Exabyte 690D Library

SCSI Reference

Exabyte

329621-001

Copyright

Disclaimer

Trademark Notices

Revision History

Revision	Date	Description
000	August 1998	Preliminary
001	December 1998	Added Tape Alert and 30-cartridge information

Note: The most current information about this product is available at Exabyte's World Wide Web site (www.exabyte.com).

Exabyte Corporation
1685 38th Street
Boulder, CO USA 80301
(303) 442-4333

329621-001

Product Warranty Caution

The Exabyte® 690D Library is warranted to be free from defects in materials, parts, and workmanship and will conform to the current product specification upon delivery. **For the specific details of your warranty, refer to your sales contract or contact the company from which the library was purchased.**

The warranty for the library shall not apply to failures of any unit when:

- The library is repaired by anyone other than the Manufacturer's personnel or approved agent.
- The library is physically abused or is used in a manner that is inconsistent with the operating instructions or product specification defined by the Manufacturer.
- The library fails because of accident, misuse, abuse, neglect, mishandling, misapplication, alteration, faulty installation, modification, or service by anyone other than the factory service center or its approved agent.
- The library is repaired by anyone, including an approved agent, in a manner that is contrary to the maintenance or installation instructions supplied by the Manufacturer.
- The Manufacturer's serial number tag is removed.
- The library is damaged because of improper packaging on return.

CAUTION

Returning the library in unauthorized packaging may damage the unit and void the warranty. If you are returning the library for repair, package it in its original packaging (or in replacement packaging obtained from your vendor). Refer to the packing instructions in *Exabyte 690D Installation and Operation.*

If problems with the library occur, contact your maintenance organization; do not void the product warranty by allowing untrained or unauthorized personnel to attempt repairs.

Notes

Contents

4 INITIALIZE ELEMENT STATUS (07h)

5 INITIALIZE ELEMENT STATUS WITH RANGE (E7h)

6 INQUIRY (12h)

7 LOG SENSE (4Dh)

8 MODE SELECT (15h)

9 MODE SENSE (1Ah)

10 MOVE MEDIUM (A5h)

11 POSITION TO ELEMENT (2Bh)

12 PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

13 READ BUFFER (3Ch)

14 READ ELEMENT STATUS (B8h)

15 READ FIRMWARE (D0h)

16 RECEIVE DIAGNOSTIC RESULTS (1Ch)

17 RELEASE (17h)

18 REQUEST SENSE (03h)

24 WRITE BUFFER (3Bh)

25 WRITE FIRMWARE (D1h)

A Library Error Handling

B Library Message Processing

C Error Codes

About This Manual

This manual provides reference information for developing SCSI applications for the Exabyte® 690D Library (referred to as the *library*). Note that SCSI operations performed by the library are separate from the SCSI operations performed by the enclosed tape drives. For SCSI operations as they relate to the tape drives, refer to the tape drive documentation.

Contents of This Manual

This manual contains the following information:

- Chapter 1 contains information about elements in the library, SCSI bus phases, SCSI messages, the SCSI command set, and common SCSI operations.

- Chapter 2 contains information about how the library operates as a device in a SCSI environment, including an overview of the control modes and common SCSI operations. It also describes how the library tracks data cartridges.

- Chapter 3 contains information about the general conditions that the library checks and the errors that can occur during the Command phase.

- Chapter 4 through Chapter 25 contain information about individual SCSI commands. For ease of reference, the commands are listed in alphabetical order.

- Appendix A describes how the library handles errors during different SCSI bus phases.

- Appendix B provides in-depth information about how the library processes SCSI messages during different SCSI bus phases.

- Appendix C provides reference information for library errors.

Conventions Used in This Manual

This manual uses the conventions shown below to highlight notes, important information, and cautions. Take special note of boxed text. Failure to follow cautions can result in equipment damage.

Note: Read *Notes* for additional information or suggestions about the topic or procedure being discussed.

➤ **Important** Read the information in *Important* notices to learn crucial information about the topic being discussed.

> **CAUTION**
>
> Read the information in *CAUTION* boxes to learn how to avoid damaging the library or tape drive or losing data.

Related Publications

This manual provides guidelines for implementing the library's SCSI command set. The following publications list additional, related information.

Exabyte 690D Library

- *Exabyte 690D Library Installation and Operation*, 329619
- *Exabyte 690D Library Product Specification*, 329620
- *Exabyte 690D Maintenance*, 329622
- *Exabyte Bar Code Label Specification for DLT Cartridges*, 321195

Standards

For information about the standards used for the library, refer to the following publications:

- ANSI *Small Computer System Interface-2 (SCSI-2)*, X3.131 – 1994
- EIA *Rack Standards*, RS-310-B

1 Overview of the Library as a SCSI Device

This chapter provides background information for understanding how the Exabyte® 690D Library operates as a device on a SCSI bus. It provides an overview of the following:

- General features of the library
- Library control modes
- The library's relationship to the SCSI bus
- The elements of the library
- SCSI bus communication, including bus phases, messages, commands, and statuses

1.1 General Features

This section describes the features of the Exabyte 690D Library (shown in Figure 1-1). The library includes the following features:

- Up to six Quantum® DLT™ tape drives. These tape drives offer high-speed, high-capacity data storage and retrieval.

- A robotic handler, also referred to as the robot. The robot automatically moves data cartridges between the enclosed data cartridge magazines, the tape drives, and the entry/exit port.

- A bar code scanner installed on the robot. The library uses the bar code scanner to read bar code labels on the cartridges.

- Up to 30, 60, or 90 data cartridges in 6, 12, or 18 data cartridge magazines, respectively. The magazines are mounted on a rotating drum. Each magazine contains five cartridge slots.

- A fixed cartridge slot that can be used to hold a cleaning cartridge for the tape drives.

- A calibration block that the library uses during its internal self-tests and diagnostics.
- An entry/exit port that you can use to insert and remove a single data cartridge or a cartridge magazine from the library's storage area without opening the front door.
- An LCD allows you to monitor library operations and control robot operation from the front panel.

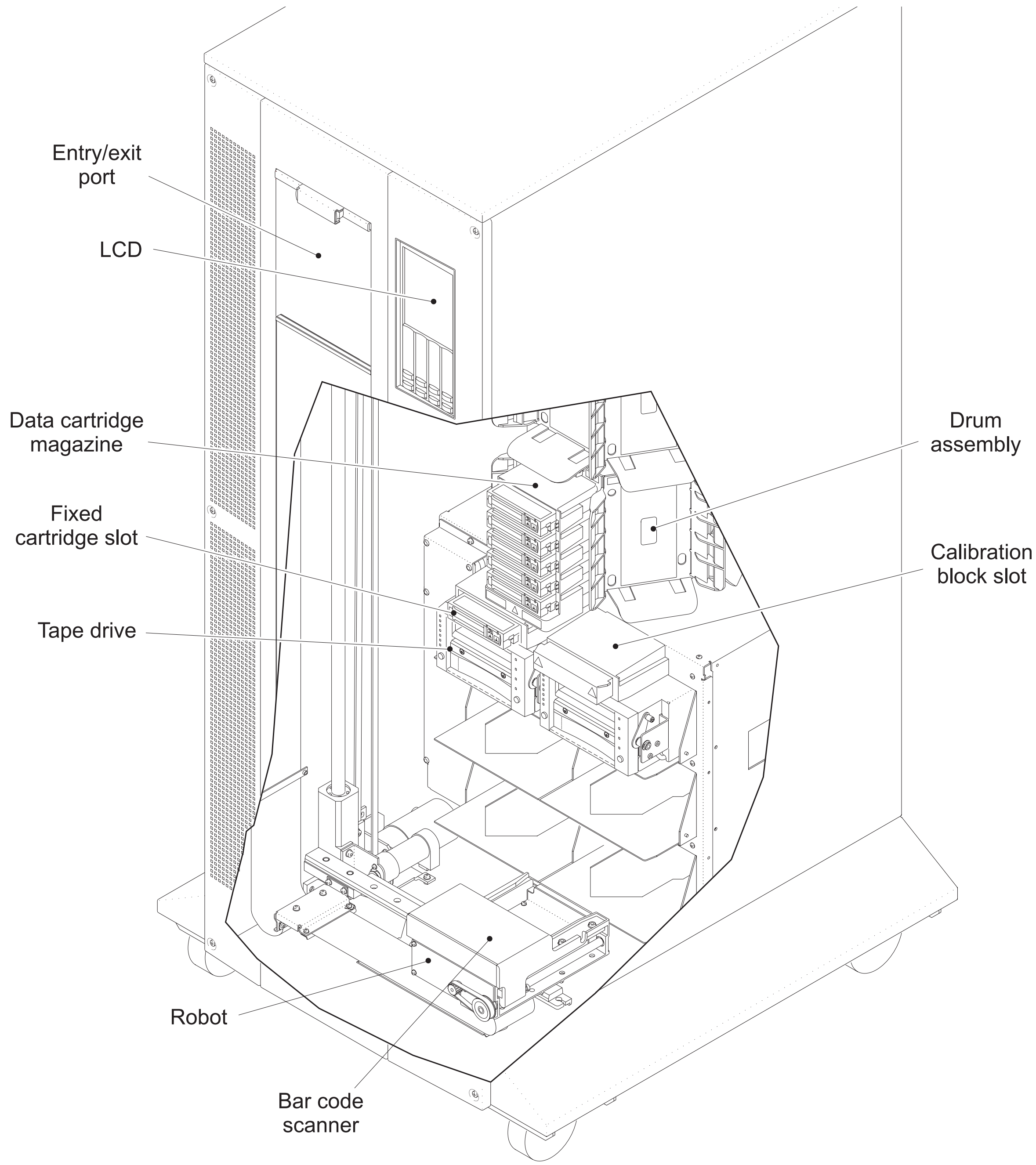

Figure 1-1 Major components of the Exabyte 690D

1.2 Control Modes

The library can operate in any of the following control modes:

- **SCSI mode**, in which robot motion is controlled by a SCSI driver. In this mode, the robot retrieves and replaces cartridges in an order you specify through the SCSI-2 command set.

  Note: The 480 Emulation option, available from the operator panel, allows the library to operate like an Exabyte 480 Library in the SCSI control mode. See page 1-4 for more information.

- **LCD mode**, in which robot motion is controlled by a user from the operator panel. The operator panel contains a context-sensitive keypad; the keys are called *softkeys*. The softkey functions change depending on where you are in the library's menu structure.

- **Console mode**, in which robot motion is controlled by a console interface program (such as Exabyte's CHSTERM) that accesses the library's resident firmware. In the Console mode, you operate the library independently of the SCSI bus, using a keyboard and monitor connected with a serial cable to the library's serial port.

  You can also use the serial port to upgrade the library firmware and to create diagnostic listings from the library. You do not need to change to Console mode to perform these functions. For detailed information about using the serial port, refer to *Exabyte 690D Maintenance*.

Note: You can issue SCSI commands to the library in any of the control modes. However, the library must be in SCSI mode if you want to control robot motion with SCSI commands.

Refer to *Exabyte 690D Installation and Operation* for instructions for using the operator panel to switch among these control modes.

480 Emulation Option

When using the 480 Emulation option, the Exabyte 690D operates like an Exabyte 480 library and can be controlled by most, but not all, SCSI drivers developed for the Exabyte 480.

The 480 Emulation option changes the Exabyte 690D's behavior when it receives certain SCSI commands, as follows:

- **Element Addresses** – The element addresses for the tape drives and robot are remapped, as follows:
  - Drive 1 = 96
  - Drive 2 = 97
  - Drive 3 = 98
  - Drive 4 = 99
  - Drive 5 = 100
  - Drive 6 = 101
  - Entry/exit port = 91 – 95
  - Robot = 102
- **INQUIRY** – The library returns "EXB-480" as the Product Identification in response to an INQUIRY command.
- **LOG SENSE** – When you issue a LOG SENSE command, the State Log Page (Page Code 31h) only reports digital sensor log parameter codes 0 through 7. Log parameter codes 8 through 41, described on page 7-13, are not reported.

  Data for the Drive Counters Page (Page Code 36h), described on page 7-21, is not returned.
- **MODE SELECT** – Depending on how you set Write Lines 1 through 4 (byte 02, bits 3 through 0) in the MODE SELECT command, the operation of Display Lines 1 through 4 (bytes 04 through 83) of MODE SELECT change. See page 8-20 for detailed information about the effect of changing the default setting for Write Lines 1 through 4.
- **MODE SENSE** – When it receives a MODE SENSE command, the Exabyte 690D reports element addresses of 5Bh (91) through 5F (95) for the import/export element (entry/exit port).

- **READ ELEMENT STATUS –** When it receives a READ ELEMENT STATUS command, the Exabyte 690D reports the default element addresses of the Exabyte 480. It does not report status information for the entry/exit port.

1.3 Relationship to the SCSI Bus

The Small Computer System Interface (SCSI) is a standard that enables a host computer and peripheral equipment, such as the library and its tape drives, to communicate. The library and the tape drives each include independent SCSI controllers, and each supports independent sets of SCSI-2 commands.

The physical components of the SCSI system consist of the following:

- **Initiator.** A computer equipped with a SCSI bus adapter card which allows it to send commands, messages, and data across the SCSI bus to targets such as the library or tape drives. The initiator can also receive data, messages, and status from the targets.

- **Targets.** Devices capable of receiving commands from an initiator. The library and tape drives are independent targets. The library is the target for cartridge inventory and movement operations. The tape drives are the target for read and write operations.

- **SCSI bus.** The SCSI cables that connect the SCSI bus adapter card to the library, tape drives, and other devices form the SCSI bus and provide a pathway for passing information between the initiator and the targets. Each device attached to a SCSI bus has a unique SCSI ID that identifies it during communication. The SCSI bus attached to the library must be terminated at both ends.

The library uses a differential wide SCSI configuration. In wide SCSI configurations, up to 16 devices (including one or more initiators) can be attached to each SCSI bus. SCSI IDs can range from 0 to 15 for each bus. Up to three SCSI buses can be attached to the library (one for each tape drive and one for the library itself).

➤ **Important** You cannot mix SCSI configurations within the same library. You cannot mix single-ended and differential devices on the same SCSI bus.

1.4 Elements and Element Addresses

When you issue SCSI commands to the library, you may need to specify an *element address* to identify a specific location (called an *element*). The library contains the following types of elements:

- **Medium transport element.** The robot is the medium transport element that moves the cartridges in the library.
- **Storage elements.** The cartridge slots in the library's data cartridge magazines are the storage elements that store the cartridges while they are not being used in the tape drives. The fixed cartridge slot is the storage element for an additional data cartridge or a cleaning cartridge. The calibration block is not addressable and is for library internal use only.
- **Import/export elements.** The entry/exit port contains the import/export elements that allow you to insert or remove a single data cartridge or a magazine containing up to five data cartridges without opening the front door.
- **Data transfer elements.** Each tape drive is a data transfer element that reads and writes data. Each tape drive has its own SCSI ID and responds to tape drive-specific SCSI commands.

Each of the elements in the library has a default element address, as shown in Figure 1-2, Figure 1-3, and Figure 1-4. Explanations of how you use the element addresses and how you can change them are provided in Chapter 2.

