



TLS-5000

TLS-6000

TLS-8000

SCSI-2

Interface Manual

501205 Rev. C

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Table of Contents

1.	Introduction.....	1-1
1.1	References	1-1
1.2	Terminology Used in this Document.....	1-1
2.	General Information.....	2-1
2.1	SCSI Bus Timing	2-1
2.2	Logical Interface	2-1
2.2.1	Messages	2-2
2.2.2	Extended Messages	2-2
2.3	SCSI Command Descriptor Block Structure.....	2-3
2.3.1	Operation Code	2-3
2.3.2	Logical Unit Implementation	2-4
2.3.3	Reserved Fields.....	2-5
2.3.4	Single-Byte Fields	2-5
2.3.5	Multi-Byte Fields.....	2-5
2.3.6	Vendor Specific	2-5
2.3.7	Flag.....	2-5
2.3.8	Link	2-5
2.4	Status Structures.....	2-5
2.4.1	Completion Status Byte	2-5
2.4.2	Internal Unit Attention Condition	2-7
2.4.3	Parity Errors Detected by the MC	2-7
2.4.4	Parity Errors Detected by the Initiator	2-9
2.4.5	Retries	2-9
2.5	Element Addressing	2-9
2.6	Errors.....	2-10
2.7	Connector Pin Assignments	2-12
3.	Exchange Medium.....	3-1
3.1	Command Description	3-1
3.1.1	Transport Element Address.....	3-1
3.1.2	Source Element Address	3-2
3.1.3	First Destination Address.....	3-2
3.1.4	Second Destination Address	3-2
3.1.5	Inv2, Inv1.....	3-2
3.2	Command Specific Errors.....	3-2
4.	Initialize Element Status.....	4-1
4.1	Command Description	4-1
5.	Initialize Element Status with Range	5-1

5.1	Command Description	5-1
5.1.1	Range.....	5-1
5.1.2	Element Address	5-1
5.1.3	Number of Elements	5-1
5.1.4	NBL.....	5-2
5.2	Command Specific Errors.....	5-2
6.	Inquiry.....	6-1
6.1	Command Description	6-1
6.1.1	EVPD.....	6-1
6.1.2	Page Code.....	6-1
6.1.3	Allocation Length	6-1
6.2	Inquiry Data.....	6-1
6.2.1	Peripheral Qualifier	6-2
6.2.2	Peripheral Device Type.....	6-2
6.2.3	RMB.....	6-3
6.2.4	Device Type Modifier.....	6-3
6.2.5	ISO Version.....	6-3
6.2.6	ECMA.....	6-3
6.2.7	ANSI.....	6-3
6.2.8	AENC	6-3
6.2.9	TrmIOP	6-3
6.2.10	Response Data Format.....	6-3
6.2.11	Additional Length.....	6-3
6.2.12	RelAdr	6-3
6.2.13	WBus32	6-3
6.2.14	WBus16	6-4
6.2.15	Sync	6-4
6.2.16	Link	6-4
6.2.17	CmdQue	6-4
6.2.18	SftRe.....	6-4
6.2.19	BarC	6-4
6.2.20	Vendor Specific	6-4
6.2.21	Vendor Identification	6-4
6.2.22	Product Identification	6-4
6.2.23	Product Revision Level.....	6-4
7.	Log Sense.....	7-1
7.1	Command Description	7-1
7.1.1	PPC.....	7-1
7.1.2	SP	7-1
7.1.3	PC	7-1

7.1.4	Log Sense Page Code.....	7-1
7.1.5	Parameter Pointer.....	7-2
7.1.6	Allocation Length.....	7-2
7.2	Log Page Structure.....	7-2
7.2.1	Log Sense Page Code.....	7-3
7.2.2	Page Length.....	7-3
7.2.3	Log Parameters.....	7-3
7.3	Log Page Formats.....	7-4
7.3.1	Supported Log Page.....	7-4
7.3.2	Event History Log Page.....	7-5
8.	Mode Select.....	8-1
8.1	Command Description.....	8-1
8.1.1	The Relationship between Current and Saved Data.....	8-1
8.1.2	PF.....	8-2
8.1.3	SP.....	8-2
8.1.4	Parameter List Length.....	8-2
8.2	Mode Pages.....	8-2
8.2.1	Element Address Assignment Page.....	8-3
8.2.2	LCD Mode Page.....	8-6
8.2.3	Configuration Mode Page.....	8-7
8.2.4	External Data Mode Page.....	8-16
8.3	Command Specific Errors.....	8-16
9.	Mode Sense.....	9-1
9.1	Command Description.....	9-1
9.1.1	DBD.....	9-1
9.1.2	PC.....	9-1
9.1.3	Mode Sense Page Code.....	9-2
9.1.4	Allocation Length.....	9-2
9.2	Mode Sense Parameter List.....	9-2
9.3	Mode Pages.....	9-2
9.3.1	Element Address Assignment Mode Page.....	9-2
9.3.2	Transport Geometry Descriptor Mode Page.....	9-4
9.3.3	Device Capabilities Mode Page.....	9-5
9.3.4	LCD Mode Page.....	9-6
9.3.5	Configuration Mode Page.....	9-7
9.3.6	External Data Mode Page.....	9-8
9.4	Command Specific Errors.....	9-9
10.	Move Medium.....	10-1
10.1	Command Description.....	10-1
10.1.1	Transport Element Address.....	10-1

10.1.2	Source Element Address	10-2
10.1.3	Destination Element Address.....	10-2
10.1.4	Invert.....	10-2
10.1.5	I/O Port Code	10-2
10.2	Command Specific Errors.....	10-3
11.	Position to Element.....	11-1
11.1	Command Description	11-1
11.1.1	Transport Element Address.....	11-1
11.1.2	Destination Address	11-1
11.1.3	Invert.....	11-1
11.2	Command Specific Errors.....	11-2
12.	Prevent/Allow Medium Removal	12-1
12.1	Command Description	12-1
12.1.1	Prevent.....	12-1
13.	Read Buffer	13-1
13.1	Command Description	13-1
13.1.1	Mode	13-1
13.1.2	Buffer ID	13-2
13.1.3	Buffer Offset	13-2
13.1.4	Allocation Length	13-2
14.	Read Element Status	14-1
14.1	Command Description	14-1
14.1.1	VolTag	14-1
14.1.2	Element Type Code	14-1
14.1.3	Starting Element Address	14-2
14.1.4	Number of Elements	14-2
14.1.5	Allocation Length	14-2
14.2	Element Status Data	14-3
14.2.1	First Element Address Reported.....	14-4
14.2.2	Number of Elements Available.....	14-4
14.2.3	Byte Count of Report Available.....	14-4
14.2.4	Element Status Page.....	14-4
14.3	Element Descriptors	14-5
14.3.1	Element Address	14-5
14.3.2	Except.....	14-5
14.3.3	Full	14-5
14.3.4	ASC and ASCQ Fields.....	14-5
14.3.5	SValid.....	14-7
14.3.6	Invert.....	14-7
14.3.7	Source Element Address	14-7

14.3.8	Primary Volume Tag Information.....	14-7
14.3.9	Medium Transport Element Descriptor.....	14-8
14.3.10	Storage Element Descriptor	14-8
14.3.11	Import/Export Element Descriptor	14-9
14.3.12	Data Transfer Element Descriptor	14-10
14.4	Volume Tag Information	14-11
14.4.1	Alternate Volume Tag Information.....	14-11
14.4.2	Volume Identifier	14-12
14.4.3	Volume Sequence Number.....	14-12
15.	Release	15-1
15.1	Command Description	15-1
15.1.1	3 rd Party	15-1
15.1.2	3 rd Party Device ID.....	15-1
15.1.3	Element.....	15-1
15.1.4	Reservation Identification	15-1
16.	Request Sense.....	16-1
16.1	Command Description	16-1
16.1.1	Allocation Length	16-2
16.2	Sense Data Format.....	16-2
16.2.1	Valid	16-2
16.2.2	Error Code.....	16-3
16.2.3	Segment Number.....	16-3
16.2.4	Filemark.....	16-3
16.2.5	EOM	16-3
16.2.6	ILI.....	16-3
16.2.7	Sense Keys	16-3
16.2.8	Information	16-3
16.2.9	Additional Sense Length.....	16-3
16.2.10	Command Specific Information.....	16-4
16.2.11	Additional Sense Code (ASC)	16-4
16.2.12	Additional Sense Code Qualifier (ASCQ)	16-4
16.2.13	Field Replaceable Unit Code	16-4
16.2.14	SKSV.....	16-4
16.2.15	Sense Key Specific.....	16-4
16.3	Request Sense Error Conditions.....	16-5
17.	Request Volume Element Address	17-1
17.1	Command Description	17-1
17.1.1	Considerations in a Multi-Initiator Environment.....	17-1
17.1.2	VolTag	17-2
17.1.3	Element Type Code	17-2

17.1.4	Starting Element Address	17-2
17.1.5	Number of Elements	17-2
17.1.6	Allocation Length	17-2
17.2	Volume Element Address Data.....	17-2
17.2.1	First Element Address Reported.....	17-3
17.2.2	Number of Elements Reported	17-3
17.2.3	Send Action Code.....	17-3
17.2.4	Byte Count of Report Available	17-3
17.3	Element Status Page	17-3
17.4	Command Specific Errors.....	17-3
18.	Reserve.....	18-1
18.1	Command Description	18-1
18.1.1	3 rd Party	18-2
18.1.2	3 rd Party Device ID.....	18-2
18.1.3	Element.....	18-2
18.1.4	Reservation Identification	18-2
18.1.5	Element List Length	18-2
18.2	Element List Descriptor	18-2
18.2.1	Number of Elements	18-3
18.2.2	Element Address	18-3
18.3	Reservation Conflicts.....	18-3
18.4	Command Specific Errors.....	18-3
19.	Rezero Unit	19-1
19.1	Command Description	19-1
20.	Send Diagnostic	20-1
20.1	Command Description	20-1
21.	Send Volume Tag	21-1
21.1	Command Description	21-1
21.1.1	Element Type Code	21-2
21.1.2	Element Address	21-2
21.1.3	Send Action Code.....	21-2
21.1.4	Parameter List Length.....	21-3
21.2	Command Specific Errors.....	21-4
22.	Test Unit Ready	22-1
22.1	Command Description	22-1
23.	Write Buffer	23-1
23.1	Command Description	23-1
23.1.1	Mode	23-1
23.1.2	Buffer ID	23-1
23.1.3	Buffer Offset	23-2

23.1.4	Parameter List Length.....	23-2
23.2	Command Specific Errors.....	23-2

1.

Introduction

This manual is intended for use by system integrators who have an understanding of the Small Computer Systems Interface (SCSI). It describes the extent to which Qualstar's Medium Changer devices (MC) implement the ANSI SCSI-2 Interface Standard. For detailed information about the ANSI SCSI-2 Interface Standard, please refer to the appropriate specifications and/or application notes.

1.1 References

The primary reference for this interface manual is the *ANSI SCSI-2 Interface specification, ANSI X3T9.2/89-042*. In this interface manual, the phrase "ANSI specification" refers to ANSI X3.131-1994.

1.2 Terminology Used in this Document

Conditions and command names are capitalized as in "Mode Sense command", and "... generates a Unit Attention condition..."; status's, signals, message names, sense keys and bus phases are written in all capital letters, as in "... return a CHECK CONDITION status", and "... set the sense key to ILLEGAL REQUEST."

In describing buffer sizes and transfer lengths, "K" equals 1024 bytes; therefore, 4K is the same as 4096 bytes.

Unless otherwise specified, all numerical references are decimal. Binary numbers are indicated by a subscript "b" (011_b for example), and hexadecimal numbers are indicated by a subscript "h" (1A3_h for example).

2.

General Information

The MC functions as a target. The initiator sends a command to the MC by sending a Command Descriptor Block (CDB) that defines the command and its parameters. The MC then examines certain fields in the CDB and will report an error if any are invalid. It then attempts to execute the command. This chapter contains information common to all commands. Information about specific commands is found in subsequent chapters.

2.1 SCSI Bus Timing

The MC conforms to the timing specifications stated in the ANSI specification.

2.2 Logical Interface

The MC implements the logical characteristics of SCSI as described in Section 5 of the ANSI specification with the following options and exceptions:

- **Bus Phases** – The MC supports all SCSI bus phases.
- **Selection Time-out Option** – The Select and Reselect Time-outs are 250 milliseconds.
- **Reselection Time-out Option** – The MC follows the reselection time-out procedure as defined in the ANSI specification, Paragraph 5.1.4.2 Option 2.
- **Phase Interruptions** – Phases can only be interrupted by the following exception conditions:
 - a. **Reset Condition** – The Reset condition can occur when the SCSI RST signal is asserted or when a Power-Fail/Power-Off condition in the device occurs. In this case, the MC terminates the phase and the connection established during SELECTION/RESELECTION with the release of the BSY signal.
 - b. **Parity Error Condition during Any Out Phase** – If the MC detects a parity error, the resulting action depends upon the Configuration\Advanced\SCSI\Parity menu item:
 - MESSAGE – The MC will perform retries before aborting the command.
 - ABORT – The MC will not perform retries but will attempt to abort the command by going to the STATUS phase, sending a CHECK CONDITION status, and then going to the BUS FREE phase. If it is unable to successfully send the status byte, it will go to the BUS FREE phase. Sense data will be available.
 - IGNORE – The MC will accept the bad data.
- **Synchronous Data Transfer REQ/ACK Offset** – The REQ/ACK offsets from 0 to 16 are supported using extended messages.

- **Reset Option** – The MC implements the hard reset option. Upon detection of a Reset condition, the MC will:
 - a. Immediately clear all incomplete or pending operations.
 - b. Release all SCSI device reservations.
 - c. Return any SCSI device operating modes (MODE SELECT, etc.) to their power-on conditions.
 - d. Perform a limited set of self-test diagnostics.
 - e. Set the Unit Attention condition.

2.2.1 Messages

The MC supports the message protocol described in Section 5 of the ANSI specification and implements the messages listed in Table 2-1.

MESSAGE CODE	DESCRIPTION
00 _h	COMMAND COMPLETE
01 _h	<i>Extended Message Prefix</i>
02 _h	SAVE DATA POINTER
03 _h	RESTORE POINTERS
04 _h	DISCONNECT
05 _h	INITIATOR DETECTED ERROR
06 _h	ABORT
07 _h	MESSAGE REJECT
08 _h	NO OPERATION
09 _h	MESSAGE PARITY ERROR
0C _h	BUS DEVICE RESET
80-87 _h or C0-C7 _h	IDENTIFY

Table 2-1 Supported Messages

2.2.2 Extended Messages

The MC supports the SYNCHRONOUS DATA TRANSFER REQUEST and WIDE DATA TRANSFER REQUEST extended messages.

If the Configuration\Advanced\SCSI\Synchronous menu item is set to YES, it will negotiate the synchronous data transfer mode, otherwise it will respond with asynchronous parameters. In all cases however, it will not MESSAGE REJECT the SYNCHRONOUS DATA TRANSFER REQUEST extended message.

The MC will always negotiate the wide data transfer mode to 8 bits. It will never MESSAGE REJECT the WIDE DATA TRANSFER REQUEST message.

2.3 SCSI Command Descriptor Block Structure

The MC supports the command descriptor blocks (CDBs) as defined in the ANSI specification. This section explains options and exceptions specific to Qualstar's implementation. The format of a generic CDB is shown in Table 2-2.

NOTE

Values other than those in parentheses in the CDBs will result in a CHECK CONDITION status. In the case of returned data, such as Mode Sense pages, values in parentheses are constants that do not change.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code							
1	LUN			Multi-Bit field				
2	Single-Byte field							
3-4	Multi-Byte field							
5	Vendor Specific (0)		Reserved (0)			Flag (0)		Link (0)

Table 2-2 Generic CDB Format

2.3.1 Operation Code

Operation codes are all shown in hexadecimal format. Table 2-3 lists the commands that the MC supports.

Operation Code	Command
00 _h	Test Unit Ready
01 _h	Rezero Unit
03 _h	Request Sense
07 _h	Initialize Element Status
12 _h	Inquiry
15 _h	Mode Select
16 _h	Reserve
17 _h	Release
1A _h	Mode Sense
1D _h	Send Diagnostic
1E _h	Prevent/Allow Medium Removal
2B _h	Position to Element
3B _h	Write Buffer
3C _h	Read Buffer
4D _h	Log Sense
A5 _h	Move Medium
A6 _h	Exchange Medium

Operation Code	Command
B5 _h	Request Volume Element Address
B6 _h	Send Volume Tag
B8 _h	Read Element Status
E7 _h	Initialize Element Status with Range

Table 2-3 Supported Commands

If an error or exception condition exists when the command is received, the MC will return a CHECK CONDITION status.

2.3.2 Logical Unit Implementation

Part of the configuration process when setting up the MC is assigning a Logical Unit Number (LUN) to the MC. This is done using the Configuration\Advanced\SCSI\Changer LUN menu item. The MC will respond to values from 0 through 7, and will also respond to any LUN value if you choose the value ANY in this menu item.

The initiator can specify the LUN by using either the SCSI-2 implementation (Selection *with* the Attention signal and IDENTIFY message) or the SCSI-1 implementation (Selection *without* the Attention signal and the LUN field in the CDB) as follows:

- **Selection with Attention Signal (SCSI-2 Implementation)** – If you select the MC with the Attention signal, specify the LUN by sending an IDENTIFY message during the first MESSAGE OUT phase. In this case the MC ignores the LUN value in the subsequent CDB.
- **Selection without Attention Signal (SCSI-1 Implementation)** – If you select the MC without the Attention signal, you must specify the LUN value in the subsequent CDB.

2.3.2.1 Preservation of Sense Data

Sense data for a given LUN is preserved in the event a command is issued to an invalid LUN, as shown in the following sequence (SCSI-1 implementation is being used):

- The MC has been assigned a LUN value of 2.
- The MC receives a command with a LUN of 2 and the command terminates with a CHECK CONDITION status.
- The MC receives a Request Sense command, but with a LUN of 1. This does not match the MC's assigned LUN value, so the MC returns a sense key of ILLEGAL REQUEST with an Additional Sense Code (ASC) of LOGICAL UNIT NOT SUPPORTED. The MC returns a GOOD status.

The MC receives another Request Sense command, but this time with a matching LUN (2). The sense data it returns reflects the outcome of the command that resulted in the CHECK CONDITION status.

