that are supported by opcode. An **INQUIRY** command is not affected by, nor does it clear, a Unit Attention condition.

Figure 2 Inquiry Command

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Logical Unit Number			Reserved			CmdDt	EVPD
2	Page Code							
3 - 4	(MSB) Allocation Length (LSB)							
5	Unused		Reserved			Flag	Link	

Figure 3 Inquiry Command

Field	Description
CmdDt	Command Support Data. If CmdDt = 0 and EVPD (see below) = 0, the media changer returns the Standard Inquiry Data . If CmdDt = 1 with EVPD = 0, the media changer returns the Command Data specified by Page Code/ Operation . Information about Command Support Data is provided in figure 9 on page 19 and table 6 on page 20.
EVPD	Enable Vital Product Data. If EVPD = 0 and CmdDt (see above) = 0, the media changer returns the Standard Inquiry Data . If EVPD = 1 and CmdDt = 0, the media changer returns the Vital Product Data Page specified by Page Code/Operation Code .
Page Code or Operation Code	Specifies the Vital Product Data Page which is to be returned by the media changer when EVPD is set. Specifies the SCSI Operation Code for command support data to be returned by the media changer when CmdDt is set. A CHECK CONDITION status is returned if this field specifies an unsupported Page or Operation Code or if both EVPD and CmdDt are set. Figure Figure 5 on page 16 shows the Page Codes for the Vital Product Pages supported by the media changer.
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 Page

[Figure 4](#) shows the format of the **Standard Inquiry Data** page returned by the media changer.

Figure 4 Standard Inquiry Data

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB	Reserved						
2	Version							
3	AERC	Obsolete	NormACA	HiSup	Response Data Format			
4	Additional Length (n-4)							
5	SCCS	Reserved						
6	BQue	EncServ	Reserved	MultiP	MChngr	Obsolete	Obsolete	Add16
7	RelAdr	Obsolete	Wbus16	Sync	Linked	Obsolete	CmdQue	Reserved
8-15	Vendor Identification (QUANTUM)							
16-31	Product Identification (UHDL)							
32-35	Product Revision Level (xxxx)							
36	Language							
37	Reserved				Image Type			
38-40	Reserved							
41	Firmware Personality							
42	Firmware Subpersonality							
43	Vendor-Specific Subtype							

The following table contains field descriptions for the data returned by the media changer.

Table 2 Standard Inquiry Data

Field Name	Description
Peripheral Qualifier	Non-zero if initiator selects an invalid logical unit (see below)
Peripheral Device Type	8 indicates that this is a media changer device.
RMB	Removable Medium Bit. Set to 1.
Version	ANSI SCSI Level 2 (SCSI-2) is supported. Note that some SCSI-3 features and fields are supported.
AERC	Asynchronous Event Notification is not supported.
NormACA	The media changer does not support the NACA bit in the control byte of the CDB.
HiSup	The hierarchical addressing model is not used.
Response Data Format	This Standard Inquiry Data is in SCSI-2 format. Note that although the loader reports SCSI-2 here, the additional SCSI-3 fields as indicated in the description of the page are supported.
Additional Length	This field indicates the number of additional bytes of INQUIRY Response Data available.
SCCS	This device does not contain an embedded storage array controller.
BQue*	Basic queueing is not supported.
EncServ	This device does not contain an embedded enclosure services component.
MultiP	This device does not implement multi-port requirements. Note that the value and support of this function is determined by the drive installed.
MChngr	This device is not an attached media changer.

Field Name	Description
Add16	This device supports 16-bit wide SCSI addresses.
RelAdr	This device does not support relative addressing.
WBUS16	This device supports 16-bit wide data transfers.
Sync	Refer to the drive interface guide to find out if synchronous data transfers are supported.
Linked	This device does not support linked commands.
CmdQue*	This device does not support command queuing.
Vendor Identification (QUANTUM)	Identification of vendor.
Product Identification (UHDL)	Identification of the product
Product Revision Level (xxxx)	This field contains 4 bytes of ASCII hex data that provides the media changer's firmware revision level.
Language	This field indicates the language used for the front panel and On-board Remote Management.
Image Type	This field indicates the type of firmware image required when downloading a new image. SuperLoader 3 reports a 2.
Firmware Personality	Numeric indicator of firmware personality. Note that when set to 4, this indicates OEM family.
Firmware Subpersonality	Set to 2, indicating standard SCSI device firmware.
Vendor-Specific Subtype	Identification of product.

* The BQue and CmdQue bits are set on HP drives, even though these options are not supported. It is necessary to set these bits for Adaptec® HBAs to support Ultra 320. These values will vary depending on the drive type in the autoloader.

Vital Product Data Page

The following sections describe the **Vital Product Data Pages** for the system.

Supported Vital Product Data Page

The **Supported Vital Product Data Pages** page provides a directory of the **Vital Product Data Pages** that are supported by the SuperLoader 3.

Figure 5 Supported Vital Product Data

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (00h)							
2	Reserved							
3	Page Length (03h)							
4	00h - (this page)							
5	80h - Unit Serial Number Page							
6	83h - Device Identification Page							

Figure 6 Unit Serial Number Page (80h)

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

Bit Byte	7	6	5	4	3	2	1	0
4 - 17	Serial Number							

Table 3 Unit Serial Number
Page Field Descriptions

Field Name	Description
Serial Number	The serial number given is the serial number of the media changer typically starting with "PM" indicating the site of manufacture.

Figure 7 Device Identification
Page (83h)

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (83h)							
2	Reserved							
3	Page Length							
4 - n	Identification Descriptors							

There are three different **Identification Descriptors** returned, in numerical order of the **Identifier Type**. Each **Identification Descriptor** takes the following form:

Figure 8 Identifier Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved				Code Set			
1	Reserved		Association		Identifier Type			
2	Reserved							
3	Identifier Length (n-3)							
4 - n	Identifier							

Table 4 Identifier Descriptor Field Descriptions

Field Name	Field Description	
Code Set	Indicates the type of data to be found in the Identifier field. A value of 1 indicates binary data. A value of 2 indicates ASCII data.	
Association	Indicates whether the Identifier is associated with the logical unit or the port. Always contains a 0, indicating the Identifier is associated with the logical unit.	
Identifier Type	Type of identifier.	
	Value	Description
	1	Concatenation of the Vendor Name, Product ID, and unit serial number
	2	Canonical form of the IEEE Extended Unique Identifier, 64 bit (EIU-64)
	3	FC-PH Name_Identifier

Field Name	Field Description
Identifier	Identifier data, based on the Identifier Type.

The following table describes the identifiers supported by the SuperLoader 3.

Table 5 Supported Identifiers

Identifier Type	Code Set	Length	Identifier
1	2	38	QUANTUM UHDL, 12 ASCII space characters (20h), followed by the unit serial number in ASCII (14 bytes).
2	1	8	8 bytes of binary data indicating the EUI-64 assigned to the drive.
3	1	8	8 bytes of binary data indicating the 64-bit, type 3, FC-PH Name_Identifier assigned to the drive.

Command Support Data

An application client can request command support data by setting the CmdDt bit of the **INQUIRY** command to 1, and specifying the SCSI operation code of the CDB for which it wants information.

The format of the command support data and definitions of the fields follow.

Figure 9 Command Support Data Page

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Reserved					Support		

Bit Byte	7	6	5	4	3	2	1	0
2	ISO Version		ECMA Version			ANSI - Approved Version		
3 - 4	Reserved							
5	CDB Size (m - 5)							
6 - n	CDB Usage Data							

Table 6 Command Support
Data Page

Field Name	Description	
Support	The value of the Support field describes the type of support that the tape drive provides for Command Support Data .	
	Value	Description
	000b	Data about the requested SCSI operation code is not currently available. In this case, all data after Byte 1 is undefined.
	001b	The device does not support the SCSI operation code requested. In this case, all data after Byte 1 is undefined.
	010b	Reserved
	011b	The device supports the SCSI operation code in conformance with the SCSI standard.
	100b	Vendor-Specific
	101b	The device supports the SCSI operation code, but in a vendor-specific manner.
	110b	Vendor-Specific
	111b	Reserved
ISO-Version	Must be 0.	

Field Name	Description
ECMA-Version	Must be 0.
ANSI-Approved Version	2.
CDB Size	This field contains the number of bytes in the CDB for the Operation Code being requested and the size of the CDB Usage Data in the data that is returned in response to the INQUIRY .
CDB Usage Data	This field contains information about the CDB for the Operation Code being queried. Note that the first byte of the CDB Usage Data contains the OpCode for the operation specified. All of the other bytes of the CDB Usage Data contain a map for bits in the CDB of the OpCode specified.

NOTE: The bits in the map have a 1-to-1 correspondence to the CDB for the **OpCode** being queried. That is, if the device senses a bit as the entire field or as part of the field of the operation, the map in **CDB Usage Data** contains a 1 in the corresponding bit position. If the device ignores a bit or declares a bit as “reserved” in the CDB for the **OpCode** being queried, the map has a 0 in that corresponding bit position.

Load Unload Command (1Bh)

The **LOAD UNLOAD** command tells the target to eject all magazines. If no magazines are present, **UNLOAD** returns a **CHECK CONDITION** status with an **ILLEGAL REQUEST** sense key.

This command will eject the magazine(s) regardless of the setting via the **PREVENT/ALLOW MEDIUM REMOVAL** command.

Figure 10 Load Unload
Command Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Bh)							
1	Logical Unit Number			Reserved				Immed
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Table 7 Unload Command
Descriptor Block

Field Name	Description
Immed	Immediate. If this bit is set to 1, status is returned as soon as the operation is started. If set to 0, status is returned after the operation has completed.

Log Sense Command (4Dh)

The **LOG SENSE** command allows the host to retrieve statistical information maintained by the media changer about its own hardware parameters.

Figure 11 LOG SENSE
Command Descriptor Block

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

Table 8 Log Sense Command
Descriptor Block

Field Name	Description	
PPC	<p>Parameter Pointer Control. A PPC of 0 indicates that the parameter data requested from the device starts with the parameter code specified in the Parameter Pointer field (Bytes 5 - 6) and returns the number of bytes specified in the Allocation Length field (Bytes 7 - 8) in ascending order of parameter codes from the specified log page. Request for changed parameters is not supported. This field must be 0.</p>	
SP	<p>Save Parameters. Not supported, must be set to 0. If for some reason the Save Parameters bit is set, the command terminates with a CHECK CONDITION status with a sense key of ILLEGAL REQUEST and an ASC of INVALID FIELD IN CDB.</p>	
PC	<p>Page Control. This field defines the type of parameter values to be returned:</p>	
	PC	Type of Parameter Values
	00b	Threshold Values
	01b	Cumulative Values
	10b	Default Threshold Values
	11b	Default Cumulative Values
	<p>The Default Threshold Values are the maximum values that each parameter can attain.</p> <p>The Current Cumulative Values are the values computed since the last reset of the device (either via power-cycle, BUS DEVICE RESET, or SCSI RESET.)</p> <p>The Default Cumulative Values are the values to which each parameter is initialized at a reset condition. Default values are 0.</p> <p>By default, Current Threshold Values = Default Threshold Values.</p>	
Page Code	<p>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, sense key set to ILLEGAL REQUEST, and additional sense code of INVALID FIELD IN CDB. Supported pages are:</p>	
	Page Code	Page Definition
	00h	Supported Pages Log Page (00h)

Field Name	Description
07h	Last n Error Events Page (07h)
2Eh	"TapeAlert Page (2Eh)" on page 29
30h	"Move Statistics Page (30h)" on page 31
31h	"Hard/Soft Error Statistics Page (31h)" on page 32
33h	"Device Wellness Page (33h)" on page 34
3Eh	"Device Status Page (3Eh)" on page 37
Parameter Pointer	<p>The Parameter Pointer field allows the host to specify at which parameter within a log page the requested data should begin. For example, if a page supports parameters 0 through 5, and the Parameter Pointer contains 3, then only parameters 3, 4, and 5 are returned to the initiator. Similarly, if a page supports parameters 1, 3, and 6, and the Parameter Pointer contains 2, then only parameters 3 and 6 are returned to the initiator.</p> <p>If the Parameter Pointer is larger than the highest numbered parameter on the page, then the target terminates the command with CHECK CONDITION status, sense key set to ILLEGAL REQUEST, and additional sense code set to INVALID FIELD IN CDB.</p> <p>Note that parameters within a page are always returned in ascending order according to parameter code.</p> <p>If the target does not support a parameter code within this page, then it does not return any data associated with this parameter.</p>
Allocation Length	This field specifies the maximum number of bytes that the initiator has allocated for returning data. The host uses this field to limit the size of data transfers to its own internal buffer size.

**Supported Pages Log
Page (00h)**

When page **00h** is requested, the 4-byte page header is returned, followed by the pages supported in ascending order, one byte for each.

Figure 12 Supported Pages
Page

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (00h)					
1	Reserved							
2 – 3	(MSB) Page Length (7h)							(LSB)
4	00h							
5	07h							
6	2Eh							
7	30h							
8	31h							
9	33h							
10	3Eh							

Last n Error Events Page (07h)

This page returns the ASCII text for the hard error event log. This page consists of a page header, a parameter header and parameter value. The parameter value returned consists of the ASCII text for the **EEROM Hard Error Log**.

Figure 13 Last n Error Events Log Sense Header

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (07h)					
1	Reserved							
2 - 3	(MSB) Page Length (n) (LSB)							

Table 9 Last n Error Events Log Sense Header

Field Name	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE command descriptor block.
Page Length	The Page Length field specifies the total number of bytes contained in this log page, not including the four bytes that make up the header.

Figure 14 Format for Last n
Error Events Log Sense

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Parameter Code (LSB)							
2	DU	DS	TSD	ETC	TMC	Rsv'd	LP	
3	Parameter Length							
4 - n	(MSB) ASCII String for Event n (LSB)							

Table 10 Parameters Last n
Error Events Log Sense

Field Name	Description
Parameter Code	The Parameter Code value represents the relative time at which the error occurred. It identifies the log parameter being transferred for that log page. The most recent 10 events will be reported.
DU	Disable Update not supported, always 0.
DS	Save not supported, always 1.
TSD	Target Save Disable not supported, always 1.
ETC	Enable Threshold Comparison not supported, always 0.
TMC	Threshold Met Criteria not supported, always 0.
LP	List Parameter. This bit is set to 1.
Parameter Length	The length in bytes of the following parameter value.

Field Name	Description
ASCII Strong for Event n	The text includes the time of the event, the error code identifying the event, and additional data specific to the event.

TapeAlert Page (2Eh)

The **TapeAlert Log** page defines error and informational flags for detailed device diagnostics. The **TapeAlert** data is event-based and the page control bits in the **LOG SENSE** command are not applicable and are ignored.