Note: When you use diagnostic functions from the operator panel, you indicate locations by specifying *element indexes*. Element indexes are identical to the default element addresses. However, element indexes are permanently coded in the library's firmware and cannot be changed. This means that even if you have changed the library's element addresses from their defaults, you must always use the defaults (the element indexes) when performing operator panel diagnostics.

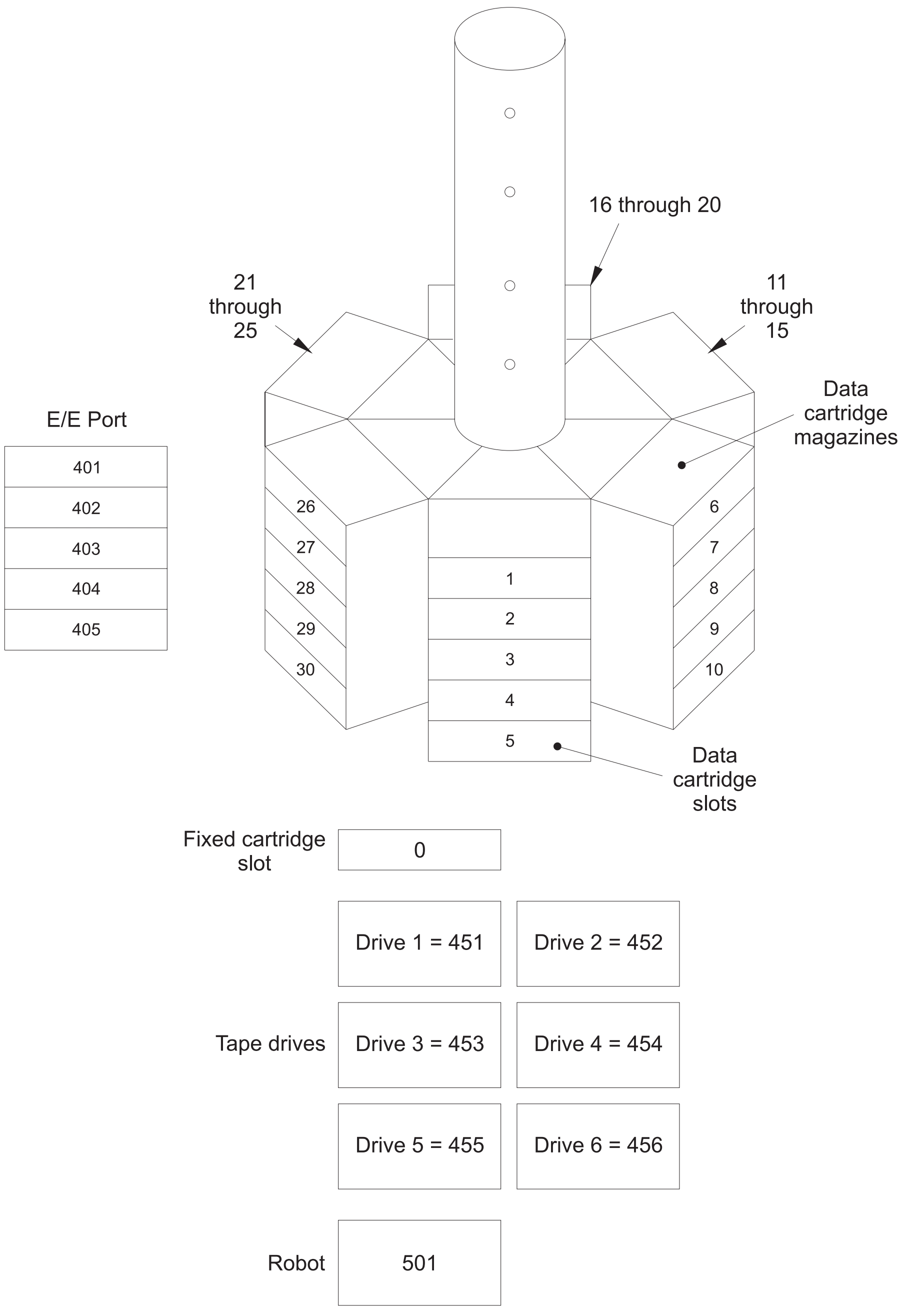

Figure 1-2 Default element addresses (element indexes) for the Exabyte 690D with 31 data storage elements

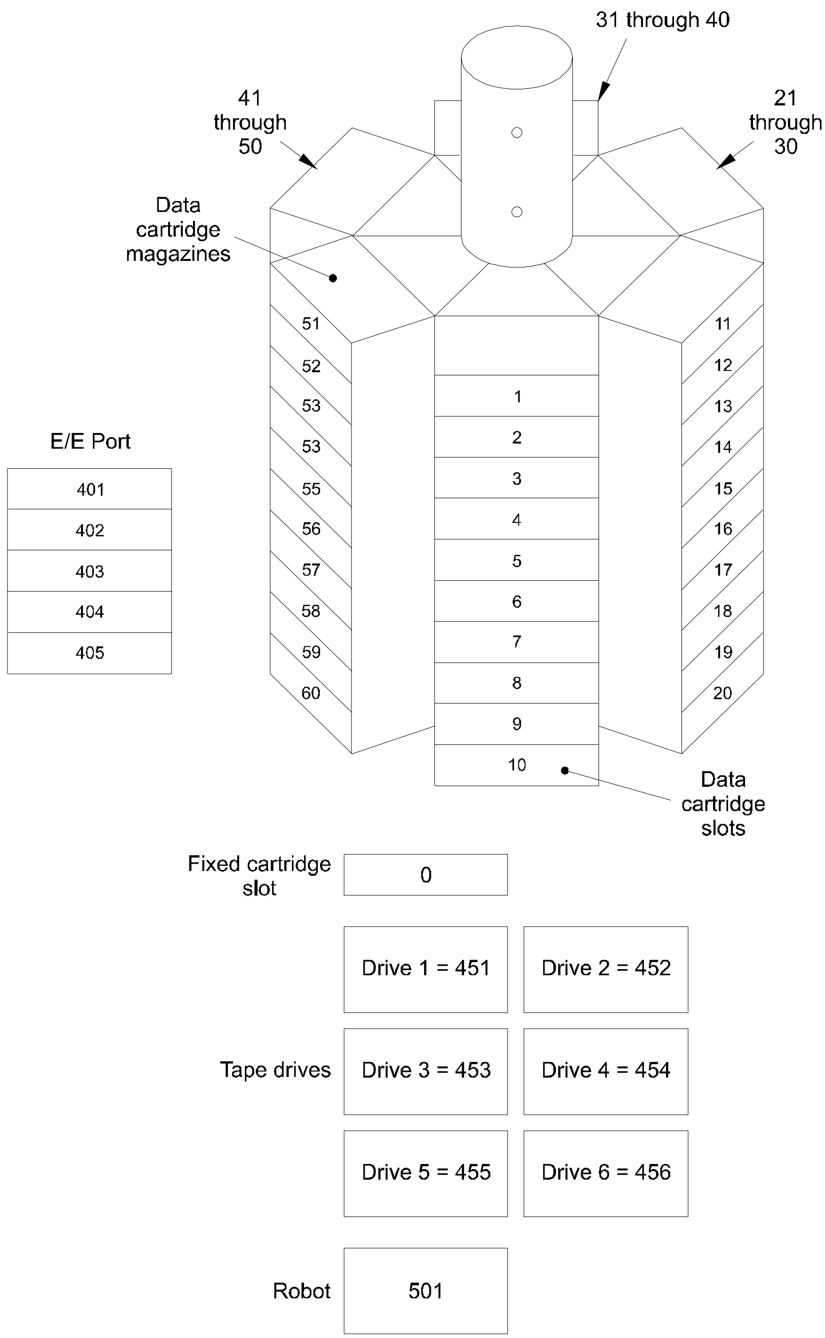

Figure 1-3 Default element addresses (element indexes) for the Exabyte 690D with 61 data storage elements

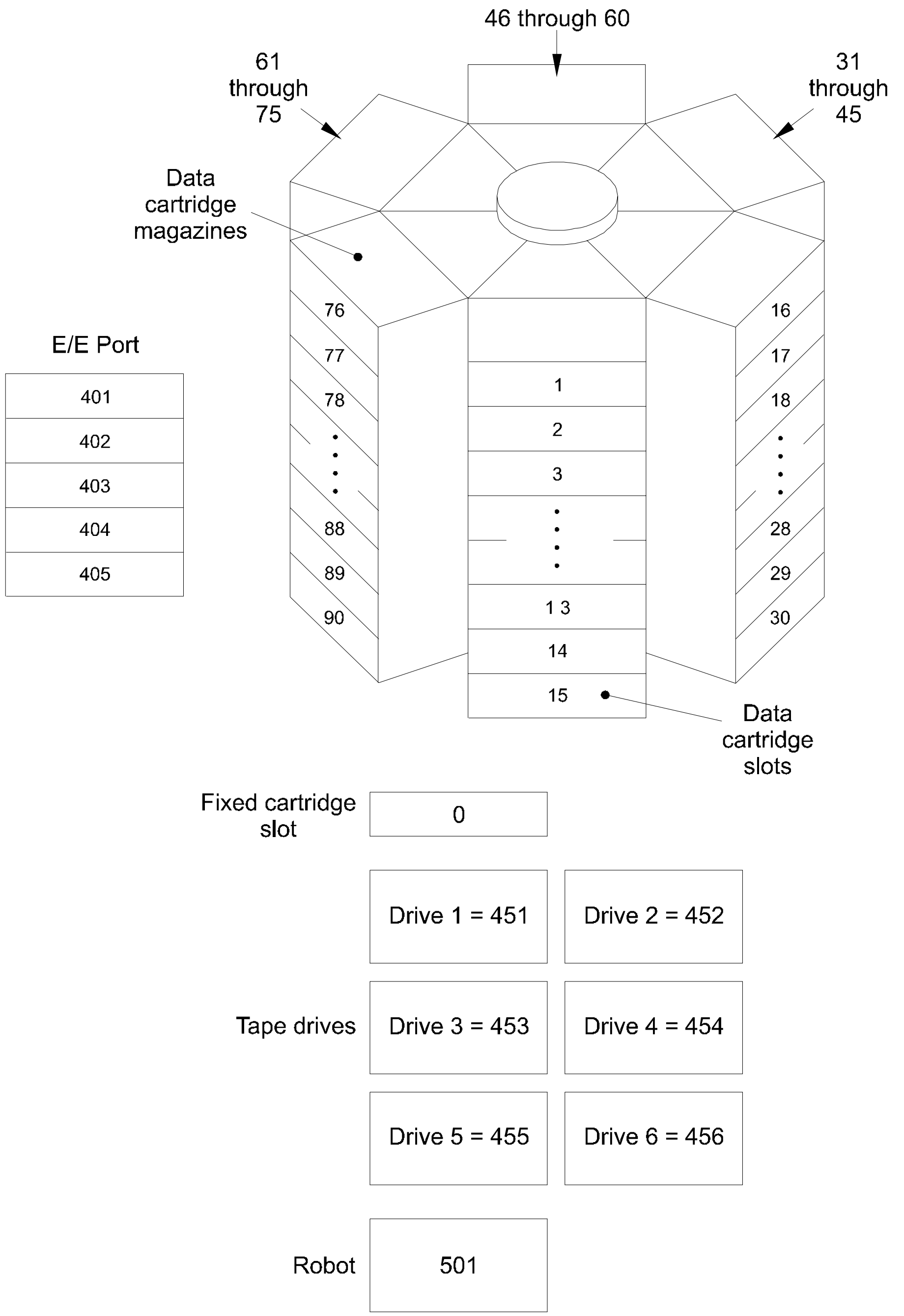

Figure 1-4 Default element addresses (element indexes) for the Exabyte 690D with 91 data storage elements

1.5 Communication across the SCSI Bus

This section explains how communication across the SCSI bus is implemented. It discusses the SCSI bus phases, messages, commands, and statuses supported by the library.

SCSI Bus Phases

Bus phases determine the direction and type of information transferred across the data lines of the SCSI bus. The possible bus phases include Bus Free, Arbitration, Selection, Reselection, and Transfer (which includes four subsets: Message In or Message Out, Command Out, Data In or Data Out, and Status In). Table 1-1 describes the bus phases.

Note: For information about how the library responds to errors during different bus phases, refer to Appendix A.

Table 1-1 SCSI bus phases and information transfer phases

Bus Phase	Description
Bus Free	The Bus Free phase specifies that no device is using the bus.
Arbitration	The Arbitration phase allows devices to compete for access on the bus.
Selection	The Selection phase allows an initiator to select the library for communication.
Reselection	The Reselection phase allows the library to reconnect to the initiator after it disconnects.
Transfer:	The Message phases help manage the physical path between the initiators and targets.
▪ Message In/ Message Out	▪ In the Message In phase, the library sends a message to the initiator. In the Message Out phase, the initiator sends a message to the library.
▪ Command Out	▪ In the Command Out phase, the initiator sends a command to the library. Commands contain information about what actions the library should perform.
▪ Data In/ Data Out	▪ In the Data In phase, the library transfers data to the initiator. In the Data Out phase, the initiator transfers data to the library.
▪ Status In	▪ In the Status In phase, the library returns a status byte to the initiator. The status byte indicates the results of the command's execution.

SCSI Messages

The SCSI message system allows communication between an initiator and the library for physical path management. Messages allow the initiator and the library to manage error detection, data transfer retries, and the data path.

The library supports the SCSI messages listed in Table 1-2. For a more in-depth discussion of these messages and a description of the actions performed by the library in response to these messages, refer to Appendix B.

Note: One or more messages can be sent during a single message phase.

Table 1-2 SCSI messages supported by the library

Message	Hex Value	Description	Direction	
			In (Library to initiator)	Out (Initiator to library)
Command Complete	00h	The library informs the initiator that the execution of the command was completed and that it sent a valid status byte to the initiator.	✔	
Extended Messages[a]	01h	**Synchronous Data Transfer Request (01h)** The initiator starts negotiations for synchronous data transfer. The library negotiates down to asynchronous data transfer.	✔	✔
		Wide Data Transfer Request (03h) The initiator starts negotiations for wide data transfer. The library negotiates down to narrow data transfer.	✔	✔
Restore Pointers	03h	The library informs the initiator that it did not properly receive a block of data or the command descriptor block (CDB) and that the data needs to be transferred again.	✔	
Disconnect	04h	The library informs the initiator that it plans to disconnect from the SCSI bus and that a reconnect will be required later.	✔	
Initiator Detected Error	05h	The initiator informs the library that an error occurred. The library can retry the operation.		✔

Table 1-2 SCSI messages supported by the library (*continued*)

Message	Hex Value	Description	Direction	
			In (Library to initiator)	**Out (Initiator to library)**
Abort	06h	The initiator is clearing the present and any pending operation for that initiator. When the library accepts this message, it releases the bus into the Bus Free phase.		✔
Message Reject	07h	Either the initiator or the library is indicating that the last message received was inappropriate or not implemented.	✔	✔
No Operation	08h	The initiator informs the library that it does not have a valid message to send in response to the library's request for a message.		✔
Message Parity Error	09h	The initiator informs the library that one or more bytes in the last message it received had a parity error.		✔
Bus Device Reset	0Ch	The initiator instructs the library to reset all of its current I/O operations for all initiators. The library releases the SCSI bus into the Bus Free phase, with no operations pending for any initiator, and performs a reset. (See page 2-3 for more information about resetting the library.)		✔
Identify	80h or C0h	This message is used to establish a physical path connection between the initiator and the library. It also indicates whether disconnect is supported and the LUN for which the command is intended. The library supports a LUN of 0.	✔	✔

[a] A wide SCSI tape drive in the library can support wide and synchronous data transfer, but the library itself negotiates down to narrow and asynchronous data transfer. See "Extended Message In/Out (01h)" on page B-4 for more information.