2.3.3 Reserved Fields

Reserved bits, bytes, fields, and code values are checked for non-zero conditions. The MC will return a CHECK CONDITION status and set the sense key to ILLEGAL REQUEST if any of these are set to 1.

2.3.4 Single-Byte Fields

The values of some fields are predetermined by the ANSI specification. In these cases, the actual values are indicated in the CDB for each command. Reserved fields are shown with a value of 0.

Supported fields that must have one particular value are shown with the field name followed by the required value in parentheses.

Other supported fields are shown with the field name only. Valid values are listed in the explanatory paragraphs.

2.3.5 Multi-Byte Fields

Multi-byte fields are *big-endian*. The numerically lower byte contains the field's most significant byte (MSB), and the numerically higher byte contains the field's least significant byte (LSB).

2.3.6 Vendor Specific

The value of this field is not specified in the ANSI specification. Vendors are allowed to extend the command's specification using these bits. For most commands the value of this field must be 0.

2.3.7 Flag

Linked commands are not supported and the value of this field must be 0.

2.3.8 Link

Linked commands are not supported and the value of this field must be 0.

2.4 Status Structures

2.4.1 Completion Status Byte

The MC sends a Completion Status Byte (referred to in this document as *Status byte* or *status*) to the initiator during the STATUS phase after each command, unless the command is cleared by an ABORT or BUS DEVICE RESET message, or by a hard reset condition. The contents of the Status byte are described in Table 2-4. At any time, additional information is available in the Sense data (returned by the Request Sense command).

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (0)		Status					Reserved (0)

Table 2-4 Completion Status Byte Contents

Table 2-5 lists the values and names for the Status field. The values are the individual field values not the values for the entire Completion Status Byte.

Status	Name
0	GOOD
1	CHECK CONDITION
4	BUSY
18	RESERVATION CONFLICT

Table 2-5 Status Field Values

The following is a description of the Status field values:

GOOD

A GOOD status (all bits zero) indicates that the MC has completed the command without errors.

CHECK CONDITION

CHECK CONDITION status indicates that the command terminated with an error, exception, or abnormal condition, and that this condition should be checked. CHECK CONDITIONs are reported when the error is detected and include:

- The specified LUN does not match the MC's assigned LUN.
- The MC receives a command with in which a reserved field is not 0.
- The MC receives a command with an invalid parameter.
- A parity error occurs while receiving the command and the message system is not enabled.
- The message system is enabled and a message error occurs while the MC is processing the command.
- The initiator sends a command other than an Inquiry or Request Sense command while a pending Unit Attention condition exists.
- The MC is not ready.
- The MC has an unrecoverable hardware error and receives a command that requires motion.
- A special condition unique to the command being processed has occurred. These special conditions are explained in the individual command chapters.

BUSY	The MC returns a BUSY status whenever it is unable to accept a command.
RESERVATION CONFLICT	The MC will return a RESERVATION CONFLICT if any access other than a Request Sense, Inquiry, or Release Unit command is received and the MC (or affected elements of the MC) is reserved for another initiator.

2.4.2 Internal Unit Attention Condition

The MC generates a Unit Attention condition when:

- The MC is power-cycled.
- The SCSI bus is reset.
- It receives a BUS DEVICE RESET message.
- The inventory of the MC is altered by manual intervention.
- The MC receives a SCSI Mode Select command that alters the configuration of the MC.

Possible initiator responses to these events are:

- Request Sense
- Inquiry
- Any other command

The following paragraphs describe these commands when a Unit Attention condition exists.

2.4.2.1 Request Sense

If a Unit Attention condition exists and the MC receives a Request Sense command, then it will return a GOOD status, set the sense key to UNIT ATTENTION, and will then clear the Unit Attention condition for that initiator. Subsequent commands will return an appropriate status and sense key to that initiator.

2.4.2.2 Inquiry

If the MC receives an Inquiry command, then it will return a GOOD status, but will not clear the Unit Attention condition. This will repeat as long as the MC receives Inquiry commands from that initiator.

2.4.2.3 Any Other Command

If the MC receives any command other than Request Sense or Inquiry command, it will return a CHECK CONDITION status and will not perform that command.

2.4.3 Parity Errors Detected by the MC

If the MC detects a parity error, the action it takes depends upon the value of the Configuration\Advanced\SCSI\Parity menu item:

-
- MESSAGE - The MC will perform retries before aborting the command.
 - ABORT - The MC will not perform retries but will attempt to abort the command by going to the STATUS phase, sending a CHECK CONDITION status, and then going to the BUS FREE phase. If it is unable to successfully send the status byte, it will go to the BUS FREE phase. Sense data will be available.
 - IGNORE - The MC will accept the bad data.

2.4.3.1 Parity Error During SELECTION Phase

NOTE

The initiator creates the SELECTION phase when it wants to select a particular target, and the MC will confirm its selection by asserting BSY. If the MC detects a parity error during the SELECTION phase, it will not assert BSY. After an election abort time-out delay, the initiator then either asserts RST, or releases SEL and goes to the BUS FREE state.

2.4.3.2 Parity Error During MESSAGE OUT Phase

The MC normally creates the MESSAGE OUT phase in response to an ATN signal from the initiator. It then transfers a message of one or more bytes out from the Initiator. If the MC detects a parity error on one or more of these bytes and the Configuration\Advanced\SCSI\Parity menu item is set to MESSAGE, it will indicate its desire, up to four times, to retry the message by asserting the REQ signal after detecting the ATN signal has gone false and prior to changing to any other phase. If the Configuration\Advanced\SCSI\Parity menu item is set to ABORT, the MC will attempt to abort the command as previously explained.

2.4.3.3 Parity Error During COMMAND Phase

If the MC detects a parity error during the COMMAND phase and the Configuration\Advanced\SCSI\Parity menu item is set to MESSAGE, it will indicate its desire, up to four times, to receive the command. If it cannot complete the COMMAND phase after four retries, the MC will go to a BUS FREE phase. If the Configuration\Advanced\SCSI\Parity menu item is set to ABORT, the MC will attempt to abort the command as previously explained. The retry sequence is explained in Section 2.4.5.

2.4.3.4 Parity Error During DATA OUT Phase

If the MC detects a parity error during a DATA OUT phase and the Configuration\Advanced\SCSI\Parity menu item is set to MESSAGE, it will send a RESTORE POINTERS message and attempt to receive the data again. This will happen until the data is successfully received or until four retries have failed. If it cannot complete the COMMAND phase after four retries, the MC will go to a BUS FREE phase. If the Configuration\Advanced\SCSI\Parity menu item is set to ABORT, the MC will attempt to abort the command as previously explained. The retry sequence is explained in Section 2.4.5.

2.4.4 Parity Errors Detected by the Initiator

2.4.4.1 Parity Error During DATA IN Phase

Parity errors detected during a DATA IN phase are handled the same way as when detected during the MESSAGE IN or STATUS phases. The initiator sends an INITIATOR DETECTED ERROR message and the MC replies with a RESTORE POINTERS message. It will then re-send the data beginning at the point specified by the last SAVE DATA POINTER message, or from the beginning if there was no SAVE DATA POINTER message.

2.4.5 Retries

The MC will perform up to four retries in an attempt to overcome error conditions. For each retry, it enters the MESSAGE IN phase, sends a RESTORE POINTERS message, and then repeats the phase which resulted in the error.

What happens after four unsuccessful retries depends upon whether or not the requested LUN is known:

- If the LUN is known, the MC terminates the command with a CHECK CONDITION status, sets the sense key to ABORTED COMMAND, the Additional Sense Code (ASC) to 47 and the Additional Sense Code Qualifier (ASCQ) to 0 to indicate a SCSI Parity Error
- If the LUN is not known, then the MC goes to a BUS FREE phase without setting any sense data.

2.5 Element Addressing

Resources under control of the MC are referred to as elements. The SCSI specification defines four types of elements: Data Transfer, Import/Export, Medium Transport, and Storage. Internally to the MC, resources are referred to as locations and fall into six types: Drive, Fixed Slot, Handler, I/O Port, Magazine Slot, and Private Slot. The mapping of location types to element types is shown in Table 2-6

Location Type	Element Type
Drive	Data Transfer
Fixed Slot	Storage
Handler	Medium Transport
I/O Port	Import/Export
Magazine Slot	Storage
Private Slot	<i>not accessible</i>

Table 2-6 Location to Element Type Mapping

Locations have defined identifiers which cannot be altered (see the TLS Installation and Operation Manual for details of the location identifiers). Elements also have identifiers that the SCSI specification refers to as element addresses. The assignment of element addresses is programmable and can be altered from the front panel as well

as over the SCSI interface via the Mode Select command. Each element type has a defined starting address. Within the range of that type, elements are assigned consecutive addresses beginning with the starting address and increasing by ones. Element addresses are a 16-bit binary number and therefore have a range of 0 to 65535. The addresses for an element type are not allowed to wrap around from 65535 to 0.

The mapping of element addresses to locations within an element type is under sole control of the MC. The rules are given by element type below:

Data Transfer	D1 is assigned the data transfer starting address, D2 is assigned the starting address + 1, etc.
Medium Transport	There is only one handler that is assigned the medium transport starting address.
Import/Export	There is either none or one I/O Port, if it exists, it is assigned the import/export starting address.
Storage	Assignment of magazine and fixed slots is controlled by the Configuration\Advanced\SCSI\Storage Order menu item. By default, the item is set to MAG. With that setting, the 1A01 magazine slot (first face, lower magazine, lowest slot) is assigned the storage starting address, 1A02 the next and so on until all magazine slots are addressed. Then the fixed slots are assigned in order (1F, 2F, etc.. or F1, F2 depending on model). If the Configuration\Advanced\SCSI\Storage Order menu item is set to FIX, the fixed slots are assigned first followed by the magazine slots.

2.6 Errors

Errors that occur during the receipt or execution of a command fall into two categories: General and Command Specific. Command specific errors are listed at the end of each individual command chapter (where applicable). General errors are listed in Table 2-7, Table 2-8, Table 2-9, Table 2-10 and Table 2-11. See Section 16.2 for a description of the Request Sense command's Sense Data format.

In the following error code tables (and all others throughout this document), a C/D Bit entry that is blank indicates that the SKSV field of the Request Sense data is 0 (and therefore there is no Sense Key Specific data). A Bit Pointer entry that is blank indicates that the BPV field is 0 (and therefore there is no Bit Pointer). Field and Bit Pointer entries that contain ? indicate that many errors of that type may occur in different fields and so there is more than one possible value.

NOTE

Emulations refers to the setting in the Configuration\Advanced\SCSI\Errors menu item.

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
2	04 _h	00 _h				Logical Unit Not Ready, Cause Not Reportable. O aborted by operator.
2	04 _h	01 _h				Logical Unit Is In Process Of Becoming Ready: I/O Port is busy, inventory scan is in progress, or sequential mode operation in progress.
2	04 _h	82 _h				I/O Port is extended.
4	00 _h	00 _h				General Unit hardware failure.
5	20 _h	00 _h	1	0000 _h		Invalid Command Operation Code.
5	24 _h	00 _h	1	???? _h	?	Invalid Field In CDB. Usually a reserved bit set.
5	25 _h	00 _h				Logical Unit Not Supported. A CDB for a LUN other than the configured LUN was received.
5	3D _h	00 _h				Invalid bits in Identify message.
6	28 _h	00 _h				Not Ready To Ready Transition, Medium May Have Changed.
6	28 _h	01 _h				Import or Export Element Accessed.
6	29 _h	00 _h				Power-On Reset or Bus Device Reset occurred.
11	43 _h	00 _h				Message Error. Initiator sent an improper message sequence.
11	47 _h	00 _h				SCSI Parity Error.
11	48 _h	00 _h				Initiator Detected Error Message Received.
11	4E _h	00 _h				Overlapped Commands Attempted. The initiator sent a CDB while it was disconnected from a previous CDB.

Table 2-7 General Errors: All Emulations

Native						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
2	04 _h	83 _h				Front door is open.

Table 2-8 General Errors: Native

Exabyte 10e Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
2	04 _h	85 _h				Front door is open.

Table 2-9 General Errors: Exabyte 10e Emulation

Exabyte 10i Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
2	04 _h	85 _h				Front door is open.

Table 2-10 General Errors: Exabyte 10i Emulation

Exabyte 120 Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
2	04 _h	83 _h				Front door is open.

Table 2-11 General Errors: Exabyte 120 Emulation

2.7 Connector Pin Assignments

Connector pin assignments for narrow single-ended and differential interfaces are given in Table 2-12 and Table 2-13. Wide single-ended and differential interfaces are shown in Table 2-14 and Table 2-15. Additional information can be found in the ANSI SCSI specification.

Signal Name	Cable Conductor Number		Signal Name
Ground	1	2	-DB0
Ground	3	4	-DB1
Ground	5	6	-DB2
Ground	7	8	-DB3
Ground	9	10	-DB4
Ground	11	12	-DB5
Ground	13	14	-DB6
Ground	15	16	-DB7
Ground	17	18	-DBP
Ground	19	20	Ground
Ground	21	22	Ground
Reserved	23	24	Reserved
Open	25	26	TERMPWR
Reserved	27	28	Reserved
Ground	29	30	Ground
Ground	31	32	-ATN
Ground	33	34	Ground
Ground	35	36	-BSY
Ground	37	38	-ACK
Ground	39	40	-RST
Ground	41	42	-MSG
Ground	43	44	-SEL
Ground	45	46	-C/D
Ground	47	48	-REQ
Ground	49	50	-I/O

Table 2-12 Narrow Single-Ended SCSI Connector Pinouts

Signal Name	Cable Conductor Number		Signal Name
Ground	1	2	Ground
+DB0	3	4	-DB0
+DB1	5	6	-DB1
+DB2	7	8	-DB2
+DB3	9	10	-DB3
+DB4	11	12	-DB4
+DB5	13	14	-DB5
+DB6	15	16	-DB6
+DB7	17	18	-DB7
+DBP	19	20	-DBP
DIFFSENS	21	22	Ground
Reserved	23	24	Reserved
TERMPWR	25	26	TERMPWR
Reserved	27	28	Reserved
+ATN	29	30	-ATN
Ground	31	32	Ground
+BSY	33	34	-BSY
+ACK	35	36	-ACK
+RST	37	38	-RST
+MSG	39	40	-MSG
+SEL	41	42	-SEL
+C/D	43	44	-C/D
+REQ	45	46	-REQ
+I/O	47	48	-I/O
Ground	49	50	Ground

Table 2-13 Narrow Differential SCSI Connector Pinouts

Signal Name	Cable Conductor Number		Signal Name
Ground	1	2	-DB12 *
Ground	3	4	-DB13 *
Ground	5	6	-DB14 *
Ground	7	8	-DB15 *
Ground	9	10	-DBP1 *
Ground	11	12	-DB0
Ground	13	14	-DB1
Ground	15	16	-DB2
Ground	17	18	-DB3
Ground	19	20	-DB4
Ground	21	22	-DB5
Ground	23	24	-DB6
Ground	25	26	-DB7
Ground	27	28	-DBP
Ground	29	30	Ground
Ground	31	32	Ground
TERMPWR	33	34	TERMPWR
TERMPWR	35	36	TERMPWR
Reserved	37	38	Reserved
Ground	39	40	Ground
Ground	41	42	-ATN
Ground	43	44	Ground
Ground	45	46	-BSY
Ground	47	48	-ACK
Ground	49	50	-RST
Ground	51	52	-MSG
Ground	53	54	-SEL
Ground	55	56	-C/D
Ground	57	58	-REQ
Ground	59	60	-I/O
Ground	61	62	-DB8 *
Ground	63	64	-DB9 *
Ground	65	66	-DB10 *
Ground	67	68	-DB11 *

Table 2-14 Wide Single-Ended SCSI Connector Pinouts

Signal Name	Cable Conductor Number		Signal Name
+DB12 *	1	2	-DB12 *
+DB13 *	3	4	-DB13 *
+DB14 *	5	6	-DB14 *
+DB15 *	7	8	-DB15 *
+DBP1 *	9	10	-DBP1 *
Ground	11	12	Ground
+DB0	13	14	-DB0
+DB1	15	16	-DB1
+DB2	17	18	-DB2
+DB3	19	20	-DB3
+DB4	21	22	-DB4
+DB5	23	24	-DB5
+DB6	25	26	-DB6
+DB7	27	28	-DB7
+DBP	29	30	-DBP
DIFFSENS	31	32	Ground
TERMPWR	33	34	TERMPWR
TERMPWR	35	36	TERMPWR
Reserved	37	38	Reserved
+ATN	39	40	-ATN
Ground	41	42	Ground
+BSY	43	44	-BSY
+ACK	45	46	-ACK
+RST	47	48	-RST
+MSG	49	50	-MSG
+SEL	51	52	-SEL
+C/D	53	54	-C/D
+REQ	55	56	-REQ
+I/O	57	58	-I/O
Ground	59	60	Ground
+DB8 *	61	62	-DB8 *
+DB9 *	63	64	-DB9 *
+DB10 *	65	66	-DB10 *
+DB11 *	67	68	-DB11 *

Table 2-15 Wide Differential SCSI Connector Pinouts

3.

Exchange Medium

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	A6 _n							
1	LUN			0				
2-3	Transport Element Address							
4-5	Source Element Address							
6-7	First Destination Element Address							
8-9	Second Destination Element Address							
10	0						Inv2 (0)	Inv1 (0)
11	Vendor Specific (0)		0				Flag (0)	Link (0)

3.1 Command Description

The Exchange command lets you replace a cartridge in one location (the *first destination*) with a cartridge from another (the *source*) using a single SCSI command. Two types of exchanges are possible. In the first, the two cartridges are simply swapped, with the source cartridge ending up in the destination location and vice versa. This operation requires an empty storage location is available, the MC will use any free slot in a magazine slot, fixed slot, or I/O Port first and finally the private slot if necessary.

NOTE

If the `Configuration\Advanced\Changer\UsePrivateSlot` menu item is set to NO and no other slot is empty, a CHECK CONDITION will result.

The second type of exchange involves a third location called the *second destination*. In this exchange, the cartridge in the first destination is moved to the second destination, and then the source cartridge is moved to the first destination. This operation does not require a temporary storage location.

You may specify any element type for the source, first, and second destinations. If the source or the first destination is empty, or if the second destination location is not equal to the source location and is full, the MC returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key.