The SuperLoader 3 supports the definition of the flags for media changer devices as defined in SMC-2.

Figure 15 TapeAlert Log Sense Header Format

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

Table 11 TapeAlert Log Sense Header Field Descriptions

Field Name	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE command descriptor block.
Page Length	The Page Length field specifies the total number of bytes contained in this log page, not including the four bytes that make up the header.

Figure 16 TapeAlert Page Log
Parameters Format

Bit Byte	7	6	5	4	3	2	1	0
$5n - 1$ to $5n$	MSB Parameter Code (n)							(LSB)
$5n + 1$	DU	DS	TSD	ETC	TMC	Rsv'd	LP	
$5n + 2$	Parameter Length							
$5n + 3$	Value of TapeAlert Flag (Flag is set when Bit 0 = 1; Bits 1 - 7 are Reserved)							

Table 12 TapeAlert Page Log
Parameters

Field Name	Description
Parameter Code	This field contains the Flag code.
DU	Disable Update
DS	Save not supported, always 1
TSD	Target Save Disable not supported, always 0.
ETC	Enable Threshold Comparison
TMC	Threshold Met Criteria
LP	List Parameter
Parameter Length	This field is set to 1.
Value of TapeAlert Flag	If Bit 0 is set to 1, indicates that TapeAlert has sensed a problem. If Bit 0 is 0, the Flag is not set and no problem has been sensed.

**Move Statistics Page
(30h)**

This page consists of the **Log Page Header** followed by a count of various movements of cartridges within the system. The entries in the log page are cumulative throughout the life of the unit and cannot be reset via SCSI or power cycle. Log Parameters are not supported for this page.

Figure 17 Move Statistics
Format

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (30h)					
1	Reserved							
2 - 3	(MSB) Page Length (18h) (LSB)							
4-7	(MSB) Total Moves (LSB)							
8-11	(MSB) Drive Loads (LSB)							
12-15	(MSB) Mail Slot Imports (LSB)							
16-19	(MSB) Mail Slot Exports (LSB)							

Bit Byte	7	6	5	4	3	2	1	0
20-23	(MSB) Magazine Moves (LSB)							
24-27	(MSB) Magazine Loads (LSB)							

Table 13 Move Statistics

Field Name	Description
Page Code	The page code is 30h.
Page Length	The page length is 18h bytes.
Total Moves	Total number of SuperLoader 3 moves.
Drive Loads	Number loads to the drive from magazines and mail slot.
Mail Slot Imports	Number times a cartridge was importing into the system.
Mail Slot Exports	Number of times a cartridge was exported from the system.
Magazine Moves	Number of moves between storage slots.
Magazine Loads	Number of times a cartridge was moved from a storage slot to the drive.

Hard/Soft Error Statistics Page (31h)

This page consists of the **Log Page Header** followed by a count of recovery actions performed. The entries in this log page are cumulative throughout the life of the unit and cannot be reset via SCSI or power cycle. Log Parameters are not supported for this page. These numbers, in relation to the total number of moves performed, can provide an indication as to the health of the servo system.

Figure 18 Hard/Soft Move
Error Statistics Format

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (31h)					
1	Reserved							
2 - 3	(MSB) Page Length (22h) (LSB)							
4-5	(MSB) Servo Hard Errors (LSB)							
6-9	(MSB) Drive Soft Error (LSB)							
10-13	(MSB) Left Magazine Soft Error (LSB)							
14-17	(MSB) Right Magazine Soft Error (LSB)							
18-21	(MSB) Mail Slot Soft Error (LSB)							
22-25	(MSB) Rotation Recovery Actions (LSB)							

Bit Byte	7	6	5	4	3	2	1	0
26-29	(MSB) Translation Recovery Actions (LSB)							
30-33	(MSB) Left Magazine Recovery Actions (LSB)							
34-37	(MSB) Right Magazine Recovery Actions (LSB)							

Table 14 Hard/Soft Error

Field Name	Description
Page Code	The page code is 31h.
Page Length	The page length is 22h bytes.
Servo Hard Errors	The number of unrecoverable errors.
Soft Errors	Each field is a count of the number of times high-level recoverable error was reported for that component.
Recovery Actions	Each field is a count of the number of times recovery actions were required in that axis to perform an operation.

Device Wellness Page (33h)

The **Device Wellness Page** returns information about any check conditions related to Sense Keys 4 and 9 logged by the media changer. Up to 16 entries (parameter code 0000h to 000Fh) can be contained in the page. Each entry records a hardware error (Sense Key = 4) or a code update event (Sense Key = 9). Note that parameter code 000h contains the oldest log information while parameter 000Fh contains the most recent.

This page begins with a 4-byte header followed by the log parameter blocks.

Figure 19 Device Wellness Log Sense Header

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

Table 15 Device Wellness Log Sense Header

Field Name	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE command descriptor block.
Page Length	The Page Length field specifies the number of bytes available and depends on the parameters requested.

Figure 20 Device Wellness Log Sense (0000h-000Fh)

Bit Byte	7	6	5	4	3	2	1	0
0-1	(MSB) Parameter Code (LSB)							

Bit Byte	7	6	5	4	3	2	1	0
2	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	Parameter Length (0Ch)							
4-7	(MSB) Time Stamp (LSB)							
8 - 9	(MSB) Source Element (LSB)							
10 - 11	(MSB) Destination Element (LSB)							
12	Sense Key							
13	Additional Sense Code							
14	Additional Sense Code Qualifier							
15	Additional Error Information							

Figure 21 Log Parameters for
Device Wellness Log Sense

Field Name	Description
Parameter Code	Parameter Codes 0000h through 000Fh are supported. This provides 16 log entries for error information capture.
DU	Disable Update. Always 0.
DS	Save not supported, always 1.

Field Name	Description
TSD	Target Save Disable not supported, always 1.
ETC	Enable Threshold Comparison. Threshold checking is not supported on this page. Always set to 0.
TMC	Threshold Met Criteria. Always 0.
LP	List Parameter. Always set to 0.
Parameter Length	The number of bytes to follow (0Ch).
Time Stamp	The Time Stamp is represented as number of power cycles and total power on hours.
Source Element/ Destination Element	These fields report the element addresses that were involved in the failure. These fields will be zero (0) if the failure did not involve a move command.

Device Status Page (3Eh)

The **Device Status Page** describes the current status of the media changer.

Figure 22 Device Status Log Sense Header

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

Table 16 Device Status Log Sense Header

Field Name	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE command descriptor block.
Page Length	The Page Length field specifies the number of bytes available and depends on the parameters requested.

Figure 23 Parameters for Device Status Log Sense Page

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	Parameter Code							
2	DU	DS	TSD	ETC	TMC	Rsv'd	LP	
3	Parameter Length (04h)							
4 - 7	(MSB) Parameter Value (LSB)							

Table 17 Parameters for
Device Status Log Sense Page

Field Name		Description
Parameter Code		Parameter Codes 0000h through 0004h are supported:
	Code	Description
	0000h	Specifies device type. This value is always 0h.
	0001h	Specifies device status (figure 24).
	0002h	Specifies the number of move operations over the lifetime of the device.
	0003h	Reserved for media changer device and shall contain 0.
	0004h	Vendor specific
DU		Disable Update. Always 0.
DS		Save not supported, always 1.
TSD		Target Save Disable not supported, always 1.
ETC		Enable Threshold Comparison. Threshold checking is not supported on this page. Always set to 0.
TMC		Threshold Met Criteria. Always 0.
LP		List Parameter. Always set to 0 (parameter codes treated as data counter).

Figure 24 Device Status Log
Sense Page (0001h)

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved				Temperature		Status	
2 - 3	Reserved							

Table 18 Device Status Log
Sense (0001h)

Field Name	Description		
Temperature	These two bits indicate the temperature of the device. This field follows the following format:		
	Bit 3	Bit 2	Description
	0	0	Not supported
	0	1	OK
	1	0	Warning: Safe temperature exceeded.
	1	1	Maximum temperature exceeded.
Status	These two bits indicate the overall condition of the device. The status of the device follows the following format:		
	Bit 1	Bit 0	Description
	0	0	Not supported
	0	1	OK
	1	0	Degraded
	1	1	Failed

Mode Select (6) / (10) Command (15h / 55h)

The **MODE SELECT** command (available in either 6- or 10-byte format) enables the host to configure the media changer. Implementing **MODE SELECT** and **MODE SENSE** requires “handshaking” between the host and the media changer. Before configuring the media changer, the host should issue a **MODE SENSE** command to the media changer to obtain a report of the current configuration and determine what parameters are configurable. The host interprets this information and then may issue **MODE SELECT** to set the media changer to the host’s preferred configuration. The **Mode Parameter List** described in [Mode Parameter List](#) is passed from the initiator to the media changer during the command’s **DATA OUT** phase. The media changer device does not allow the host to save any values on any page.

Information for the media changer is carried on a number of pages, each of which serves to set the media changer’s operating parameters. The **MODE SELECT** pages supported, and the page within this manual that details each, are:

Page Code	Description
1Ch	“TapeAlert Page (1Ch)” on page 53
1Dh	“Element Address Assignment Page” on page 56
1Eh	“Transport Geometry Parameters Page” on page 58
1Fh	“Device Capabilities Page” on page 60

Figure 25 Mode Select (6)
 Command Descriptor

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

Bit Byte	7	6	5	4	3	2	1	0
2 – 3	Reserved							
4	Parameter List Length							
5	Unused (00)		Reserved				Flag	Link

Figure 26 Mode Select (10)
 Command Descriptor

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

Table 19 Mode Select (6)/(10)
 Command Descriptor

Field Name	Description
PF	Page Format. The Page Format bit indicates that the data sent by the host after the MODE SELECT header and block descriptors complies with the definition of pages in the SCSI-2 specification. The SCSI-1 format will not be implemented so this bit must be set to 1. It is an ILLEGAL REQUEST to have page parameters while the PF bit is 0.
SP	Save Parameters. Must be 0. If set, this bit instructs the SuperLoader 3 to save all savable pages, and this is not supported.

Mode Parameter List

The following figure shows the format of the **Mode Parameter List** that is passed by the initiator to the media changer during the command's **DATA OUT** phase.

Figure 27 Mode Select (6)
 Mode Parameter List

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	Mode Parameter Header							
4 - 11	Mode Parameter Block Descriptor (Optional)							
4 - 11 or 12 - n	Page(s) (Optional)							

Figure 28 Mode Select (10)
 Mode Parameter List

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	Mode Parameter Header							
8 - 15	Mode Parameter Block Descriptor (Optional)							
8 - n or 16 - n	Page(s) (Optional)							

Table 20 Mode Select
 Parameter List

Field Name	Description
ModeParameter Header	4 or 8 bytes in length, contains information about the remainder of the Parameter List and is always present.

Field Name	Description
ModeParameter Block Descriptor	8 bytes in length; not applicable to a media changer device.
Page(s)	The Page Code(s) of the pages that are a part of this MODE SELECT command.

Mode Parameter Header

The figures and table that follow provide an illustration and description of the fields that make up the **MODE SELECT** command's **Mode Parameter** header.

Figure 29 Mode Select (6)
 Parameter Header

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

Figure 30 Mode Select (10)
 Parameter Header

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

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

Table 21 Mode Select
 Parameter Header

Field Name	Description
Block Descriptor Length	This field specifies the length in bytes of all the block descriptors. Since the media changer only allows one block descriptor, the value must be either 0 or 8. A value of 0 indicates no block description is included; a value of 8 indicates a block descriptor is present and precedes the mode page data. Any other value other than 0 or 8 causes a CHECK CONDITION status with sense key of ILLEGAL REQUEST to be returned.

Mode Parameter Block Descriptor

The figure and table that follow provide an illustration and description of the fields that make up the **MODE SELECT** command's **Mode Parameter Block Descriptor**.

Figure 31 Mode Select
 Parameter

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							
1 - 3	(MSB) Number of Blocks							(LSB)
4	Reserved							
5 - 7	(MSB) Block Length							(LSB)

Table 22 Mode Select
 Parameter Block

Field Name	Description
Number of Blocks	This field is sent as 0. It is not applicable to media changer devices.
Block Length	This field is sent as 0. It is not applicable to media changer devices.

Mode Page Descriptors

Following the **MODE SELECT** command's **Mode Parameter Block Descriptor** are the **MODE SELECT** pages, each of which sets a different device parameter. Each mode page has a 2-byte header that identifies the page code and indicates the number of bytes in that page.

Figure 32 Mode Select Page
 Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code					
1	Additional Page Length							
2 - n	Page-Defined or Vendor Specific Parameter List							

Table 23 Mode Select Page
 Descriptor

Field Name	Description
PS	Parameters Savable. For the MODE SELECT (6) (10) commands, this field is reserved (0).
Additional Page Length	Indicates number of bytes in that page (not including bytes 0 and 1).
Page-Defined or Vendor Specific Parameter List	Information in this field depends on the mode page. Refer to “Element Address Assignment Page” on page 56 to “Device Capabilities Page” on page 60.

Mode Sense (6) / (10) Command (1Ah/ 5Ah)

The **MODE SENSE** command allows the media changer to report its current or changeable configuration parameters to the host. It is a complementary command to **MODE SELECT**.

The command descriptor block for the 6-byte **MODE SENSE (1Ah)** is shown below. An illustration of the command descriptor block for the 10-byte **MODE SENSE (5Ah)** follows on the next page.

Figure 33 Mode Sense (6)
 Command Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Logical Unit Number			Rsv'd	DBD	Reserved		
2	PC		Page Code					
3	SubPage							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

The **MODE SENSE (10)** command returns descriptor data in a different format than **MODE SENSE (6)**.

Figure 34 Mode Sense (10)
 Command Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Ah)							
1	Logical Unit Number		Rsv'd	DBD	Reserved			
2	PC		Page Code					
3	SubPage							
4 – 6	Reserved							
7 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved			Flag	Link	

Table 24 Mode Sense
 Command Descriptor Block

Field Name	Description								
DBD	Disable Block Descriptors. This field is ignored. This device does not return a block descriptor regardless of this field.								
PC	Page Control. The Page Control field indicates the type of page parameter values to be returned to the host:								
	<table border="1"> <thead> <tr> <th>PC</th> <th>Type of Parameter Values</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>Report Current Values</td> </tr> <tr> <td>01</td> <td>Report Changeable Values</td> </tr> <tr> <td>10</td> <td>Report Default Values</td> </tr> </tbody> </table>	PC	Type of Parameter Values	00	Report Current Values	01	Report Changeable Values	10	Report Default Values
PC	Type of Parameter Values								
00	Report Current Values								
01	Report Changeable Values								
10	Report Default Values								

Field Name	Description	
	11	Report Saved Values
	Note that the media changer device does not support saved values.	
Page Code	This field allows the host to select any specific page or all of the pages supported by the media changer.	
	Page Code	Description
	1Ch	“TapeAlert Page (1Ch)” on page 53
	1Dh	“Element Address Assignment Page” on page 56
	1Eh	“Transport Geometry Parameters Page” on page 58
	1Fh	“Device Capabilities Page” on page 60
	3Fh	Return all pages
SubPage	This field can have three values: 41h Extended Device Capabilities SubPage FFh All SubPages 00h No SubPage format	
Allocation Length	This field specifies the number of bytes that the host has allocated for returned MODE SENSE data. An allocation length of zero indicates that the media changer will return no MODE SENSE data. This is not considered an error, and GOOD status is returned.	