SCSI Commands

Table 1-3 lists the SCSI commands supported by the library.

Note: The commands issued to the library are independent of the commands issued to the tape drives. For information about the commands for the tape drives, refer to the documentation for the tape drives.

Table 1-3 SCSI commands supported by the library

OP Code	Command	Discussed in...
00h	TEST UNIT READY (6 bytes)	Chapter 23
03h	REQUEST SENSE (6 bytes)	Chapter 18
07h	INITIALIZE ELEMENT STATUS (6 bytes)	Chapter 4
12h	INQUIRY (6 bytes)	Chapter 6
15h	MODE SELECT (6 bytes)	Chapter 8
16h	RESERVE (6 bytes)	Chapter 20
17h	RELEASE (6 bytes)	Chapter 17
1Ah	MODE SENSE (6 bytes)	Chapter 9
1Ch	RECEIVE DIAGNOSTIC RESULTS (6 bytes)	Chapter 16
1Dh	SEND DIAGNOSTIC (6 bytes)	Chapter 21
1Eh	PREVENT/ALLOW MEDIUM REMOVAL (6 bytes)	Chapter 12
2Bh	POSITION TO ELEMENT (10 bytes)	Chapter 11
3Bh	WRITE BUFFER (10 bytes)	Chapter 24
3Ch	READ BUFFER (10 bytes)	Chapter 13
4Dh	LOG SENSE (10 bytes)	Chapter 7
A5h	MOVE MEDIUM (12 bytes)	Chapter 10
B5h	REQUEST VOLUME ELEMENT ADDRESS (12 bytes)	Chapter 19
B6h	SEND VOLUME TAG (12 bytes)	Chapter 22
B8h	READ ELEMENT STATUS (12 bytes)	Chapter 14
D0h	READ FIRMWARE (12 bytes)[a]	Chapter 15
D1h	WRITE FIRMWARE (12 bytes)[a]	Chapter 25
E7h	INITIALIZE ELEMENT STATUS WITH RANGE (10 bytes)[a]	Chapter 5

[a] The INITIALIZE ELEMENT STATUS WITH RANGE, READ FIRMWARE, and WRITE FIRMWARE commands are Exabyte-unique commands.

Chapter 4 through Chapter 25 contain the detailed descriptions of the SCSI commands supported by the library. The commands are arranged in alphabetical order with each command starting in a new chapter. For ease of reference, the command name and operation code (OP code) are included in the header at the top of each page.

SCSI Command Format

The library uses six-, ten-, and twelve-byte commands, whose formats are described in the SCSI-2 standard. Any command descriptor block (CDB) fields that are specific to the library for a given command are described in the command chapter. This section describes the CDB fields that are common for every command.

Note: Any errors caused by illegal parameters in a CDB or parameter list for a particular command are listed at the end of the command chapter. Errors of this type return a sense key of Illegal Request (5h).

Logical Unit Number (LUN) Field The library is a single device target and does not support multiple devices. The library only supports a LUN of 0. The LUN field for each CDB should be set to 0. Note that if the Identify message is sent before the CDB, the LUN field in the CDB is ignored. However, the LUN field in the Identify message must be set to 0.

Reserved Fields The word *Reserved* (or *RSVD*) in a field definition for a SCSI command refers to fields defined as reserved by the SCSI-2 standard. The library checks these fields for a value of 0. If a 0 is not present, the library returns Check Condition status with a sense key of Illegal Request (5h).

Control Byte The vendor unique portion of the Control byte (as indicated in the SCSI-2 standard) is defined for each specific command, if used. The library does not support linked commands or recognize the Flag bit.

Fields Not Implemented The field description, “This field not supported by the library,” indicates that the field is supported by the SCSI-2 standard, but is not implemented in the library.

SCSI Command Status Bytes

The library sends one status byte to the initiator in response to each command.

Table 1-4 contains a summary of the status bytes used by the library. Chapter 3 contains descriptions of the conditions that are checked and the order in which they are checked to enable the library to determine status after receiving a command.

Table 1-4 SCSI command status bytes supported by the library

Status	Hex Value	Description
Good	00h	Indicates that the library successfully completed the operation specified by the CDB.
Check Condition	02h	Indicates an error, exception, or abnormal condition that has caused sense information to be set.
Busy	08h	Indicates that the library is unable to accept a command from an initiator.
Reservation Conflict	18h	Indicates that the elements identified in the command are reserved by another initiator.

Note: The library may go to the Bus Free phase without reporting status in response to a command sequence. If this happens, immediately issue a REQUEST SENSE (03h) command to determine the cause of the unexpected disconnect.

Status Descriptions

The following are expanded descriptions of the status bytes listed in Table 1-4.

Good The library returns Good status to indicate that the operation specified by the CDB completed normally.

Check Condition The library returns Check Condition status to indicate that an error has occurred while it is executing a command. The library reports Check Condition status as soon as it detects the error unless it is disconnected from the SCSI bus. If the library is disconnected, it reports Check Condition status after the reconnect process.

Examples of situations that result in Check Condition status are listed below:

- The library detects a SCSI message error. For example, if immediately following selection, the initiator sends an Identify message with the reserved bits set to a value other than 0, the library returns Check Condition status.
- You send an Identify message with an invalid LUN or a command other than INQUIRY or REQUEST SENSE with an invalid LUN without first sending a valid Identify message.
- You send a command other than INQUIRY or REQUEST SENSE when there is a pending Unit Attention condition of the library.
- The library has an unrecoverable hardware error and receives a motion command.
- The library is not ready when it receives a motion command. For example, the library is not ready when it is operating in LCD mode or Console mode (see page 3-20 for more information about the Not Ready condition).
- You set a reserved field to a value other than 0 in the CDB or the parameter list for the requested command.
- You specify an invalid parameter in the CDB or parameter list for the requested command.
- The command fails for one of the reasons listed in the command chapter. For example, a MOVE MEDIUM command terminates with Check Condition status if the source for the move is empty.
- For specific situations that return Check Condition status, refer to the command descriptions in Chapter 4 through Chapter 25.

Busy The library returns Busy status to any initiator that sends a command other than INQUIRY or REQUEST SENSE when the library is disconnected from the SCSI bus or when it is waiting for a SCSI motion process to be aborted.

- If allowed, the library disconnects from the SCSI bus when performing any lengthy operations, such as a move operation.
- The library aborts motion processes in response to an Abort message from the initiator that requested the motion command. The library has to abort the motion process completely before it can process commands other than INQUIRY and REQUEST SENSE.

Reservation Conflict The library returns Reservation Conflict status to indicate that either the entire library or the elements requested to be accessed are currently reserved by another initiator. This status is reported until the initiator that reserved the library or elements issues a RELEASE (17h) command or a reset condition occurs.

Notes

2 Implementing SCSI Operations

This chapter provides information about performing the following common SCSI operations:

- Controlling parity checking
- Disconnecting from the SCSI bus
- Resetting the library
- Setting element addresses
- Using the cartridge inventory
- Moving cartridges
- Reserving elements
- Inquiring about the status of a specific operation
- Performing diagnostic tests
- Copying firmware

For detailed information about the SCSI commands that the library uses to perform these operations, refer to Chapter 4 through Chapter 25.

2.1 Controlling Parity Checking

When it receives data (commands, messages, and so on) across the SCSI bus from the initiator, the library can check this information for parity and notify you if a parity error has occurred. You can use either of the following methods to enable or disable parity checking:

- **Set the Parity bit on the Configuration page in the MODE SELECT (15h) command** (refer to Chapter 8). If you specify that you want to save the MODE SELECT parameters, the library saves this setting in nonvolatile memory and uses it whenever it is powered on or reset.

- **Set the parity option through the operator panel** (refer to the operating instructions provided with your library). This setting overrides the current MODE SELECT setting and becomes the new saved setting. The library saves this setting in nonvolatile memory and uses it whenever it is powered on or reset.

  Note: The last change to the parity setting takes precedence.

When the library is shipped from the factory, parity checking is enabled. That is, the LCD parity option is set to ON, and the Parity bit in the Mode parameters is set to 1. Table 2-1 summarizes how to change the parity setting.

Table 2-1 Enabling and disabling parity checking

If you want parity checking to be...	Use *either* of the following methods...	
	Set the LCD parity option to...	Set the MODE SELECT Parity bit to...
Enabled	ON	1
Disabled	OFF	0

Setting the Maximum Number of Parity Retries

If parity checking is enabled, you can specify the maximum number of times the library will retry a Message Out phase, Command Out phase, or Data Out phase when a parity error occurs. Specify a value between 0 and 255 for the Maximum Parity Retries field on the Parity page of the MODE SELECT command (refer to Chapter 8). The factory default is one retry.

2.2 Disconnecting from the SCSI Bus

The library disconnects from the SCSI bus to process a command that requires a lengthy amount of time, thereby freeing the SCSI bus to allow another I/O process to occur. The library can disconnect from the SCSI bus only if it has been granted permission to do so by the initiator. To grant the library permission to disconnect, do the following:

1. Select the library with the Attention signal to enable the message system.

2. Send the library an Identify message (C0h) with the DiscPriv bit set to 1.

If an initiator grants the library permission to disconnect and then makes a request to process a command that requires a lengthy amount of time, the following occurs:

1. The library disconnects from the SCSI bus to process the command. It does not send a Save Data Pointers message to the initiator.

2. When the library is finished processing the command, it arbitrates for the SCSI bus.

3. Upon winning arbitration, the library reselects the initiator and sends an Identify message to the initiator.

   This revives the I_T_L nexus (initiator-target-LUN connection) so that the initiator can retrieve the correct set of pointers for the I/O process.

4. The initiator restores the active pointers to their most recent saved values (which, in this case, are the initial values), and the library completes the I/O process.

While disconnected, processing the command, or trying to reconnect to the initiator, the library returns Busy status to other initiators requesting commands other than REQUEST SENSE (03h) and INQUIRY (12h). If the same initiator selects the library to request another command, an Invalid Initiator Reselection occurs. (See Chapter 3 for more information.)

2.3 Resetting the Library

You can use any of the following methods to reset the library and its tape drives.

Note: If the device that supplies SCSI bus terminator power is powered off, the RST line is left in an indeterminate state (either reset or not, depending on the voltages). It may be impossible to communicate with the library. To avoid this situation, you may want to put the library at the end of the SCSI bus so that you have an external terminator on one of the library's SCSI connectors.

- **Power-on reset.** Power the library off and back on again to reset the library and its tape drives.

- **Operator panel reset.** Press the Reset softkey on the operator panel to reset the library and its tape drives. A confirmation screen allows you to cancel or proceed with the reset.

- **SCSI bus reset.** Send a RST pulse on the SCSI bus for a minimum of 25 µsec. A SCSI bus reset immediately clears all devices from the bus, resets their associated equipment, and terminates all pending I/O processes.

- **SCSI Bus Device Reset message.** Issue a Bus Device Reset (0Ch) message to the library or a tape drive to reset the individual device. A Bus Device Reset message clears the device from the bus, causes all commands sent to it to be cleared, and terminates all pending I/O processes. Note that a Bus Device Reset message received by the library does not reset the tape drives or the SCSI bus.

Note: If the library is performing a cartridge move operation when it is reset, it completes the move operation.

Effect of Power-on and Operator Panel Resets

The power-on and operator panel resets have the following effects:

- If the library is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.

- The checksum of the flash code is validated.

- All library parameters are reset to their default states.

- The library performs its power-on self-test.

- A power-on reset of the library resets the tape drives and causes them to perform their power-on self tests.

After a power-on reset, the library will respond on the SCSI bus within 30 seconds.

Effect of SCSI Bus and Bus Device Resets

A SCSI bus reset or device reset has the following effects:

- If the library is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.
- All library parameters are reset to their default states.
- A SCSI bus reset also resets the tape drives.

After a SCSI bus or device reset, the library will respond on the SCSI bus within 250 msec.

Note: If the device that supplies SCSI bus terminator power is powered off, the RST line is left in an indeterminate state (either reset or not, depending on the voltages). It may be impossible to communicate with the library. To avoid this situation, you may want to place the library at the end of the SCSI bus (place an external terminator on one of the library's SCSI connectors).

2.4 Setting Element Addresses

If you want, you can assign different element addresses to the library's elements (storage, data transfer, import/export, and medium transport elements). You may want to do this to create a single "virtual" library from multiple libraries on multiple SCSI buses. By assigning unique element addresses to every element in all of the libraries in your system, you can ensure that cartridges can be easily located no matter which library they are in.

The figures on page 1-7 through page 1-9 show the default element addresses assigned to each element in the library. When assigning new addresses, assign the lowest address to the fixed cartridge. The library automatically assigns the others in sequential order.

To assign different element addresses, use the MODE SELECT (15h) command. To view the current addresses, use the MODE SENSE (1Ah) command, view the assigned element addresses through the operator panel, or use diagnostic software on a computer connected to the serial port.

2.5 Understanding the Cartridge Inventory

The library maintains a cartridge inventory in nonvolatile memory. The inventory contains information about the following element locations:

- Medium transport element (one robot)
- Import/export elements (one entry/exit port containing up to five data cartridges)
- Storage elements (six, twelve, or eighteen data cartridge magazines with five data cartridges each and one fixed cartridge slot)
- Data transfer elements (from two to six tape drives)

The library uses the information stored in the cartridge inventory to process SCSI commands.

Establishing the Cartridge Inventory

The library automatically updates the cartridge inventory when it is powered up. You can also use the INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command to establish the cartridge inventory whenever the integrity of the inventory becomes questionable (for example, after the door has been opened) or whenever you want to read the bar code labels.

Retrieving Cartridge Inventory Information

After the current cartridge inventory has been determined using an INITIALIZE ELEMENT STATUS command, you can retrieve the inventory information by issuing a READ ELEMENT STATUS (B8h) command (see Chapter 14).