3.1.1 Transport Element Address

This is the address of the handler or 0. If the value is 0, the MC internally supplies the address of the handler; otherwise the MC compares the value of this field with the value set by the last Mode Select command (or with the default if no Mode Select command was received). If the values do not compare, the MC returns the appropriate error message.

3.1.2 Source Element Address

This field specifies the element address of the cartridge that will end up in the first destination when the command is complete.

3.1.3 First Destination Address

This field specifies the element address where the cartridge in the source location will be when the command is complete.

3.1.4 Second Destination Address

This field specifies the element address where the cartridge in the first destination location will be when the command is complete. For a simple exchange, set the value of this field to the value of the Source Element Address field.

3.1.5 Inv2, Inv1

Because the MC does not invert media, the Invert 2 and Invert 1 fields must both be 0.

3.2 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
2	04 _h	00 _h				Logical Unit Not Ready, Cause Not Reportable. No free slot available or operation aborted by operator.
5	3B _h	0D _h	1	0008 _h		Medium Destination Element Full. Second Destination Element full.
5	3B _h	0E _h	1	0004 _h		Medium Source Element Empty.
5	80 _h	00 _h	1	0006 _h		First Destination Element Empty.
5	80 _h	07 _h	1	0004 _h		I/O Port access or Import prohibited by configuration, Attempted use as Source Element (or First Destination Element).
5	80 _h	07 _h	1	0006 _h		I/O Port access or Import/Export prohibited by configuration, Attempted use as First Destination Element (or Second for Export).
5	80 _h	07 _h	1	0008 _h		I/O Port access or Export prohibited by configuration, Attempted use as Second Destination Element.

Table 3-1 Exchange Command Specific Errors: All Emulations

Native						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	21 _h	01 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	21 _h	01 _h	1	0006 _h		Invalid Element Address. Invalid First Destination Element address.
5	21 _h	01 _h	1	0008 _h		Invalid Element Address. Invalid Second Destination Element address.
5	3B _h	90 _h	1	0004 _h		Tape is not ejected from drive. Could be Source Element or First Destination Element.
5	80 _h	01 _h	1	0002 _h		Handler Full.
5	80 _h	03 _h				Source Magazine not installed.
5	80 _h	04 _h				Destination Magazine not installed.
5	80 _h	05 _h				Source Drive not installed.
5	80 _h	06 _h				Destination Drive not installed.

Table 3-2 Exchange Command Specific Errors: Native

Exabyte 10i Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	24 _h	80 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	24 _h	80 _h	1	0006 _h		Invalid Element Address. Invalid First Destination Element address.
5	24 _h	80 _h	1	0008 _h		Invalid Element Address. Invalid Second Destination Element address.
5	3B _h	83 _h	1	0004 _h		Tape is not ejected from drive. Could be Source Element or First Destination Element.
5	80 _h	01 _h	1	0002 _h		Handler Full.
2	04 _h	86 _h				Source Magazine not installed.
2	04 _h	86 _h				Destination Magazine not installed.
5	3B _h	83 _h				Source Drive not installed.
5	3B _h	84 _h				Destination Drive not installed.

Table 3-3 Exchange Command Specific Errors: Exabyte 10i Emulation

Exabyte 10e Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	24 _h	80 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	24 _h	80 _h	1	0006 _h		Invalid Element Address. Invalid First Destination Element address.
5	24 _h	80 _h	1	0008 _h		Invalid Element Address. Invalid Second Destination Element address.
5	3B _h	83 _h	1	0004 _h		Tape is not ejected from drive. Could be Source Element or First Destination Element.
5	80 _h	01 _h	1	0002 _h		Handler Full.
2	04 _h	86 _h				Source Magazine not installed.
2	04 _h	86 _h				Destination Magazine not installed.
5	3B _h	83 _h				Source Drive not installed.
5	3B _h	84 _h				Destination Drive not installed.

Table 3-4 Exchange Command Specific Errors: Exabyte 10e Emulation

Exabyte 120 Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	21 _h	01 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	21 _h	01 _h	1	0006 _h		Invalid Element Address. Invalid First Destination Element address.
5	21 _h	01 _h	1	0008 _h		Invalid Element Address. Invalid Second Destination Element address.
5	3B _h	83 _h	1	0004 _h		Tape is not ejected from drive. Could be Source Element or First Destination Element.
5	3B _h	80 _h	1	0002 _h		Handler Full.
5	80 _h	03 _h				Source Magazine not installed.
5	80 _h	04 _h				Destination Magazine not installed.
5	80 _h	05 _h				Source Drive not installed.
5	80 _h	06 _h				Destination Drive not installed.

Table 3-5 Exchange Command Specific Errors: Exabyte 120 Emulation

4. Initialize Element Status

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	07 _h							
1	LUN			0				
2-4	0							
5	NBL	0	0				Flag (0)	Link (0)

4.1 Command Description

The Initialize Element Status command instructs the MC to scan all elements for the presence of a data cartridge. If the unit is equipped with a barcode reader, the NBL field is not set, and the

Configuration\Advanced\Changer\Inventory\Fixed Labels, Configuration\Advanced\Changer\Inventory\Mag. Labels, and Configuration\Advanced\Changer\Inventory\Seq. Labels menu items are set to SOME or ALL, the MC will also scan for barcode labels.

In general, the use of this command is to remove the 'unknowns' from the element descriptor data that is returned by the Read Element Status and Request Volume Element Address commands.

5. Initialize Element Status with Range

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	E7 _h							
1	LUN			0				Range
2-3	Element Address							
4-5	0							
6-7	Number of Elements							
8	0							
9	NBL	0	0				Flag (0)	Link (0)

5.1 Command Description

The Initialize Element Status with Range command instructs the MC to scan some elements for the presence of a data cartridge. If the unit is equipped with a barcode reader, the NBL field is not set, and the

Configuration\Advanced\Changer\Inventory\Fixed Labels, Configuration\Advanced\Changer\Inventory\Mag. Labels, and Configuration\Advanced\Changer\Inventory\Seq. Labels menu items are set to SOME or ALL, the MC will also scan for barcode labels.

The results of this scan are stored and can be retrieved using the Read Element Status command (see Chapter 14).

NOTE

This command is provided for compatibility with EXABYTE model medium changers. The range restrictions may not be respected.

5.1.1 Range

This field specifies which elements are to be scanned. If its value is 0, all elements are to be scanned, otherwise, the Element Address and Number of Elements fields specify the range to be scanned. In a ranged scan, any element address greater than or equal to Element Address and less than Element Address + Number of Elements, will be scanned.

5.1.2 Element Address

This field specifies the starting element address for the range of elements to be checked. Its value does not have to be a valid element address.

5.1.3 Number of Elements

This field specifies the maximum number of elements to be scanned.

5.1.4 NBL

This field specifies whether barcode labels should be scanned. A value of 0 specifies that barcodes should be scanned in accordance with the unit's configuration. A value of 1 specifies that no barcodes should be scanned and takes precedence over the unit's configuration.

NOTE

If the unit is not configured with a barcode reader and the NBL field is set to 0, the unit will return a CHECK CONDITION.

5.2 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	85 _h	01 _h	1	0009 _h	7	No Barcode Reader installed.

6.

Inquiry

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	12 _h							
1	LUN			0				EVPD (0)
2	Page Code (0)							
3	0							
4	Allocation Length							
5	Vendor Specific (0)		0				Flag (0)	Link (0)

6.1 Command Description

The Inquiry command instructs the MC to return Inquiry Data. The Inquiry Data consists of a set of fields that describe the MC.

6.1.1 EVPD

The MC does not support the Enable Vital Product Data field and this field must contain 0.

6.1.2 Page Code

Because the MC does not support the Enable Vital Product Data field, this field must also be 0.

6.1.3 Allocation Length

The Allocation Length field tells the MC the maximum number of bytes that the initiator has allocated for the returned Inquiry Data. The MC can return up to 56 bytes. It will return the specified number of bytes or all available data whichever is less.

6.2 Inquiry Data

The default format of the Inquiry Data is shown in Table 6-1. The MC returns the values shown in parentheses unless a predefined or custom data has been selected, in which case different values are returned. Three exceptions to this are:

- **Peripheral Qualifier** – The MC will return a 0 or a 3 as described later in this section.
- **Sync** – The MC will return a value of 0 or 1 as described later in this section.
- **BarC** – The MC will return a value of 0 or 1 as described later in this section.

Predefined inquiry strings are available and you can also create your own custom Inquiry string. Instructions for selecting a predefined Inquiry string and for customizing an Inquiry string are given in the appropriate TLS Installation and

Operation Manual. The predefined Inquiry strings are shown in Table 6-3. For an exact definition of each field, refer to the ANSI Specification.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier			Peripheral Device Type (8)				
1	RMB (1)	Device-Type Modifier (0)						
2	ISO Version (0)		ECMA Version (0)			ANSI Version (2)		
3	AENC (0)	TrmlOP (0)	0		Response Data Format (2)			
4	Additional Length							
5-6	0							
7	RelAdr (0)	Wbus32 (0)	Wbus16 (0)	Sync	Linked (0)	0	CmdQue (0)	SftRe (0)
8-15	Vendor Identification							
16-31	Product Identification							
32-35	Product Revision Level							
36-54	Vendor Specific (0)							
55	Vendor Specific (0)							BarC

Table 6-1 Default Inquiry Data

6.2.1 Peripheral Qualifier

The value which the MC returns depends upon the value of the `Configuration\Advanced\SCSI\Changer LUN` menu item and the LUN supplied by the command. If the command's LUN matches the configured LUN (or if the configured LUN is ALL), the field returns 0, otherwise it returns 3. The SCSI specification defines these values according to Table 6-2.

Qualifier	Description
0	The specified peripheral device type is currently connected to this logical unit. If the target cannot determine whether or not a physical device is currently connected, it shall also use this peripheral qualifier when returning the INQUIRY data. This peripheral qualifier does not mean that the device is ready for access by the initiator.
3	The target is not capable of supporting a physical device on this logical unit. For this peripheral qualifier the Peripheral Device Type shall be set to 1F _h to provide compatibility with previous versions of SCSI. All other peripheral device type values are reserved for this peripheral qualifier.

Table 6-2 Peripheral Qualifier Values

6.2.2 Peripheral Device Type

The MC returns a value of 8 (Medium Changer device) unless overridden by custom inquiry data. Also, if an unsupported LUN is used by the initiator, a value of 1F_h (unknown or no device type) will be returned

6.2.3 RMB

The MC returns a value of 1 for the Removable Medium Bit unless overridden by custom inquiry data.

6.2.4 Device Type Modifier

The MC returns a value of 0 in the Device-Type Modifier field unless overridden by custom inquiry data.

6.2.5 ISO Version

The MC returns a value of 0 in the International Standards Organization field unless overridden by custom inquiry data.

6.2.6 ECMA

The MC returns a value of 0 in the European Computer Manufacturers Association field unless overridden by custom inquiry data.

6.2.7 ANSI

The MC returns a value of 2 unless overridden by custom inquiry data, indicating compliance with ANSI SCSI-2 specifications.

6.2.8 AENC

The MC does not support Asynchronous Event Notification Capability and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.9 TrmIOP

The MC does not support Terminate I/O Process and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.10 Response Data Format

The MC will return a value of 2 in this field unless overridden by custom inquiry data.

6.2.11 Additional Length

The Additional Length field specifies how many more bytes will follow Byte 7 in the Inquiry Data. Its value is 33_h by default. This value is configurable, but should never exceed 33_h. If the Allocation Length in the Inquiry CDB is less than the number of bytes in the Inquiry Data, the MC will truncate the Inquiry Data and will not adjust the Additional Length value to reflect this truncation.

6.2.12 RelAdr

The MC does not support relative addressing and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.13 WBus32

The MC does not support 32-bit wide bus transfers and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.14 WBus16

The MC does not support 16-bit wide bus transfers and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.15 Sync

The value of the Synchronous field will be 1 if the Configuration\Advanced\SCSI\Synchronous menu item is set to ON, otherwise it will be 0.

6.2.16 Link

The MC does not support linked commands and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.17 CmdQue

The MC does not support command queuing and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.18 SftRe

The MC does not support soft resets and will return a value of 0 in this field unless overridden by custom inquiry data.

6.2.19 BarC

This bit has a value of 1 if the MC is configured with a Barcode Reader; otherwise its value is 0.

NOTE

This field is vendor specific and may not be supported on other vendors' SCSI implementations.

6.2.20 Vendor Specific

The contents these bytes are 0 unless overridden by custom inquiry data.

6.2.21 Vendor Identification

This field contains 8 ASCII characters identifying the Vendor of the product. The value in this field is left justified and padded with spaces as necessary. The predefined values are given in Table 6-3. This field may be configured to a custom value as well.

6.2.22 Product Identification

This field contains 16 ASCII characters identifying the product. The value in this field is left justified and padded with spaces as necessary. The predefined values are given in Table 6-3. This field may be configured to a custom value as well.

6.2.23 Product Revision Level

This field contains 4 ASCII characters identifying the product revision. The value in this field is left justified and padded with spaces as necessary. When configured to use

any of the predefined inquiry data, the MC will return the actual firmware revision. The revision format is d.dd (where d represents a decimal digit). This field may be configured to a custom value as well.

Inquiry Data	Vendor ID	Product ID
QUALSTAR TLS-5433	QUALSTAR	TLS-5433
QUALSTAR TLS-5466	QUALSTAR	TLS-5466
QUALSTAR TLS-58132	QUALSTAR	TLS-58132
QUALSTAR TLS-58264	QUALSTAR	TLS-58264
QUALSTAR TLS-6110	QUALSTAR	TLS-6110
QUALSTAR TLS-6210	QUALSTAR	TLS-6210
QUALSTAR TLS-6220	QUALSTAR	TLS-6220
QUALSTAR TLS-6430	QUALSTAR	TLS-6430
QUALSTAR TLS-6460	QUALSTAR	TLS-6460
QUALSTAR TLS-68120	QUALSTAR	TLS-68120
QUALSTAR TLS-68240	QUALSTAR	TLS-68240
QUALSTAR TLS-8111	QUALSTAR	TLS-8111
QUALSTAR TLS-8211	QUALSTAR	TLS-8211
QUALSTAR TLS-8222	QUALSTAR	TLS-8222
QUALSTAR TLS-8433	QUALSTAR	TLS-8433
QUALSTAR TLS-8466	QUALSTAR	TLS-8466
QUALSTAR TLS-88132	QUALSTAR	TLS-88132
QUALSTAR TLS-88264	QUALSTAR	TLS-88264
EXABYTE 10e	EXABYTE	EXB-10e
EXABYTE 10i	EXABYTE	EXB-10i
EXABYTE 120	EXABYTE	EXB-120
EXABYTE 210	EXABYTE	EXB-210
EXABYTE 218	EXABYTE	EXB-218
EXABYTE 440	EXABYTE	EXB-440
EXABYTE 480	EXABYTE	EXB-480

Table 6-3 Predefined Inquiry Strings

7.

Log Sense

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	4D _h							
1	LUN			0			PPC	SP (0)
2	PC (1)			Log Sense Page Code				
3-4	0							
5-6	Parameter Pointer							
7-8	Allocation Length							
9	Vendor Specific (0)		0				Flag (0)	Link (0)

7.1 Command Description

The Log Sense command instructs the MC to return a log page containing certain statistical information about itself. The format of the log pages is described in Section 7.3.

7.1.1 PPC

If the value of the Parameter Pointer Control field is 1, the MC will return only those Parameter Code values which have changed since the last Log Select or Log Sense command, starting with the Parameter Code specified in the following Parameter Pointer field.

A value of 0 tells the MC to return Parameter Code values beginning with the one specified in the following Parameter Pointer field and continuing until the number of bytes specified in the following Allocation Length field has been returned. If the value of the Parameter Pointer is also 0, the MC will return all available log parameters for the specified log page (subject to the specified Allocation Length).

7.1.2 SP

The MC does not save log parameters, and the value of the Save Parameters field must be 0.

7.1.3 PC

Because the MC only maintains cumulative values, the value of the Page Control field must be 1.

7.1.4 Log Sense Page Code

Each log page has its own unique page code number. The Log Sense Page Code field 2 tells the MC which log page to return. The MC supports the log pages shown in Table 7-1.

Page Code	Page Name	Description
00 _h	Supported Log Page	Returns a list of log pages which the MC Supports.
32 _h	Event History Log Page	Returns a history of the most recent events that occurred during the operation of the MC.

Table 7-1 Valid Log Sense Page Codes

7.1.5 Parameter Pointer

This two-byte field identifies the first parameter code the MC is to return (described in Section 7.2.3). The MC stops returning data after returning either the maximum parameter code it supports or the number of bytes specified by Allocation Length, whichever is less.

If this field is 0, the MC will return *all* available log parameters for the specified page up to the specified allocation length.

7.1.6 Allocation Length

This two-byte field specifies the maximum number of bytes to send. The MC will return the specified number of bytes or all requested data, whichever is less.

The MC will not return partial log parameters. If the allocation length is such that only part of the last requested parameter would be returned, the MC will stop after sending the last *complete* log parameter.

7.2 Log Page Structure

A *log page* is a collection of data pertaining to a particular facet of the MC. The log pages that the MC supports are shown in Table 7-1.

The MC returns the log page specified in the Log Sense Page Code field. Each log page begins with a four-byte header (bytes 0 - 3) followed by one page of zero or more variable length log parameters. Table 7-2 shows the format of a log page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0			Page Code				
1	0							
2-3	Page Length (n-3)							
4-x	First byte of first Log Parameter (x-3 bytes long)							
n	Last byte of last Log Parameter							

Table 7-2 Log Page Structure

7.2.1 Log Sense Page Code

This field identifies the following Log page. Valid Log Sense Page codes are shown in Table 7-1

7.2.2 Page Length

This field tells the initiator how many bytes follow and equals the byte number of the last byte transferred (n) minus 3. For example, for a 32-byte log page, n would equal 31 and the Page Length field would equal 28.