MODE SENSE may be either **MODE SENSE (6)** or **MODE SENSE (10)**. **MODE SENSE (6)** data contains a 4-byte header followed by one 8-byte block descriptor, followed by zero or more variable length pages, depending on the **Page Code** and **Allocation Length**.

Mode Sense Data Headers

The **MODE SENSE (6)** and **MODE SENSE (10)** headers are illustrated in the following figures.

Figure 35 Mode Sense (6)
 Data Header

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

Figure 36 Mode Sense (10)
 Data Header

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

Table 25 Mode Sense Data Header

Field Name	Description
Mode Sense Data Length	This field specifies the length (in bytes) of the MODE SENSE data that is available to be transferred during the DATA IN phase. Note that the Mode Sense Data Length does not include itself.
Block Descriptor Length	This field specifies the length (in bytes) of all of the block descriptors. This value will be 0, indicating no Block Descriptors were sent.

Mode Sense Mode Pages

The following figure depicts the variable length page descriptor.

Figure 37 Mode Sense Page Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code					
1	Additional Page Length							
2	Page Defined or Vendor Specific Parameter Bytes							

Descriptions of the **MODE SENSE** page descriptor fields are provided in the following table. Detailed descriptions of each of the **MODE SENSE Pages** follow.

Table 26 Mode Sense Page Descriptor

Field Name	Description
PS	Parameters Savable. When 0, the supported parameters cannot be saved (savable pages are not supported). When set to 1, it indicates that the page can be saved in nonvolatile memory by the media changer.

Field Name	Description
Additional Page Length	This field indicates the number of bytes in the page. Note that this value does not include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set to the same value when performing MODE SELECT .

TapeAlert Page (1Ch)

The SuperLoader 3 supports the **TapeAlert Page** that is used to set/change the supported **TapeAlert** configuration options. Use the **MODE SENSE** command to read the settings of the **TapeAlert** page.

Figure 38 TapeAlert Page Format Descriptor

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

Table 27 TapeAlert Page
Format Descriptor

Field Name	Description				
PS	Parameters Savable. Not supported, this bit must be 0.				
Additional Page Length	This field indicates the number of bytes in the page. However, this value does not include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set to the same value when performing MODE SELECT . If the page length does not match that expected by the drive, a CHECK CONDITION status is returned, sense key set to ILLEGAL REQUEST . The device returns a <i>CHECK CONDITION</i> status with sense key set to ILLEGAL REQUEST if it receives an unsupported Page Code or a Page field with values not supported or changeable. In such cases, no parameters are changed as a result of the command.				
Perf	Performance bit. Performance Impacting Exceptions are acceptable. This bit is ignored.				
DExcpt	Disable Information Exception Operations. If = 0, the reporting method specified by the contents of MRIE is selected. When this bit is set to 1, all information exception conditions are disabled regardless of the contents for the MRIE field. To enable CHECK CONDITION mode, DExcpt should = 0. Default setting = 1.				
Test	Test bit. Used to generate false TapeAlert conditions to test the response to failure conditions. See the Report Count/Test Flag Number description for more information. If both Test and DExcpt are set to 1, the drive will return CHECK CONDITION status, with a send key ILLEGAL REQUEST , and additional sense data of INVALID FIELD IN PARAMETER LIST .				
LogErr	Error Log. Not supported.				
MRIE	Method for Reporting Information Exceptions. The tape drive uses the contents of this field to report information about exception conditions.				
	<table border="1"> <thead> <tr> <th>Value</th> <th>Method</th> </tr> </thead> <tbody> <tr> <td>00h</td> <td>No reporting of Informational Exception Conditions. The device server does not report information exception conditions.</td> </tr> </tbody> </table>	Value	Method	00h	No reporting of Informational Exception Conditions. The device server does not report information exception conditions.
Value	Method				
00h	No reporting of Informational Exception Conditions. The device server does not report information exception conditions.				

Field Name	Description	
	03h	<p>Conditionally Generate Recovered Error. The device server reports information exception conditions, if such reports of recovered errors is allowed, by returning CHECK CONDITION status on the next SCSI command (except INQUIRY and REQUEST SENSE commands) following detection of the condition. The Sense Key is set to RECOVERED ERROR with an additional sense code of 5D 00 (TapeAlert Event). The SCSI command with CHECK CONDITION completes without error prior to the report of any exception condition, and does not need to be repeated.</p>
	04h	<p>Unconditionally Generate Recovered Error. The drive reports information exception conditions by returning CHECK CONDITION status on the next SCSI command (except INQUIRY and REQUEST SENSE commands) following detection of the condition. The Sense Key is set to RECOVERED ERROR with an additional sense code of 5D 00 (TapeAlert Event). The SCSI command with CHECK CONDITION completes without error prior to the report of any exception condition, and does not need to be repeated.</p>
	06h	<p>Only Report Informational Exception Condition on Request. The device server preserves informational exception data. To access the data, a poll can be taken by issuing an unsolicited REQUEST SENSE command. The Sense Key is set to NO SENSE with an additional sense code of 5D 00 (TapeAlert Event).</p> <p>The additional sense code of 5D 00 for values 03h, 04h, and 06h signals that a TapeAlert event has occurred. Information about the event is stored in the TapeAlert Log Page. The setting of MRIE does not impact logging of events in the TapeAlert Log Page.</p>
Interval Timer	Not supported.	
Report Count/Test Flag Number	<p>Report Count or Test Flag Number. This field must be set to 0 unless the Test bit is set. When the Test bit is set, this field indicates that a test condition to be generated as follows:</p>	

Field Name	Description	
	Value	Result
	0	Change no TapeAlert Flag but report an exception condition based on the setting of the MRIE field.
	1 to 64	Set the TapeAlert Flag indicated in the value and generate an exception condition based on the MRIE field.
	-1 to -64	Clear the TapeAlert Flag in an equivalent manner to taking corrective action as indicated by the absolute number of the value.
	32767	Set all TapeAlert Flags and generate an exception condition based on the setting of the MRIE field.

Element Address Assignment Page

The element address assignment page is used to report element address assignments to the host. This page also defines the number of each type of element present. None of the fields in this page are changeable.

Figure 39 Element Address Assignment Page

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	RSVD	Page Code (1Dh)					
1	Parameter List Length (12h)							
2-3	(MSB)	First Medium Transport Element Address						(LSB)

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

Table 28 Element Address
 Assignment Page

Field Name	Description
First Medium Transport Element Address	Identifies the address of the first medium transport element contained in the media changer. The SuperLoader 3 uses the default address of 0.
Number of Medium Transport Elements	Defines the total number of medium transport elements contained in the media changer. The SuperLoader 3 contains 1.
First Storage Element Address	Identifies the address of the first medium storage element contained in the media changer.
Number of Storage Elements	Defines the total number of storage elements contained in the media changer. There are 16 total, although since the magazines are removable, eight of them may be “inaccessible” at times.
First Import/Export Element Address	Identifies the address of the first import/export element that is accessible both by the medium transport device and also by an operator from outside the media changer.
Number of Import/Export Elements	Defines the total number of import/export elements contained in the media changer.
First Data Transfer Element Address	Identifies the address of the first data transfer element contained in the media changer. The first element is 0020h .
Number of Data Transfer Elements	Defines the total number of data transport elements contained in the media changer. The SuperLoader 3 contains 1.

Transport Geometry Parameters Page

The transport geometry parameters page defines whether each medium transport element of a media changer is a member of a set of elements that share a common robotics subsystem and whether the element is capable of media rotation. One transport geometry descriptor is transferred for each medium transport element, beginning with the first medium transport element. None of the fields in the page are changeable.

Figure 40 Transport Geometry Parameters Page

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	RSVD	Page Code (1Eh)					
1	Parameter Length (02h)							
2-n	Transport Geometry Descriptor(s)							

The geometry of each medium transport element is defined using a two-byte field as defined in [figure 41](#).

Figure 41 Transport Geometry Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							Rotate
1	Member Number In Transport Element Set							

Table 29 Transport Geometry Parameters Page

Field Name	Description
Parameter length	Specifies the number of bytes of transport geometry descriptors to follow. This field has a value of 2.
Rotate	This bit is sent as 0. Rotation of the medium transport element is not supported.
Member Number in Transport Element Set	This field is sent as 0. There is only one medium transport element and robotic subsystem.

Device Capabilities Page

The device capabilities page defines characteristics of the element types of a media changer. This information may be employed by the initiator to determine functions permitted by the **MOVE MEDIUM** command. None of the fields in the page are changeable.

Figure 42 Device Capabilities Page

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	SPF (0)	Page Code (1Fh)					
1	Parameter Length (12h)							
2	Reserved			STORDT (1)	STORI/E (0)	STORST (1)	STORMT (1)	
3	Reserved							
4	Reserved			MT->DT (1)	MT->I/E (0)	MT->ST (1)	MT->MT (1)	
5	Reserved			ST->DT (1)	ST->I/E (0)	ST->ST (1)	ST->MT (1)	
6	Reserved			I/E->DT (0)	I/E->I/E (0)	I/E->ST (0)	I/E->MT (0)	
7	Reserved			DT->DT (1)	DT->I/E (0)	DT->ST (1)	DT->MT (1)	
8-11	Reserved							
12	Reserved			MT<>DT (0)	MT<>I/E (0)	MT<>ST (0)	MT<>MT (0)	
13	Reserved			ST<>DT (0)	ST<>I/E (0)	ST<>ST (0)	ST<>MT (0)	

Bit Byte	7	6	5	4	3	2	1	0
14	Reserved				I/E<>DT (0)	I/E<>I/E (0)	I/E<>ST (0)	I/E<>MT (0)
15	Reserved				DT<>DT (0)	DT<>I/E (0)	DT<>ST (0)	DT<>MT (0)
16-19	Reserved							

The field names in [figure 42](#) use the following element type abbreviations:

- MT – a medium transport element
- ST – a storage element
- I/E – an import/export element
- DT – a data transfer element

In the descriptions, XX and YY are any of the element type abbreviations.

Table 30 Device Capabilities Page

Field Name	Description
PS	Parameters Savable. This bit is reserved for MODE SELECT and must be 0. Saved parameters are not supported and must be 0 for MODE SENSE .
SPF	A SubPage Format bit set to zero indicates that the subpage format is not used for this page.
STORXX	These bits are sent as 1 for all element types to indicate that each element type provides storage for a unit of media.
XX->YY	These bits are sent as 1 for all element types to indicate that the media changer supports all MOVE MEDIUM commands between all types of elements.
XX<>YY	These bits are sent as 0 to indicate that the media changer does not support the EXCHANGE MEDIUM command for any combination of element types.

Extended Device Capabilities Page

The extended device capabilities page defines characteristics of the media changer. This information may be employed by the application client to determine functions permitted by the media changer.

Figure 43 Extended Device Capabilities Page

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	SPF (1)	Page Code (1Fh)					
1	SubPage Code (41h)							
2-3	(MSB) Page Length (10h) (LSB)							
4	Reserved	MVPRV	MVCL	MVOP	USRCL	USROP	IEST	
5	Reserved		DTEDA	RSSEA	MVTRY	IEMGZ	SMGZ	
6	Reserved				TREXC	LCKIE	LCKD	
7	Reserved				SPMER	DPMER	PEPOS	
8	Reserved						UCST	
9-19	Reserved							

Table 31 Extended Device
 Capabilities Page

Field Name	Description
PS	The parameters savable (PS) bit is only used with the MODE SENSE command. This bit is reserved with the MODE SELECT command. A PS bit set to one indicates that the device server is capable of saving the page in a nonvolatile vendor specific location. A PS bit set to zero indicates that the device server is not able to save the page.
SPF	A SubPage Format (SPF) bit set to one indicates that the subpage mode page format is being used.
MVPRV	A move prevented to import/export element (MVPRV) bit set to one indicates that the media changer prevents moves with the import/export element as destination element address when medium removal is prevented with the PREVENT ALLOW MEDIUM REMOVAL command. An MVPRV bit set to zero indicates that the media changer does not prevent moves with the import/export element as destination element address when medium removal is prevented with the PREVENT ALLOW MEDIUM REMOVAL command.
MVCL	A move closes import/export element (MVCL) bit set to one indicates that the media changer will closes the import/export element whenever a command is issued to move media from an open import/export element. An MVCL bit set to zero indicates that the media changer does not close the import/export element whenever a command is issued to move media from an open import/export element.
MVOP	A move opens import/export element (MVOP) bit set to one indicates that the media changer opens the import/export element for operator access whenever a command is issued to move media with an import/export element as a destination element address. An MVOP bit set to zero indicates that the media changer does not open the import export element for operator access whenever a command is issued to move media with an import/export element as a destination element address.
USRCL	A user control import/export element close (USRCL) bit set to one indicates that the media changer requires the operator to manually close an open import/export element. An USRCL bit set to zero indicates that the media changer does not require the operator to manually close an open import/export element.

Field Name	Description
USROP	A user control import/export element open (USROP) bit set to one indicates that the media changer requires the operator to manually open a closed import/export element. An USROP bit set to zero indicates that the media changer does not require the operator to manually open a closed import/export element.
IEST	An import/export element state (IEST) bit set to one indicates that the media changer is able to detect medium presence in all import/export elements. An IEST bit set to zero indicates that the media changer is not able to detect medium presence in all import/export elements.
DTEDA	A data transfer element empty on door access (DTEDA) bit set to one indicates that the media changer requires all data transfer elements not contain media before access via the door is possible. A DTEDA bit set to zero indicates that the door may be opened while data transfer elements contain media.
RSSEA	A return to source storage element address (RSSEA) bit set to one indicates that the media changer requires the application client to return the medium to the element address specified in the SOURCE STORAGE ELEMENT ADDRESS field. An RSSEA bit set to zero indicates that the application client does not need to return the medium to the element address specified in the SOURCE STORAGE ELEMENT ADDRESS field.
MVTRY	A move tray (MVTRY) bit set to one indicates that the media changer uses removable trays in its elements, which requires the medium to be placed in a tray and the tray moved to the desired position. An MVTRY bit set to zero indicates that the media changer does not use trays in its elements.
IEMGZ	An import/export magazine (IEMGZ) bit set to one indicates that the media changer uses medium magazines for some import/export elements. An IEMGZ bit set to zero indicates that the media changer does not use medium magazines for any import/export element.
SMGZ	A storage magazine (SMGZ) bit set to one indicates that the media changer uses medium magazines for some storage elements. A SMGZ bit set to zero indicates that the media changer does not use medium magazines for any storage element.