When the Cartridge Inventory is Questionable

The library must ensure that the data integrity of the cartridge inventory remains intact. The cartridge inventory is reset to a questionable state when there is any possibility that a user manually moved cartridges, added cartridges, removed cartridges, exchanged magazines, or removed or replaced a cartridge in a tape drive. The library's cartridge inventory becomes questionable when:

- The library is powered off and then on
- The library's door is opened and then closed

Types of Information Stored in the Cartridge Inventory

As described in this section, the cartridge inventory contains the following information for every element location:

- Element index and element address
- Cartridge magazine or tape drive present
- Element occupied status
- Bar code label information
- Vertical, horizontal, reach, and drum axis coordinates
- SCSI element reservation information
- Tape drive accessible status
- Cartridge pick and put (place) retry counts
- Total number of cartridge puts (places)
- Source element address

Element Index and Element Address

The cartridge inventory contains an Element Index and Element Address field for each element location, as follows:

Element Index The Element Index field contains an index number for the element location. The element index is fixed for each element location and cannot be changed. The element indexes are numbered from 0 to 501 and are grouped as follows:

0	Fixed cartridge slot
1 – 90	Cartridge slots
401 – 405	Entry/exit port
451	Tape drive 1
452	Tape drive 2
453	Tape drive 3
454	Tape drive 4
455	Tape drive 5
456	Tape drive 6
501	Robot

You use the element indexes when specifying sources and destinations for operator panel or console move operations.

Element Address The Element Address field contains the address of the element location. You use element addresses to reference element locations when you issue SCSI commands to the library. Unlike element indexes, you can change element addresses if you want. To change element addresses, use the MODE SELECT (15h) command (see Chapter 8). The figures on page 1-7 through page 1-9 show the element indexes and the default element addresses for the library.

Present

The Present flag indicates whether a specific magazine or tape drive is installed. It is also used to indicate whether the robot, fixed cartridge slot, and entry/exit port are present. If the element index references a storage element, the Present flag indicates whether a particular data cartridge magazine is installed. If the element index references a tape drive, this flag indicates whether that particular tape drive is installed.

The values for this flag are as follows:

0 – Not installed
1 – Installed

Note: This flag is always set to 1 for the robot, the fixed cartridge slot, and the calibration block. The flag is set to 1 for each of the elements in the entry/exit port when the port is retracted and the magazine is installed. It is set to 0 when the port is extended.

When the library is reset, or when the door is opened and then closed, the library performs its initialization process. During this process, the library checks to see how many tape drives and magazines are installed. The Present flag is updated accordingly.

Element Occupied Status

The library uses the Occupied and Occupied Valid flags in the cartridge inventory to determine whether a given element is occupied as follows:

Occupied The Occupied flag indicates whether the library considers the specified element location to contain a data cartridge, as follows:

0 – The element location does not contain a data cartridge
1 – The element location contains a data cartridge

Occupied Valid The Occupied Valid flag indicates whether the Occupied flag is accurate, as follows:

0 – The Occupied flag is questionable (may not be accurate)
1 – The Occupied flag is accurate

The Occupied Valid flag is set to 0 after the library is reset or when the door is opened to indicate that a data cartridge could have been added or removed from the location. The Occupied Valid flag is set to 1 when an operation that validates the Occupied flag is performed (for example, an initialize or move operation).

Bar Code Label Information

➤ **Important** This information is available only if bar code labels are attached to each cartridge.

The library uses the following fields in the cartridge inventory to indicate bar code label information:

- Label
- Label Valid
- Label Error
- Label Scan Retries
- Send Volume Match

These fields are used only if you have attached bar code labels to each data cartridge and you have scanned the labels. Descriptions of these fields follow:

Label If the element location contains a cartridge whose bar code label has been scanned, the Label field contains the cartridge label.

Label Valid The Label Valid field indicates whether the Label field is accurate, as follows:

0 – The Label field is not accurate
1 – The Label field is accurate

The Label Valid flag is set to 0 after the library is reset or when the door is opened to indicate that a cartridge may have been added or removed from the location. The Label Valid flag is set to 1 when the label is successfully scanned.

Label Error The Label Error field indicates whether the bar code scanner was unable to read the cartridge label, as follows:

0 – The bar code scan was successful, a reset condition occurred, or the door was opened.

60 – The bar code scanner could not read the bar code label because there was no label on the cartridge.

61 – The bar code scanner could not read the bar code label because the label was unreadable.

62 – The bar code scanner could not read the bar code label because the data cartridge magazine or the tape drive was not installed.

Label Scan Retries The Label Scan Retries field contains the total number of bar code scanner retries for each cartridge. This field is cleared when the library is reset.

Send Volume Match The Send Volume Match flag indicates whether the cartridge label matched the template sent with the last SEND VOLUME TAG (B6h) command, as follows:

0 – The label did not match the template
1 – The label matched the template

The REQUEST VOLUME ELEMENT ADDRESS (B5h) command references the Send Volume Match flag and sets it to 0 after the label information is returned to the initiator. This flag is also set to 0 when the library is reset or when the door is opened to indicate that a data cartridge may have been added or removed from the location.

Axis Coordinates

The cartridge inventory contains the axis positions for each element, as follows:

Vertical Axis The Vertical Axis field indicates the distance the robot has to move along the vertical axis from its home position to the specified element location. (This field is not used for the robot.)

Reach Axis The Reach Axis field indicates the distance the robot has to move from its home position to touch the magazine or a data cartridge in the magazine. (This field is not used for the robot, tape drives, or entry/exit port.)

Drum Axis The Drum Axis field indicates the rotational position of the element.

Horizontal Axis The Horizontal Axis field indicates the distance the robot has to move along the horizontal axis from its home position to the specified element location.

SCSI Element Reservation

Using the RESERVE (16h) command, an initiator can either reserve the entire library as a unit or reserve individual elements or groups of elements for its exclusive use. The library uses three fields to indicate element reservation by an initiator:

Reserved The Reserved flag indicates whether the element is reserved by an initiator, as follows:

0 – The element is not reserved
1 – The element is reserved

Host ID The Host ID field contains the SCSI ID of the initiator that reserved the element.

Reservation ID The Reservation ID field contains the reservation ID as set in the RESERVE command.

Note: When the library is reset, all reservation information is cleared. For more information about the RESERVE command, see Chapter 20.

Tape Drive Accessible

The Tape Drive Accessible flag indicates whether a particular tape drive is empty, a cartridge is loaded in the tape drive, or the cartridge is ejected, as follows:

0 – A cartridge may be loaded in the drive
1 – The drive is empty, or the cartridge is unloaded or ejected and ready to be picked

This flag is set to 0 when the library loads a cartridge in the tape drive and after the library is reset or the door is opened.

This flag is set to 1 when the library detects that the tape drive is accessible. The library can detect that the drive is accessible after a move operation, after a cartridge scan operation, or when the tape drive notifies the library that it is accessible.

Cartridge Pick and Put Retry Counts

The Cartridge Pick Retry Counts and Cartridge Put Retry Counts fields indicate the total number of pick retries and the total number of put (place) retries for each element location. These fields are cleared when the library is reset.

Total Number of Cartridge Puts

The Total Number of Cartridge Puts field indicates the total number of put operations for each element location. Each time a cartridge is moved to an element location, the total number of puts for that location is incremented. This field is cleared when the library is reset.

Source Element Address

The Source Element Address field shows the address of the last storage element from which the cartridge was moved.

Whenever the library is reset or the door is opened, the Source Element Address field is set to FFFFh to indicate that a magazine could have been added or removed from the location. After a subsequent move operation, the Source Element Address field is set to the address of the source cartridge.

2.6 Moving Cartridges

To instruct the library to move cartridges between the storage locations, the tape drives, and the entry/exit port, issue the MOVE MEDIUM (A5h) command. The MOVE MEDIUM command allows you to specify a source element address and a destination element address for a specific move operation.

2.7 Reserving Elements

To reserve specific cartridge locations, tape drives, the robot, the entry/exit port, or the entire library for exclusive use by one initiator, use the RESERVE (16h) command. For example, if any initiator needs to access specific cartridges, it can issue the RESERVE command to set aside those storage locations so that no other initiator can access the cartridges.

Note: Use a tape drive's RESERVE UNIT command to ensure that the initiator has exclusive use of the tape drive for tape operations.

When an initiator reserves an element or the entire library, the same initiator must use the RELEASE (17h) command to cancel the reservation.

2.8 Inquiring about Library Status

To inquire about library status, you can use the following commands:

TEST UNIT READY (00h) Command

Use this command to determine if the library is ready to accept all other commands, including motion commands. This is not a request for a self-test, which occurs at power-on. This command returns Good status if the library is ready to accept any command without returning Check Condition, Reservation Conflict, or Busy status.

REQUEST SENSE (03h) Command

If an error occurs during an operation, use the REQUEST SENSE (03h) command to determine the type of error. This command returns the following information:

- Sense key for the error indicating the type of error (Not Ready, Hardware Error, Illegal Request, Unit Attention, or Aborted Command)
- Additional sense code (ASC) indicating the type of error in the given sense key category
- Additional sense code qualifier (ASCQ) indicating the specific error in the sense key and ASC categories

Note: This information is also available through the operator panel and the serial port.

INQUIRY (12h) Command

Use the INQUIRY (12h) command to obtain information about the library's firmware level and the version of SCSI supported by the library.

LOG SENSE (4Dh) Command

Use the LOG SENSE command to retrieve the library's statistical and state information. This type of information includes the following:

- Statistics
- History of recent events
- State of the hardware
- Element statistics
- Cartridge scan retries
- Element position information
- Drive statistics

2.9 Performing Diagnostics

You can perform diagnostics to find out detailed information about library operations. The SEND DIAGNOSTIC (1Dh) command allows you to run special diagnostic tests. The RECEIVE DIAGNOSTIC RESULTS (1Ch) command allows you to obtain diagnostic results of library operations.

2.10 Copying Firmware

If you want to copy the firmware from one library to another, or if new firmware becomes available, you can use the READ FIRMWARE (D0h), READ BUFFER, (3Ch) WRITE BUFFER (3Bh), and WRITE FIRMWARE (D1h) commands.

Use the READ BUFFER or READ FIRMWARE command to read the firmware from a library's flash memory (EEPROM). Use the WRITE BUFFER command to load new firmware across the SCSI bus from the initiator to the library's flash memory.

Notes

3 General Command Processing

This chapter describes the general conditions that the library checks and the errors that can occur during the Command phase.

Note: This chapter only describes the processing of a command through the Command phase. If the message system is enabled, additional errors can occur anytime the library responds to ATN with a Message Out phase. For more information about the message system and possible error conditions, see Appendix B.

The sequence of events that occurs when the library receives a command is referred to as *general command processing*. General command processing occurs during the Command phase (that is, after the library is selected by an initiator and when it is in the process of reading the command descriptor block).

General command processing is affected by:

- Whether the message system is enabled when the library is selected
- Which command and parameters were sent

This chapter lists general conditions that the library checks and the effect on each command if the condition occurs. The library checks the conditions in the following order:

1. Error conditions before the library receives the CDB

2. Error conditions while the library is receiving the CDB

3. Invalid logical unit number

4. Invalid initiator reselection condition

5. Reservation conflict condition

6. Busy condition
7. Pending Unit Attention condition
8. Unrecoverable hardware error condition
9. Not Ready condition
10. CDB reserved bit set

Note that if the library can read the CDB successfully and none of these ten conditions are present, or if they are present but do not affect the requested command, the library checks for any additional conditions specific to the command. For information about the conditions and errors specific to each command, refer to the section called “Command Execution” in the chapter for that command.

Condition 1. Error Conditions Before the CDB is Received

Did an error occur before the library received the CDB?

Note: Error conditions before the CDB is received can occur only when the message system is enabled and the library detects an error during or after the first Message Out phase following selection.

NO

Go to Condition 2 (page 3-5).

YES

The library's handling of errors during the first Message Out phase is independent of the requested command, since the command is not yet known. The following errors can occur:

- **Invalid first message.** If the first message received during the Message Out phase following selection is not the Abort message, Bus Device Reset message, or Identify message, the library immediately goes bus free. Sense data is not set because a logical unit number (LUN) has not been established.

- **Invalid Identify message.** If the Identify message has one or more reserved bits set, the library returns Check Condition status and sets the sense data as follows:

Sense Key	Illegal Request (5h)
ASC	Invalid Bits in the Identify Message (3Dh)
ASCQ	0

- **Improper message sequence.** If the initiator sent an improper message sequence (for example, the initiator sends an Identify message followed by a Message Parity Error message), the library returns Check Condition status and sets the sense data as follows:

Sense Key	Aborted Command (Bh)
ASC	Message Error (43h)
ASCQ	0

- **Unexpected SCSI status.** If the library encounters an unusual condition, such as an unexpected status returned from the SCSI hardware, it sets the sense data as follows:

Sense Key	Hardware Error (4h) or Aborted Command (Bh)
ASC	Internal Target Failure (44h)
ASCQ	80h to AFh

When such an error occurs, there may be a problem with the library. If this is the case, contact your vendor.

Condition 2. Error Conditions while Receiving the CDB

Did an error occur while the library was receiving the CDB?

NO

Go to Condition 3 (page 3-6).

YES

The library's handling of errors received during the command phase is independent of the requested command. The following errors can occur:

- **Unsupported Operation (OP) code received**. If the OP code is not supported, the library receives the remaining CDB bytes, then returns Check Condition status with the sense data set as follows:

Sense Key	Illegal Request (5h)
ASC	Invalid OP Code (20h)
ASCQ	00h

- **Parity error detected in CDB byte.** If a parity error is detected in a CDB byte, the library's response depends on whether the message system is enabled.

Condition 3. Invalid Logical Unit Number

Was the logical unit number (LUN) in the Identify message non-zero, or if no Identify message was sent, was the LUN in the CDB non-zero?

NO

Go to Condition 4 (page 3-9).

YES

See Table 3-1 for information about how the library responds to an invalid LUN for each command.

Table 3-1 Command handling when an invalid LUN has been sent to the library

When the LUN is invalid and you issue this command...	The library does this...		
	Terminates the command and sets sense data.[a] Returns Check Condition status.	Continues processing the command. Sets inquiry data.[b]	Continues processing the command. Sets sense data.[a]
INITIALIZE ELEMENT STATUS	✔		
INITIALIZE ELEMENT STATUS WITH RANGE	✔		
INQUIRY		✔	
LOG SENSE	✔		
MODE SELECT	✔		
MODE SENSE	✔		
MOVE MEDIUM	✔		
POSITION TO ELEMENT	✔		
PREVENT/ALLOW MEDIUM REMOVAL	✔		
READ BUFFER	✔		
READ ELEMENT STATUS	✔		
READ FIRMWARE	✔		
RECEIVE DIAGNOSTIC RESULTS	✔		
RELEASE	✔		
REQUEST SENSE			✔
REQUEST VOLUME ELEMENT ADDRESS	✔		
RESERVE	✔		
SEND DIAGNOSTIC	✔		
SEND VOLUME TAG	✔		
TEST UNIT READY	✔		
WRITE BUFFER	✔		
WRITE FIRMWARE	✔		

[a] The library sets the sense data as follows:
Sense key = Illegal Request (5h)
ASC = Logical unit not supported (25h)
ASCQ = 0

[b] The library sets byte 00 in the Inquiry data to Invalid Peripheral Byte (7Fh), where the Peripheral Qualifier field (bits 7 to 5) is 011b and the Peripheral Device Type field (bits 4 to 0) is 1Fh.