7.2.3 Log Parameters

The remaining bytes are the log parameters themselves. Each log parameter begins with a four-byte header containing a two-byte identification code, a control byte that describes the parameter, and the length of the log parameter. The generic format of a log parameter is shown in Table 7-3. The header is followed by one or more bytes of log parameter data. The log parameter data can be one of the following:

- A value indicating the number of occurrences of a particular event
- A value indicating the status of the MC hardware
- A list of strings that contain the MC event history

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Log Parameter Code							
2	DU	DS	TSD	ETC	TMC		0	LP
3	Log Parameter Length (n-3)							
4-n	Log Parameter Value							

Table 7-3 Generic Log Parameter Format

7.2.3.1 Log Parameter Code

Every log parameter has a unique log parameter code. This two-byte field identifies the log parameter in the log page being returned.

7.2.3.2 Byte 2 - Parameter Control Byte

Most log parameters contain this Parameter Control byte which provides information about that particular parameter. The byte contains the following fields:

- **DU** – Disable Update. A value of 0 indicates that before the MC returns the value, it updates it to reflect all events that should be noted by that parameter. A value of 1 indicates the MC will not update the log parameter except when it receives another Log Sense command that has a new value for that parameter.
- **DS** – Disable Save. A value of 0 indicates that the MC can save the value of that log parameter; a value of 1 indicates that it cannot. The MC will always return a value of 1 in this field.

- **TSD** – Target Save Disable. A value of 0 indicates that the MC will provide a self-defined method for saving log parameters. A value of 1 indicates either that the MC will not provide a self-defined method for saving log parameters, or that the initiator has disabled the self-defined method. The MC will always return a value of 1 in this field.
- **ETC** – Enable Threshold Comparison. A value of 0 indicates that a comparison to the threshold value is not performed whenever the cumulative value is updated. A value of 1 indicates that the comparison is performed. The MC will always return a value of 0 in this field.
- **TMC** – Threshold Met Criteria. This bit defines the basis for comparison of the cumulative and threshold values and is only valid if the ETC bit is 1.
- **LP** – List Parameter. This bit indicates the format of the log parameter. If this bit is 0, the parameter is a data counter. If this bit is 1, the parameter is a list parameter.

7.2.3.3 Log Parameter Length

This field specifies the length of the following parameter in bytes. If the specified length is less than the actual length of the parameter, the MC will truncate the parameter.

7.2.3.4 Log Parameter Value

The Log Parameter can be one of the following types:

- A two- or four-byte event counter
- A value indicating the on/off state of a particular piece of the MC's hardware
- A string describing a MC history event

The bytes following the Log Parameter Length field contain the actual Log Parameter data.

7.3 Log Page Formats

This section describes the formats of the log pages that the MC supports.

7.3.1 Supported Log Page

The Supported log page (Page Code 00h) is a list of the log pages which the MC supports. Unlike the other log pages, the Supported log page does not contain a Parameter Control Byte and does not have log parameters. Its format is shown in Table 7-4.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0		Page Code (00 _h)					
1	0							
2-3	Page Length (0002 _h)							
4	Supported Log Page (00 _h)							
5	Event History Log Page (32 _h)							

Table 7-4 Support Log Page Format

7.3.2 Event History Log Page

The Event History log page returns the most recent events that occurred in the MC. Each event string is variable length. The format of the Event History log page is shown in Table 7-5.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Event Parameter Code							
2	DU (1)	DS (1)	TSD (0)	ETC (0)	TMC (0)		0	LP (1)
3	Event Parameter Length (n-3)							
4-n	Event Parameter Character(s)							

Table 7-5 Event History Log Parameter Format

7.3.2.1 Event Parameter Code

This field contains the index number of the event. 0 is the most recent event, -1 (FFFF_h) is the next most recent, and so on.

7.3.2.2 Event Parameter Length

This field contains the number of bytes that follow.

7.3.2.3 Event Parameter Character(s)

This field contains the string of ASCII characters that describe the event. The string is not terminated in any way. The Event Parameter Length field determines the number of characters.

8.

Mode Select

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	15h							
1	LUN			PF (1)	0			SP
2-3	0							
4	Parameter List Length							
5	Vendor Specific (0)		0				Flag (0)	Link (0)

8.1 Command Description

The Mode Select command sends a Mode Select Parameter list to the MC to specify various operating parameters. The Mode Select Parameter list consists of a four-byte header followed by zero or more optional Mode pages (described in Section 8.2). The parameters are used to configure the MC upon subsequent power-ups, SCSI bus resets, or BUS DEVICE RESET messages.

If an initiator sends a Mode Select command that changes any parameters, the MC returns a CHECK CONDITION status with a UNIT ATTENTION sense key, and an ASC/ASCQ combination of MODE PARAMETERS CHANGED to all other initiators that issue a request to the MC.

If the value of any Mode Select parameter is invalid, the MC will return the appropriate error and will not change any other of the parameters associated with that command.

8.1.1 The Relationship between Current and Saved Data

The following paragraphs explain the relationship between current and saved data.

8.1.1.1 Current Data

Current data is that data which reflects the current operation condition of the MC. It is stored in RAM. Current data can be changed in three ways:

- **Manually** – You can change the current data manually using the Configuration\SET TO DEFAULTS or the Configuration\Advanced\SCSI\Mode Parameters\LC Display\COPY TO CURRENT menu commands. Changes are effective at the time you make them.
- **SCSI command** – You can change the current data by sending a Mode Select command. Changes are immediate.
- **Upon reset** – Any power up or reset event causes the current data to immediately assume the saved data values.

8.1.1.2 Saved Data

Saved Data is that data which is stored in non-volatile RAM. Each time the MC is switched on and whenever a reset occurs, the saved data is copied to the current data. Saved data can be changed in two ways:

- **Manually** – You can change the saved data manually the Configuration\SET TO DEFAULTS or the Configuration\Advanced\SCSI\Mode Parameters\LC Display\COPY TO SAVED menu commands.
- **SCSI command** – You can change the saved data by sending a Mode Select command with the SP bit in the Mode Select command set to 1. If the SP bit is 0, only the current data will be changed. Changes are immediate.

8.1.2 PF

The MC supports the SCSI-2 Mode Select parameter format and the Page Format field must be 1.

8.1.3 SP

If the value of the Saved Page field is 0, the MC will change the current configuration values to the values in this command, but will not change the saved values stored in non-volatile memory.

If the value of the Saved Page field is 1, the MC will save current configuration values specified by this command in non-volatile memory for subsequent operations.

NOTE

The Configuration and External Data pages may alter non-volatile memory regardless of the state of the SP field.

8.1.4 Parameter List Length

The Mode Select Parameter List Length specifies the number of bytes which will be transferred during the DATA OUT phase and equals the number of bytes in the requested page(s) plus four (the header). A value of zero specifies that no data is to be transferred.

8.2 Mode Pages

The format of the Mode Select Parameter list is shown in Table 8-1.

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

Table 8-1 Mode Select Parameter List

The MC supports the following Mode pages in a Mode Select command:

- Element Address Assignment Page
- LCD Page
- Configuration Page
- External Data Page

You may send any number of pages (including none) in one command, but any page may appear only once. The pages may be sent in any order.

8.2.1 Element Address Assignment Page

The Element Address Assignment page lets you assign your own SCSI element addresses to the elements inside the MC. The Element Address Assignment page format is shown in Table 8-2.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	Element Address Assignment Page Code (1D _h)					
1	Parameter List Length (12 _h)							
2-3	Medium Transport Element Address							
4-5	Number of Medium Transport Elements (0001 _h)							
6-7	Storage Element Starting Address							
8-9	Number of Storage Elements							
10-11	Import/Export Element Address							
12-13	Number of Import/Export Elements							
14-15	Data Transfer Element Starting Address							
16-17	Number of Data Transfer Elements							
18-19	0							

Table 8-2 Element Address Assignment Page

8.2.1.1 Element Address Assignment Page Code

This is the code number of the Element Address Assignment page and its value must be 1D_h.

8.2.1.2 Parameter List Length

This field tells the MC how many more bytes follow, and its value must be 18 (12_h).

8.2.1.3 Medium Transport Element Address

This field contains the address to be assigned to the handler.

8.2.1.4 Number of Medium Transport Elements

The only valid value for this field is 1.

8.2.1.5 Storage Element Starting Address

This field contains the address to be assigned to the first storage element.

8.2.1.6 Number of Storage Elements

The only valid value for this field is the default (see Table 8-3).

8.2.1.7 Import/Export Element Starting Address

This field contains the address to be assigned to the I/O port.

8.2.1.8 Number of Import/Export Elements

The only valid value for this field is the default (see Table 8-3).

8.2.1.9 Data Transfer Element Starting Address

This field contains the address to be assigned to the first cartridge drive.

8.2.1.10 Number of Data Transfer Elements

The only valid value for this field is the default (see Table 8-3).

8.2.1.11 Element Address Default Values

The default element address assignments are shown in Table 8-3.

Field	5433	5466	58132	58264
Medium Transport Element Address	63000			
Number of Medium Transport Elements	1			
Storage Element Starting Address	0			
Number of Storage Elements	34	67	132	264
Import/Export Element Starting Address	64000			
Number of Import/Export Elements	1			
Data Transfer Element Starting Address	65000			
Number of Data Transfer Elements	4		8	

Field	6110	6210	6220	6430	6460	68120	68240
Medium Transport Element Address	63000						
Number of Medium Transport Elements	1						
Storage Element Starting Address	0						
Number of Storage Elements	10	11	21	31	61	120	240
Import/Export Element Starting Address	64000						
Number of Import/Export Elements	0	1					
Data Transfer Element Starting Address	65000						
Number of Data Transfer Elements	1	2		4		8	

Field	8111	8211	8222	8433	8466	88132	88264
Medium Transport Element Address	63000						
Number of Medium Transport Elements	1						
Storage Element Starting Address	0						
Number of Storage Elements	11	12	23	34	67	132	264
Import/Export Element Starting Address	64000						
Number of Import/Export Elements	0	1					
Data Transfer Element Starting Address	65000						
Number of Data Transfer Elements	1	2		4		8	

Table 8-3 Element Address Default Values

8.2.2 LCD Mode Page

The LCD page lets you display your own information on the MC's LC display. Normally, display Line 1 shows the model number of the library system. Display Line 2 shows the time and date. Display Line 3 presents status information about the handler. While you can replace the data on these lines with your own information using this page, Qualstar recommends you use Display Line 4 for messages or other data. The format of the LCD page is shown in Table 8-4.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	LCD Page Code (22 _h)					
1	Parameter List Length (52 _h)							
2	0				Write Line 1	Write Line 2	Write Line 3	Write Line 4
3	0							
4-23	Display Line 1							
24-43	Display Line 2							
44-63	Display Line 3							
64-83	Display Line 4							

Table 8-4 LCD Page

8.2.2.1 LCD Page Code

This is the code number of the LCD page and its value must be 22_h.

8.2.2.2 LCD Parameter List Length

This field tells the MC how many more bytes follow and its value must be 52_h.

8.2.2.3 Write Line 1

This field controls the text for Display Line 1 (the top line). If its value is 0, the MC displays its own internal text. If its value is 1, the MC displays the text specified in the Display Line 1 field of this page.

8.2.2.4 Write Line 2, 3, and 4

These fields are identical to Write Line 1, except they determine what is displayed in Display Lines 2, 3, and 4 of the MC.

8.2.2.5 Display Line 1, 2, 3, and 4

These fields let you specify what text will be displayed on the MC's control panel. You can specify up to twenty characters in each field. If you specify less than twenty characters in a field, at least one byte following the last text character in that field must be 0.

By default, line 2 of the display is blank for the TLS-5/6/8000 Series units.

8.2.3 Configuration Mode Page

The Configuration page lets set the value of various configuration items. Each configuration item has a name and a value. The Mode Select command is used to both change the value of an item as well as set the name of the item which will be returned by a subsequent Mode Sense command for the Configuration page. The format of the Configuration page is shown in Table 8-5.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	Configuration Page Code (3D _h)					
1	Parameter List Length (28 _h)							
2	Write	Type			Length			
3	0							
4-23	Variable Name							
24	0							
25-40	Variable Value							
41	0							

Table 8-5 Configuration Page

8.2.3.1 Configuration Page Code

This is the code number of the Configuration page and its value must be 3D_h.

8.2.3.2 Configuration Parameter List Length

This field tells the MC how many more bytes follow and its value must be 28_h.

8.2.3.3 Write

This field indicates whether the Mode Select command is attempting to alter the variable or just set it as the variable to be returned by the next Mode Sense command on this page. A value of 1 indicates that a new value has been supplied and the variable is to be altered. Alteration requires that the Type, Length, and Variable Name fields be set properly and that the item is alterable.

8.2.3.4 Type

This field indicates the type of data that is stored in the Variable Value field. The type must match the Variable's data type. The type code values are listed in Table 8-6.

Type	Type Name	Description
0	ASCII	ASCII character data. If the Length field is 0, this is a zero-terminated string; otherwise, the length field determines the number of characters. A zero-terminated string may be up to 16 characters in length by using the 0 at byte 41 as the terminator. Bytes after the last character (or terminator) are ignored and may be any value.
1	Byte	Byte array data. The Length field indicates the size of the byte array up to 16 bytes.
2	Signed	Signed integer data. The length field indicates the size of the integer in bytes and will have the values: 1, 2, or 4. Signed integers are stored in 2's complement form with the most significant byte first.
3	Unsigned	Unsigned integer data. The length field indicates the size of the integer in bytes and will have the values: 1, 2, or 4. Unsigned integers are stored most significant byte first.

Table 8-6 Configuration Page Type Values

8.2.3.5 Length

This field indicates the size in bytes of the Variable Value. For ASCII zero-terminated strings, the Length field's value is 0.

8.2.3.6 Variable Name

This field holds a zero-terminated ASCII string that selects the variable by name. The variable name may be up to 20 characters in length (in which case the zero terminator will be at byte 24). If the Mode Select is being used to alter a variable's value, this field must exactly match one of the existing variable names. If the Mode Select is being used to select a variable to be returned by a subsequent Mode Sense command, this field may be set to a null string (that is byte 4 may be set to 0). The null string will cause the first variable to be returned by the next Mode Sense command for the Configuration page.

8.2.3.7 Variable Value

This field holds the new value for a variable that is to be altered. Its length and format is determined by the contents of the Length and Type fields. This field is only relevant if the Write field is set to 1.

8.2.3.8 Configuration Variables

Following is a list of configuration variables, their types, and their values as of the version 1.08 release of the firmware. Multiple choice type items have the default value listed first.

Name	Write	Length	Type	Value(s)	Comments
				SONY SDT-7000 SONY SDT-9000 TANDBERG MLR1 TANDBERG MLR3 TANDBERG SLR32 TANDBERG SLR50 TANDBERG SLR100 UNKNOWN	Sony Sony
DRIVE_T1_SCSI_BUS	1	0	ASCII	CHANGER INVALID OTHER	
DRIVE_T1_SCSI_ID	0	0	ASCII	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	
DRIVE_T?_CLEANING	1	0	ASCII	(see DRIVE_T1_CLEANING)	? is 2 through 8
DRIVE_T?_FIRST	1	0	ASCII	(see DRIVE_T1_FIRST)	? is 2 through 8
DRIVE_T?_LAST	1	0	ASCII	(see DRIVE_T1_LAST)	? is 2 through 8
DRIVE_T?_MODE	1	0	ASCII	(see DRIVE_T1_MODE)	? is 2 through 8
DRIVE_T?_MODEL	1	0	ASCII	(see DRIVE_T1_MODEL)	? is 2 through 8
DRIVE_T1_SCSI_BUS	1	0	ASCII	(see DRIVE_T1_SCSI_BUS)	? is 2 through 8
DRIVE_T1_SCSI_ID	0	0	ASCII	(see DRIVE_T1_SCSI_ID)	? is 2 through 8
FP_ALARM_DOOR_OPEN	1	2	Unsigned	0	
FP_ALARM_HANDLER_ERR	1	2	Unsigned	3700	
FP_ALARM_INVENTORY_V	1	2	Unsigned	4700	
FP_ALARM_IO_WAITING	1	2	Unsigned	1800	
FP_ALARM_LOW_POWER	1	2	Unsigned	2400	
FP_ALARM_TEMPERATURE	1	2	Unsigned	3200	
FP_BACKLIGHT	1	0	ASCII	ON 5 MIN OFF	
FP_CONTRAST	1	0	ASCII	LOW MEDIUM HIGH VERY LOW	
HNDLR_BUSY	1	0	ASCII	WAIT BUSY NOT READY	

Name	Write	Length	Type	Value(s)	Comments
HNDLR_DOOR_LOCK_MOTN	1	0	ASCII	NO YES	
HNDLR_DOOR_LOCK_PRVT	1	0	ASCII	NO YES	
HNDLR_DOOR_OPEN	1	0	ASCII	ABORT HOLD	
HNDLR_FILTER_DAYS	1	2	Unsigned	120	
HNDLR_INV_INVALIDATE	1	0	ASCII	SENTRY DOOR NEVER	
HNDLR_INV_LABELS_FIX	1	0	ASCII	SOME ALL NONE	
HNDLR_INV_LABELS_MAG	1	0	ASCII	SOME ALL NONE	
HNDLR_INV_LABELS_SEQ	1	0	ASCII	SOME ALL NONE	
HNDLR_INV_LABEL_SCAN	1	0	ASCII	ALWAYS COMMAND	
HNDLR_INV_POWER_ON	1	0	ASCII	INVALIDATE RETAIN	
HNDLR_INV_SOURCE_DRV	1	0	ASCII	NO YES	
HNDLR_INV_SOURCE_IO	1	0	ASCII	NO YES	
HNDLR_IO_CALL_KEY	1	0	ASCII	1 MIN 2 MIN DISABLE	
HNDLR_IO_EXPORT	1	0	ASCII	YES NO	
HNDLR_IO_EXTENDED	1	0	ASCII	NOT READY RETRACT BUSY	
HNDLR_IO_IMPORT	1	0	ASCII	YES NO	
HNDLR_IO_IMPORT_SCAN	1	0	ASCII	YES NO	
HNDLR_IO_SLOT_ACCESS	1	0	ASCII	BOTH FRONT HOST	
HNDLR_LABELCHECKCHAR	1	0	ASCII	YES NO	
HNDLR_MECH_BCR	0	0	ASCII	NONE WA3600/A-111 WA3700/B-2221	
HNDLR_MECH_CARRIAGE	0	0	ASCII	A B	