Field Name	Description
TREXC	A true exchange capable (TREXC) bit set to one indicates that the media changer allows an EXCHANGE MEDIUM command that has the second destination element address equal to the source element address. A TREXC bit set to zero indicates that the media changer does not allow an EXCHANGE MEDIUM command that has the second destination element address equal to the source element address.
LCKIE	A lock import/export element (LCKIE) bit set to one indicates that the PREVENT ALLOW MEDIUM REMOVAL command with the PREVENT field set to 01b secures the media changer import/export element(s). An LCKIE bit set to zero indicates that the PREVENT ALLOW MEDIUM REMOVAL command with the PREVENT field set to 01b does not secure the media changer import/export element(s).
LCKD	A lock door (LCKD) bit set to one indicates that the PREVENT ALLOW MEDIUM REMOVAL command with the PREVENT field set to 01b secures the media changer door(s). An LCKD bit set to zero indicates that the PREVENT ALLOW MEDIUM REMOVAL command with the PREVENT field set to 01b does not secure the media changer door(s).
SPMER	A source pre-move eject required (SPMER) bit set to one indicates that the media changer requires the application client to send an explicit command to the data transfer element to eject the medium before the media changer is able to move the medium from the data transfer element. A SPMER bit set to zero indicates that the application client does not need to send an explicit command to the data transfer element to eject the medium before the media changer is able to move the medium from a data transfer element.
DPMER	A destination pre-move eject required (DPMER) bit set to one indicates that the media changer requires the application client to send an explicit command to the data transfer element to extend the drive mechanism before the media changer is able to move the medium to the data transfer element. (e.g. a CD-ROM changer that requires the tray to be presented before the MOVE MEDIUM operation starts). A DPMER bit set to zero indicates that the application client does not need to send an explicit command to the data transfer element before the media changer is able to move the medium to the data transfer element.

Field Name	Description
PEPOS	An pre-eject position (PEPOS) bit set to one indicates that the media changer requires a POSITION TO ELEMENT command to position the medium transport element to a data transfer element before an eject (see SSC-3). An PEPOS bit set to zero indicates that the media changer does not require a POSITION TO ELEMENT command to position the medium transport element to a data transfer element before an eject.
UCST	An unassigned cleaning storage (UCST) bit set to one indicates that the device server does not assign element addresses to the physical entities that contain cleaning media. These unassigned physical entities are not reported in the READ ELEMENT STATUS data. A UCST bit set to zero indicates that the device server assigns element addresses to physical entities that contain cleaning media.

Move Medium Command (A5h)

The **MOVE MEDIUM** command requests that the SuperLoader 3 move a volume from a source element to a destination element.

Figure 44 Move Medium
Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	Logical Unit Number			Reserved				
2-3	(MSB) Medium Transport Address (LSB)							
4-5	(MSB) Source Address (LSB)							
6-7	(MSB) Destination Address (LSB)							
8-9	Reserved							
10	Reserved							INV
11	Unused	Reserved				Flag	Link	

If the Source Address element is empty, the target shall return **CHECK CONDITION** status. The sense key shall be **ILLEGAL REQUEST** and the additional sense code **Medium Source Element Empty**. If the **Destination Address** element is full, and different from the **Source Address** element, the target shall return **CHECK CONDITION** status. The sense key shall be **ILLEGAL REQUEST** and the additional sense code **Medium Destination Element Full**.

Table 32 Move Medium Command

Field Name	Description
Medium Transport Address	Must be set to 0. Specifies the medium transport element that is to be used in executing this command.
Source Address Destination Address	These fields can be any valid element address. If it is not valid, the media changer shall return CHECK CONDITION status. The sense key shall be ILLEGAL REQUEST and the additional sense code INVALID ELEMENT ADDRESS .
INV	Must be set to 0. Inverting and rotating are not supported.

The device capabilities **MODE SENSE** page provides a matrix with the supported source element or destination element combinations for the **MOVE MEDIUM** command.

Persistent Reserve In Command (5Eh)

The **PERSISTENT RESERVE IN** command is a 10-byte command used to obtain information about persistent reservations and registrations that are active within a device server. It is used in conjunction with the **PERSISTENT RESERVE OUT** command.

Note: Support for Persistent Reserve is drive type dependent. See individual drive documentation for complete details.

The following figure illustrates the format of the **PERSISTENT RESERVE IN** command; the table that follows explains the data fields of the command.

Figure 45 Persistent Reserve
 In Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Eh)							
1	Reserved			Service Action				
2 - 6	Reserved							
7 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved			Flag		Link

Note: The original SCSI specification allowed users to specify the LUN (Logical Unit Number) in bits 7 - 5 in byte 1. Systems still set the LUN on the initial **INQUIRY** when talking to a newer than SCSI-2 device. There are systems/drivers in the field that set the legacy LUN field in all CDBs. HP drives ignore the legacy LUN field in all CDBs that identify bits 7 - 5 in byte 1 as reserved. These values will vary depending on the drive type.

Table 33 Persistent Reserve In Command

Field Name	Description		
Service Action	Service actions that require information about persistent reservation and registrations may require enabling of nonvolatile memory within the logical unit. Service action codes available are:		
	Code	Name	Description
	00h	Read Keys	Reads all registered reservation keys
	01h	Read Reservations	Reads all current persistent reservations
	02-1Fh	Reserved	Reserved
	<p>A Read Keys service action requests that the device server return a parameter list that includes a header and a complete list of all of the reservation keys currently registered with the device server. If multiple initiators have registered with the same key, then the key is listed multiple times, once for each registration. Refer to figure 46 and table 34 for information about Read Keys parameter data.</p> <p>A Read Reservation service action requests that the device server return a parameter list that contains a header and a complete list of all persistent reservations that are presently active in the device server. Refer to figure 47 on page 73 and table 35 on page 73 for information about Read Reservations parameter data.</p>		

Field Name	Description
Allocation Length	<p>This field indicates how much space has been reserved for the returned parameter list (Read Keys or Read Reservations parameters). The actual length of the parameter data is indicated in the parameter data field for those parameters.</p> <p>If the Allocation Length is not sufficient to contain the entire list of parameters, the first portion of the list that does fit is returned. If it is determined that the remainder of the list is required, the client should send a new PERSISTENT RESERVE IN command with an Allocation Length field large enough to contain the entire list of parameters.</p>

The figure and table below illustrate and describe the data fields of **Read Key** data parameters.

Figure 46 Read Keys Parameters

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Generation (LSB)							
4 - 7	(MSB) Additional Length ($n - 7$) (LSB)							
(Reservation Key List Follows in Bytes 8 - n)								
8 - 15	(MSB) First Reservation Key (LSB)							
...								

Bit Byte	7	6	5	4	3	2	1	0
<i>n</i> – 7 to <i>n</i>	(MSB) Last Reservation Key							(LSB)

Table 34 Read Keys Parameters

Field Name	Description
Generation	<p>The value in this field is a 32-bit counter in the device server that is incremented each time a PERSISTENT RESERVE OUT command requests a Register, Clear, Pre-empt, or Pre-empt and Clear operation. Note that PERSISTENT RESERVE IN commands do not increment the counter, nor do PERSISTENT RESERVE OUT commands that perform a Reserve or Release service action, or by a PERSISTENT RESERVE OUT command that is not done due to an error or a reservation conflict. The value in the Generation field is set to 0 as part of the power on or reset processes.</p> <p>The value in the Generation field allows the application client that examines the value to verify that the configuration of the initiators attached to a logical unit has not been modified by another application client without any notification of the application client doing the examination.</p>
Additional Length	<p>This field contains the count of the number of bytes that are in the Reservation Key list (bytes 8 – <i>n</i>). Note that this field contains the number of bytes in the reservation key list regardless of the value prescribed by the Allocation Length field in the command's CDB.</p>
Reservation Keys	<p>Each of the Reservation Keys appear as items in a list as bytes 8 through <i>n</i>. Each entry reflects an 8-byte reservation key registered with the device server via the PERSISTENT RESERVE OUT, Register or Register and Ignore Existing Key service actions. Each key can be examined by the application client for correlation with a set of initiators and SCSI ports.</p>

The following figure and table illustrate and describe the data fields of **Read Reservations** data parameters.

Figure 47 Read Reservations
Parameters

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

Table 35 Read Reservations
Parameters

Field Name	Description
Generation	<p>The value in this field is a 32-bit counter in the device server that is incremented each time a PERSISTENT RESERVE OUT command requests a Register, Clear, Pre-empt, or Pre-empt and Clear operation. Note that PERSISTENT RESERVE IN commands do not increment the counter, nor do PERSISTENT RESERVE OUT commands that perform a Reserve or Release service action, or by a PERSISTENT RESERVE OUT command that is not done due to an error or a reservation conflict. The value in the Generation field is set to 0 as part of the power on or reset processes.</p> <p>The value in the Generation field allows the application client that examines the value to verify that the configuration of the initiators attached to a logical unit has not been modified by another application client without any notification of the application client doing the examination.</p>

Field Name	Description
Additional Length	This field contains the count of the number of bytes of Reservation descriptors (bytes 8 – <i>n</i>). Note that this field contains the number of bytes regardless of the value prescribed by the Allocation Length field in the command's CDB .
Reservations Descriptors	One Reservation descriptor is reported for each unique persistent reservation on the logical unit when the PERSISTENT RESERVE IN command has indicated a Read Reservations action. Figure 48 and table 36 detail the contents of each Reservation Descriptors field.

The figure and table below illustrate and describe the data fields of each **Read Reservations** descriptor's data fields.

Figure 48 Persistent Reserve
 In Read Reservations

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

Table 36 Persistent Reserve In
 Read Reservations Descriptor

Field Name	Description		
Reservation Key	The Reservation Key field contains an 8-byte value that identifies the reservation key under which the persistent reservation is held.		
Scope-Specific Address	Used to indicate the element that is the reservation affects when a reservation is for an element rather than a logical unit. The SuperLoader 3 does not support reservations of elements, so this field is always 0.		
Scope	<p>The value in this field indicates whether a persistent reservation applies to an entire logical unit, to a part of the logical unit (defined as an extent), or to an element.</p> <p>The values for the Scope field are:</p>		
	Code	Name	Description
	0h	LU	Logical Unit. Persistent reservation applies to the full logical unit. The LU scope is therefore implemented by all device servers that implement PERSISTENT RESERVE OUT .
	1h	Obsolete	
	2h	Element	Persistent reservation applies to an element. Reservations of elements. Is not supported.
	3h - Fh	Reserved	Reserved
Type	The value of the Type field specifies the characteristics of the persistent reservation being established for all data blocks within the extent or within the logical unit. Refer to table 39 on page 87 for the applicable Type codes and their meanings.		

The following table describes the available “**Type**” values from the **Type** field of the **PERSISTENT RESERVE IN Read Reservations** parameters.

Each of the codes provides handling instructions for **READ** operations, for **WRITE** operations, and for subsequent attempts to establish persistent reservations, referred to as “**Additional Reservations Allowed**” in the table.

Table 37 Persistent
 Reservation Type Codes

Code	Name	Description
0h	Obsolete	
1h	WRITE Exclusive	<p>READS: Shared; any application client on any initiator may execute commands that perform transfers from the target to the initiator.</p> <p>WRITES: Exclusive; any command from any initiator other than the initiator that holds the persistent reservation that attempts a transfer to the target results in a reservation conflict</p> <p>ADDITIONAL RESERVATIONS: Allowed; any initiator may reserve the logical unit, extents, or elements as long as the persistent reservations do not conflict with any reservations already known to the device server.</p>
2h	Obsolete	
3h	Exclusive Access	<p>READS: Exclusive; any command from any initiator other than the initiator holding the persistent reservation that attempts a transfer from the target results in a reservation conflict.</p> <p>WRITES: Exclusive; any command from any initiator other than the initiator holding the persistent reservation that attempts a transfer to the target results in a reservation conflict.</p> <p>ADDITIONAL RESERVATIONS: Restricted; any PERSISTENT RESERVE OUT command with the Reserve service action from any initiator other than the initiator holding the persistent reservation results in a reservation conflict. The initiator that holds the persistent reservation can reserve the logical unit, extents, or elements as long as the persistent reservations do not conflict with any reservations already known to the device server.</p>
4h	Obsolete	

Code	Name	Description
5h	WRITE Exclusive, Registrants Only	<p>READS: Shared; any application client on any initiator may execute commands that perform transfers from the target to the initiator.</p> <p>WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the device server that attempts a transfer to the target results in a reservation conflict</p> <p>ADDITIONAL RESERVATIONS: Allowed; any initiator may reserve the logical unit, extents, or elements as long as the persistent reservations to not conflict with any reservations already known to the device server.</p>
6h	Exclusive Access, Registrants Only	<p>READS: Exclusive; any command from an initiator that has not previously performed a Register service action with the device server that attempts a transfer from the target results in a reservation conflict.</p> <p>WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the device server that attempts a transfer to the target results in a reservation conflict</p> <p>ADDITIONAL RESERVATIONS: Allowed; any initiator may reserve the logical unit, extents, or elements as long as the persistent reservations to not conflict with any reservations already known to the device server.</p>
7h-Fh	Reserved	Not applicable

Persistent Reserve Out Command (5Fh)

The **PERSISTENT RESERVE OUT** command is a 10-byte command used to reserve a logical unit for the exclusive or shared use by an initiator. The command is used in conjunction with the **PERSISTENT RESERVE IN** command; it is not used with the **RESERVE** and **RELEASE** commands.

Persistent reservations conflict with reservations made via the **RESERVE** command. Initiators that perform **PERSISTENT RESERVE OUT** actions are identified by a reservation key assigned by the application client. The client may use the **PERSISTENT RESERVE IN** command to identify which other initiators within a system hold conflicting or invalid persistent reservations and use the **PERSISTENT RESERVE OUT** command to preempt those reservations if necessary.

Note that since persistent reservations are not reset by the **TARGET RESET** task management function or other global actions, they can be used to enact device sharing among multiple initiators. The **PERSISTENT RESERVE OUT** and **PERSISTENT RESERVE IN** commands provide the means for resolving contentions in multiple-initiator systems with multiple port target. By using the reservation key to identify persistent reservations, it is possible to determine which ports hold conflicting persistent reservations and to take over such reservations from failing or “greedy” initiators.

Note: Support for Persistent Reserve is drive type dependent. See individual drive documentation for complete details.

The following figure illustrates the format of the **PERSISTENT RESERVE OUT** command; the table that follows explains the data fields of the command.