About Logical Unit Numbers

The library supports a logical unit number (LUN) of 0 only. You can specify the LUN in either of two ways:

- By sending an Identify message with the LUN field set to 0
- By sending a CDB with the LUN field set to 0 and not sending an Identify message

If the library is selected with the Attention signal and receives an Identify message during the first Message Out phase, it determines the LUN from the Identify message and ignores the LUN in the CDB. If the library does not receive an Identify message after selection, it uses the LUN in the CDB.

Preservation of Sense Data for LUN 0

To ensure that the initiator receives the correct sense data for the specified LUN, the sense data for LUN 0 is not affected by commands issued to an invalid LUN.

Example — Invalid LUN Sent to the Library

1. Initiator 3 selects the library with a LUN of 0 and requests that a cartridge be moved from location 0 to location 3. Location 0 is empty, so the move operation terminates with Check Condition status.

2. Initiator 3 selects the library with a LUN of 2 and issues the REQUEST SENSE command. The following sense data is returned and the command completes with Good status.

Sense Key	Illegal Request (5h)
ASC	Logical Unit Not Supported (25h)
ASCQ	0

3. Initiator 3 selects the library with a LUN of 0 and issues another REQUEST SENSE command. The following sense data is returned and the command completes with Good status.

Sense Key	Illegal Request (5h)
ASC	Move Error (3Bh)
ASCQ	Source for Move Empty (3Dh)

Condition 4. Invalid Initiator Reselection

Has an invalid initiator reselection occurred?

NO

Go to Condition 5 (page 3-10).

YES

An invalid initiator reselection condition occurs when the library has disconnected from an initiator to perform a lengthy operation and the same initiator selects the library and issues a command to LUN 0. The library takes the following actions:

1. It aborts the command that it was processing.
2. It returns Check Condition status and sets the sense data as follows:

Sense Key	Aborted Command (Bh)
ASC	Overlapped Commands Attempted (4Eh)
ASCQ	0

Condition 5. Reservation Conflict

Is the entire library reserved by a different initiator?

Note: Refer to Chapter 20 for more information about the RESERVE command.

NO

Go to Condition 6 (page 3-12).

YES

A different initiator has reserved the entire library. See Table 3-2 for command handling.

Table 3-2 Command handling when the library is reserved by a different initiator

When the library is reserved by a different initiator and you issue this command...	The library does this...	
	Terminates the command and returns Reservation Conflict status.	**Continues processing the command.**
INITIALIZE ELEMENT STATUS	✔	
INITIALIZE ELEMENT STATUS WITH RANGE	✔	
INQUIRY		✔
LOG SENSE	✔	
MODE SELECT	✔	
MODE SENSE	✔	
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
PREVENT/ALLOW MEDIUM REMOVAL (PREVENT command)	✔	
PREVENT/ALLOW MEDIUM REMOVAL (ALLOW command)		✔
READ BUFFER	✔	
READ ELEMENT STATUS	✔	
READ FIRMWARE	✔	
RECEIVE DIAGNOSTIC RESULTS	✔	
RELEASE		✔
REQUEST SENSE		✔
REQUEST VOLUME ELEMENT ADDRESS	✔	
RESERVE	✔	
SEND DIAGNOSTIC	✔	
SEND VOLUME TAG	✔	
TEST UNIT READY	✔	
WRITE BUFFER	✔	
WRITE FIRMWARE	✔	

Condition 6. Busy

Is the library busy?

Note: The library returns Busy status to an initiator when it is disconnected from the SCSI bus to process a SCSI command for a different initiator or when it is aborting a SCSI motion command.

NO

Go to Condition 7 (page 3-14).

YES

See Table 3-3 for command handling.

While the library is in the process of aborting a motion command, it returns Busy status to all initiators requesting any command other than INQUIRY (12h) and REQUEST SENSE (03h). This allows the library to complete the abort process as quickly as possible. The library aborts a motion command under the following conditions:

- When it receives an Abort message from the same initiator that requested the command (see Section 1.5 for information about the Abort message).
- After an invalid initiator reselection (see “Condition 4. Invalid Initiator Reselection” on page 3-9).

Table 3-3 Command handling when the library is busy

When the library is busy and you issue this command...	The library does this...	
	Terminates the command and returns Busy status.	Continues processing the command.
INITIALIZE ELEMENT STATUS	✔	
INITIALIZE ELEMENT STATUS WITH RANGE	✔	
INQUIRY		✔
LOG SENSE	✔	
MODE SELECT	✔	
MODE SENSE	✔	
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
PREVENT/ALLOW MEDIUM REMOVAL	✔	
READ BUFFER	✔	
READ ELEMENT STATUS	✔	
READ FIRMWARE	✔	
RECEIVE DIAGNOSTIC RESULTS	✔	
RELEASE	✔	
REQUEST SENSE		✔
REQUEST VOLUME ELEMENT ADDRESS	✔	
RESERVE	✔	
SEND DIAGNOSTIC	✔	
SEND VOLUME TAG	✔	
TEST UNIT READY	✔	
WRITE BUFFER	✔	
WRITE FIRMWARE	✔	

Condition 7. Pending Unit Attention

Is there a pending Unit Attention condition for the library?

NO

Go to Condition 8 (page 3-17).

YES

See Table 3-4 for command handling.

Table 3-4 Command handling when a Unit Attention condition is pending

When the library has a Unit Attention condition pending and you issue this command...	The library does this...	
	Sets sense data for the pending Unit Attention and then clears the Unit Attention. Terminates the command and returns Check Condition status.	Continues processing the command. Reports any pending status. Preserves the pending Unit Attention sense data.
INITIALIZE ELEMENT STATUS	✔	
INITIALIZE ELEMENT STATUS WITH RANGE	✔	
INQUIRY		✔
LOG SENSE	✔	
MODE SELECT	✔	
MODE SENSE	✔	
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
PREVENT/ALLOW MEDIUM REMOVAL	✔	
READ BUFFER	✔	
READ ELEMENT STATUS	✔	
READ FIRMWARE	✔	
RECEIVE DIAGNOSTIC RESULTS	✔	
RELEASE	✔	
REQUEST SENSE		✔
REQUEST VOLUME ELEMENT ADDRESS	✔	
RESERVE	✔	
SEND DIAGNOSTIC	✔	
SEND VOLUME TAG	✔	
TEST UNIT READY	✔	
WRITE BUFFER	✔	
WRITE FIRMWARE	✔	

About Unit Attention Condition

The library establishes a Unit Attention condition when a user may have accessed any of the cartridges or tape drives or when any of the internal parameters of the library have been changed. Specifically, the library establishes a Unit Attention condition after any of the following happen:

- The library is reset (whether by a power-on reset, a Bus Device Reset message, a SCSI bus reset, or an operator panel reset).
- The library's firmware is upgraded.
- The library's door is closed.
- The MODE SELECT parameters are changed by an initiator other than the one attempting to communicate with the library.
- The library is put in SCSI mode after operating in another control mode (refer to *Exabyte 690D Installation and Operation* for instructions for switching between control modes).
- The entry/exit port is retracted.

For example, the library reports Not Ready when the door is open and Unit Attention as soon as it closes.

First Command Received after Unit Attention is Reported

If REQUEST SENSE is the first command received after the Unit Attention condition is reported with Check Condition status, the library sends the sense data for the Unit Attention condition to the initiator.

If the library receives any other command after reporting the Unit Attention condition, the library clears the sense data for the Unit Attention and executes the command normally.

Reporting of Multiple Unit Attention Conditions

The library does not stack Unit Attention conditions. Whenever there are two or more Unit Attention conditions, the library reports only the last one encountered. For example, if the library is powered on, returned to SCSI mode, and the initiator issues its first SCSI command, the library only reports that it has just been returned to SCSI mode.

Condition 8. Unrecoverable Hardware Error

Has an unrecoverable hardware error occurred?

NO

Go to Condition 9 (page 3-20).

YES

The library is able to process SCSI commands after an unrecoverable hardware error has occurred unless the failure occurs within the SCSI interface. When the library receives SCSI commands after an unrecoverable hardware error, it processes the commands as described in Table 3-5.

Table 3-5 Command handling when an unrecoverable hardware error has occurred

When an unrecoverable hardware error has occurred and you issue this command...	**The library does this...**	
	Sets sense data for the existing hardware error. **Terminates the command and returns Check Condition status.**	**Continues processing the command.**
INITIALIZE ELEMENT STATUS	✔	
INITIALIZE ELEMENT STATUS WITH RANGE	✔	
INQUIRY		✔
LOG SENSE		✔
MODE SELECT		✔
MODE SENSE		✔
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
PREVENT/ALLOW MEDIUM REMOVAL		✔
READ BUFFER		✔
READ ELEMENT STATUS		✔
READ FIRMWARE		✔
RECEIVE DIAGNOSTIC RESULTS		✔
RELEASE		✔
REQUEST SENSE		✔
REQUEST VOLUME ELEMENT ADDRESS		✔
RESERVE		✔
SEND DIAGNOSTIC	✔	
SEND VOLUME TAG		✔
TEST UNIT READY	✔	
WRITE BUFFER		✔
WRITE FIRMWARE		✔

About Hardware Error Conditions

A Hardware Error condition occurs when the library detects a failure that prevents it from finishing a requested operation. If the error requires intervention from an operator, the failure is determined to be an *unrecoverable hardware error* and the following occurs:

- The library displays the error code for the failure on the LCD.
- The library does not perform motion commands.

For a complete list of hardware error conditions and the sense data set for each, refer to Appendix C.

Clearing an Unrecoverable Hardware Error

To clear an unrecoverable hardware error, do the following:

1. Determine the cause of the error and fix it. This may involve actions such as removing a cartridge from the robot.

   Note: Fixing some hardware errors may require that you turn off the power first.

2. Reset the library. Refer to Section 2.3 on page 2-3 for a description of reset alternatives and the effects of each.

Condition 9. Not Ready

Has a Not Ready condition occurred?

NO

Go to Condition 10 (page 3-25).

YES

The library is unable to accept or perform any motion commands. See Table 3-6 for command handling.

Table 3-6 Command handling when the library is Not Ready

When the library is Not Ready and you issue this command...	The library does this...	
	Sets sense data for the Not Ready condition. Terminates the command and returns Check Condition status.	Continues processing the command.
INITIALIZE ELEMENT STATUS	✔	
INITIALIZE ELEMENT STATUS WITH RANGE	✔	
INQUIRY		✔
LOG SENSE		✔
MODE SELECT		✔
MODE SENSE		✔
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
PREVENT/ALLOW MEDIUM REMOVAL		✔
READ BUFFER		✔
READ ELEMENT STATUS	✔	
READ FIRMWARE		✔
RECEIVE DIAGNOSTIC RESULTS		✔
RELEASE		✔
REQUEST SENSE		✔
REQUEST VOLUME ELEMENT ADDRESS	✔	
RESERVE		✔
SEND DIAGNOSTIC	✔	
SEND VOLUME TAG	✔	
TEST UNIT READY	✔	
WRITE BUFFER		✔
WRITE FIRMWARE		✔

About the Not Ready Condition

The library establishes the Not Ready condition when it is unable to accept any motion commands. The library performs all other commands as specified. The library is not ready when:

- **Its initialization routine is in progress.** Initialization occurs after any of the following:
  - The library is powered on or reset.
  - The front door is closed.
- **It is operating in LCD mode or Console mode**. (Refer to *Exabyte 690D Installation and Operation* for instructions for switching between control modes.)
- **Its door is opened.** When the library's door is opened, electric current to all motors is shut off.
- **The entry/exit port is extended.**

The library takes different corrective actions for different types of Not Ready conditions. The following sections describe how the library handles the different Not Ready conditions.

Initialization Process

If a Not Ready condition is caused by a reset condition, the following occurs:

1. The library establishes a Unit Attention condition as a result of the reset and begins its initialization process.

2. During the initialization sequence, the library returns Check Condition status in response to each motion command. If the library receives a REQUEST SENSE command during initialization, it reports the following:

Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Initialization in Progress (01h)

Operating in LCD Mode or Console Mode

If a Not Ready condition occurs because the library is operating in either LCD or Console mode, the following occurs:

1. While the library is operating in one of these modes, it returns Check Condition status in response to each motion command. If the library receives a REQUEST SENSE command, it reports the following:

When in Console mode:	
Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Console mode (89h)
When in LCD mode:	
Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	LCD mode (8Dh)

2. When the library is operating in SCSI mode again, it establishes a Unit Attention condition. If the library receives a REQUEST SENSE command, it reports the following:

After Console mode:	
Sense key	Unit Attention (6h)
ASC	Not Ready to Ready transition (28h)
ASCQ	Console mode (89h)
After LCD mode:	
Sense key	Unit Attention (6h)
ASC	Not Ready to Ready transition (28h)
ASCQ	LCD mode (8Dh)

Door Open

If a Not Ready condition occurs because the library's door is open, the following occurs:

1. While the front door is open, the library returns Check Condition status in response to each motion command. If the library receives a REQUEST SENSE command, it reports the following:

Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Front door is open (83h)

2. After the door is closed, the library begins its initialization process.

3. During its initialization process, the library returns Check Condition status to each motion command. If the library receives a REQUEST SENSE command during initialization, it reports the following:

Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Initialization in Progress (01h)

4. After its initialization process is complete, the library establishes a Unit Attention condition and reports the following in response to a REQUEST SENSE command:

Sense key	Unit Attention (6h)
ASC	Not Ready to Ready transition (28h)
ASCQ	Front door was opened then closed (00h)

Condition 10. CDB Reserved Bit Set

Is a reserved bit set to 1 in the CDB?

Note: The library checks to make sure all of the reserved bits are set to 0 in the CDB. The reserved bits, if present, are checked from the most significant bit in the least significant byte of the CDB to the least significant bit in the most significant byte of the CDB.

NO

The general command processing for this command completed successfully. For information about the conditions and errors specific to a SCSI command, refer to the section called "Command Execution" in the chapter for that command.

YES

This error is handled in the same manner for every command. The library returns Check Condition status after the first invalid reserved bit is detected and does not continue processing the remainder of the CDB. The sense data is set as follows:

Sense Key	Illegal Request (5h)
ASC	Invalid Field in CDB (24h)
ASCQ	00h
SKSV	1
C/D	1
BPV	1
Bit Pointer	Bit number of invalid reserved bit
Field Pointer	CDB byte number of invalid reserved bit

Notes

4 INITIALIZE ELEMENT STATUS (07h)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	1	1	1
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	NBL	0	Reserved				0	0

4.1 About This Command

The INITIALIZE ELEMENT STATUS command causes the library to check all elements for cartridges. If bar code labels are attached to each cartridge, the library also scans the bar code labels unless the NBL field in the CDB is set to 1 (see page 4-3). The information obtained by this command can be returned to the initiator using the READ ELEMENT STATUS (B8h) command.

Notes:

- For specifications for the bar code labels that can be used with the library, refer to the *Exabyte Bar Code Label Specification for DLT Cartridges*.
- Refer to *Exabyte 690D Installation and Operation* for information about positioning the bar code labels on the data cartridges.
- The library cannot scan labels on cartridges that are in a tape drive. However, it can scan cartridges that are in the entry/exit port.