Name	Write	Length	Type	Value(s)	Comments
HNDLR_MECH_DOOR_LOCK	0	0	ASCII	NONE A	
HNDLR_MECH_IO_PORT	0	0	ASCII	A NONE	
HNDLR_MECH_MODEL	0	0	ASCII	2218 2218A 2236 2472 24144 412180 412300 412360 412600 4210 4210A 4212 4212i 4220 4222 4222i 4420 4440 4480 46120 4660 5433 5466 58132 58264 6110 6210 6220 6430 6460 68120 68240 8111 8211 8222 8433 8466 88132 88264	
HNDLR_POWER_ON_CLEAR	1	0	ASCII	YES NO	
HNDLR_USE_PRIVATE	1	0	ASCII	YES NO	
IDENTIFIER	0	4	Unsigned		Unique to unit.
LOG_CLEAN	1	0	ASCII	ON OFF	
LOG_IOPORT	1	0	ASCII	ON OFF	

Name	Write	Length	Type	Value(s)	Comments
LOG_RBT_COMMANDS	1	0	ASCII	ON OFF	
LOG_RBT_IOPORT	1	0	ASCII	ON OFF	
LOG_RBT_SEQUENCES	1	0	ASCII	ON OFF	
LOG_RBT_STATES	1	0	ASCII	ON OFF	
LOG_SCSI_COMMANDS	1	0	ASCII	ON OFF	
LOG_SCSI_INTERRUPTS	1	0	ASCII	ON OFF	
LOG_SCSI_PHASES	1	0	ASCII	ON OFF	
LOG_SCSI_STATES	1	0	ASCII	ON OFF	
LOG_SEQUENTIAL	1	0	ASCII	ON OFF	
PART_NUMBER	0	0	ASCII	700105 or 700115	
REVISION	0	0	ASCII		Varies with revision.
SCSI_DISCONNECT	1	0	ASCII	ON OFF	
SCSI_DT_ACCESS	1	0	ASCII	EJECTED ! INSIDE INSTALL	
SCSI_ELEMENTS_DRIVES	1	1	Unsigned	255	
SCSI_ELEMENTS_FIXED	1	1	Unsigned	255	
SCSI_ELEMENTS_IOPORT	1	0	ASCII	YES NO	
SCSI_ELEMENTS_SLOTS	1	2	Unsigned	65535	
SCSI_ENABLE	0	0	ASCII	ON OFF	
SCSI_ERRORS	1	0	ASCII	NATIVE EXABYTE 10i EXABYTE 10e EXABYTE 120	
SCSI_HANDLER_ID	0	0	ASCII	0 1 2 3 4 5 6 7	

Name	Write	Length	Type	Value(s)	Comments
SCSI_HANDLER_LUN	0	0	ASCII	0 1 2 3 4 5 6 7 ANY	
SCSI_INQUIRY	1	0	ASCII	NATIVE EXABYTE 10i EXABYTE 440 EXABYTE 480 CUSTOM EXABYTE 10e EXABYTE 120 EXABYTE 210 EXABYTE 218	
SCSI_INQUIRY_FIELDS	1	8	Byte	08 80 02 02 33 00 00 10	

Name	Write	Length	Type	Value(s)	Comments
SCSI_INQUIRY_PRODUCT	1	16	ASCII	2218 2218A 2236 2472 24144 412180 412300 412360 412600 4210 4210A 4212 4212i 4220 4222 4222i 4420 4440 4480 46120 4660 5433 5466 58132 58264 6110 6210 6220 6430 6460 68120 68240 8111 8211 8222 8433 8466 88132 88264	
SCSI_INQUIRY_REV	1	4	ASCII		
SCSI_INQUIRY_VENDOR	1	8	ASCII	QUALSTAR	
SCSI_INQUIRY_VS_0	1	16	Byte	00...	
SCSI_INQUIRY_VS_16	1	4	Byte	00...	
SCSI_PARITY	1	0	ASCII	ABORT IGNORE MESSAGE	
SCSI_STORAGE_ORDER	1	0	ASCII	MAG FIX	
SCSI_SYNCHRONOUS	1	0	ASCII	OFF ON	
SCSI_VOLUME_TAG_PAD	1	0	ASCII	SPC 00	

Table 8-7 Configuration Variables

8.2.4 External Data Mode Page

The External Data page is used to access a non-volatile, 32 byte memory which can be used to store data in the MC. This data is not used or altered by the MC in any way. Only a Mode Select command for the External Data page can alter this memory's contents. A Mode Sense command can be used to read its contents.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	External Data Page Code (3E _h)					
1	Parameter List Length (20 _h)							
2-33	External Data							

Table 8-8 External Data Page

8.2.4.1 External Data Page Code

This is the code number of the External Data mode page and its value is 3E_h.

8.2.4.2 Parameter List Length

This field specifies how many more bytes follow, and its value is 20_h.

8.2.4.3 External Data

This field contains 32 bytes of data to be saved by the MC in non-volatile RAM.

8.3 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	1A _h	00 _h	1	0004 _h		Parameter List Length Error.
5	26 _h	00 _h	0	???? _h		Invalid Field in Parameter List.
5	26 _h	00 _h	0	???? _h	7	Invalid Field in Parameter List. PS bit set.

9.

Mode Sense

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1Ah							
1	LUN			0	DBD	0		
2	PC		Page Code					
3	0							
4	Allocation Length							
5	Vendor Specific (0)		0			Flag (0)	Link (0)	

9.1 Command Description

The Mode Sense command is the complement to the Mode Select command, and tells the MC to send a Mode Sense Parameter list. The list contains a four-byte header followed by zero or more mode pages.

9.1.1 DBD

The MC does not support block descriptors and the value of the Disable Block Descriptors field is ignored.

9.1.2 PC

The Page Control field tells the MC which type of parameters to return. Table 9-1 lists the Page Control field values.

PC	Name	Description
0	Current Values	The MC will return the requested pages with each supported parameter set to its current value. Current values are: The parameters set in the last successful Mode Select command; The saved values, if a Mode Select command has not been executed since the last power-on, SCSI bus reset, or BUS DEVICE RESET message; The default values, if saved values are not available.
1	Changeable Values	The MC will return the requested pages with each bit of each field set to 1 if that bit in that field is changeable. The Page Code and Parameter List Length fields will contain their actual values.
2	Default Values	The MC will return the requested pages with each supported parameter set to its default value. The MC will return a value of 0 for all unsupported parameters.
3	Saved Values	The MC will return the requested pages with each supported parameter set to its saved value. The MC will return a value of 0 for all unsupported parameters. If no page has been saved, the MC will return default values.

Table 9-1 Page Control Values

9.1.3 Mode Sense Page Code

This field tells the MC which page to return. Table 9-2 lists the mode pages supported by the MC.

Page Code	Page Name
1D _h	Element Address Assignment
1F _h	Device Capabilities
22 _h	LCD
3D _h	Configuration
3E _h	External Data
3F _h	All pages in page code order.

Table 9-2 Supported Mode Pages

9.1.4 Allocation Length

The Allocation Length specifies the number of bytes the initiator has allocated for returned mode sense data. If the MC receives an allocation length of zero, it will not transfer any mode sense data.

The MC will stop when it has transferred the requested amount of data or the number specified by the Allocation Length, whichever is less.

9.2 Mode Sense Parameter List

The format of the Mode Sense Parameter List is shown in Table 9-3.

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

Table 9-3 Mode Sense Parameter List

9.3 Mode Pages

9.3.1 Element Address Assignment Mode Page

The Element Address Assignment page provides information to the initiator about the MC's element address assignment capabilities. Its format is shown in Table 9-4.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (1)	0	Element Address Assignment Page Code (1D _h)					
1	Parameter List Length (12 _h)							
2-3	Medium Transport Element Address							
4-5	Number of Medium Transport Elements (0001 _h)							
6-7	Storage Element Starting Address							
8-9	Number of Storage Elements							
10-11	Import/Export Element Address							
12-13	Number of Import/Export Elements							
14-15	Data Transfer Element Starting Address							
16-17	Number of Data Transfer Elements							
18-19	0							

Table 9-4 Element Address Assignment Page

9.3.1.1 PS

The MC returns a value of 1 in the Parameters Savable field, indicating that it can save this page to non-volatile memory.

9.3.1.2 Element Address Assignment Page Code

This is the code number of the Element Address Assignment page and its value is 1D_h.

9.3.1.3 Parameter List Length

This field tells the initiator how many more bytes follow, and its value is 18 (12_h).

9.3.1.4 Bytes 2 through 17

These bytes are described in Section 8.2.1.

9.3.2 Transport Geometry Descriptor Mode Page

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (0)	0	Transport Geometry Page Code (1E _h)					
1	Parameter List Length (02 _h)							
2	0							Rotate (0)
3	Member Number in Transport Element Set (0)							

Table 9-5 Transport Geometry Page

9.3.2.1 PS

The MC returns a value of 0 in the Parameters Savable field because it does not save this page to non-volatile memory.

9.3.2.2 Transport Geometry Page Code

This is the code number of the Transport Geometry page and its value is 1E_h.

9.3.2.3 Transport Geometry Parameter Length

This field tells the initiator how many more bytes follow, and its value is 02_h.

9.3.2.4 Member Number in Transport Element Set

The MC has only one transport element and the value of this field will always be 0.

9.3.3 Device Capabilities Mode Page

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (0)	0	Device Capabilities Page Code (1F _h)					
1	Parameter List Length (12 _h)							
2	0				StorDT (1)	StorI/E (1)	StorST (1)	StorMT (1)
3	0							
4	0				MT→DT (1)	MT→I/E (1)	MT→ST (1)	MT→MT (0)
5	0				ST→DT (1)	ST→I/E (1)	ST→ST (1)	ST→MT (1)
6	0				I/E→DT (1)	I/E→I/E (0)	I/E→ST (1)	I/E→MT (1)
7	0				DT→DT (1)	DT→I/E (1)	DT→ST (1)	DT→MT (1)
8-11	0							
12	0				MT↔DT (1)	MT↔I/E (1)	MT↔ST (1)	MT↔MT (0)
13	0				ST↔DT (1)	ST↔I/E (1)	ST↔ST (1)	ST↔MT (1)
14	0				I/E↔DT (1)	I/E↔I/E (0)	I/E↔ST (1)	I/E↔MT (1)
15	0				DT↔DT (1)	DT↔I/E (1)	DT↔ST (1)	DT↔MT (1)

Legend: DT = Data Transfer Element,
I/E = Import/Export Element,
MT = Medium Transport Element,
ST = Storage Element

Table 9-6 Device Capabilities Page

9.3.3.1 PS

The value of the Parameters Savable field is 0, indicating that the MC cannot save this page to non-volatile memory.

9.3.3.2 Device Capabilities Page Code

This is the code number of the Device Capabilities page and its value is 1F_h.

9.3.3.3 Device Capabilities Parameter Length

This field tells the initiator how many more bytes follow, and its value is 12_h.

9.3.3.4 Byte 2 - Medium Storage Capability

Byte 2 indicates which elements of the MC are media storage elements. A value of 1 indicates that an element is a media storage element. See Table 9-6.

9.3.3.5 Bytes 4 through 7 - Medium Movement Capabilities

Bytes 4 through 7 indicate when the MC will support the Move Medium command. Referring to Table 9-6, a value of 1 indicates the MC supports the Move Medium command when the source is the first specified element and the destination is the second.

For example: The value of byte 4, bit 3 will be 1, because the MC can move a cartridge from the handler (MT = Medium Transport element) to a drive (DT - Data Transfer element). The value of byte 6 bit 2, however, will be 0, because having only one I/O port (I/E = Import/Export element), the MC cannot move a cartridge from one I/O port to another.

9.3.3.6 Bytes 12 through 15 - Medium Exchange Capabilities

Bytes 4 through 7 indicate when the MC will support the Exchange Medium command. Referring to Table 9-6, a value of 1 indicates the MC supports the Exchange Medium command between the two specified elements.

9.3.4 LCD Mode Page

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (1)	0	LCD Page Code (22 _h)					
1	Parameter List Length (52 _h)							
2	0				Write Line 1	Write Line 2	Write Line 3	Write Line 4
3	0							
4-23	Display Line 1							
24-43	Display Line 2							
44-63	Display Line 3							
64-83	Display Line 4							

Table 9-7 LCD Page

9.3.4.1 PS

The value of the Parameters Savable field is 1, indicating that the MC can save this page to non-volatile RAM.

9.3.4.2 LCD Page Code

This is the code number of the LCD Mode page and its value is 22_h.

9.3.4.3 LCD Mode Parameter List Length

This field tells the initiator how many more bytes follow, and its value is 52_h.

9.3.4.4 Write Line 1, 2, 3, and 4

These fields tell the initiator whether the data on the MC's LC display are internally generated or are the result of a previous Mode Select command. They refer to display lines 1 through 4 on the MC control panel. A value of 0 indicates the data on the LCD

is internally generated by the MC, and a value of 1 indicates the data came from a previous Mode Select command.

9.3.4.5 Display Line 1, 2, 3, and 4

These fields reflect the current contents of the LC display on the MC control panel.

9.3.5 Configuration Mode Page

The Configuration page is used to return the values of various non-volatile configuration items. These items are set using either the front panel or the Mode Select command (using the Configuration page). Reading the configuration variables involves using a Mode Select (with the Configuration page) to select a variable by name and then a Mode Sense (for the Configuration page) to return the value. If multiple Mode Sense commands are issued for the Configuration page, each Mode Sense will return the next variable after the previous command's returned variable. Thus the entire variable space may be read in Variable Name order by issuing one Mode Select followed by n Mode Sense commands (where n is the number of variables).

NOTE

The number of variables may change over time as the MC firmware is revised. It is possible that variables may be removed or added in subsequent revisions of the firmware. In addition, the values for a variable may also change (e.g. the values allowed for tape drive models will increase as the MC supports more models). See Table 8-7 for a list of variables and values.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (1)	0	Configuration Page Code (3D _h)					
1	Parameter List Length (28 _h)							
2	Write	Type	Length					
3	0							
4-23	Variable Name							
24	0							
25-40	Variable Value							
41	0							

Table 9-8 Configuration Page

9.3.5.1 PS

The value of the Parameters Savable field is 1, indicating that the MC can save this page to non-volatile RAM.

9.3.5.2 Configuration Page Code

This is the code number of the Configuration Mode page and its value is 3D_h.

9.3.5.3 Parameter List Length

This field tells the initiator how many more bytes follow, and its value is 28_h.

9.3.5.4 Write

This field indicates whether the returned configuration variable can be altered. A 0 indicates the variable is read-only and cannot be altered, whereas a 1 indicates the variable's value can be changed.

9.3.5.5 Type

This field indicates the format of the variable's value as returned in the Variable Value field. The type code values are listed in Table 9-9.

Type	Type Name	Description
0	ASCII	ASCII character data. If the Length field is 0, this is a zero-terminated string, otherwise, the length field determines the number of characters. A zero-terminated string may be up to 16 characters in length by using the 0 at byte 41 as the terminator. Bytes after the last character (or terminator) are ignored and may be any value.
1	Byte	Byte array data. The Length field indicates the size of the byte array up to 16 bytes.
2	Signed	Signed integer data. The length field indicates the size of the integer in bytes and will have the values: 1, 2, or 4. Signed integers are stored in 2's complement form with the most significant byte first.
3	Unsigned	Unsigned integer data. The length field indicates the size of the integer in bytes and will have the values: 1, 2, or 4. Unsigned integers are stored most significant byte first.

Table 9-9 Configuration Page Type Values

9.3.5.6 Length

This field indicates the size in bytes of the Variable Value. For ASCII zero-terminated strings, the Length field's value is 0.

9.3.5.7 Variable Name

This field holds a zero-terminated ASCII string that specifies the variable by name. The variable name may be up to 20 characters in length (in which case the zero terminator will be at byte 24).

9.3.5.8 Variable Value

This field holds the value for the variable. Its length and format is determined by the contents of the Length and Type fields.

9.3.6 External Data Mode Page

The External Data page is used to access a non-volatile, 32 byte memory which can be used to store data in the MC. This data is not used or altered by the MC in any way. Only a Mode Select command for the External Data page can alter this memory's contents. A Mode Sense command can be used to read its contents.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (1)	0	External Data Page Code (3E _h)					
1	Parameter List Length (20 _h)							
2-33	External Data							

Table 9-10 External Data Page

9.3.6.1 PS

The value of the Parameters Savable field is 1, indicating that the MC can save this page to non-volatile RAM.

9.3.6.2 External Data Page Code

This is the code number of the External Data mode page and its value is 3E_h.

9.3.6.3 Parameter List Length

This field tells the initiator how many more bytes follow, and its value is 20_h.

9.3.6.4 External Data

This field contains 32 bytes of data.

9.4 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	00 _h	1	0002 _h		Invalid Field In CDB. Unsupported page code.

10.

Move Medium

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	A5 _n							
1	LUN			0				
2-3	Transport Element Address							
4-5	Source Element Address							
6-7	Destination Element Address							
8-9	0							
10	0							Invert (0)
11	I/O Port Code	0				Flag (0)	Link (0)	

10.1 Command Description

The Move Medium command asks the MC to move a data cartridge from the location specified in Source Element Address to the location specified in Destination Element Address. The MC returns a GOOD status after the cartridge has successfully been placed in its destination.

The addresses specified by the source and destination fields can be those of a storage slot, the I/O port, a drive, or of the handler itself. The MC checks the validity of the addresses and status of the element locations before the handler moves. If the source is empty or the destination is occupied, the MC will return a CHECK CONDITION status and will not move the handler. However, it is permissible for the Source and Destination Element Addresses to be equal. In the case of a Data Transfer Element (Tape Drive), this will cause an ejected tape to be re-inserted into the drive, for other element types, no operation will result. In all cases, the element must be occupied or a CHECK CONDITION will result.

The MC updates the cartridge inventory dynamically during the command to reflect the actual location of the cartridge being moved.

NOTE

Movement of cartridges to and/or from the I/O Port is affected by the settings of the Configuration\Advanced\Changer\I/O Port\Export and Configuration\Advanced\Changer\I/O Port\Import menu items. Attempted export and/or import of cartridges when these items are set to NO, will result in a CHECK CONDITION.

10.1.1 Transport Element Address

This is the address of the handler or 0. If the value is 0, the MC internally supplies the address of the handler, otherwise the MC compares the value of this field with the value set by the last Mode Select command (or with the default if no Mode Select

command was received). If the values do not compare, the MC returns the appropriate error message.