Figure 49 Persistent Reserve
 Out Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Fh)							
1	Reserved			Service Action				
2	Scope				Type			
3 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (18h) (LSB)							
9	Unused		Reserved			Flag		Link

Figure 50 Persistent Reserve
 Out Command

Field Name	Description		
Service Action	Service actions that require information about persistent reservation and registrations may require enabling of nonvolatile memory within the logical unit. Service action codes available are:		
	Code	Name	Description
	00h	Register	Register a reservation key with the device server
	01h	Reserve	Create a persistent reservation using a reservation key
	02h	Release	Release a persistent reservation
	03h	Clear	Clear all reservation keys and all persistent reservations

Field Name	Description		
	04h	Pre-empt	Pre-empt persistent reservations from another initiator
	05h	Pre-empt and Clear	Pre-empt persistent reservations from another initiator and clear the task set for the pre-empted initiator
	06h	Register and Ignore Existing Key	Register a reservation key with the device server. Existing reservation key is ignored.
	07-1Fh	Reserved	Reserved (HP drives support Service Action 07h - Register and Move)
	Refer to table 40 on page 89 for detailed descriptions of each of the service action codes.		
Scope	The value in this field indicates whether a persistent reservation applies to an entire logical unit or to an element. The values for the Scope field are:		
	Code	Name	Description
	0h	LU	Logical Unit. Persistent reservation applies to the full logical unit. The LU scope is therefore implemented by all device servers that implement PERSISTENT RESERVE OUT .
	1h	Obsolete	
	2h	Element	Persistent reservation applies to the specified element. When Element is the scope, it indicates that the persistent reservation applies to the element of the logical unit defined by the Scope-Specific Address field in the PERSISTENT RESERVE OUT parameter list. Element reservations are not supported.
	3h-3F	Reserved	Reserved

Field Name	Description
Type	The value of the Type field specifies the characteristics of the persistent reservation being established for all data blocks within the extent or within the logical unit. Refer to table 37 on page 76 for the applicable Type codes and their meanings. (HP drives only support Type codes 3h, 6h, and 8h.)
Parameter List Length	Fields contained in the PERSISTENT RESERVE OUT parameter list specify the reservation keys and extent information required to perform a persistent reservation service action. The parameter list is 24 bytes in length; the Parameter List Length field contains 24 (18h) bytes.

The following table provides detailed descriptions of each of the **PERSISTENT RESERVE OUT** command's seven possible service actions. **Service Action Codes** appear in bits 0–4 of Byte 1.

Table 38 Persistent Reserve
 Out Command Service Action

Code	Name	Description
00h	Register	<p>When the command executes a Register service action, it registers a reservation key with a device server without generating a reservation. The device server holds these reservation keys from each initiator that performs a PERSISTENT RESERVE OUT command with a Register service action until the key is changed by a new PERSISTENT RESERVE OUT command with Register service action from the same initiator, or until the initiator registration is removed by:</p> <p>Powering down the logical unit, if the last Activate Persist Through Power Loss (APTPL); see figure 51 on page 88 and table 40 on page 89) received by the device server was 0;</p> <p>Performing a Clear service action;</p> <p>Performing a Pre-empt service action;</p> <p>Performing a Pre-empt and Clear service action; or</p> <p>Performing a Register service action from the same initiator with the value of the service action reservation key set to 0.</p> <p>When a reservation key has not yet been established or when the reservation key has been removed, a reservation key of 0 is used when the initiator performs a PERSISTENT RESERVE OUT with the Register service action. When the reservation has been removed, no information is reported for the initiator in the Read Keys service action of the resulting PERSISTENT RESERVE IN command.</p>
01h	Reserve	<p>A PERSISTENT RESERVE OUT command with Reserve service action creates a persistent reservation with a specified Scope and Type.</p> <p>Persistent reservations are not superseded by a new persistent reservation from any initiator except by the execution of a PERSISTENT RESERVE OUT command that specifies a Release, Clear, Pre-empt, or Pre-empt and Clear service action.</p>

Code	Name	Description
02h	Release	<p>A PERSISTENT RESERVE OUT command with Release service action removes a persistent reservation held by the same initiator.</p> <p>The fields associated with a Release service action match fields of the active persistent reservation. Sending of a PERSISTENT RESERVE OUT command that specifies a Release service action when no persistent reservation exists from that initiator does not result in an error. Instead, the device server returns a GOOD message without altering any other reservation: the reservation key is not changed by the Release service action.</p> <p>The device server returns a CHECK CONDITION status for any PERSISTENT RESERVE OUT command that specifies the release of a persistent reservation held by the requesting initiator that does not match the Scope and Type. The sense key is set to ILLEGAL REQUEST and additional sense data is set to INVALID RELEASE OF ACTIVE PERSISTENT RESERVATION. Attempts to release persistent reservations in which none of the Scope, Type, Reservation Key, and extent values match an existing persistent reservation held by the initiator making the request are not errors.</p> <p>An active persistent reservation may also be released by:</p> <p>Powering off. When the most recent APTPL value received by the device server is 0, a power-off performs a hard reset, clears all persistent reservations, and removes all registered reservation keys; or</p> <p>Executing a PERSISTENT RESERVE OUT command from another initiator with a persistent reserve service action of Clear, Pre-empt, or Pre-empt and Clear.</p> <p>Note that a Release service action should not be performed if any operations interlocked by the persistent reservation have not yet completed.</p> <p>Powering off. When the most recent APTPL value received by the device server is 0, a power-off performs a hard reset, clears all persistent reservations, and removes all registered reservation keys; or</p> <p>Executing a PERSISTENT RESERVE OUT command from another initiator with a persistent reserve service action of Clear, Pre-empt, or Pre-empt and Clear.</p> <p>Note that a Release service action should not be performed if any operations interlocked by the persistent reservation have not yet completed.</p>

Code	Name	Description
03h	Clear	<p>A PERSISTENT RESERVE OUT command with a successful Clear service action removes all persistent reservations for all initiators. All reservation keys are also removed. Any commands from any initiator that have been accepted by the device server as non-conflicting continue their normal executions.</p> <p>A UNIT ATTENTION condition is established for all registered initiators for the logical unit. The sense key is set to UNIT ATTENTION; the additional sense data is set to RESERVATIONS PREEMPTED.</p> <p>Note that applications should not use the Clear action service except during recoveries associated with initiator or system reconfiguration, since data integrity may be compromised.</p>
04h	Pre-empt	<p>A PERSISTENT RESERVE OUT command with a successful Pre-empt service action removes all persistent reservations for all initiators that have been registered with the Service action Reservation key specified in the PERSISTENT RESERVE OUT command's parameter list. A persistent reservation is also established for the pre-empting initiator. Any commands from any initiator that have been accepted by the device server as non-conflicting continue their normal executions. If a PERSISTENT RESERVE OUT command is sent that specifies a Pre-empt service action and no persistent reservation exists for the initiator identified by the Service action Reservation key, it is not an error condition.</p> <p>A UNIT ATTENTION condition is established for the pre-empted initiators. The sense key is set to UNIT ATTENTION; the additional sense data is set to RESERVATIONS PREEMPTED. Commands that follow are subject to the persistent reservation restrictions set by the pre-empting initiator.</p>

Code	Name	Description
04h (cont)	Pre-empt	<p>The persistent reservation thus created by the pre-empting initiator is defined by the Scope and Type fields of the PERSISTENT RESERVE OUT command and the corresponding fields of the command's parameter list.</p> <p>The registration keys for the pre-empted initiators are removed by the Pre-empt service action; the reservation key for an initiator that has performed a Pre-empt service action with its own Reservation key specified in the Service action Reservation key remains unchanged, although all other specified releasing actions and reservation actions are performed.</p> <p>Note that persistent reservations are not superseded by a new persistent reservation from any initiator except by the execution of a PERSISTENT RESERVE OUT that specifies either the Pre-empt or the Pre-empt and Clear service actions. New persistent reservations that do not conflict with an existing persistent reservation execute normally.</p>

Code	Name	Description
05h	Pre-empt and Clear	<p>A PERSISTENT RESERVE OUT command with a Pre-empt and Clear service action removes all persistent reservations for all initiators that have been registered with the Service action Reservation key specified in the PERSISTENT RESERVE OUT command's parameter list. It also establishes a persistent reservation for the pre-empting initiator. Any commands from the initiators being pre-empted are terminated as if an ABORT TASK management function had been performed by the pre-empted initiator. If a PERSISTENT RESERVE OUT command is sent that specifies a Pre-empt and Clear service action and no persistent reservation exists for the initiator identified by the Service action Reservation key, it is not an error condition. If the key is registered, however, the Clear portion of the action executes normally.</p> <p>A UNIT ATTENTION condition is established for the pre-empted initiators. The sense key is set to UNIT ATTENTION; the additional sense data is set to RESERVATIONS PREEMPTED. Commands that follow, and retries of commands that timed out because there were cleared are subject to the persistent reservation restrictions set by the pre-empting initiator.</p> <p>The persistent reservation thus created by the pre-empting initiator is defined by the Scope and Type fields of the PERSISTENT RESERVE OUT command and the corresponding fields of the command's parameter list.</p> <p>The Pre-empt and Clear service action clears any ACA or CA condition associated with the initiator that is pre-empted and clears any tasks with an ACA attribute from that initiator.</p> <p>The reservation key for the other initiators pre-empted are removed by the Pre-empt and Clear service action. The reservation key for an initiator that has sent a Pre-empt and Clear action with its own reservation key specified in the service action's reservation key remains unchanged, although all other specified clearing actions, releasing actions, and reservation actions are performed.</p> <p>Persistent reservations are not superseded by a new persistent reservation from any initiator except via execution of a PERSISTENT RESERVE OUT that specifies either the Pre-empt or Pre-empt and Clear service action. New persistent reservations not in conflict with an existing persistent reservation execute normally.</p>

Code	Name	Description
06h	Register and Ignore Keys	This service action functions the same as the Register (00h) action except the reservation key in the parameter list is ignored and treated as if it matched the current registration, if one exists for the initiator.

The following table presents the definitions of the characters of the available **Type** values from the **Type** field of the **PERSISTENT RESERVE IN Read Reservations** parameters.

Each of the codes provides handling instructions for **READ** operations, for **WRITE** operations, and for subsequent attempts to establish persistent reservations, referred to as **Additional Reservations Allowed** in the table.

Table 39 Persistent Reservation Type Codes

Code	Name	Description
0h	Obsolete	
1h	WRITE Exclusive	READS: Shared; any application client on any initiator may execute commands that perform transfers from the storage medium to the initiator. WRITES: Exclusive; any command from any initiator other than the initiator that holds the persistent reservation that attempts a transfer to the storage medium results in a reservation conflict.
2h	Obsolete	
3h	Exclusive Access	READS: Exclusive; any command from any initiator other than the initiator holding the persistent reservation that attempts a transfer from the storage medium results in a reservation conflict. WRITES: Exclusive; any command from any initiator other than the initiator holding the persistent reservation that attempts a transfer to the storage medium results in a reservation conflict.
4h	Obsolete	

Code	Name	Description
5h	WRITE Exclusive, Registrants Only	READS: Shared; any application client on any initiator may execute commands that perform transfers from the storage medium to the initiator. WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the device server that attempts a transfer to the storage medium results in a reservation conflict.
6h	Exclusive Access, Registrants Only	READS: Exclusive; any command from an initiator that has not previously performed a Register service action with the device server that attempts a transfer from the storage medium results in a reservation conflict. WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the device server that attempts a transfer to the storage medium results in a reservation conflict
7h - Fh	Reserved	N/A

The **PERSISTENT RESERVE OUT** command requires a parameter list, illustrated in the following figure and defined in the following table. Each of the fields of the parameter list are sent for every **PERSISTENT RESERVE OUT** command, even if the field is not required for the specific **Service** action and/or **Scope** values.

Figure 51 Persistent Reserve Out Parameter List

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

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

Table 40 Persistent Reserve Out Parameter List

Field Name	Description
Reservation Key	This field contains an 8-byte token that is provided by the application client to the device server to identify which initiator is the source of the PERSISTENT RESERVE OUT command. For all service actions except Register and Ignore Existing Key , the device server verifies that the Reservation Key in the PERSISTENT RESERVE OUT command matches the Reservation Key that is registered for the initiator from which the command is received. If there is no match, the device server returns a RESERVATION CONFLICT status. The Reservation Key of the initiator is valid for all Service action and Scope values.

Field Name	Description
Service Action Reservation Key	<p>This field contains information needed for 3 service actions: the Register service action, the Pre-empt service action, and the Pre-empt and Clear service action. The Service Action Reservation Key is ignored for all other service actions.</p> <p>For the Register service action, the Service Action Reservation Key field contains the new Reservation Key to be registered.</p> <p>For the Pre-empt and the Pre-empt and Clear service actions, the Service Action Reservation Key contains the reservation key of the persistent reservations that are being pre-empted. For the Pre-empt and the Pre-empt and Clear actions, any failure of the Service Action Reservation Key to match any registered keys results in the device server returning a RESERVATION CONFLICT status.</p>
Scope-Specific Address	Ignored.
APTPL	<p>Activate Persist Through Power Loss. This bit is valid only for Register and Register and Ignore Existing Key service actions; it is ignored for all other types of service actions.</p> <p>If the last valid APTPL bit value received by the device server is 0, the loss of power in the target releases any persistent reservations and removes all reservation keys. If the last valid APTPL bit value is 1, the logical unit retains all persistent reservations and all reservation keys for all initiators even if power is lost and later returned. The most recently received valid APTPL value from any initiator governs the logical unit's behavior in the event of a power loss.</p>

The following table illustrates which fields are set by the application client and interpreted by the device server for each **Service** and **Scope** value.

Table 41 Device Server
 Interpretation of Service and
 Scope Value

Service Action	Allowed Scope	Parameters		
		Type	Service Action Reservation Key	Reservation Key
Register	Ignored	Ignored	Valid	Valid
Reserve	LU	Valid	Ignored	Valid
Release	LU	Valid	Ignored	Valid
Clear	Ignored	Ignored	Ignored	Valid
Pre-empt	LU	Valid	Valid	Valid
Pre-empt and Clear	LU	Valid	Valid	Valid
Register and Ignore Existing Key	Ignored	Ignored	Valid	Ignored

Position to Element Command (2Bh)

The **POSITION TO ELEMENT** command shall position the **Medium Transport Address** element such that further motion of the **Medium Transport Address** element is unnecessary to execute an appropriate **MOVE MEDIUM** command between the **Medium Transport Address** element and the **Destination Address** element.

Figure 52 Position to Element Descriptor

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

Table 42 Position to Element
Command

Field Name	Description
Medium Transport Address	Address of the medium transport element to position. Must be set to 0.
Destination Address	Address of the element in which to position the medium transport element. This can be any valid element address.
Invert	Must be set to 0. Inverting or rotating of the Medium Transport Element is not supported.