When to Use This Command

The library supports two INITIALIZE ELEMENT STATUS commands. Use one of these two commands after a reset or any manual operation or configuration change that may affect the status of the cartridge inventory.

Use these guidelines to decide which of the two commands to use:

- Use the INITIALIZE ELEMENT STATUS (07h) command when you want the entire cartridge inventory to be updated. When you use this command, the library checks every element for the presence of a data cartridge.

- Use the INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command to update the cartridge inventory for a range of cartridges when a manual operation or configuration change has affected those cartridges. When you use this command, the library checks only the elements in the specified element address range. For more information, see Chapter 5.

Time to Complete This Command

The amount of time required for the library to perform an INITIALIZE ELEMENT STATUS command depends on whether the following conditions are met:

- Bar code labels are attached to the cartridges.

- The No Bar Code Label (NBL) bit in the command is set. (When this bit is 1, the library does not scan bar code labels.)

For specific information about the time required to complete this command, refer to the *Exabyte 690D Product Specification*.

4.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

NBL (No Bar Code Labels) – Byte 05, Bit 7

This field indicates whether the library should scan the bar code labels on each cartridge, as follows:

0 – Scan the bar code labels
1 – Do not scan the bar code labels

- When this field is set to 0 (scan labels), the library scans the labels and saves this information for the application to use during a Read Element Status operation.

- When this field is set to 1, the library checks for the presence of a cartridge at each location by detecting full or empty slots in a cartridge magazine with the laser, but does not scan the bar code labels.

4.3 Effects on the Cartridge Inventory

The library updates the cartridge inventory after it checks for the presence of a cartridge at each location and (if requested) scans the bar code labels. This section describes how the library updates the cartridge inventory.

Table 4-1 through Table 4-3 illustrate the various outcomes of a requested scan operation and the effect on the cartridge inventory.

- A request is made to scan a cartridge in a storage location or in the entry/exit port and the scan operation completed successfully (the library bar code scanner was able to read the label on the cartridge or the location was empty). See Table 4-1 for details about how the cartridge inventory is updated.

Table 4-1 Effect on the cartridge inventory of a cartridge scan in a storage location or the entry/exit port

This cartridge inventory field...	...is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	cartridge label
Label Valid	0	1
Label Error	0	0
Label Scan Retries	0	updated if retried
Source Address	no change	no change

- A request is made to check for the presence of a cartridge in a storage location or the entry/exit port and the operation completed successfully. See Table 4-2 for more information about how the cartridge inventory is updated.

Table 4-2 Effect on the cartridge inventory of a request to check the occupied status of a storage location or the entry/exit port

This cartridge inventory field...	...is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	no change
Label Valid	0	no change
Label Error	0	no change
Label Scan Retries	0	no change
Source Address	no change	no change

- A request is made to scan a cartridge in a storage location or the entry/exit port, and the operation failed because the bar code scanner was unable to read the label on the cartridge. The bar code scan will fail if the library was unable to read the label or if the cartridge does not have a label. The scan will not fail if the location is empty. See Table 4-3 for details about how the cartridge inventory is updated.

Table 4-3 Effect on the cartridge inventory when the library is unable to read a cartridge label in a storage location or in the tape drive

This cartridge inventory field...	...is changed to the following when the library cannot read the cartridge label
Occupied	1
Occupied Valid	1
Label	blanks
Label Valid	0
Label Error	0 – No error 60 – No label on cartridge 61 – Label present but unreadable 62 – No cartridge magazine or tape drive not installed
Label Scan Retries	updated if retried
Source Address	no change

4.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from executing. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 4-1 shows the steps that the library takes when executing the command through the Bus Free phase.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

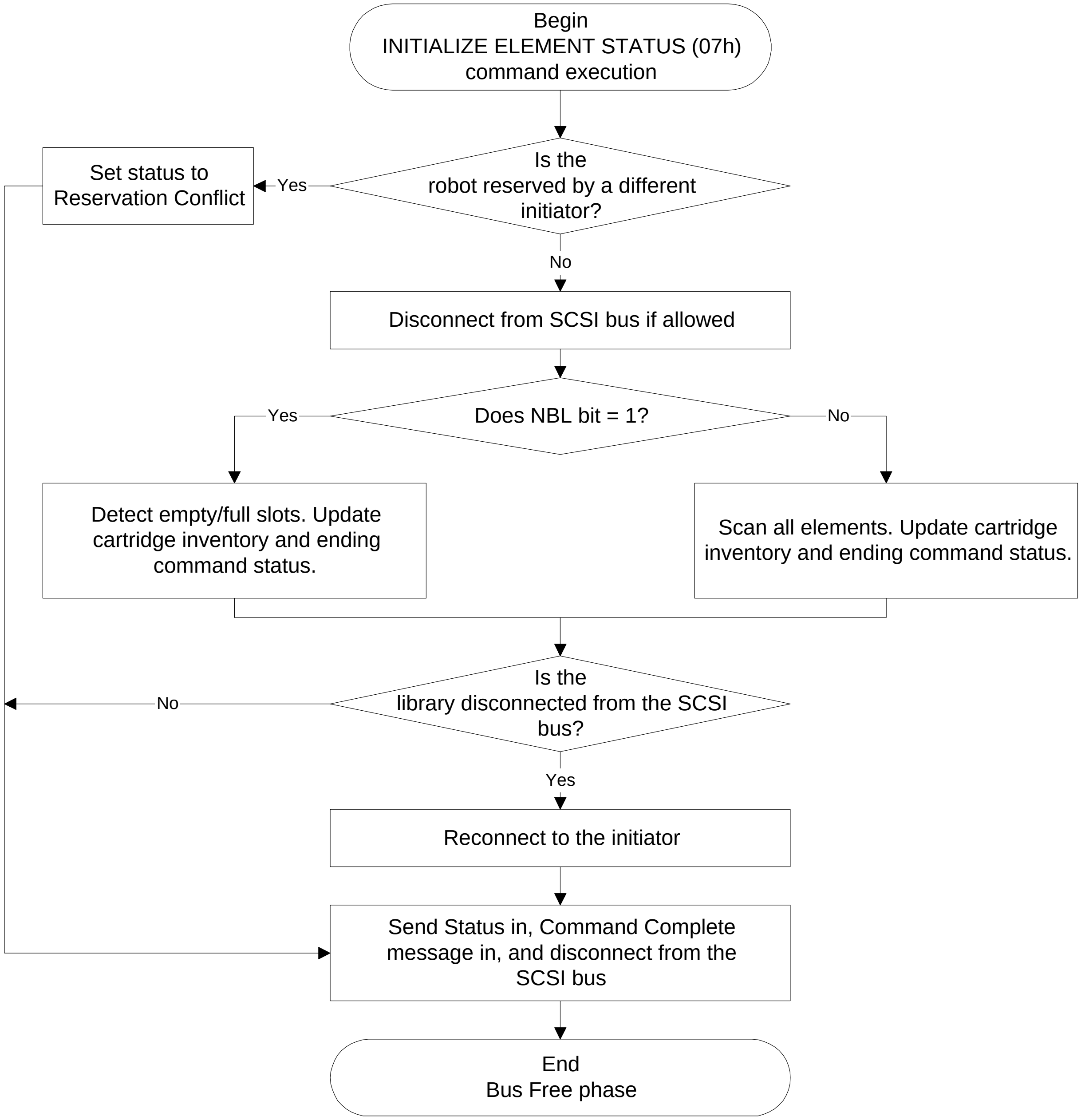

Figure 4-1 INITIALIZE ELEMENT STATUS command execution

4.5 Command Status

The library returns a status byte after processing the INITIALIZE ELEMENT STATUS command as follows:

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it or the robot is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

Check Condition status is returned for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects a parity error while receiving the CDB and the message system is not enabled.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The library has experienced an unrecoverable hardware error.
- A reserved bit is set to 1 in the CDB or a parameter in the CDB is invalid.
- The library encounters a problem while scanning the cartridges.
- The library is not ready because the door is open, the entry/exit port is extended, or it is operating in LCD mode or Console mode.

5 INITIALIZE ELEMENT STATUS WITH RANGE (E7h)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>01</td><td colspan="3">Logical Unit Number</td><td colspan="4">Reserved</td><td>Range</td></tr>
<tr><td>02</td><td colspan="8" rowspan="2">(MSB)
Element Address
(LSB)</td></tr>
<tr><td>03</td></tr>
<tr><td>04</td><td colspan="8" rowspan="2">Reserved</td></tr>
<tr><td>05</td></tr>
<tr><td>06</td><td colspan="8" rowspan="2">(MSB)
Number of Elements
(LSB)</td></tr>
<tr><td>07</td></tr>
<tr><td>08</td><td colspan="8">Reserved</td></tr>
<tr><td>09</td><td>NBL</td><td>0</td><td colspan="4">Reserved</td><td>0</td><td>0</td></tr>
</table>

5.1 About This Command

The INITIALIZE ELEMENT STATUS WITH RANGE command is an Exabyte-unique command that causes the library to check the requested range of storage elements for cartridges. If bar code labels are attached to each cartridge, the library also scans the bar code labels unless the NBL field in the CDB is set to 1 (see page 5-3). The information obtained by this command can be returned to the initiator using the READ ELEMENT STATUS (B8h) command.

Notes:

- For specifications for the bar code labels that can be used with the library, refer to the *Exabyte Bar Code Specification for DLT Cartridges*.
- Refer to *Exabyte 690D Library Installation and Operation* for information about positioning the bar code labels on the data cartridges.
- The library cannot scan labels on cartridges that are in a tape drive.
- If an initialize element status operation is performed on the robot, no action is taken because the status of the robot is always current and valid.

When to Use This Command

The library supports two INITIALIZE ELEMENT STATUS commands. Use one of these two commands after a reset or any manual operation or configuration change that may affect the status of the cartridge inventory.

Use these guidelines to decide which of the two commands to use:

- Use the INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command to update the cartridge inventory for a range of cartridges when a manual operation or configuration change has affected those cartridges. When you use this command, the library checks only the elements in the specified element address range.
- Use the INITIALIZE ELEMENT STATUS (07h) command when you want the entire cartridge inventory to be updated. When you use this command, the library checks every element for the presence of a data cartridge. For more information, see Chapter 4.

5.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Range – Byte 01, Bit 0

The Range field indicates which elements are to be checked, as follows:

0 – Initialize all elements

1 – Initialize the range of elements specified by the Element Address and Number of Elements fields

Element Address – Bytes 02 and 03

This field specifies the address of the element or the starting address of a series of elements to be checked. This field is ignored when the Range field is 0. Figure 1-2 on page 1-7, Figure 1-3 on page 1-8, and Figure 1-4 on page 1-9 show the default element addresses for the library.

Number of Elements – Bytes 06 and 07

This field indicates the maximum number of elements to be checked. This field is ignored when the Range field is 0.

If an initialize element status operation is performed on the robot, the request does not count toward the total number of elements requested in the Number of Elements field.

NBL (No Bar Code Labels) – Byte 09, Bit 7

This field indicates whether the library should scan the bar code labels on each cartridge, as follows:

0 – Scan the bar code labels
1 – Do not scan the bar code labels

- When this field is set to 0 (scan labels), the library scans the bar code labels and saves this information for the application to use during a Read Element Status operation.

- When this field is set to 1, the library checks for the presence of a cartridge at each location by detecting full or empty slots in a cartridge magazine with the laser, but does not scan the bar code labels.

5.3 Effects on the Cartridge Inventory

The library updates the cartridge inventory after it checks for the presence of a cartridge at each location and (if requested) scans the bar code labels. This section describes how the library updates the cartridge inventory.

Table 5-1 through Table 5-3 illustrate the various outcomes of a requested scan operation and show the effect on the cartridge inventory.

- A request is made to scan a cartridge in a storage location or the entry/exit port and the operation completed successfully. (The bar code scanner was able to read the label on the cartridge or the location was empty.) See Table 5-1 for details about how the cartridge inventory is updated.

Table 5-1 Effect on the cartridge inventory of a cartridge scan in a storage location or the entry/exit port

This cartridge inventory field...	...is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	cartridge label
Label Valid	0	1
Label Error	0	0
Label Scan Retries	0	updated if retried
Source Address	no change	no change

- A successful request is made to check for the presence of a cartridge in a storage location or the entry/exit port. Table 5-2 shows the effect on the cartridge inventory.

Table 5-2 Effect on the cartridge inventory of a request to check the occupied status of a storage location

This cartridge inventory field...	...is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	no change
Label Valid	0	no change
Label Error	0	no change
Label Scan Retries	0	no change
Source Address	no change	no change

- An unsuccessful request is made to scan a cartridge in a storage location or the entry/exit port. The scan is successful if the location is empty. The scan fails if there is no label or the library cannot read the label. Table 5-3 shows the effect on the cartridge inventory.