10.1.2 Source Element Address

This field tells the MC where the cartridge is to be taken from.

10.1.3 Destination Element Address

This field tells the MC where to place the cartridge.

10.1.4 Invert

The value of this field must be 0 because the MC handler cannot invert (turn or rotate) a data cartridge.

10.1.5 I/O Port Code

Moving a cartridge from a source location to the I/O port does not make that cartridge available to the user unless he presses the Call switch. This field provides a means of extending or retracting the I/O port via the interface to allow the user to access the cartridge in the I/O port.

Bit 7	Bit 6	Definition
0	0	Normal move (no I/O Port effect)
0	1	Extend I/O Port (addresses ignored)
1	0	Retract I/O Port (addresses ignored)
1	1	ILLEGAL REQUEST

Table 10-1 I/O Port Code Values

If the value of the I/O Port Code field is other than zero, the MC ignores the values in the Transport, Source, and Destination Element Address fields. Therefore, to make a cartridge available to the user without the use of the Call switch, two Move Medium commands must be issued; one to move the cartridge from the source to the I/O port, and another to extend the I/O port.

The I/O port will automatically retract when the user inserts a cartridge into it. Otherwise, it will remain extended until the MC receives a command to retract it, or until some other condition occurs which requires the I/O port be retracted.

To insert a cartridge into the library system when the I/O port is retracted and without using the Call switch, issue a Move Medium command with the I/O Port Code set to Extend I/O Port. After a cartridge has been inserted, the I/O port will automatically retract. A second Move Medium command can then be issued to move the cartridge from the I/O port to its intended destination.

NOTE

Control of the I/O Port is affected by the setting of the Configuration\Advanced\Changer\I/O Port\Slot Access menu item. If it is set to FRONT, attempts to extend or retract the I/O Port using the Move Medium command will result in a CHECK CONDITION.

10.2 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
2	04 _h	00 _h				Logical Unit Not Ready, Cause Not Reportable. No free slot available or operation aborted by operator.
5	3B _h	0D _h	1	0006 _h		Medium Destination Element Full. Second Destination Element full.
5	3B _h	0E _h	1	0004 _h		Medium Source Element Empty.
5	53 _h	02 _h				Medium Removal Prevented. Entry/Exit Port cannot be extended because medium removal is prevented.
5	80 _h	07 _h	1	0004 _h		I/O Port access or Import prohibited by configuration, Attempted use as Source Element.
5	80 _h	07 _h	1	0006 _h		I/O Port access or Import/Export prohibited by configuration, Attempted use as Destination Element.
5	80 _h	07 _h	1	000B _h	7	I/O Port access prohibited by configuration, Attempted extension or retraction.

Table 10-2 Move Medium Command Specific Errors: All Emulations

Native						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	21 _h	01 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	21 _h	01 _h	1	0006 _h		Invalid Element Address. Invalid First Destination Element address.
5	21 _h	01 _h	1	0008 _h		Invalid Element Address. Invalid Second Destination Element address.
5	3B _h	90 _h	1	0004 _h		Tape is not ejected from Source drive.
5	80 _h	01 _h	1	0002 _h		Handler Full.
5	80 _h	03 _h				Source Magazine not installed.
5	80 _h	04 _h				Destination Magazine not installed.
5	80 _h	05 _h				Source Drive not installed.
5	80 _h	06 _h				Destination Drive not installed.

Table 10-3 Move Medium Command Specific Errors: Native

Exabyte 10i Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	24 _h	80 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	24 _h	80 _h	1	0006 _h		Invalid Element Address. Invalid Destination Element address.
5	3B _h	83 _h	1	0004 _h		Tape is not ejected from Source drive.
5	80 _h	01 _h	1	0002 _h		Handler Full.
2	04 _h	86 _h				Source Magazine not installed.
2	04 _h	86 _h				Destination Magazine not installed.
5	3B _h	83 _h				Source Drive not installed.
5	3B _h	84 _h				Destination Drive not installed.

Table 10-4 Move Medium Command Specific Errors: Exabyte 10i Emulation

Exabyte 10e Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	24 _h	80 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	24 _h	80 _h	1	0006 _h		Invalid Element Address. Invalid First Destination Element address.
5	24 _h	80 _h	1	0008 _h		Invalid Element Address. Invalid Second Destination Element address.
5	3B _h	83 _h	1	0004 _h		Tape is not ejected from Source drive.
5	80 _h	01 _h	1	0002 _h		Handler Full.
2	04 _h	86 _h				Source Magazine not installed.
2	04 _h	86 _h				Destination Magazine not installed.
5	3B _h	83 _h				Source Drive not installed.
5	3B _h	84 _h				Destination Drive not installed.

Table 10-5 Move Medium Command Specific Errors: Exabyte 10e Emulation

Exabyte 120 Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	21 _h	01 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.
5	21 _h	01 _h	1	0006 _h		Invalid Element Address. Invalid First Destination Element address.
5	21 _h	01 _h	1	0008 _h		Invalid Element Address. Invalid Second Destination Element address.
5	3B _h	83 _h	1	0004 _h		Tape is not ejected from Source drive.
5	3B _h	80 _h	1	0002 _h		Handler Full.
5	80 _h	03 _h				Source Magazine not installed.
5	80 _h	04 _h				Destination Magazine not installed.
5	80 _h	05 _h				Source Drive not installed.
5	80 _h	06 _h				Destination Drive not installed.

Table 10-6 Move Medium Command Specific Errors: Exabyte 120 Emulation

11. Position to Element

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	2B _n							
1	LUN			0				
2-3	Transport Element Address							
4-5	Destination Element Address							
6-7	0							
8	0							Invert (0)
9	Vendor Specific (0)		0			Flag (0)		Link (0)

11.1 Command Description

The Position to Element command tells the MC to move the handler to the specified destination. The addresses specified by the source and destination fields can be those of a storage slot, the I/O port, a drive, or of the handler itself. The MC checks the validity of the addresses and status of the element locations before the handler moves.

Upon successful completion of this command, the handler will be positioned to insert or remove a cartridge at that location and the MC will return a GOOD status.

11.1.1 Transport Element Address

This is the address of the handler or 0. If the value is 0, the MC internally supplies the address of the handler, otherwise the MC compares the value of this field with the value set by the last Mode Select command (or with the default if no Mode Select command was received). If the values do not compare, the MC returns the appropriate error message.

11.1.2 Destination Address

The Destination address is the location to which you want to position the handler.

11.1.3 Invert

The value of this field must be 0 because the MC handler cannot invert (turn or rotate) the medium transport.

11.2 Command Specific Errors

Native						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	21 _h	01 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.

Table 11-1 Position to Element Command Specific Errors: Native

Exabyte 10i Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	24 _h	80 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.

Table 11-2 Position to Element Command Specific Errors: Exabyte 10i Emulation

Exabyte 10e Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	24 _h	80 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.

Table 11-3 Position to Element Command Specific Errors: Exabyte 10e Emulation

Exabyte 120 Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Transport Element address.
5	21 _h	01 _h	1	0004 _h		Invalid Element Address. Invalid Source Element address.

Table 11-4 Position to Element Command Specific Errors: Exabyte 120 Emulation

12. Prevent/Allow Medium Removal

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1E _h							
1	LUN			0				
2-3	0							
4	0							Prevent
5	Vendor Specific (0)		0				Flag (0)	Link (0)

12.1 Command Description

The Prevent/Allow Medium Removal command controls the ability of the front panel Call switch to extend the I/O Port. Initiators can use this command to prevent the Call switch from extending the I/O Port thereby providing a level of security over the cartridge inventory.

Also, on units with the optional Door Lock kit installed, this command can be used to prevent the front door from being opened.

12.1.1 Prevent

A value of 1 in the Prevent field (i.e., a Prevent command) prevents the MC from extending the I/O port; a value of 0 (i.e., an Allow command) allows the MC to extend the I/O port. If the I/O port is already extended when the MC receives a Prevent command, the MC will retract the I/O port.

On units with the optional Door Lock kit installed and the `Configuration\Advanced\Changer\Door Lock\Prevent` menu item set to YES, a value of 1 will cause the lock mechanism to be used to prevent the front door from being opened.

The MC keeps track of Prevent and Allow commands from multiple initiators and will not allow the I/O port to be extended until it receives an Allow command from every initiator that sent a Prevent command.

If an initiator sends a Prevent command and the MC is reserved by another initiator, the MC will return a RESERVATION CONFLICT error to the initiator sending the Prevent command. However, the MC will always accept an Allow command without regard to reservation status.

Whether or not a prevent state can be overridden by the Call switch depends upon the setting of the `Configuration\Advanced\Changer\I/O Port\Slot Access` menu item. If the item is set to FRONT, the Call switch will operate regardless of the prevent state.

Following a Bus Reset, BUS DEVICE RESET message or a power-up, all initiators are set to Allow.

13.

Read Buffer

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	3C _h							
1	LUN			0		Mode		
2	Buffer ID							
3-5	Buffer Offset							
6-8	Allocation Length							
9	Vendor Specific (0)		0			Flag (0)		Link (0)

13.1 Command Description

The Read Buffer command is used to read the unit's internal firmware from its Flash Prom. The firmware data consists of up to 512 packets of 1030 bytes each. These packets contain the firmware data along with error checking and addressing information.

The process of reading an entire firmware image is to issue Read Buffer commands to read every packet in order. This can be done with an number of Read Buffer commands from 1 to 512 as a single Read Buffer command can return any part or all of the packet data. These packets can then be used in conjunction with the Write Buffer command to re-program any other TLS unit.

NOTE

The packet data is encrypted which results in random looking data. In addition, the same packet read from the same machine will yield different data on each read.

13.1.1 Mode

This field is used to specify the command operation mode. The MC accepts the modes described in Table 13-1.

Mode	Name	Description
1	Vendor Specific	This mode is used to read Flash Prom Firmware packets.
3	Descriptor	This mode is used to return Buffer Descriptors.

Table 13-1 Read Buffer Mode Values

13.1.2 Buffer ID

The MC accepts only Buffer ID 0 as a valid buffer. In the Descriptor Mode, the MC will return a buffer length of 000000_h for all Buffer IDs except 0, for 0 it returns 040000_h. Buffer 0 is the Flash Prom Firmware buffer and can only be read using the Vendor Specific mode.

13.1.3 Buffer Offset

In the Descriptor Mode, this field is reserved and must be 0. In the Vendor Specific mode, this field must have a value of 0 to 0000FF_h and represents a packet number.

13.1.4 Allocation Length

In the Descriptor Mode, this field should contain 000004_h or more. In the Vendor Specific mode, this field must contain a multiple of 1030. The formula $((512 - \text{Buffer Offset}) * 1030 - \text{Allocation Length})$ must be greater than or equal to 0.

14. Read Element Status

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	B8 _n							
1	LUN			VolTag	Element Type Code			
2-3	Starting Element Address							
4-5	Number of Elements							
6	0							
7-9	Allocation Length							
10	0							
11	Vendor Specific (0)			0			Flag (0)	Link (0)

14.1 Command Description

The Read Element Status command tells the MC to report information about elements. This information returned is called Element Status Data and is explained in Section 14.2.

The MC builds a data set (Element Status Data) based upon the Starting Element Address and the Number of Elements data fields. Once built, its contents are not altered until the command completes. How much of the data set the MC returns is determined by the command's Allocation Length field as explained in Section 14.1.5.

14.1.1 VolTag

The MC may return volume tag information (usually derived from cartridge labels) if the value of the Volume Tag field is 1, and will not return volume tag information if the value is 0. The Volume Tag information is explained in Section 14.4.

14.1.2 Element Type Code

The value of this field tells the MC which type of element to report. Table 14-1 lists the values of this field.

Element Type Code	Type	Description
0	All element types	All element types are reported in element address order starting with the Starting Element Address.
1	Medium Transport Element	The handler element is reported.
2	Storage Element	Cartridge storage elements are reported (both magazine and fixed locations).
3	Import/Export Element	The I/O Port element is reported.
4	Data Transfer Element	Tape drive elements are reported.

Table 14-1 Element Type Code Values

14.1.3 Starting Element Address

This field specifies the lowest address to be reported in the overall Element Status Data. Only elements of the specified element type code whose element address equals or are greater than the Starting Element Address will be reported. The MC will not create an element descriptor for an undefined element address.

14.1.4 Number of Elements

The Number of Elements field tells the MC the number of element descriptors to return (beginning with the element specified in the Starting Element Address field).

14.1.5 Allocation Length

The Allocation Length field specifies how many bytes the initiator has reserved for element status data, and is processed differently than in the Mode Sense and Log Sense commands:

- If the allocation length is equal to or greater than the length of the data set, The MC ends the DATA OUT phase when the entire data set is returned.
- If the allocation length is such that it would cause a partial element descriptor to be returned, the MC ends the DATA OUT phase after it transmits the previous element descriptor. This means that even though the number of returned bytes would be less than the number of bytes specified by the allocation length, one or more element descriptors will not be returned. It is important to note that the MC will not alter the contents of the pre-built data set to reflect this truncation.
- If the allocation length is such that it would cause a partial header to be returned (either the Element Status Data header or an Element Status Page header), the MC ends the DATA OUT phase after it transmits the number of bytes specified by the allocation length. This means that even though all the expected number of bytes was transmitted, the last header will be incomplete and one or more element descriptors will not be returned. As before, the MC will not alter the contents of the pre-built data set to reflect this truncation.

The last two conditions are not considered errors by the SCSI specification.

14.2 Element Status Data

Figure 14-1 illustrates the hierarchical format of the Element Status data. Element Status data begins with an eight-byte header and contains zero or more element status pages. Each element type has its own Element Status page, and each page in turn begins with an eight-byte header and contains one or more element descriptors. Pages are only present if they contain descriptors. Pages and descriptors are returned in element address order. Since the element addresses are alterable (using the front panel or the Mode Select command), pages may not be returned in the same order from command to command.

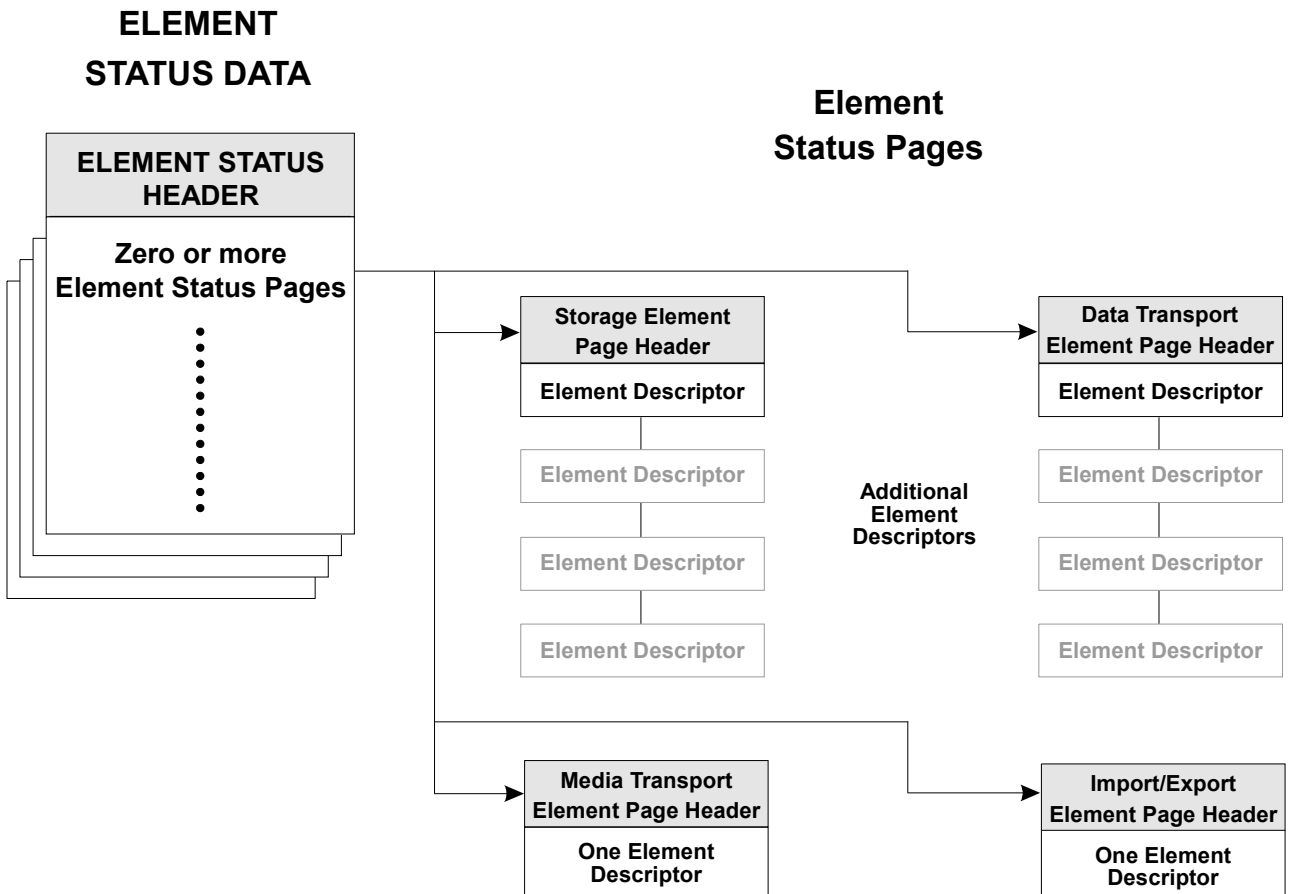


Figure 14-1 Element Status Data Hierarchy

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	First Element Address Reported							
2-3	Number of Elements Available							
4	0							
5-7	Byte Count of Report Available (n-7)							
8-n	Element Status Page(s)							

Table 14-2 Element Status Data

14.2.1 First Element Address Reported

This field contains the element address of the element having the lowest element address that meets the command specifiers.

14.2.2 Number of Elements Available

This field contains the number of element descriptors found which meet the command specifiers. If the specified Allocation Length was sufficient the MC will return status for this number of elements.

14.2.3 Byte Count of Report Available

The value in this field is the number of bytes of Element Status data the MC could return if the command's Allocation Length value permitted it to do so.