Prevent/Allow Medium Removal (1Eh)

This command enables or disables the removal of the magazines as well as removal of tape cartridges through the mail slot via front panel and On-board Remote Management control. It does not prevent removal via the SCSI **Load Unload** command.

Figure 53 Prevent/Allow Medium Removal

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

Table 43 Prevent/Allow Medium Removal Command Descriptor Block

Field Name	Description
Prevent	<p>When set to 1, removal via operator control is disabled. A MOVE MEDIUM command with a destination address equal to the mail slot would return a CHECK CONDITION status. The sense key shall be ILLEGAL REQUEST with the additional sense code MEDIA REMOVAL PREVENTED. The PREVENT/ALLOW status in the device is maintained separately by each initiator.</p> <p>When set to 0, the prevent state corresponding to that initiator is cleared. By default, after power up, a hard reset, or BUS Device Reset message, the prevent medium removal function is cleared.</p>

Read Buffer Command (3Ch)

The **READ BUFFER** command is used in conjunction with **WRITE BUFFER** as a diagnostic function for testing the device's data buffer for possible diagnostic data and for checking the integrity of the SCSI bus.

Figure 54 Read Buffer
Command Descriptor Block

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

Table 44 Read Buffer
Command Descriptor Block

Field Name	Description	
Mode	The SuperLoader 3 supports the following values within this field. If any non-supported value is set, the drive terminates the command with a CHECK CONDITION status, ILLEGAL REQUEST sense key set:	
	Mode	Description
	0000b	Combined Header and Data Mode (000b)
	0010b	Data Mode (0010b)
	0011b	Descriptor Mode (0011b)
	1010b	Read Data from Echo Buffer (1010b)
	1011b	“Echo Buffer Descriptor Mode (1011b)” on page 98
Buffer ID	This field is ignored in some modes and reserved in others. Refer to the specific mode description for more detail.	
Buffer Offset	This field is ignored in some modes, reserved in others, and valid in mode 0010b . Refer to the specific mode description for more detail.	
Allocation Length	This field specifies the maximum number of bytes that the initiator has allocated for returning data. The host uses this field to limit the size of data transfers to its own internal buffer size.	

The host should first send a **READ BUFFER** command, in Descriptor mode, to determine the size of the buffer being returned. In response to the **READ BUFFER** command, the device returns four bytes of data, three of which contain the size of the buffer. The host can then use this data to establish the **Buffer Offset/Allocation Length** fields of the **CDB**. Once the size of the buffer is known, **Mode 2 (Data Only)**, see [Data Mode \(0010b\)](#) can be used to transfer the data across the SCSI Bus.

Combined Header and Data Mode (000b)

In this mode, the device returns a 4-byte header followed by data bytes. The device terminates the **DATA IN** phase when the **Allocation Length** bytes of header and data have been transferred or when all available data has been transferred to the initiator, whichever is less. The 4-byte **READ**

BUFFER header is followed by data bytes from the target data buffer. The figure below illustrates the format of the header. The buffer ID must be set to 0. The buffer offset must be less than the size of the buffer.

Figure 55 Read Buffer Header

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							
1 - 3	(MSB) Available Length							(LSB)

Table 45 Read Buffer Header

Field	Description
Available Length	This field specifies the total number of data bytes available in the target's buffer. This number is not reduced to reflect the allocation length, nor is it reduced to reflect the actual number bytes written using the WRITE BUFFER command. Following the READ BUFFER header, the target transfers data from its data buffer.

Data Mode (0010b)

In this mode, the **DATA IN** phase contains only buffer data. The buffer ID must be set to 0. The buffer offset must be less than the size of the buffer.

Descriptor Mode (0011b)

In this mode, a maximum of four bytes of **READ BUFFER** descriptor information is returned. The device returns the descriptor information for the buffer specified by the **Buffer ID**. In this mode, the device does not reject the invalid **Buffer IDs** with a **CHECK CONDITION** status, but returns all zeros in the **READ BUFFER** descriptor.

Figure 56 Read Buffer
Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Offset Boundaries (0h)							
1 - 3	(MSB)	Buffer Capacity						(LSB)

Read Data from Echo Buffer (1010b)

In this mode the device transfers data to the application client from the **Echo Buffer**. The **Echo Buffer** will transfer the same data as when the **WRITE BUFFER** command with the mode field set to **Echo Buffer** was issued. The **Buffer ID** and **Buffer Offset** fields are ignored in this mode.

The **READ BUFFER** command will return the same number of bytes of data as received in the prior echo buffer mode **WRITE BUFFER** command from the same initiator. If a prior **Echo Buffer** mode **WRITE BUFFER** command was not successfully completed, the **Echo Buffer** mode **READ BUFFER** command will terminate with a **CHECK CONDITION** status, the sense key shall be set to **ILLEGAL REQUEST** and the additional sense code to **COMMAND SEQUENCE ERROR**. If the data in the **Echo Buffer** has been overwritten by another initiator the drive will terminate the command with a **CHECK CONDITION** status, the sense key will be set to **ABORTED COMMAND** and the additional sense code to **ECHO BUFFER OVERWRITTEN**.

Echo Buffer Descriptor Mode (1011b)

In this mode, a maximum of four bytes of **READ BUFFER** descriptor information is returned. The device will return the descriptor information for the **Echo Buffer**. The **Buffer Offset** field is reserved in this mode. The allocation length should be set to four or greater. The device shall transfer the lesser of the allocation length or four bytes of **READ BUFFER** descriptor.

Figure 57 Echo Buffer
Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							EBOS
1	Reserved							
2	Reserved			Buffer Capacity				
3	Buffer Capacity							

Table 46 Echo Buffer
Descriptor

Field Name	Description
EBOS	Echo Buffer Overwritten Supported. Set to 1 to indicate the drive will return the ECHO BUFFER OVERWRITTEN additional sense code if the data being read from the Echo Buffer is not the data previously written by the same initiator.
Buffer Capacity	Returns 252 indicating the size of the Echo Buffer in bytes.

Read Element Status Command (B8h)

The **READ ELEMENT STATUS** command requests that the target report the status of its internal elements to the initiator.

Figure 58 Read Element Status Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Logical Unit Number			VOLTAG	Element Type Code			
2-3	(MSB) Starting Element Address (LSB)							
4-5	(MSB) Number Of Elements (LSB)							
6	Reserved					CURDATA	DVCID	
7-9	(MSB) Allocation Length (LSB)							
10	Reserved							
11	Unused		Reserved			Flag	Link	

Table 47 Read Element Status
Command Descriptor Block

Field Name	Description														
VOLTAG	When set to 1, the SuperLoader 3 will report volume tag information. When set to 0, no volume tag information will be reported.														
Element Type Code	Specifies the particular element type(s) selected for reporting by this command. The element type codes are defined as follows.														
	<table border="1"> <thead> <tr> <th>Code</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0h</td> <td>All element types reported (valid in CDB only)</td> </tr> <tr> <td>1h</td> <td>Medium transport element</td> </tr> <tr> <td>2h</td> <td>Storage element</td> </tr> <tr> <td>3h</td> <td>Import/export element</td> </tr> <tr> <td>4h</td> <td>Data transfer element</td> </tr> <tr> <td>5h-Fh</td> <td>Reserved</td> </tr> </tbody> </table>	Code	Description	0h	All element types reported (valid in CDB only)	1h	Medium transport element	2h	Storage element	3h	Import/export element	4h	Data transfer element	5h-Fh	Reserved
Code	Description														
0h	All element types reported (valid in CDB only)														
1h	Medium transport element														
2h	Storage element														
3h	Import/export element														
4h	Data transfer element														
5h-Fh	Reserved														
Starting Element Address	Specifies the minimum element address to report. Only elements with an element type code permitted by the Element Type Code field, and an element address greater than or equal to this address shall be reported. Element descriptor blocks are not generated for undefined element addresses.														
Number of Elements	Specifies the maximum number of element descriptors to be reported.														
CURDATA	When set to 1, the SuperLoader 3 will return the current element status information. When set to 0, the SuperLoader 3 may cause device motion to confirm element status data.														
DVCID	When set to 1, the SuperLoader 3 will return the supported device identifiers. When set to 0, the SuperLoader 3 will not return the device identifiers.														
Allocation Length	Specifies the number of bytes to be returned. If it is not sufficient to transfer all the requested element descriptors, the SuperLoader 3 will only transfer those descriptors that can be completely transferred and this shall not be considered an error.														

Element Status Data

The data returned by the **READ ELEMENT STATUS** command is defined in [figure 59](#) and [Element Status Page](#) through [Data Transfer Element Descriptor](#). Element status data consists of an eight-byte header, followed by zero or more element status pages.

Figure 59 Element Status Data Header

Bit Byte	7	6	5	4	3	2	1	0
0-1	First Element Address Reported							
2-3	(MSB) Number Of Elements Available							(LSB)
4	Reserved							
5-7	(MSB) Byte Count Of Report Available (all pages, n-7)							(LSB)
8-n	Element status page(s)							

Note: The **READ ELEMENT STATUS** command can be issued with an **Allocation Length** of eight bytes in order to determine the **Allocation Length** required to transfer all the element status data specified by the command.

Table 48 Element Status Data

Field Name	Description
First Element Address Reported	Indicates the element address of the element with the smallest element address found to meet the CDB request.

Field Name	Description
Number Of Elements Available	Indicates the number of elements meeting the request in the command descriptor block. The status for these elements is returned if sufficient Allocation Length was specified.
Byte Count Of Report Available	Indicates the number of bytes of element status page data available for all elements meeting the request in the command descriptor block. This value shall not be adjusted to match the Allocation Length available.

Element Status Page

The element status page is defined in [figure 60](#). Each element status page includes an eight-byte header followed by zero or more element descriptor blocks. The header includes the element type code, the length of each descriptor block and the number of bytes of element descriptor information that follow the header for this element type.

Figure 60 Element Status Page

Bit Byte	7	6	5	4	3	2	1	0
0	Element Type Code							
1	PVOLTAG	AVOLTAG (0)	Reserved					
2-3	Element Descriptor Length							
4	Reserved							
5-7	(MSB)	Byte Count Of Descriptor Data Available (all pages, y-7)						(LSB)

Bit Byte	7	6	5	4	3	2	1	0
8-y	(MSB) Element descriptor(s)							(LSB)

Figure 61 Data

Field Name	Description
Element Type Code	Indicates the element type (see table 47) reported by this page.
PVOLTAG	When set to 1, indicates that the Primary Volume Tag Information field is present in each of the following element descriptor blocks. A value of zero indicates that these bytes are omitted from the element descriptors that follow.
AVOLTAG	This field is sent as 0. Alternate volume tag information is not supported.
Element Descriptor Length	Indicates the number of bytes in each element descriptor.
Byte Count Of Descriptor Data Available	Indicates the number of bytes of element descriptor data available for elements of this element type meeting the request in the CDB . This value shall not be adjusted to match the Allocation Length available.

Each element descriptor includes the element address and status flags; it may also contain sense code information as well as other information depending on the element type (see [Medium Transport Element Descriptor](#) through [“Data Transfer Element Descriptor”](#) on page 110).

Medium Transport Element Descriptor

[Figure 62](#) defines the medium transport element descriptor.

Figure 62 Medium Transport
Element Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0-1	Element Address							
2	Reserved					Except	RSVD	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	Reserved							
9	SVALID	Invert (0)	Reserved					
10-11	Source Storage Element Address							
...								
(36 bytes)	Primary Volume Tag Information (field omitted if PVOLTAG=0)							
...								
(1 byte)	Reserved					Code Set		
(1 byte)	Reserved					Identifier Type		
(1 byte)	Reserved							
(1 byte)	Identifier Length							

Table 49 Medium Transport
Element Descriptor

Field Name	Description
Element Address	Specifies the address of the media changer element whose status is reported by this element descriptor block.
Except	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	When set to 1, indicates that the element contains a unit of media. A value of zero indicates that the element does not contain a unit of media. When the Except bit is one, the value of the Full bit is not valid.
Additional Sense Code	Provides specific information on an abnormal element state. The values in this field are as defined for the Additional Sense Code field of REQUEST SENSE command response data. This field is valid only if the Except bit is one.
Additional Sense Code Qualifier	Provides more detailed information on an abnormal element state. The values in this field are as defined for the Additional Sense Code Qualifier field of REQUEST SENSE command response data. This field is valid only if the Except bit is one.
SVALID	When set to 1, indicates that the Source Storage Element Address field and the Invert bit information are valid. A value of zero indicates that the values in these fields are not valid.
Invert	This field is sent as 0. Inverting and rotating of media is not supported.
Source Storage Element Address	Provides the address of the last storage element this unit of media occupied. This field is valid only if the SVALID bit is one.
Primary Volume Tag Information	This field contains the bar code label information of the media currently stored in this element. This is only included if VOLTAG was set and label information is available. In which case, the PVOLTAG field shall be set on the Element Status page header.
Code Set	This field is 0.
Identifier Type	This field is 0.
Identifier Length	This field contains the length in bytes of the Identifier field.

**Storage Element
Descriptor**

[Figure 63](#) defines the storage element descriptor.

Figure 63 Storage Element
Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0-1	Element Address							
2	Reserved				Access	Except	RSVD	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	Reserved							
9	SVALID	Invert	Reserved					
10-11	Source Storage Element Address							
...								
(36 bytes)	Primary Volume Tag Information (field omitted if PVOLTAG=0)							
...								
(1 byte)	Reserved				Code Set			
(1 byte)	Reserved				Identifier Type			
(1 byte)	Reserved							
(1 byte)	Identifier Length							

Table 50 Storage Element Descriptor

Field Name	Description
Access	Indicates that access to the element by a medium transport element is allowed. An Access bit of zero indicates that access to the element by the medium transport element is denied. When a magazine is removed from the SuperLoader 3, the corresponding storage elements shall have an Access bit of 0. Access will also be denied if the storage element is configured as the location of a cleaning tape when auto clean is enabled. When the Except bit is one, the value of the Access bit is not valid.
Source Storage Element Address	Provides the address of the last storage element this unit of media occupied. This element address value may or may not be the same as this element. This field is valid only if the SVALID bit is one.

NOTE: For fields not defined in this table, see [table 49](#).

Import/Export Element Descriptor

[Figure 64](#) defines the import/export element descriptor.