Table 5-3 Effect on the cartridge inventory of an unsuccessful cartridge scan in a storage location or in the entry/exit port

This cartridge inventory field...	...is changed to the following
Occupied	1
Occupied Valid	1
Label	blanks
Label Valid	0
Label Error	0 – No error 60 – No label on cartridge 61 – Label present but unreadable 62 – No cartridge magazine or tape drive not installed
Label Scan Retries	updated if retried
Source Address	no change

5.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 5-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB. Table 5-4 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

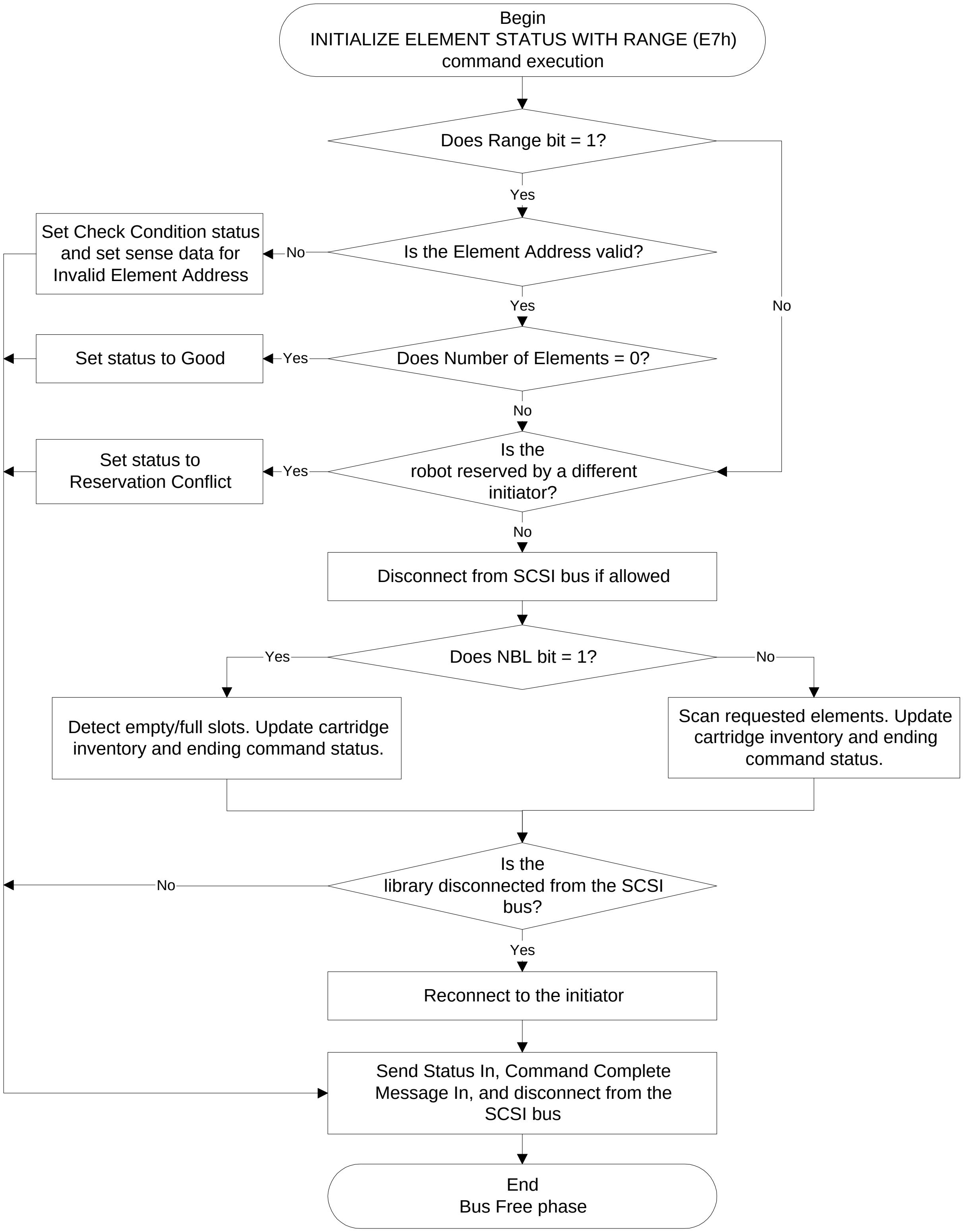

Figure 5-1 INITIALIZE ELEMENT STATUS WITH RANGE command execution

5.5 Command Status

The library returns a status byte after processing the INITIALIZE ELEMENT STATUS command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when the library is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it or the robot is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The library has experienced an unrecoverable hardware error.
- The library encounters a problem scanning the cartridges.
- The library is not ready because the door is open, the entry/exit port is extended, or it is operating in LCD mode or Console mode.

- A reserved bit is set to 1 in the CDB or a parameter in the CDB is invalid (see Table 5-4 for sense data).

Table 5-4 Invalid parameters in the INITIALIZE ELEMENT STATUS WITH RANGE CDB

Sense Key	ASC	ASCQ	SKS Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	0	0002h	Invalid element address.

Notes

6 INQUIRY (12h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	0
01	Logical Unit Number			Reserved				EVPD
02	Page Code							
03	Reserved							
04	Allocation Length							
05	0	0	Reserved				0	0

6.1 About This Command

The INQUIRY command requests that the library send information regarding its parameters to the initiator.

Typical inquiry data for the Exabyte 690D looks like this:

```
08h 80h 02h 02h 33h 00h 00h 00h      (bytes 00 through 07)
E   X   A   B   Y   T   E   _        (bytes 08 through 15)
E   x   a   b   y   t   e   _   6   9   0 D _ _ _ _
                                     (bytes 16 through 31)
3   .   1   _                        (bytes 32 through 35)
3   .   1   .   3   7   _ _ _ _ _ _ _ _ _ _ _ _ _
                                     (bytes 36 through 54)
```

Each "_" indicates an ASCII space character. The inquiry data that the library returns is described in Section 6.3.

Note: When the 480 Emulation option is selected from the operator panel, the library returns the ASCII representation of “EXB-480,” followed by nine spaces for the Product Identification (bytes 16 through 31). The 480 Emulation option allows the Exabyte 690D to use most, but not all, SCSI drivers developed for the Exabyte 480 Library. See “480 Emulation Option” on page 1-4 for additional information about the 480 Emulation option.

6.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

EVPD (Enable Vital Product Data) – Byte 01, Bit 0

This field indicates the type of inquiry data you are requesting, as follows:

0 – Standard inquiry data (described on page 6-4)

1 – Vital product data (described on page 6-8), based on the Page Code field (byte 02)

Page Code – Byte 02

This field contains the page number of the vital product data page to be returned for this INQUIRY command. The library supports the following page codes:

00h – Supported Vital Product Data page
80h – Unit Serial Number page

If the EVPD bit is set to 0, the Page Code must be 00h.

Allocation Length – Byte 04

This field specifies the number of bytes that the initiator has allocated for returned inquiry data. A value of 0 indicates that no inquiry data is to be transferred. This condition is not an error.

The library terminates the Data In phase when it has transferred either the number of bytes specified by the Allocation Length field or all of the available inquiry data, whichever is less. The Allocation Lengths for inquiry data returned by the library are:

- 38h (56) bytes to return the standard inquiry data
- 06h (6) bytes to return the Supported Vital Product Data page
- 0Eh (14) bytes for the Unit Serial Number page

6.3 What the Library Returns

When the EVPD bit (byte 01, bit 0) is 0, the library returns 56 bytes of standard inquiry data, as described in the following sections.

Standard Inquiry Data

Bit / Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	RMB	Device Type Qualifier						
02	ISO Version		ECMA Version			ANSI (Approved Version)		
03	AENC	TrmIOP	Reserved		Response Data Format			
04	Additional Length							
05	Reserved							
06								
07	RelAdr	WBus32	WBus16	Sync	Linked	RSVD	CmdQue	SftRe
08	(MSB)							
⋮	Vendor Identification							
15								(LSB)
16	(MSB)							
⋮	Product Identification							
31								(LSB)
32	(MSB)							
⋮	Firmware Revision Level							
35								(LSB)
36	(MSB)							
⋮	Full Firmware Revision Level							
54								(LSB)
55	Vendor Specific							BarC

Peripheral Qualifier – Byte 00, Bits 7 through 5

The value returned for this field is 0, indicating that the library is a single LUN device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 011b, which indicates that the library is not capable of supporting a physical device on the specified logical unit.

Peripheral Device Type – Byte 00, Bits 4 through 0

The value returned for this field is 08h, identifying the library as a medium changer device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 1Fh, indicating that the peripheral device type is unknown. The remainder of the standard inquiry data is returned normally for the library.

RMB (Removable Medium Bit) – Byte 01, Bit 7

The value returned for this field is 1, indicating that the media is removable.

Device Type Qualifier – Byte 01, Bits 6 through 0

The value returned for this field is 00h, indicating that there are no qualifiers.

Standards Versions (ISO Version, ECMA Version, ANSI Approved Version) – Byte 02

The value returned for this byte is 02h, indicating support of the current ANSI version of the SCSI-2 specification.

AENC (Asynchronous Event Notification Capability) – Byte 03, Bit 7

The value returned for this field is 0, indicating that the library does not support this function.

TrmIOP (Terminate I/O Process) – Byte 03, Bit 6

The value returned for this field is 0, indicating that the library does not support this function.

Response Data Format – Byte 03, Bits 3 through 0

The value returned for this field is 2h, indicating that the data is in accordance with SCSI-2.

Additional Length – Byte 04

The value returned for this field is 33h, indicating that there are 33h (51) additional bytes of inquiry data available to be returned to the initiator.

RelAdr (Relative Addressing) – Byte 07, Bit 7

The value returned for this field is 0, indicating that the library does not support this function.

WBus32 (Wide Bus 32) – Byte 07, Bit 6

The value returned for this field is 0, indicating that the library does not support 32-bit-wide bus transfers.

WBus16 (Wide Bus 16) – Byte 07, Bit 5

The value returned for this field is 0, indicating that the library does not support 16-bit-wide bus transfers.

Sync (Synchronous Transfer) – Byte 07, Bit 4

The value returned for this field is 0, indicating that the library does not support synchronous data transfer.

Linked (Linked Command) – Byte 07, Bit 3

The value returned for this field is 0, indicating that the library does not support linked commands.

CmdQue (Command Queuing) – Byte 07, Bit 1

The value returned for this field is 0, indicating that the library does not support tag command queuing.

SftRe (Soft Reset) – Byte 07, Bit 0

The value returned for this field is 0, indicating that the library does not support the soft reset alternative in response to a reset condition.

Vendor Identification – Bytes 08 through 15

The value contained in these bytes is the ASCII representation of "EXABYTE" followed by a single space.

Product Identification – Bytes 16 through 31

The value contained in these bytes is the ASCII representation of the product name, "Exabyte 690D," followed by four spaces.

Note: When the 480 Emulation option is selected from the operator panel, the library returns the ASCII representation of "EXB-480," followed by nine spaces for the Product Identification. The 480 Emulation option allows the Exabyte 690D to use most, but not all, SCSI drivers developed for the Exabyte 480 8mm Library. See "480 Emulation Option" on page 1-4 for additional information about the 480 Emulation option.

Firmware Revision Level – Bytes 32 through 35

The value contained in these bytes is the ASCII representation of the firmware revision level (for example, "3.01" or other Exabyte firmware revisions).

Full Firmware Revision Level – Bytes 36 through 54

The value contained in these bytes is the ASCII representation of the full firmware revision level (for example, "3.01.037"), followed by sufficient spaces to fill the 19-byte field.

BarC (Bar Code) – Byte 55, Bit 0

The value returned for this field is 1, indicating that the library has a bar code scanner installed.

Supported Vital Product Data Page

When the EVPD bit is 1 and the Page Code is 00h, the library returns the Supported Vital Product Data page as described below.

Bit / Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length							
04	Supported Vital Product Data page (00h)							
05	Unit Serial Number page (80h)							

Peripheral Qualifier – Byte 00, Bits 7 through 5

The value returned for this field is 0, which indicates that the library is a single LUN device.

Peripheral Device Type – Byte 00, Bits 4 through 0

The value returned for this field is 08h, which identifies the library as a medium changer device. If the LUN in the CDB is not 0, the value returned for this field is 7Fh, which indicates that the LUN is invalid.

Page Code – Byte 01

The value returned for this field is 00h, which is the Page Code for the Supported Vital Product page.

Page Length – Byte 03

The value returned for this field is 02h, which indicates the number of remaining bytes in this page (excluding this byte).

Unit Serial Number Page

When the EVPD bit is 1 and the Page Code is 80h, the library returns the Unit Serial Number page as described below.

Bit / Byte	7	6	5	4	3	2	1	0
00	Device Type Code							
01	Page Code							
02	Reserved							
03	Page Length							
04 ⋮ 13	(MSB) Unit Serial Number (LSB)							

Device Type Code – Byte 00

The value returned for this field is 08h, which identifies the library as a medium changer device. If the LUN in the CDB is not 0, the value returned for this field is 7Fh, which indicates that the LUN is invalid.

Page Code – Byte 01

The value returned for this field is 80h, which is the Page Code for the Unit Serial Number page.

Page Length – Byte 03

The value returned for this field is 0Ah, which indicates the number of remaining bytes in this page (excluding this byte).

Unit Serial Number – Bytes 04 through 13

The value returned for this field is the serial number for the library, as set from the operator panel. The MSB is contained in byte 04. Serial numbers of less than 10 characters contain trailing blanks (20h).

The library serial number is normally entered at the factory. If the serial number has never been set, the value returned for this field is 99999999**__**, where each "**_**" represents a blank. (See *Exabyte 690D Installation and Operation* for information about setting or verifying the library's serial number from the operator panel.)

6.4 How the Library Executes This Command

This section describes how the library executes the INQUIRY command. The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 6-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB. Table 6-1 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

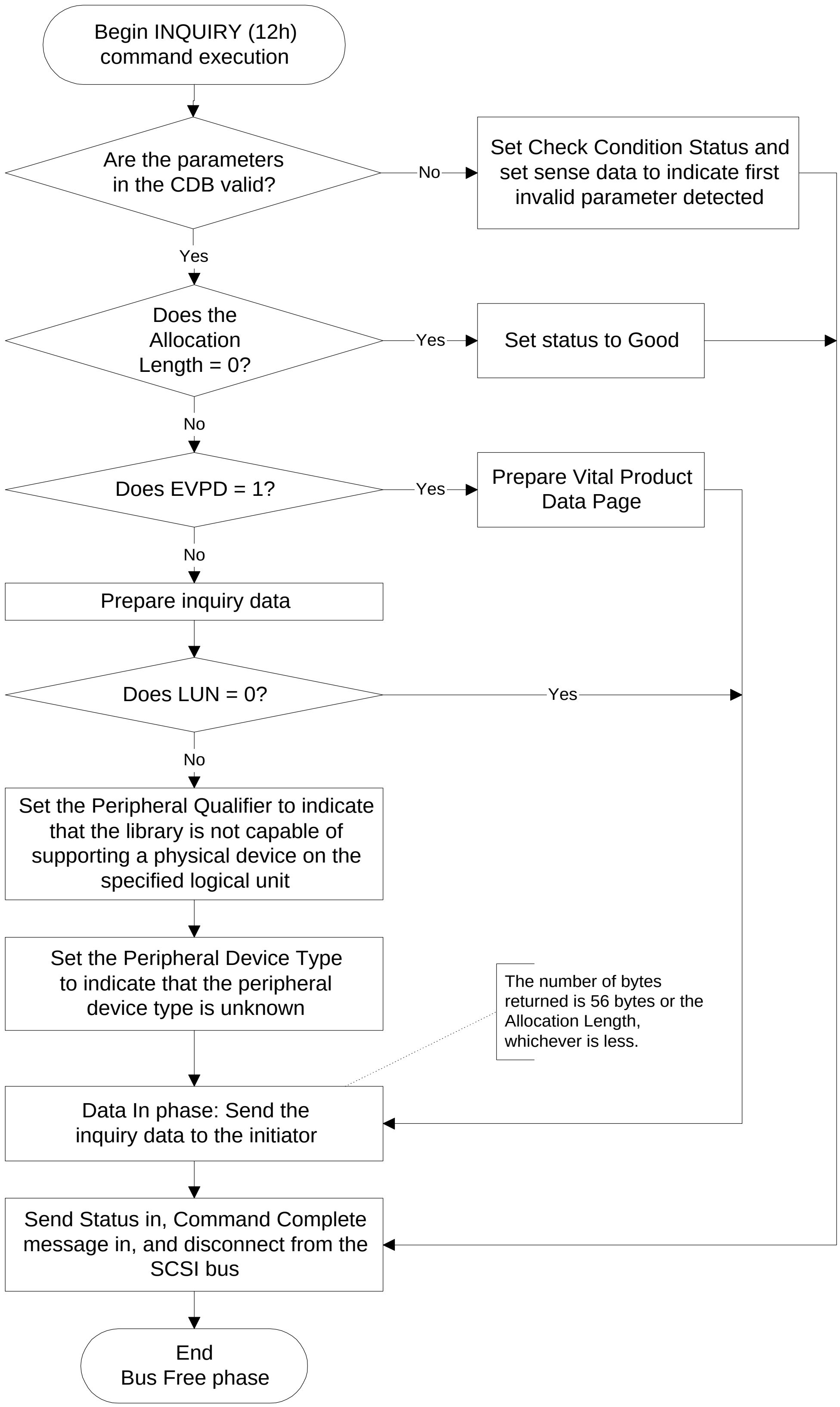

Figure 6-1 INQUIRY command execution

6.5 Command Status

The library returns a status byte after processing the INQUIRY command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library never returns Busy status for the INQUIRY command.