14.2.4 Element Status Page

Each Element Status page begins with an eight-byte header and contains one or more element descriptors. The format of an Element Status page is shown in Table 14-3.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Element Type Code							
1	PVolTag	AVolTag (0)	0					
2-3	Element Descriptor Length (10 _h or 34 _h)							
4	0							
5-7	Byte Count of Descriptor Data Available (n-7)							
8-n	Element Descriptor(s)							

Table 14-3 Element Status Page

14.2.4.1 Element Type Code

Table 14-1 lists the values of this field (the 0 value will not occur).

14.2.4.2 PVolTag

The MC returns a value of 0 if the following element descriptors do not contain Primary Volume Tag information (label information), and a value of 1 if they do. Volume Tag information is explained in Section 14.4.

For units without barcode readers, the Primary Volume Tag field will always be 0.

14.2.4.3 AVolTag

The MC does not support the use of alternate volume tags and returns a value of 0 in the Alternate Volume Tag field.

14.2.4.4 Element Descriptor Length

This field indicates how many bytes are in a single element descriptor, and its value will be 16 or 52 (10h or 34h).

14.2.4.5 Byte Count of Descriptor Data Available

This value in this field is the number of bytes of Element Descriptor data the MC could return if the command's Allocation Length value permitted it to do so. The value equals the Element Descriptor Length times the number of element descriptors.

14.3 Element Descriptors

Element descriptors are very similar to one another. Fields common to all element descriptors are explained in this section, and differences or unique fields are explained in subsequent sections for each element descriptor.

14.3.1 Element Address

The first two bytes contain the element address of the element for which the descriptor was generated.

14.3.2 Except

The third byte contains an Except field whose value will be 0 if the element is in its normal state, and will be 1 if an exception condition exists. An exception indicates the MC is uncertain of an element's status. This could happen if, for example, the integrity of the inventory has been compromised (somebody opened the door and stuck their hand in the cartridge area).

In this case, the MC will set the Exception field to 1, return an ASC and ASCQ indicating that the validity of the information is questionable (see Section 14.3.4), and will return the last information it was sure of (Full field, and Primary Volume Tag field).

14.3.3 Full

The value of the Full field will be 1 if the element contains a cartridge, and 0 if the handler does not contain a cartridge.

14.3.4 ASC and ASCQ Fields

The Additional Sense Code and Additional Sense Code Qualifier fields together identify a specific exception condition when the Exception field is 1. The values for

these fields are described in Table 14-4, Table 14-5, Table 14-6, Table 14-7 and Table 14-8.

All Emulations		
ASC	ASCQ	Description
83 _h	00 _h	Label information is questionable. The volume tag may contain data but this data may not be correct. Note that this exception does not occur on a unit without a barcode reader or in Exabyte 10e or 10i error emulation.
83 _h	01 _h	Label error. A label was scanned but was in error. Note that this exception does not occur in a unit without a barcode reader or in Exabyte 10e or 10i error emulation.
83 _h	04 _h	Drive not present. There is space for the drive in the unit but no drive is configured in that space. This condition is due to: Configuration\Drive\T?\Mdl being set to NONE, Configuration\Drive\T?\Enabled being set to FALSE, or Configuration\Drive\T?\Mode being set to SEQUENTIAL.

Table 14-4 Element Descriptor Additional Sense Codes: All Emulations

Native		
ASC	ASCQ	Description
83 _h	02 _h	Magazine not present.
83 _h	03 _h	Full and label information questionable. The last known data is returned but may not be correct.
83 _h	07 _h	Full information questionable. The last known data is returned but may not be correct. This exception is returned instead of Full and Label information questionable on units without a barcode reader.
83 _h	09 _h	No label information. The cartridge in this element has no label (or has a label sufficiently damaged that the scanner could not detect its presence). Note that this exception does not occur on a unit without a barcode reader.

Table 14-5 Element Descriptor Additional Sense Codes: Native

Exabyte 10e Emulation		
ASC	ASCQ	Description
90 _h	02 _h	Magazine not present.
90 _h	03 _h	Full information questionable. The last known data is returned but may not be correct.

Table 14-6 Element Descriptor Additional Sense Codes: Exabyte 10e Emulation

Exabyte 10i Emulation		
ASC	ASCQ	Description
90 _h	02 _h	Magazine not present.
90 _h	03 _h	Full information questionable. The last known data is returned but may not be correct.

Table 14-7 Element Descriptor Additional Sense Codes: Exabyte 10I Emulation

Exabyte 120 Emulation		
ASC	ASCQ	Description
83 _h	01 _h	No label information. The cartridge in this element has no label (or has a label sufficiently damaged that the scanner could not detect its presence).
83 _h	03 _h	Full and label information questionable. The last known data is returned but may not be correct. This code is returned whether or not the unit has a barcode reader.

Table 14-8 Element Descriptor Additional Sense Codes: Native

14.3.5 SValid

If the value of the Source Valid field is 1, the values of the Invert and Source Storage Element Address fields are valid. A value of 0 indicates the values in the Invert and Source Storage Element Address fields are not valid.

14.3.6 Invert

The value of this field will always be 0 because the MC cannot invert cartridges.

14.3.7 Source Element Address

If the value of the Source Valid field is 1, the Source Element Address field contains the address of the last storage element from which the cartridge came. The value of this field is not valid if the value of the Source Valid field is 0.

NOTE

By default, the MC only considers elements of type STORAGE to be storage elements (this means magazine and fixed slots). However, this can be changed using the Configuration\Advanced\Changer\Inventory\Source Drive and/or Configuration\Advanced\Changer\Inventory\Source I/O Port menu items.

14.3.8 Primary Volume Tag Information

If the PVolTag field in the element status page header is 1, this field contains 36 bytes of information which identify the cartridge residing in this element. This field is omitted if the PVolTag is 0. In this case, the element descriptor will contain 16 bytes instead of 52. Volume Tag information is explained in Section 14.4.

The following sections provide information pertinent to specific element descriptors.

14.3.9 Medium Transport Element Descriptor

The MC contains one handler (medium transport element). The format of the Medium Transport Element Descriptor is shown in Table 14-9.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
	0					Except	0	Full
3	0							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	0							
9	Svalid	Invert (0)	0					
10-11	Source Element Address							
12-47	Primary Volume Tag							
48-51	0							

Table 14-9 Medium Transport Element Descriptor

14.3.10 Storage Element Descriptor

The number of storage locations varies according to the model number and the number of installed magazines. Fixed slots are considered storage locations. The format of the Storage Element Descriptor is shown in Table 14-10.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	0				Access	Except	0	Full
3	0							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	0							
9	Svalid	Invert (0)	0					
10-11	Source Element Address							
12-47	Primary Volume Tag							
48-51	0							

Table 14-10 Storage Element Descriptor

14.3.10.1 Access

The value of the Access field will be 1 if access is permitted. The value will be 0 (access denied) if the element is reserved as a result of being used Sequential mode for any tape drive (Configuration\Drive\T?\Mode is set to SEQUENTIAL and the

element is in the sequential range), or if the magazine containing that element is not installed.

14.3.11 Import/Export Element Descriptor

The Import/Export element is the I/O port. The I/O port is used to move cartridges into and out of the MC. The format of the Import/Export Element Descriptor is shown in Table 14-11.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	0		InEnab	ExEnab	Access	Except	ImpExp	Full
3	0							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	0							
9	Svalid	Invert (0)	0					
10-11	Source Element Address							
12-47	Primary Volume Tag							
48-51	0							

Table 14-11 Import/Export Element Descriptor

14.3.11.1 Access

A value of 0 in the Access field indicates that the I/O port is not retracted; a value of 1 means the I/O port is retracted.

NOTE

This field's value will be forced to 0 if the Configuration\Advanced\Changer\I/O Port\Slot Access menu item is set to FRONT.

14.3.11.2 ExEnab

A value of 0 in the Export Enable field indicates that media movement from the handler to the I/O port is denied; a value of 1 indicates that the movement is permitted.

NOTE

This field's value reflects the setting of the Configuration\Advanced\Changer\I/O Port\Export menu item.

14.3.11.3 ImpExp

The value of the Import/Export field will be 1 if the cartridge currently in the I/O port was placed there by the operator and 0 if it was placed there by the handler.

14.3.11.4 InEnab

A value of 0 in the Import Enable field indicates that media movement from the I/O port to the handler is denied; a value of 1 indicates that the movement is permitted.

NOTE

This field's value reflects the setting of the Configuration\Advanced\Changer\I/O Port\Import menu item.

14.3.12 Data Transfer Element Descriptor

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	0			Access	Except	0	Full	
3	0							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Not Bus	0	ID Valid	LU Valid	0	LUN (0)		
7	SCSI Bus Address							
8	0							
9	Svalid	Invert (0)	0					
10-11	Source Element Address							
12-47	Primary Volume Tag							
48-51	0							

Table 14-12 Data Transfer Element Descriptor

14.3.12.1 Access

This value of 1 in the Access field indicates that a cartridge may be moved to or from the drive (but not both) the drive. On non-DLT units, a tape is not movable from the drive unless it is ejected. Access will be set during an Initialize Element Status command, and during a Position to Element command with the Data Transfer Element as the destination.

NOTE

The setting of the Configuration\Advanced\SCSI\DT Access menu item affects this value. If the Configuration\Advanced\SCSI\DT Access menu item is set to ! INSIDE, the value will be 1 if a tape is ejected or if the drive is empty. If the Configuration\Advanced\SCSI\DT Access menu item is set to INSTALL, the value will be 1 if a tape drive is installed (and enabled) at the element and 0 otherwise.

14.3.12.2 ID Valid

The value of this field is dependent on the value of the Configuration\Drive\T?\SCSI Bus menu item for this drive. If the value is

set to CHANGER or OTHER, this field will be returned with a value of 1, indicating that the value of the SCSI Bus Address field in Byte 7 is valid. If the value is set to INVALID, the field will be returned 0.

14.3.12.3 LUN

The value of this field will always be 0.

14.3.12.4 LU Valid

The value of this field is dependent on the value of the Configuration\Drive\T?\SCSI Bus menu item for this drive. If the value is set to CHANGER or OTHER, this field will be returned with a value of 1, indicating that the value of the LUN field in this byte is valid. If the value is set to INVALID, the field will be returned 0.

14.3.12.5 Not Bus

The value of this field is dependent on the value of Configuration\Drive\T?\SCSI Bus menu item for this drive. If the value is set to OTHER, this field will be returned with a value of 1, indicating that the value of the SCSI Bus Address field in Byte 7 is valid but refers to a different SCSI bus than the bus the MC is on. If the value is set to CHANGER or INVALID, the field will be returned 0.

14.3.12.6 SCSI Bus Address

This field contains the SCSI ID of the tape drive at this element address. A value will be returned whether or not a tape drive is actually present and/or configured. This value is the value of the Configuration\Drive\T?\SCSI Id menu item for this drive.

14.4 Volume Tag Information

A Volume Tag contains information about the cartridge to which it is attached. The information may exist in the form of a barcode label on the cartridge or it may have been sent to the MC in a previous Send Volume Tag command. There is no requirement that the volume tag information be the same as the volume identification information recorded on the tape.

The format of Volume Tag information is shown in Table 14-13.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-31	Volume Identifier							
32-33	0							
34-35	Volume Sequence Number (0)							

Table 14-13 Volume Tag

14.4.1 Alternate Volume Tag Information

Alternate Volume Tag information pertains to the other side of double-sided media. The other side of the media is the side that would be accessed via a Move Medium command with the Invert field set to 1. Because the MC does not invert cartridges, Alternate Volume Tag information is not supported.

14.4.2 Volume Identifier

The Volume Identifier consists of 32 bytes of left-justified ASCII characters. Unused positions are filled with space (20_h). In order for the Send Volume Tag (translate) to work, there must be no asterisks, question marks or embedded blanks within the significant part of the Volume Identifier field. If Volume Tag information for a particular element is not defined, the Volume Identifier field will be 0.

NOTE

If the Configuration\Advanced\SCSI\Volume Tag Pad menu item is set to 00, Volume Identifiers will be padded with 00_h instead of 20_h.

14.4.3 Volume Sequence Number

The Volume Sequence Number field contains a two-byte integer and its value must be 0.

15.

Release

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	17 _h							
1	LUN			3 rd Party	3 rd Party Device ID			Element
2	Reservation Identification							
3-4	0							
5	Vendor Specific (0)		0				Flag (0)	Link (0)

15.1 Command Description

The Release command lets an initiator release reservations made by previous Reserve commands from that initiator. The Reserve command is explained in Chapter 18. An initiator cannot release reservations that were reserved by other initiators. Releasing unreserved elements is not an error.

15.1.1 3rd Party

The MC supports third-party reservations. A value of 1 in the 3rd Party field indicates the release is a third party release.

15.1.2 3rd Party Device ID

If the 3rd Party field is 1, the 3rd Party Device ID specifies the device for which the release is made.

15.1.3 Element

A value of 0 in the Element field specifies that all previous unit and element reservations made by that initiator be released.

A value of 1 tells the MC that the following Reservation Identification field contains the number of the reservation to be released.

15.1.4 Reservation Identification

This field contains the number of the reservation identification to be released.

16.

Request Sense

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	03 _h								
1	LUN			0					
2-3	0								
4	Allocation Length								
5	Vendor Specific (0)		0				Flag (0)	Link (0)	

16.1 Command Description

The Request Sense command tells the MC to return sense data to the initiator. The MC maintains separate sense data for up to eight initiators. It clears each initiator's sense data when:

- It executes the next command from the same initiator.
- It receives a BUS DEVICE RESET message or a SCSI bus reset condition.

If a CHECK CONDITION status occurs during a command from an unknown initiator, i.e., one that does not include its SCSI ID during the selection phase), the MC will maintain the sense data and will return it to the next unknown initiator as described in the preceding paragraph. It is not advisable to have more than one unknown initiator on the bus.

Sense data will be available to an initiator after any of the following:

- That initiator's previous command to the MC resulted in a CHECK CONDITION status.
- That initiator's previous command to the MC was terminated by an unexpected Bus Free error.
- The Request Sense command was issued to a LUN other than the unit's configured LUN as specified in the Configuration\Advanced\SCSI\Changer LUN menu item.

In the last case, The MC returns the following sense data:

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	25 _h	00 _h				Logical Unit Not Supported

Table 16-1 Sense Data for Wrong LUN

If no sense data is available, the MC returns:

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
0	00 _h	00 _h				No Sense and No Additional Sense Information.

Table 16-2 Sense Data for No Sense

If more than one error occurs during the processing of a SCSI command, the sense key reflects the last error that occurred.

16.1.1 Allocation Length

The MC supports 18 bytes of Sense data.

If the MC receives an Allocation Length value of 0, it will return no data.

If the allocation length is less than the number of bytes the MC has to transfer, the MC will only return the number of bytes specified in the Allocation Length field of the CDB.

If the allocation length is greater than the number of bytes the MC has to transfer, the MC will return all available bytes.

16.2 Sense Data Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Valid (0)	Error Code (00 _h or 70 _h)						
1	Segment Number (0)							
2	Filemark (0)	EOM (0)	ILI (0)	0	Sense Key			
3-6	Information (0)							
7	Additional Sense Length (0A _h)							
8-11	Command Specific Information (0)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Field Replaceable Unit Code (0)							
15	SKSV	Sense Key Specific						
16-17								

Table 16-3 Sense Data

16.2.1 Valid

The MC does not support the Information field and returns a value of 0.

16.2.2 Error Code

The MC returns only current error information and returns a value of 70h in the Error Code field. A current error is one that occurs while the MC is executing the last received SCSI command. If there is no pending error, the MC returns a value of 0.

16.2.3 Segment Number

The MC does not support the Segment Number field and returns a value of 0.

16.2.4 Filemark

The MC does not support filemarks and returns a value of 0.

16.2.5 EOM

The MC does not support End-Of-Medium and returns a value of 0.

16.2.6 Ill

The MC does not support Illegal-Length-Indication and returns a value of 0.

16.2.7 Sense Keys

Sense Key	Name	Description
0	No Sense	There is no specific sense key currently stored for the requesting initiator (i.e., the command was successful).
2	Not Ready	The MC is not currently ready to process commands. Operator intervention may be required to correct this condition.
4	Hardware Error	This condition indicates that the MC detected an unrecoverable hardware error while attempting to perform a command or the power-up diagnostics.
5	Illegal Request	This condition indicates that either the CDB or the additional parameters supplied as data for some commands (i.e., Mode Select) contained an illegal parameter, or that the MC does not (currently) support the command.
6	Unit Attention	This condition indicates that the cartridge inventory may not be valid (i.e., the door was opened, a cartridge was manually moved from or to one of the magazines, etc.), or that the MC has received a BUS DEVICE RESET message or a hard reset condition (which may be as a result of a power-up or a SCSI Bus Reset).
11	Aborted Command	The MC aborted the command. The system may be able to recover by trying the command again.

Table 16-4 Supported Sense Keys

16.2.8 Information

The MC does not support the Information field and returns a value of 0.

16.2.9 Additional Sense Length

This byte tells the host that ten more bytes of Sense data follow.

16.2.10 Command Specific Information

The MC does not support this field and returns a value of 0.

16.2.11 Additional Sense Code (ASC)

The Additional Sense Code field, together with the Additional Sense Code Qualifier field, indicates a specific error condition.

16.2.12 Additional Sense Code Qualifier (ASCQ)

The Additional Sense Code Qualifier field, together with the Additional Sense Code field, indicates a specific error condition.

16.2.13 Field Replaceable Unit Code

The MC does not support the Field Replaceable Unit Code field and returns a value of 0.

16.2.14 SKSV

A value of 0 in the Sense Key Specific Valid field indicates the information in the Sense Key Specific field is not valid. A value of 1 indicates the information is valid. The value of the SKSV field will be 1 only for an ILLEGAL REQUEST sense key.

16.2.15 Sense Key Specific

When the SKSV field is 1, the Sense Key Specific field indicates which field in the CDB or parameter list of a command caused the CHECK CONDITION status. The format of this field is shown in Table 16-5.

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

Table 16-5 Sense Key Specific Field

16.2.15.1 C/D

The value of the Command/Data field will be 0 if the CHECK CONDITION status resulted from an illegal parameter in the parameter list (Data); it will be 1 if the CHECK CONDITION status resulted from an illegal parameter in the CDB (Command).

16.2.15.2 BPV

The value of the Bit Pointer Valid field will be 0 if the value contained in the Bit Pointer is not valid, and will be 1 if the Bit Pointer value is valid.