Figure 64 Import/Export Element Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0-1	Element Address							
2	Reserved		INENAB (1)	EXENAB (1)	Access	Except	IMPEXP	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							

Bit Byte	7	6	5	4	3	2	1	0
6-8	Reserved							
9	SVALID	Invert	Reserved					
10-11	Source Storage Element Address							
...								
(36 bytes)	Primary Volume Tag Information (filed omitted if PVOLTAG=0)							
...								
(1 byte)	Reserved				Code Set			
(1 byte)	Reserved				Identifier Type			
(1 byte)	Reserved							
(1 byte)	Identifier Length							

Table 51 Import / Export
Element Descriptor

Field Name	Description
INENAB	This field is sent as 1 to indicate that the import/export element supports movement of media into the scope of the media changer device.
EXENAB	This field is sent as 1 to indicate that the import/export element supports movement of media out of the scope of the media changer.
Access	When set to 1 it indicates that access to the element by a medium transport is allowed. When set to 0 it indicates that access is denied. This may occur if the user is performing an operation from the front panel or Ethernet connection that prohibits access from SCSI.

Field Name	Description
IMPEXP	When set to 1 it indicates that the unit of media in the import/export element was placed there by an operator. When set to 0, it indicates that it was placed there by the medium transport element. When the Except bit is 1, the value of the IMPEXP bit is invalid.

NOTE: For fields not defined in this table, see [table 49](#) on page 106.

Data Transfer Element Descriptor

[Figure 65](#) defines the data transfer element descriptor.

Figure 65 Data Transfer Element Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0-1	Element Address							
2	Reserved				Access	Except	RSVD	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Not BUS (0)	RSVD	ID Valid	LU Valid	RSVD	Logical Unit Number		
7	SCSI BUS Address							
8	Reserved							
9	SVALID	Invert	Reserved					

Bit Byte	7	6	5	4	3	2	1	0
10-11	Source Storage Element Address							
• • •								
(36 bytes)	Primary Volume Tag Information (field omitted if PVOLTAG=0)							
• • •								
(1 byte)	Reserved				Code Set			
(1 byte)	Reserved				Identifier Type			
(1 byte)	Reserved							
(1 byte)	Identifier Length							
• • •								
(16 bytes)	Drive Serial Number (field omitted if Identifier Length = 0)							

Table 52 Data Transfer
Element Descriptor

Field Name	Description
Access	When set to 1 it indicates access to the data transfer element by the medium transport element is allowed. When set to 0 it indicates access is denied. This may occur if the device is performing an auto clean operation.
Not Bus	This field is sent as 0. The data transfer element is on the same bus as the media changer device.
ID Valid	When set to 1, it indicates that the SCSI BUS address field contains valid information.
LU Valid	When set to 1, it indicates that the Logical Unit Number field contains valid information.

Field Name	Description
Logical Unit Number	If it is valid, it provides the logical unit number within the SCSI bus device of the primary device served by the media changer at this element address. This field is always 0.
SCSI BUS Address	If valid, it provides the SCSI address of the primary device served by the media changer at this element address.
Code Set	Set to 2 (ASCII)
Identifier Type	Set to 0 (Serial Number only)
Identifier Length	When set to 0, the Drive Serial Number field is omitted. When set to 16, the Drive Serial Number field is included.
Drive Serial Number	A 16-byte field containing the drive serial number padded with zeros (drive serial numbers range from 10 to 14 bytes).

NOTE: For fields not defined in this table, see [table 49](#) on page 106.

Release Element (10) Command (57h)

The **RELEASE** and the **RESERVE** commands are used for contention resolution in multiple-initiator systems. The **RELEASE (10)** command is used to release a previously reserved logical unit. The media changer will not return an error if the initiator attempts to release a reservation that is not currently valid.

Figure 66 Release (10)
Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (57h)							
1	Reserved			3rdPty	Reserved		LongID	Element
2	Reservation Identification							
3	Third Party Device ID							
4 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (LSB)							
9	Unused		Reserved				Flag	Link

Table 53 Release (10)
Command

Field Name	Description
3rdPty	3rdPty Release allows an initiator to release a logical unit that was previously reserved. If the value in this field is 0, third party release is not requested. If 3rdPty = 1, then the device server shall release the specified logical unit, but only if the initiator ID, 3rdPty bit, and third party device ID are identical when compared to the RESERVE command that established the reservation.
Long ID	If the Long ID bit is set to 1, the Parameter List Length is 8 and the eight bytes of the parameter list carry the device ID of the third party device; the contents of the Third Party Device ID in the CDB (byte 3) are ignored.
Element	The SuperLoader 3 supports reservations only on entire logical units. The value must be 0.
Reservation Identification	Any value in this field is ignored by the SuperLoader 3.
Third Party Device ID	If the Third Party Device ID value that is connected with the reservation release is smaller than 255, the LongID bit may be 0 and the ID value sent in the CDB . If LongID bit = 0, the Parameter List Length field also = 0. If the Third Party Device ID value is greater than 255, LongID = 1. Device servers that support device IDs greater than 255 will accept commands with LongID = 1; device servers that do not support IDs greater than 255 may reject commands with LongID set = 1. Device ID formats are protocol-specific.
Parameter List Length	The contents of this field specify the length, in bytes, of the parameter list that will be transferred from the initiator to the target.

NOTE: Assuming that the **RELEASE Command Descriptor Block** is valid, the SuperLoader 3 always returns a **GOOD** status for this command. An actual release only happens if the initiator has the unit reserved for itself or a third-party initiator.

If the **LongID** bit = 1 and the **Element** bit = 0, then the parameter list length is eight and the parameter list has the following format.

Figure 67 Release (10) ID Only
 Parameter List

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	(MSB) Third Party Device ID (LSB)							

Release Unit (6) Command (17h)

The **RELEASE UNIT** command releases the media changer if it is currently reserved by the requesting initiator. It is not an error to release the media changer if it is not currently reserved by the requesting initiator. If the media changer is reserved by another initiator, however, it is not released; the media changer is only released from the initiator that issued the **RELEASE** command. Element reservations are not supported.

Third party reservations are not supported by this command. **RELEASE ELEMENT (10)** should be used instead.

Figure 68 Release Unit (6)
Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	Logical Unit Number			Obsolete				Rsv'd
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Report Device Identifier Command (A3h)

The **REPORT DEVICE IDENTIFIER** command requests that the device server send device identification information to the applicable client.

Figure 69 Report Device Identifier Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A3h)							
1	Reserved			Service Action (05h)				
2 - 5	Reserved							
6 - 9	(MSB) Allocation Length (LSB)							
10	Reserved							
11	Unused		Reserved				Flag	Link

Table 54 Report Device Identifier Command Descriptor Block

Field	Description
Service Action	Must be 05h . Any other value will return Check Condition, Illegal Request .

Field	Description
Allocation Length	If the Allocation Length is not sufficient to contain all the parameter data, the first portion of the data shall be returned. This shall not be considered an error. The actual length of the parameter data is available in the Identifier Length field in the parameter data. If the remainder of the parameter data is required, the application client should send a new REPORT DEVICE IDENTIFIER command with an Allocation Length field large enough to contain all the data.

The **REPORT DEVICE IDENTIFIER** parameter list contains a four-byte field that contains the length in bytes of the parameter list and the logical unit's identifier.

Figure 70 Report Device Identifier

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Identifier Length (n - 4)							(LSB)
4 - n	Identifier							

Table 55 Report Device Identifier Parameter Data

Field	Description
Identifier Length	Specifies the length in bytes of the Identifier field. If the Allocation Length field in the CDB is too small to transfer all of the identifier, the length is not adjusted to reflect the truncation. The identifier length is initially equal to zero, and is changed only by a successful SET DEVICE IDENTIFIER command.

Field	Description
Identifier	The value reported is the last value written by a successful SET DEVICE IDENTIFIER command. The value of the identifier is changed only by a successful SET DEVICE IDENTIFIER command. The identifier value persists through resets, and power cycles.

Report LUNS Command (A0h)

The **REPORT LUNS** command requests that the peripheral device logical unit numbers of known logical units in the target be sent to the applications client. The command only returns information about the logical units to which commands may be sent.

Figure 71 Report LUNS
Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A0h)							
1 - 5	Reserved							
6 - 9	(MSB) Allocation Length (LSB)							
10	Reserved							
11	Unused		Reserved				Flag	Link

Table 56 Report LUNS
Command Descriptor Block

Field	Description
Allocation Length	If the Allocation Length is not sufficient to contain the logical unit number values for all configured logical units, the device server still reports as many logical number values as will fit in the Allocation Length . The format of the report of configured logical units is shown in figure 72 .

Figure 72 LUN Reporting
Parameter List

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) LUN List Length (n - 7) (LSB)							
4 - 7	Reserved							
8 - 15	(MSB) LUN (first LUN) (LSB)							
n-7 - n	LUN (last LUN, if more than one)							

The **LUN List Length** field contains the length in bytes of the LUN list that can be transferred. The **LUN List Length** equals the number of logical unit numbers reported multiplied by eight. If the allocation length in the **CDB** is too small to allow transfer of information about all of the logical units configured, the **LUN List Length** value is not adjusted to reflect the truncation.

Request Sense Command (03h)

The **REQUEST SENSE** command causes the media changer to transfer detailed sense data to the initiator.

Figure 73 Request Sense Command Descriptor Block

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

Figure 74 Request Sense Command Data

Field	Description
Allocation Length	This field specifies the maximum number of sense bytes to be returned. The media changer terminates the transfer when this number of bytes has been transferred or when all available sense data has been transferred to the host, whichever is less.

The sense data is valid for a **CHECK CONDITION** or **RESERVATION CONFLICT** status returned on the previous command. The sense data bytes are preserved by the media changer until retrieved by a **REQUEST SENSE** command, or until the receipt of any other command from the same initiator, though some commands, such as **INQUIRY**, do not change sense data.

If the media changer receives an unsolicited **REQUEST SENSE**, it returns sense data with the appropriate values in the **Sense Key**, **Additional Sense Code**, and **Additional Sense Code Qualifier**.

The following illustration portrays the format of **REQUEST SENSE DATA**.

Figure 75 Request Sense

Bit Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code						
1	Obsolete							
2	Filemark	EOM	ILI	Reserved	Sense Key			
3 - 6	(MSB) Information Bytes (LSB)							
7	Additional Sense Length							
8 - 11	(MSB) Command-Specific Information Bytes (LSB)							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Sub-Assembly Code (0)							
15	SKSV	C/D	Reserved		BPV	Bit Counter		
16 - 17	(MSB) Field Pointer (LSB)							

Table 57 Request Sense Data

Field	Description
Valid	When set to 1, this field indicates that the information bytes contain valid information as defined in the ANSI SCSI-2 specification.
Error Code	A value of 70h indicates a current error – the report is associated with the most recently received command. A value of 71h indicates a deferred error – the report is associated with a previous command and not as a result of the current command. No other values are returned in this field.
Filemark	This bit indicates that the current command has read a Filemark . Not applicable to a media changer device.
EOM	End of Medium . Not applicable to a media changer device.
ILI	Incorrect Length Indicator . Not applicable to a media changer device.
Sense Key	Indicates generic information describing an error or exception condition. Sense keys are defined in table 58 .
Information Bytes	Not applicable to a media changer device. This field should always be 0.
Additional Sense Length	This field specifies the number of additional sense bytes to follow. If the Allocation Length of the Command Descriptor Block is too small to transfer all of the Additional Sense bytes, the Additional Sense Length is not adjusted to reflect the truncation.
Command Specific Information Bytes	Command Specific Information Bytes depend on the command executed. This field is not used.
Additional Sense Code (ASC)	This field (and the field for Additional Sense Code Qualifier) provides additional information about the Sense Key and cause of a CHECK CONDITION status. Additional Sense Codes are discussed in detail later in this section.
Additional Sense Code Qualifier (ASCQ)	This field (and the field for Additional Sense Code) provides additional information about the Sense Key and cause of a CHECK CONDITION status. Additional Sense Code Qualifiers are discussed in detail later in this chapter.
Sub-Assembly Code	Not used. Returned as 0.

Field	Description
SKSV	Sense-Key Specific Valid. When = 1, indicates that the Sense Key specific field is as defined by the International Standard.
C/D	Command / Data. When set to 1, this field indicates that the illegal parameter is contained in the Command Descriptor Block . A C/D set to 0 indicates that the illegal parameter is in the Parameter List from the initiator.
BPV	Bit Pointer Valid. When set to 1, this field indicates that the Bit Pointer field is valid and designates which bit of the byte designated by the field pointer is in error. For a multi-bit field, it points to the most significant bit of the field.
Field Pointer	This field indicates which byte of the CDB or Parameter List is in error. For a multi-byte field, the most significant byte is indicated.

Table 58 Supported Sense Keys for Request Sense

Sense Key	Description
0h	NO SENSE.
1h	RECOVERED ERROR. This can be caused by rounding of Mode Parameters on a MODE SELECT , or may report that recovery algorithms were required to complete a move operation. The device may still be able to continue to function without any unrecovered errors for a long period of time, however.
2h	NOT READY. The media changer is not ready for move operation commands. Initialization or calibration may be in-progress or may have failed.
4h	HARDWARE ERROR. The Additional Sense Code / Additional Sense Code Qualifier fields may present more specific information.
5h	ILLEGAL REQUEST. The CDB or supplied parameter data had an unsupported or illegal operation specified. Check bytes 15, 16, and 17.
6h	UNIT ATTENTION. Unit Attentions are created after a device reset, if the medium asynchronously becomes ready to the initiator, if another initiator changes Mode Parameters , and/or if the firmware is updated.

Sense Key	Description
Bh	COMMAND ABORTED. This key is generated when a command has been aborted by the media changer for some reason. Check the Additional Sense Code / Additional Sense Code Qualifier bytes.

The following table provides the additional sense codes (**ASCs**) and additional sense code qualifiers (**ASCQs**) that may be reported. Additional information, explanations, or suggestions for action are included in some of the descriptions.