16.2.15.3 Bit Pointer

The Bit Pointer specifies which bit is in error in the byte identified by the Field Pointer field. If the error is in a multiple bit field, the Bit Pointer contains the value of

the most significant bit of the field (the most significant bit of a field is the one with the highest number).

16.2.15.4 Field Pointer

The Field Pointer specifies the erroneous byte, starting from byte 0000_h. If the error is in a multiple byte field, the Field Pointer contains the value of the most significant byte of the field (the most significant byte of a field is the one with the lowest number).

16.3 Request Sense Error Conditions

If a fatal error occurs while the MC is processing a Request Sense command, the MC will return a CHECK CONDITION status. Following a fatal error on a Request Sense command, the Sense data may not be valid. Examples of fatal errors are:

- A non-zero reserved bit is detected in the CDB
- An unrecoverable parity error occurs on the data bus
- A MC malfunction prevents the return of Sense data

If a nonfatal error occurs during the execution of the Request Sense command, the MC will return the Sense data with a GOOD status.

17. Request Volume Element Address

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	B5 _n							
1	LUN			VolTag	Element Type Code			
2-3	Starting Element Address							
4-5	Number of Elements							
6	0							
7-9	Allocation Length							
10	0							
11	Vendor Specific (0)			0			Flag (0)	Link (0)

17.1 Command Description

The Request Volume Element Address command tells the MC to return information (Volume Element Address data) for element addresses whose flags were set as a result of a previous Send Volume Tag (Translate) command.

If no Send Volume Tag command was completed successfully since the unit was last reset, or if the Send Action Code of the last Send Volume Tag command was Assert, Replace, or Undefine, then the Request Volume Element Address command will return a CHECK CONDITION status with an ILLEGAL REQUEST sense key.

This command specifies a starting address and returns information in ascending element address order. Once it reports information for a given element address, the MC clears the flag for that element address.

The MC returns the information in the form of Element Status pages containing element descriptors. The Element Status pages returned in the Volume Element Address data are the same ones returned by the Read Element Status command, and are described beginning in Section 14.2.

This command is the counterpart to the Send Volume Tag command explained in Chapter 21. Chapter 21 contains important information that you need to understand when working with the Request Volume Element Address command.

17.1.1 Considerations in a Multi-Initiator Environment

To insure successful completion of a Send Volume Tag and Request Volume Element Address sequence in a multi-initiator environment, first reserve the MC device by issuing a unit Reserve command prior to the Send Volume Tag command. Delay issuing the Release command until after issuing the last Request Volume Element Address command.

The Request Volume Element Address command ignores reservations. If an initiator has reserved some number of elements, and another initiator sends a Send Volume Tag (Translate) command to match all elements, and then sends a Request Volume

Element Address command, the MC will report information for all elements, including those reserved by a different initiator.

Once reported, element information is not reported until after another Send Volume Tag command has been completed. If the MC is not first reserved, a problem will arise in the case where an initiator issues a Send Volume Tag (Translate) command and a second initiator issues a Request Volume Element Address before the first initiator can. When the first initiator then issues its request, it will receive no information, because the MC will have already reported that information to the second initiator.

17.1.2 VolTag

The MC reports volume tag information if the Volume Tag field is 1; otherwise, it does not report Volume Tag information.

17.1.3 Element Type Code

Table 14-1 lists the values of this field.

17.1.4 Starting Element Address

The effect of the value in the Starting Element Address field depends on the value of the Send Action Code field received in the last Send Volume Tag command:

Translate - This field identifies the minimum element address (starting address) to be reported by this command.

Assert, Replace, or Undefine - The MC will return a CHECK CONDITION status and no element address data.

17.1.5 Number of Elements

The Number of Elements field tells the MC the maximum number of element descriptors to return (beginning with the element specified in the Starting Element Address field).

17.1.6 Allocation Length

The Allocation Length field tells the MC the number of bytes that the initiator has allocated for the returned Volume Element Address data. The MC will return the specified number of bytes or all available data whichever is less.

It is not an error if the allocation length is not sufficient to transfer all the element descriptors. The MC will transfer as many complete element descriptors as it can.

If the Allocation Length is 0, the MC will not return any data.

17.2 Volume Element Address Data

The Volume Element Address data consists of an eight-byte header followed by one or more element type-specific status pages. Table 17-1 shows the format of the Volume Element Address data.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	First Element Address Reported							
2-3	Number of Elements Available							
4	0			Send Action Code				
5-7	Byte Count of Report Available (n-7)							
8-n	Element Status Page(s)							

Table 17-1 Volume Element Address Data

17.2.1 First Element Address Reported

This field contains the element address of the element having the lowest element address that meets the command specifiers.

17.2.2 Number of Elements Reported

This field contains the number of element descriptors found which meet the command specifiers. If the specified Allocation Length was sufficient, the MC will return status for this number of elements.

17.2.3 Send Action Code

The Send Action Code field contains the value of the Send Action Code field in the last Send Volume Tag command the MC completed.

17.2.4 Byte Count of Report Available

The value in this field is the number of bytes of Element Status data the MC could return if the command's Allocation Length value permitted it to do so.

17.3 Element Status Page

The Element Status pages returned in the Volume Element Address data are the same ones returned by the Read Element Status command, and are described beginning in Section 14.2.

17.4 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	2C _h	00 _h				Command Sequence Error. The last SEND VOLUME TAG was not a FIND action or no previous SEND VOLUME TAG command has been executed.

Table 17-2 Request Volume Element Address Command Specific Errors: All Emulations

18.

Reserve

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	16 _h							
1	LUN			3 rd Party	3 rd Party Device ID			Element
2	Reservation Identification							
3-4	Element List Length							
5	Vendor Specific (0)		0				Flag (0)	Link (0)

18.1 Command Description

The Reserve command reserves the entire MC (*unit* reservation) or a portion thereof (*element* reservation) for the exclusive use of the requesting initiator or of another initiator (third party).

Once reserved, a unit or element reservation remains in effect until:

- The initiator that reserved the unit or element(s) specifically releases the unit or element(s).
- The MC receives a BUS DEVICE RESET message.
- A hard reset condition occurs.

The following restrictions apply to reserving units and elements:

- An initiator cannot reserve an element that is reserved by another initiator.
- An initiator cannot reserve an element in a reserved unit, even if the unit was reserved by itself.
- A command cannot specify overlapping elements. For example, a command cannot reserve elements 1 through 6 and 4 through 8.
- An element cannot be reserved if it does not exist.

Element reservations have no effect on Initialize Element Status, Read Element Status, Send Volume Tag (Translate), and Read Volume Element Address commands. This means, for example, that if an initiator creates or modifies volume tags using the Send Volume Tag command and then reserves those elements, another initiator can issue an Initialize Element Status command and alter the Element Status data of all elements, including those reserved by the first initiator. Likewise, if the other initiator issues a Send Volume Tag (Translate) command, the match flags for *all* elements, including those reserved by the first initiator, will be cleared.

18.1.1 3rd Party

The MC supports third-party reservations. A value of 1 in the 3rdPty field indicates the reservation is being made for another device (i.e., the third party). A third party reservation can be either a unit or an element reservation.

18.1.2 3rd Party Device ID

If the 3rdPty field is 1, the Third Party Device ID specifies the device for which the reservation is made. Only the third party device can access the reserved entity. The third party cannot release reservations that have been reserved for it.

18.1.3 Element

A value of 0 in the Element field specifies unit reservation and reserves the entire unit; a value of 1 specifies element reservation and reserves the element(s) or a series of elements specified in the Element List Descriptor.

18.1.4 Reservation Identification

Reservation events may be assigned unique Reservation ID numbers for use by the Release command (described in Chapter 15). This field assigns a number to the reserved group of elements. A subsequent Release command can release all the elements in that group at once by specifying the group's Reservation ID number rather than the individual elements. The MC supports up to 512 reservation IDs.

18.1.5 Element List Length

The Element List Length field specifies the length of the following Element List Descriptors. Valid values are 0, 6 and multiples of 6. This field is only valid when the Element field is 1. If the value for this field is 0 and the Element field is 1, no elements are reserved.

18.2 Element List Descriptor

The Element List Descriptor contains the number of elements and their addresses that are to be reserved. The format of the Element List Descriptor is shown in Table 18-1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	0							
2-3	Number of Elements							
4-5	Element Address							

Table 18-1 Element List Descriptor

The Element List Descriptor is sent after the CDB. You can send zero or more descriptors to reserve specific elements, and only one type element can be specified in each descriptor.

18.2.1 Number of Elements

This field specifies the number of elements (of a single type) to be reserved. If the value of this field is 0, all elements starting with the one specified in the following Element Address field, and ending with the last element address of that type will be reserved.

18.2.2 Element Address

The Element Address field specifies the element, or the starting address of a series of elements, to be reserved.

18.3 Reservation Conflicts

The following events cause the MC to return a RESERVATION CONFLICT status:

- An attempt is made to reserve the MC, or an element, while it is reserved by another initiator.
- Any other initiator attempts to perform any command other than an Inquiry, Request Sense, or Release command on the MC while it is reserved.

18.4 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	1A _n	00 _n	1	0003 _n		Parameter List Length Error.
5	26 _n	00 _n	0	???? _n		Invalid Field In Parameter List. Reserved field set.
5	26 _n	02 _n	0	???? _n		Parameter Value Invalid. Invalid element address.

Table 18-2 Reserve Command Specific Errors: All Emulations

19.

Rezero Unit

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	01 _h							
1	LUN			0				
2-4	0							
5	Vendor Specific (0)		0			Flag (0)		Link (0)

19.1 Command Description

The Rezero Unit command returns the carriage to its Park position.

20.

Send Diagnostic

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1D _n							
1	LUN			PF (0)	0	SelfTest (1)	Dev Offline (0)	Unit Offline (0)
2	0							
3-4	Parameter List Length (0)							
5	Vendor Specific (0)		0			Flag (0)		Link (0)

20.1 Command Description

The Send Diagnostic command lets you tell the MC to perform its self-test function.

The MC supports the SelfTest function only. The SelfTest field must be 1, and the value of all other fields (except LUN) must be 0.

If the self-test function completes successfully, the MC returns a GOOD status; otherwise, it returns a CHECK CONDITION status.

21.

Send Volume Tag

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	B6 _n							
1	LUN			0	Element Type Code			
2-3	Element Address							
4	0							
5	0			Send Action Code				
6-7	0							
8-9	Parameter List Length							
10	0							
11	Vendor Specific (0)		0				Flag (0)	Link (0)

21.1 Command Description

The Send Volume Tag command is used primarily to search elements for volume tags containing specific information. The command does this by sending a template containing the desired search criteria. When the MC receives the template, it searches all element volume tags and sets a match flag in those elements that fit the template. It then creates a list of flagged element addresses and returns that list in a subsequent Request Volume Element Address command. This use of the Send Volume Tag command can be referred to as the Translate function.

The other use of the Send Volume Tag command is to write, overwrite, or clear volume tags on a single element basis. These functions are supported for Primary Volume Tags only, and can be referred to as the Assert, Replace, and Undefine functions.

The results of consecutive Send Volume Tag commands are not additive, because every Send Volume Tag command clears all match flags. The Translate function, however, then sets them according to the template. This becomes important if the goal is to find element addresses that meet more than one set criterion. For example, to find the addresses of cartridges whose volume tags start with 1 or 2, two separate Send Volume Tag commands are required, each followed by a Request Volume Element Address command.

In a multi-initiator environment, it is good practice to reserve the entire unit when searching for volume tags. This prevents a second initiator from altering the inventory after the first initiator has completed a Translate function but before it has sent a Request Volume Element Address command.

The MC will preserve the results of a Send Volume Tag command for as long as possible and will clear an element's match flag whenever one of the following conditions occurs:

- Any Reset condition will cause the MC to clear all match flags.

-
- Any Send Volume Tag command will cause the MC to clear all match flags.
 - Any user activity which leaves the inventory in question (i.e., placing a hand in the area of the magazines, or moving a single cartridge or magazine) will reset all match flags.
 - If the MC receives a Send Volume Tag (Translate) command and then the inventory is altered (by a Move or Exchange command or manually from the control panel the match flags of the source and destination elements are updated if the cartridges in those elements were affected by the Send Volume Tag command.
 - If the I/O Port element is flagged and the user then removes the cartridge from the I/O port, the MC clears that element's flag.
 - A Request Volume Element Address command specifying that element.
 - A Move and Exchange command will clear the flag of any element that is left empty, and may change the flag of the destination element(s).

21.1.1 Element Type Code

The Element Type Code identifies the type of element to which the command applies. If the Send Action Code indicates a Translate operation, the Element Type Code field indicates the type of elements to be searched. If the Send Action Code is other than Translate, the Element Type Code field must be 0.

Table 14-1 lists the values of this field.

21.1.2 Element Address

The effect of the value in this field depends on the value in the Send Action Code field:

- Translate - This field specifies the starting element to be examined for satisfaction of the search criteria.
- Assert, Replace or Undefine - This field specifies the address of a single element whose volume tag information modified.

21.1.3 Send Action Code

The Send Action Code specifies the type of operation the command will perform. Table 21-1 lists the supported values.

Send Action Code	Action	Description
4	Translate - All Tags	Search all defined tags and ignore sequence numbers. The Volume ID Template field in the Send Volume Tag parameter list specifies a search template.
5	Translate - Primary Tags	Search all primary tags and ignore sequence numbers. The Volume ID Template field in the Send Volume Tag parameter list specifies a search template. In effect, this is equivalent to 4h since the MC does not support alternate tags.
8	Assert - Primary Tag	The Volume ID Template field in the Send Volume Tag parameter list specifies new Primary Volume Tag information for a single element that does not already have volume tag information.
10	Replace - Primary Tag	The Volume ID Template field in the Send Volume Tag parameter list overwrites the existing Primary Volume Tag information. It is not an error if no Primary Volume Tag was previously defined.
12	Undefined - Primary Tag	Undefine, in the sense of clear. Clears the Primary Volume Tag information. The parameter list length must be 0. It is not an error if no Primary Volume Tag was previously defined.

Table 21-1 Send Action Code Values

21.1.4 Parameter List Length

The Parameter List Length field specifies the number of bytes in the Send Volume Tag parameter list. The minimum length is 32 bytes and the maximum length is 40. The format of the Send Volume Tag parameter list is shown in Table 21-2.

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

Table 21-2 Send Volume Tag Parameter List

21.1.4.1 Volume Identification Template

If the Send Action Code is 4 or 5, the Volume Identification Template field specifies a search template for translate function.

As a search template, it may contain the wildcard characters * and ? (2Ah and 3Fh). An asterisk matches any string of characters, and when it appears in a template, the remainder of the template is not used. A question mark matches any single character.

In Assert, Replace, and Undefine functions, wild cards are not allowed.

21.1.4.2 Minimum/Maximum Volume Sequence Numbers

The MC does not support these fields, and they will be ignored.

21.2 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	1A _h	00 _h	1	0008 _h		Parameter List Length Error.
5	3A _h	00 _h	1	0002 _h		Medium Not Present. An ASSERT, REPLACE or UNDEFINE action was attempted on an empty element.

Table 21-3 Send Volume Tag Command Specific Errors: All Emulations

Native						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Starting element address.

Table 21-4 Send Volume Tag Command Specific Errors: Native

Exabyte 10e Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Starting element address.

Table 21-5 Send Volume Tag Command Specific Errors: Exabyte 10e Emulation

Exabyte 10i Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	24 _h	80 _h	1	0002 _h		Invalid Element Address. Invalid Starting element address.

Table 21-6 Send Volume Tag Command Specific Errors: Exabyte 10i Emulation

Exabyte 120 Emulation						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21 _h	01 _h	1	0002 _h		Invalid Element Address. Invalid Starting element address.

Table 21-7 Send Volume Tag Command Specific Errors: Exabyte 120 Emulation

22.

Test Unit Ready

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	00 _h							
1	LUN			0				
2-4	0							
5	Vendor Specific (0)		0				Flag (0)	Link (0)

22.1 Command Description

The Test Unit Ready command returns the current status of the MC to the initiator. If the MC is ready to receive a motion command, the Test Unit Ready command will execute without a CHECK CONDITION.

23.

Write Buffer

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	3B _n							
1	LUN			0		Mode (5)		
2	Buffer ID (0)							
3-5	Buffer Offset (0)							
6-8	Parameter List Length							
9	Vendor Specific (0)		0				Flag (0)	Link (0)

23.1 Command Description

The Write Buffer command is used to download new firmware into the MC (which then re-programs its internal Flash Prom with the new program). Firmware images can be obtained either in the form of a data file, or from an MC by using the Read Buffer command. The firmware data consists of up to 512 packets of 1030 bytes each. These packets contain the firmware data along with error checking and addressing information. Firmware images distributed by Qualstar also contain a variable length string of data before the packet data that can be displayed and describes the data file (version and revision data).

The firmware upgrade process involves issuing one or more Write Buffer commands. Each command may send as few as one or as many as all of the packets from the firmware image. Packets must be sent in order and without duplication. However, if an error occurs or if the upgrade is to be aborted, the upgrade process can be restarted simply by re-sending the firmware data again starting from the first packet.

Internally, the unit programs an unused area of its Flash Prom with the new firmware until it has been completely received. It then checks the entire image for validity. Finally the unit shuts down and copies the data to the primary area. While this copy stage is running, the unit displays a message on the LC display warning against powering-down the unit. If the unit is powered-down during the last stage (which lasts approximately 30-60 seconds), the unit will require service to be restored to working condition.

23.1.1 Mode

This field is used to specify the command operation mode. The MC accepts only value 5 (Download Microcode and Save).

23.1.2 Buffer ID

This field specifies which buffer is to be downloaded and must contain 0.

23.1.3 Buffer Offset

This field specifies the offset into the buffer for the command's data. Since the firmware data is packetized and the packets contain an internal data address, this field must contain 0000_h.

23.1.4 Parameter List Length

This field contains the length of the data that is being sent with the command. This length must be a multiple of 1030. A complete firmware image contains up to 512 packets of 1030 bytes each. These packets can be sent in any number of Write Buffer commands from 1 to 512. However, the complete data image must be sent in order without duplication of data.

23.2 Command Specific Errors

All Emulations						
Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
4	3F _h	80 _h				Flash PROM programming error.
5	26 _h	02 _h	0	0000 _h		Parameter Value Invalid. Bad firmware data packet.

Table 23-1 Write Buffer Command Specific Errors: All Emulations