Table 59 Supported ASC / ASCQ (Hex) for Request Sense

Sense Key	ASC	ASCQ	Description
00 NO SENSE	00	00	No Additional Sense Code
	44	00	Internal Target Error
01 RECOVERED ERROR			
	47	00	SCSI Parity Error
	48	00	IDE Message Received
	5D	00	Failure Predictive Threshold Exceeded
	5D	FF	Failure Predictive Threshold Exceeded (False)
02h NOT READY			
	04	00	Logical Unit Not Ready, Cause Unreportable
	04	01	Unit Not Ready, Calibration/Initialization in Process
	04	03	Unit Not Ready, Manual Intervention Needed (no magazine is present or a mechanical failure has occurred)

Sense Key	ASC	ASCQ	Description
	04	07	Unit Not Ready, Operation in Progress
	44	00	Internal Target Failure
04h HARDWARE ERROR	08	00	LUN Communication Failure
	08	01	LUN Communication Timeout Failure
	0B	01	Over Temperature Condition Error
	15	01	Mechanical Positioning Error
	40	83	Diagnostic Failure
	40	84	POST Soft Error
	53	00	Media Load Failure
	53	01	Media Unload Failure
05h ILLEGAL REQUEST	1A	00	Parameter List Length Error
	20	00	Illegal Opcode
	21	01	Invalid Element Address
	24	00	Invalid CDB Field
	24	86	Invalid Offset
	24	87	Invalid Size
	24	89	Image Data Over Limit
	24	8B	Image/Personality is Bad
	24	8C	Not Immediate Command during Code Update
	24	91	Bad Autoloader Image EDC
	25	00	Illegal LUN
	26	00	Parameter List Error, Invalid Field

Sense Key	ASC	ASCQ	Description
	26	01	Parameter List Error, Parameter Not Supported
	26	02	Parameter List Error, Parameter Value Invalid
	26	03	Threshold Parameters Not Supported
	26	04	Invalid Release of Persistent Reservation
	39	00	Saving Parameters Not Supported
	3B	0D	Media Destination Element Full
	3B	0E	Media Source Element Empty
	3B	11	Magazine Not Accessible
	3B	12	Magazine Removed
	53	02	Media Removal Prevented
	55	04	Insufficient Registration Resources
06h UNIT ATTENTION	28	00	Not Ready To Ready Transition
	28	01	Import/Export Element Accessed
	29	00	Reset Occurred
	29	01	Power On Occurred
	29	02	SCSI BUS Reset Occurred
	29	03	BUS Device Reset Function Occurred
	29	04	Device Internal Reset
	29	05	Transceiver Mode Changed to Single-Ended
	29	06	Transceiver Mode Changed to LVD
	2A	01	Mode Parameters Changed
	2A	02	Log Parameters Changed
	2A	03	Reservations Preempted
	2A	04	Reservations Released

Sense Key	ASC	ASCQ	Description
	2A	05	Registrations Preempted
	3B	12	Magazine Removed
	3B	13	Magazine Inserted
	3F	01	Microcode has been Changed
	3F	05	Device Identifier Changed
0Bh COMMAND ABORTED	08	00	Command Aborted - LUN Communication Failure
	08	01	Command Aborted - LUN Communication Time-out
	3F	00	Operating Conditions have Changed
	3F	0F	Echo Buffer Overwritten
	43	00	Message Error
	44	80	Unexpected Selection Interrupt
	44	82	Command Complete Sequence Failure
	44	83	SCSI Chip, Gross Error/ Illegal - Command Status
	44	84	Unexpected/Unexplained Residue Count in Transfer Register
	44	87	Disconnect/ SDP Sequence Failed
	45	00	Select/Reselect Failure
	47	00	SCSI Parity Error (check SCSI bus configuration and connections)
	48	00	IDE Message Error
	49	00	Invalid Message Error
	4A	00	Command Phase Error
	4B	00	Data Phase Error

Sense Key	ASC	ASCQ	Description
	4E	00	Overlapped Commands Attempted

Reserve Element (10) Command (56h)

The **RESERVE** and **RELEASE** commands are used for contention resolution in multiple-initiator systems. The **RESERVE** command is used to reserve a logical unit. The **RESERVE (10) Command Descriptor Block** is shown in [figure 76](#), and the data fields are described in [table 60](#).

Figure 76 Reserve Element (10) Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (56h)							
1	Reserved			3rdPty	Reserved		LongID	Element
2	Reservation Identification							
3	Third Party Device ID							
4 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (LSB)							
9	Unused		Reserved				Flag	Link

Table 60 Reserve Element
(10) Command

Field	Description
3rd Pty	When set to 1, it indicates that the Third Party Device ID field is valid.
LongID	When 0, indicates that the third party device associated with the reservation release has a number smaller than 255 and the ID value can be sent within the CDB . If set = 1, indicates that the third party device ID is greater than 255, the ID value within the CDB is ignored, and the parameter list length is at least eight.
Element	Not supported. Must be 0.
Reservation Identification	Ignored.
Third Party Device ID	<p>Required and used only when the 3rdPty bit is set, in which case this field specifies the SCSI ID of the initiator to be granted the reservation of the logical unit. The drive preserves the reservation until one of the following occurs:</p> <ul style="list-style-type: none"> • It is superseded by another valid RESERVE command from the initiator; • It is released by the same initiator; • It is released by a TARGET RESET message from any initiator; • It is released by a TARGET RESET message from any initiator; or • It is released by a hard reset condition. <p>The media changer ignores any attempt to release the reservation made by any other initiator. For example, if ID7 sends ID2 a Third Party reservation on behalf of ID6 (the target at ID2 gets reserved for the initiator ID6), then only ID7 can release the target at ID2 (using a Third Party release). ID6 cannot release the reservation even though the reservation was made on its behalf.</p>
Parameter List Length	This field specifies the length, in bytes, of the parameter list that will be transferred from the initiator.

If the **LongID** bit = 1 and the **Element** bit = 0, then the parameter list length is eight and the parameter list has the following format.

Figure 77 Reserve (10) ID Only
 Parameter List

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	(MSB) <div style="text-align: center;">Third Party Device ID</div> <div style="text-align: right;">(LSB)</div>							

Reserve Element (6) Command (16h)

The **RESERVE ELEMENT** command reserves the specified media changer for exclusive use by the requesting initiator or for another specified SCSI device. Element reservations are not supported.

Third party reservations are not supported by this command. The **Reserve Element (10)** must be used instead.

Figure 78 Reserve Element (6) Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	Logical Unit Number			Obsolete				Rsv'd
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

A reservation via the **RESERVE ELEMENT** command remains in effect until one of the following conditions is met:

- The initiator that made the reservation sends another **RESERVE ELEMENT** command.
- The device is released via a **RELEASE ELEMENT** command from the same initiator.
- A **BUS DEVICE RESET** message is received from any initiator.
- A hard reset occurs.

The occurrence of the last two conditions is indicated by the media changer returning a **CHECK CONDITION** status, sense key of **UNIT ATTENTION** on the next command following the condition. It is not an error to issue a **RESERVE ELEMENT** command to a media changer that is currently reserved by the requesting initiator.

If another initiator has previously reserved the logical unit, the target returns a **RESERVATION CONFLICT** status.

If, after honoring the reservation, any other initiator attempts to perform any command except **INQUIRY**, **REQUEST SENSE**, or **RELEASE ELEMENT**, the command is rejected with a **RESERVATION CONFLICT** status. That logical unit ignores a **RELEASE ELEMENT** command issued by another initiator.

Send Diagnostic Command (1Dh)

The **SEND DIAGNOSTIC** command directs the media changer to perform its self-diagnostic tests.

Figure 79 Send Diagnostic Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	Logical Unit Number		PF (0)	Reserved	Selfst	DevOfl	UnitOfl	
2	Reserved							
3 - 4	(MSB) Parameter List Length (LSB)							
5	Unused		Reserved			Flag	Link	

Table 61 Send Diagnostic Command Data

Field	Description
PF	Page Format. Not supported; must be 0.
Selfst	Self Test. A Selfst bit of 1 directs the media changer to perform its default self test. A Selfst bit of 0 is not supported.
DevOfl	Device Off-line. This bit is used in conjunction with Selfst and UnitOfl to specify the type of testing to be done. This bit must be set to 0.

Field	Description
UnitOfI	Unit Off-line. This bit is used in conjunction with Selfst and DevOfI to specify the type of testing to be done. This bit must be set to 0.
Parameter List Length	Not supported; must be 0.

Set Device Identifier Command (A4h)

The **SET DEVICE IDENTIFIER** command requests that the device identifier information in the logical unit be set to the value received in the **SET DEVICE IDENTIFIER** parameter list. This command is optional for all device types.

On successful completion of a **SET DEVICE IDENTIFIER** command, a unit attention shall be generated for all initiators except the one that issued the service action. When reporting the unit attention condition, the additional sense code shall be set to **DEVICE IDENTIFIER CHANGED**.

Figure 80 Set Device Identifier Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A4h)							
1	Reserved			Service Action (06h)				
2 - 5	Reserved							
6 - 9	(MSB) Parameter List Length (LSB)							
10	Reserved							
11	Unused		Reserved			Flag		Link

The **Identifier** field shall be a vendor specific value, to be returned in subsequent **REPORT DEVICE IDENTIFIER** commands.

Table 62 Set Device Identifier Command Descriptor Block

Field	Description
Service Action	Must be 06h . Any other value will return Check Condition, Illegal Request .
Parameter List Length	Specifies the length in bytes of the Identifier that shall be transferred from the application client to the device server. The maximum value for this field shall be 64 bytes. A parameter list length of zero indicates that no data shall be transferred, and that subsequent REPORT DEVICE IDENTIFIER commands shall return an Identifier length of zero. If the parameter list length exceeds 64 bytes, then the drive will return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN CDB .

The **SET DEVICE IDENTIFIER** parameter list contains the identifier to be set by the addressed logical unit.

Figure 81 Set Device Identifier Parameter List

Bit Byte	7	6	5	4	3	2	1	0
0 - n	Identifier							

Table 63 Set Device Identifier Parameter List

Field	Description
Identifier	Data to be returned by all subsequent REPORT DEVICE IDENTIFIER commands, until replaced by another valid SET DEVICE IDENTIFIER command.

Test Unit Ready Command (00h)

The **TEST UNIT READY** command checks the media changer to ensure that the unit is ready for commands involving cartridge movement. If the media changer has successfully completed its initialization process and the unit is not in an error state, the command returns a **GOOD** status. Otherwise, **CHECK CONDITION** is reported. Some conditions that would cause a **CHECK CONDITION** include over temperature, no magazines installed, or user access via front panel or On-board Remote Management interfaces.

Due to power cycle and code update, it is possible to get multiple check conditions on a **TEST UNIT READY** command.

Figure 82 Test Unit Ready Descriptor

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

Write Buffer Command (3Bh)

The **WRITE BUFFER** command is used with **READ BUFFER** as a diagnostic function and for downloading and updating microcode (firmware).

Figure 83 Write Buffer Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (3Bh)							
1	Logical Unit Number			Reserved	Mode			
2	Buffer ID							
3 - 5	(MSB) Buffer Offset (LSB)							
6 - 8	(MSB) Transfer Length (LSB)							
9	Unused		Reserved			Flag	Link	

Table 64 Write Buffer Command Data

Field	Description
Mode	The media changer supports the following values within the field. If any other value is set, the media changer terminates the command with CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

Field	Description	
	Mode	Description
	0000b	Write Combined Header and Data Mode (0000b)
	0010b	Write Data Mode (0010b)
	0100b	Download Microcode Mode (0100b)
	0101b	Download Microcode and Save Mode (0101b)
	1010b	Write Data to Echo Buffer (1010b)
Buffer ID	For all of the modes described for the Mode field, only a Buffer ID of 0 is supported. If the Buffer ID field is a value other than 0, the command is rejected. The target detects and rejects commands that would overrun the buffer.	
Buffer Offset	See Download Microcode Mode (0100b) and Download Microcode and Save Mode (0101b) for the appropriate settings.	

Write Combined Header and Data Mode (0000b)

The data to be transferred is preceded by a 4-byte header consisting entirely of reserved bytes. This header is discarded (not stored within the buffer). The buffer offset field must be 0 for this mode.

Write Data Mode (0010b)

Similar to **Header** and **Data Mode**, except there is no header in the data passed to the target. Any potential buffer overruns are detected and the command is rejected.

Download Microcode Mode (0100b)

Using buffer offsets, the host can download the firmware image into the target's buffer in pieces. These commands do not cause the new image to become active. A **Download and Save Mode WRITE BUFFER** command must be issued for the image to become active.

Any error on a **WRITE BUFFER** command causes any downloaded image data to be discarded and the download must be restarted from the beginning.

Caution: During the actual reprogramming of the **FLASH EEPROM**, if any type of power fail occurs, or if the reprogramming fails before completion, the SuperLoader 3 subsystem may become unusable and the unit must be replaced.

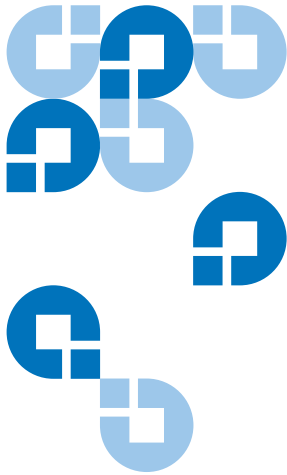
Download Microcode and Save Mode (0101b)

This mode is used to download and save the entire image at once, or to download the image and save it, or to cause a save operation after the image data has been downloaded using the **Download Microcode** mode (without the **Save**).

This mode of the **WRITE BUFFER** command causes the image data to be verified and the **Flash EEPROM** firmware area to be updated. During the reprogramming front panel displays progress information. Also, when it is updating the **Flash**, it disconnects from the SCSI bus and will not respond until the update is complete and the system has reset.

Write Data to Echo Buffer (1010b)

In this mode the drive transfers data from the application client and stores it in an **Echo Buffer**. The **Buffer ID** and **Buffer Offset** fields are ignored in this mode. Upon successful completion of a **WRITE BUFFER** command the data shall be preserved in the **Echo Buffer** unless there is an intervening command to write the **Echo Buffer** or the device is reset in anyway.



Index

A

ASC/ASCQ codes

Request Sense (media changer)
126

C

Commands

media changer 7

I

Initialize Element Status command
10

Inquiry command
media changer 11

L

Load Unload command 22

Log Sense command
media changer 23

M

Media changer commands

Initialize Element Status 10

Inquiry 11

Log Sense 23

Mode Select 41

Mode Sense 48

Move Medium 67

overview 7

Persistent Reserve In 69

Persistent Reserve Out 78

Position to Element 92

Prevent/Allow Medium
Removal 94

Read Element Status 100

Release Element 113

Release Unit 116

Report Device Identifier 117

Report LUNS 120

Request Sense 122

Reserve Element 130, 133

Send Diagnostic 135

Test Unit Ready 139

Write Buffer 140

Mode Select command
media changer 41

Mode Sense command
media changer 48

Move Medium command 67

P

Persistent Reserve In command
media changer 69

Persistent Reserve out command
media changer 78

Position to Element command 92

Prevent/Allow Medium Removal
command

media changer 94

R

- Read Buffer command 95
- Read Element Status command 100
- Release Element command 113
- Release Unit command
 - media changer 116
- Report Device Identifier command
 - media changer 117
- Report LUNS command
 - media changer 120
- Request Sense command
 - media changer 122
 - sense keys (media changer) 125
 - supported ASC/ASCQ codes (media changer) 126
- Reserve Element command 130
 - media changer 133

S

- Send Diagnostic command
 - media changer 135
- Sense keys
 - Request Sense (media changer) 125
- Set Device Identifier command 137

T

- Tape drive commands
 - Load Unload 22
 - Read Buffer 95
 - Set Device Identifier 137
- Test Unit Ready command

media changer 139

W

- Write Buffer command
 - media changer 140