Reservation Conflict

The library never returns Reservation Conflict status for the INQUIRY command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 6-1 for sense data).

Table 6-1 Invalid parameters in the INQUIRY CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	0	0	0002h	Invalid Page Code.

7 LOG SENSE (4Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	1
01	Logical Unit Number			Reserved			PPC	SP
02	PC		Page Code					
03	Reserved							
04								
05	(MSB)			Parameter Pointer				
06								(LSB)
07	(MSB)			Allocation Length				
08								(LSB)
09	0	0	Reserved				0	0

7.1 About This Command

The LOG SENSE command enables the initiator to retrieve statistical information about various library parameter values. The library maintains the following pages of parameters:

- Supported Pages (00h)
- Tape Alert page(2Eh)
- System Statistics (30h)
- State Page (31h)
- History of Events page (32h)
- Element Statistics page (33h)
- Cartridge Scan Retries page (34h)
- Element Position page (35h)
- Drive Counters page (36h)

7.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

PPC (Parameter Pointer Control) – Byte 01, Bit 1

The value for the PPC field must be 0. This directs the library to return the number of bytes that you specify in the Allocation Length field, beginning with the parameter code specified in the Parameter Pointer field (bytes 05 and 06). The library returns the bytes in ascending order of parameter codes from the specified log page. When both the PPC bit and the Parameter Pointer field are set to 0 and the Allocation Length is sufficient, the library returns all available log parameters for the specified log page to the initiator.

SP (Saved Parameters) – Byte 01, Bit 0

The value for this field must be 0, indicating that the library will perform the LOG SENSE command and will not save log parameters.

PC (Page Control) – Byte 02, Bits 6 and 7

The PC field must be set to 01b. This indicates that the library will always return the cumulative values for any log parameter requested. The library does not support any threshold values or default cumulative values.

Page Code – Byte 02, Bits 0 through 5

The Page Code field allows you to specify the page that you want the library to return. The value for this field must be one of the values listed in Table 7-1; otherwise, the library terminates the command with Check Condition status and sets the sense key to Illegal Request with the ASC set to Invalid Field in CDB.

Table 7-1 Valid values for the Page Code field

Page Code	Page Name	Description
00h	Supported Log Pages	Returns a list of supported log pages.
2Eh	Tape Alert	Returns information from the library's internal Tape Alert firmware. This firmware constantly monitors the library for errors and potential difficulties. When a problem is detected, the library sets a flag on this page to identify the type of problem detected.
30h	System Statistics	Returns system statistics and retry counts.
31h	State	Returns the hardware state of the library, which includes the state of library sensors.
32h	History of Events	Returns a history of the most recent events that occurred during the operation of the library.
33h	Element Statistics	Returns element statistics and retry counts.
34h	Cartridge Scan Retries	Returns the number of times the library had to retry scanning the cartridge at the specified element address.
35h	Element Position	Returns the reach, horizontal, vertical, and drum axis positions of the specified element.
36h	Drive Counters	Returns cumulative statistics for each tape drive, including total loads, total push retries, total reloads, total double picks, and total recover repicks.

Parameter Pointer – Bytes 05 and 06

The Parameter Pointer field allows you to request parameter data by specifying any of the following types of values. (The value from this field becomes the value in the Parameter Code field of the requested log pages.)

- **A log parameter code.** When you request the System Statistics log page or the State log page, specify a log parameter code. The library returns the parameter data for that code and all other codes in ascending order until the value specified in the Allocation Length field has been reached or until it completes sending parameter data for the highest code.

Example If you request the State log page and specify 100 the Log Parameter Code, the library returns the analog sensor information for all of the analog sensors (100 through 105), if the Allocation Length is long enough.

- **A history record index value.** When you request the History of Events log page, specify an index value between –299 and 0. The library returns a history record index for that index and all other indexes in order (up to a maximum of 250 events), where 0 is the index of the most recent event, –1 is the index of the next most recent event, and so on.

  Example If you specify –4 for this field and the Allocation Length is long enough, the library returns event history on the events starting with the most recent specified (–4) back 250 events to the oldest (–253). (Up to 250 events are returned for each request.)

- **An element address value.** When you request the Element Statistics log page, the Cartridge Scan Retries page, the Element Position log page, or the Drive Counters log page, specify a valid element address value. The library returns the parameter data for the specified element and all other elements in ascending element address order until the value specified in the Allocation Length field has been reached or until it completes sending parameter data for the element with the highest element address.

  Note: When you request the Drive Counters page, you can specify an element address of 0 or a valid element address for a tape drive.

- **Example** If you specify 451h for this field and the Allocation Length is long enough, the library returns statistics for the tape drives (element addresses 451 through 456) and the robot (element address 501).

Notes:

- When the Parameter Pointer is 0, the library returns all available log parameters for the specified log page (up to the specified Allocation Length).

- When the Page Code field is set to 00h, the Parameter Pointer field must also be set to 0, indicating that you are requesting the Supported Log Pages page (00h), which lists all log pages.

- If the value of the Parameter Pointer field is not a valid parameter code for the specified page (and is not set to 0), the library terminates the command with Check Condition status and sets the sense key to Illegal Request and the ASC to Invalid Field in CDB.
- Element addresses may have been changed with the MODE SELECT command.

Allocation Length – Bytes 07 and 08

The Allocation Length field allows you to determine the maximum amount of data to be transferred from the library to the initiator. If you specify an allocation length that is greater than the bytes available, the library terminates the Data In phase when all bytes have been transferred. You can specify FFFFh to include all available data.

7.3 What the Library Returns

This section describes the log page format and the log pages that the library supports. The LOG SENSE command returns the single log page specified in the Page Code field of the CDB. Each log page begins with a four-byte page header (bytes 00 through 03), followed by zero or more variable-length log parameters defined for that page. The log page format is defined as:

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Reserved							
02	(MSB) Page Length							
03								(LSB)
04	Log Parameter (First)							
⋮	⋮							
n	Log Parameter (Last)							

Page Code – Byte 00, Bits 0 through 5

The Page Code field identifies which log page is being transferred. This field contains one of the codes described in Table 7-1.

Page Length – Bytes 02 and 03

The Page Length field specifies the length, in bytes, of the following Log Parameters. The value returned for this field depends on the value you specified for the Page Code and the Parameter Pointer in the CDB. This value is independent of what you specified for the Allocation Length.

Log Parameters – Bytes 04 through *n*

Log parameters are data structures that are contained in log pages and can be one of the following:

- Data counters that record a count of a particular event
- A numeric value indicating the state of the library hardware
- A string that contains the library event history

The general format of a log parameter is shown in the following section.

Log Parameter Format

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td colspan="8" rowspan="2">(MSB)
Parameter Code
(LSB)</td></tr>
<tr><td>01</td></tr>
<tr><td>02</td><td>DU</td><td>DS</td><td>TSD</td><td>ETC</td><td colspan="2">TMC</td><td>RSVD</td><td>LP</td></tr>
<tr><td>03</td><td colspan="8">Parameter Length (n–3)</td></tr>
<tr><td>04
⋮
n</td><td colspan="8">Parameter Value</td></tr>
</table>

Each log parameter begins with a four-byte header followed by one or more bytes of parameter value data. The fields in the log parameter are described below.

Parameter Code – Bytes 00 and 01

The Parameter Code field identifies which log parameter is being transferred for that log page. The valid values for this field depend on the type of log page the library is returning, as described later in this chapter.

Parameter Control (DU, DS, TSD, ETC, TMC, LP) – Byte 02

The Parameter Control field consists of the following bits:

DU – Disable Update. This bit indicates that the library updates the log parameter value to reflect all events that should be recorded by that parameter. This bit is always 0.

DS – Disable Save. This bit indicates that the library does not support saving for that log parameter. This bit is always 1.

TSD – Target Save Disable. This bit indicates that the library provides a self-defined method for saving log parameters. This bit is always 0.

ETC – Enable Threshold Comparison. This bit indicates a comparison to the threshold value is not performed whenever the cumulative value is updated. This bit is always 0.

TMC – Threshold Met Criteria. This field defines the basis for comparison of the cumulative and threshold values. This field is always 0.

LP – List Parameter. The List Parameter bit indicates the format of the log parameter:

0 – The parameter is a data counter.
1 – The parameter is a list parameter.

Parameter Length – Byte 03

The Parameter Length field specifies the length in bytes of the following Parameter Value field (bytes 04 through *n*).

Parameter Value – Bytes 04 through *n*

The Parameter Value field can be one of the following:

- A data counter for a library event, which can be either a two-byte or four-byte value or a one-byte flag.
- A value that indicates the state of a certain part of the library hardware. If this field is 1, the state of the part is on. If this field is 0, the state of the part is off.
- A string that describes a library history event.

The following sections describe all log parameters that the library supports.

Supported Log Pages Page (Page Code 00h)

The Supported Log Pages page is returned when the Page Code in the CDB is 00h. Unlike other LOG SENSE pages, no parameter information is returned on this page. Instead, the Supported Log Pages page lists the LOG SENSE pages supported by the library. The page codes are listed in ascending order. The remaining log pages are described in the following sections.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (00h)					
01	Reserved							
02	Page Length (8h)							
03								
04	Supported Log Pages page (00h)							
05	Tape Alert page (2Eh)							
06	System Statistics log page (30h)							
07	State log page (31h)							
08	History of Events log page (32h)							
09	Element Statistics page (33h)							
10	Cartridge Scan Retries page (34h)							
11	Element Positions page (35h)							
12	Drive Counters page (36h)							

Tape Alert Page (Page Code 2Eh)

The Tape Alert page provides an industry-standardized method for reporting errors and potential difficulties in the library. The library's internal Tape Alert firmware constantly monitors the library's operation for problems. When a problem is identified, the firmware sets a flag on the Tape Alert page.

To use Tape Alert, periodically poll the library to determine whether any Tape Alert flags have been set. As a minimum, poll the library whenever any of the following occur:

- Immediately after a SCSI Check Condition status followed by a REQUEST SENSE
- Between each cartridge move
- At some regularly scheduled interval (for example, once a minute)

If you use MRIE to configure the library to report informational exception conditions (see page 8-8), you can use REQUEST SENSE to poll the library. A sense key of No Sense (0h) with an ASC and ASCQ of 5Dh and 00h, respectively, indicates that a Tape Alert flag has been set. You can then issue a LOG SENSE command to read the Tape Alert page. Using REQUEST SENSE to poll the library eliminates the need to read the Tape Alert page to determine whether a flag is set.

When you issue a LOG SENSE command and request the Tape Alert page, the library returns the information about the parameters listed in Table 7-2. Each parameter is one byte long. Bit 0 contains the value for the flag, as follows:

0 – The flag is not currently set.
1 – The flag is currently set.

The remaining 7 bits of the flag are not used.

Note: Issuing a LOG SENSE command to return the Tape Alert page resets all of the flags to 0. The flags are also reset whenever the library is reset or when the condition indicated by the flag is corrected. Undefined flags are always set to 0.

Table 7-2 Parameters returned for the LOG SENSE Tape Alert page

Parameter	Flag Name	Type[a]	Description
02h	Library Hardware B	W	There is a problem with the library mechanism. If the problem persists, contact Exabyte Technical Support.
03h	Library Hardware C	C	The library has a hardware fault: ▪ Make sure the library and drives are not being used by any host, then reset the library from the front panel. ▪ If the problem persists, contact Exabyte Technical Support.
04h	Library Hardware D	C	▪ Make sure the library and drives are not being used by any host, then reset the library from the front panel. ▪ If the problem persists, contact Exabyte Technical Support.
06h	Library Interface	C	The library has a problem with the host interface.
07h	Predictive Failure	W	The library has detected a fan failure in a drive FRU. Replace the drive containing the inoperable fan.
0Bh	Library Voltage Limits	C	The voltage supply to the library exceeds specifications. There is a potential problem with the power supply or failure of a redundant power supply.
0Dh	Library Pick Retry	W	There is a potential problem with the robot picking a cartridge from a drive or slot. ▪ No action needs to be taken at this time. ▪ If the problem persists, contact Exabyte Technical Support. This flag is cleared when the next move command is received.
0Eh	Library Place Retry	W	There is a potential problem with the robot placing a cartridge into a slot. ▪ No action needs to be taken at this time. ▪ If the problem persists, contact Exabyte Technical Support. This flag is cleared when the next move command is received.
0Fh	Drive Load Retry	W	There is a potential problem with the robot or drive when placing a cartridge into a drive. ▪ No action needs to be taken at this time. ▪ If the problem persists, contact Exabyte Technical Support. This flag is cleared when the next move command is received.

Table 7-2 Parameters returned for the LOG SENSE Tape Alert page (*continued*)

Parameter	Flag Name	Type[a]	Description
10h	Library Door	W	The operation has failed because the library door is open. ▪ Clear any obstructions from the library door. ▪ Close the library door. ▪ If the problem persists, contact Exabyte Technical Support. This flag is cleared when the door is closed.
11h	Library Entry/Exit Port	C	There is a mechanical problem with the library entry/exit port. ▪ Clear any obstructions from the library door. ▪ Close the library door. ▪ If the problem persists, contact Exabyte Technical Support.
13h	Library Security	W	Library security has been compromised. The door was opened then closed during operation.
14h	Library Security Mode	I	The security mode of the library has been changed. The library has either been put into a secure mode, or the library has exited the secure mode.
15	Library Offline	I	The library has been taken offline.
17h	Library Scan Retry	W	There is a potential problem with the bar code label or the scanner hardware in the robot. This flag is cleared when the next move command is received.

[a] I = Informational suggestion to user.
W = Warning. Remedial action is advised. Performance of data may be at risk.
C = Critical. Immediate remedial action is required.

System Statistics Log Page (Page Code 30h)

The System Statistics log page returns the cumulative library system statistics from nonvolatile memory shown in Table 7-3. These values are not reset after power cycles or resets.

Table 7-3 Library system statistics (saved in nonvolatile memory)

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Total Number of Moves	0	0	1	0	0	0	0	4
Total Number of Pick Retries	1	0	1	0	0	0	0	4
Total Number of Put Retries	2	0	1	0	0	0	0	4
Total Number of Scans	3	0	1	0	0	0	0	4
Total Number of Scan Retries	4	0	1	0	0	0	0	4
Total Number of Scan Failures	5	0	1	0	0	0	0	4
Total Number of Entry/Exit Port Cycles	6	0	1	0	0	0	0	4
Reserved[a]	7	0	1	0	0	0	0	4

[a] A value of 0 is returned for reserved parameters.

State Log Page (Page Code 31h)

The State log page returns log parameters that indicate the current state of the library hardware sensors. The library includes two types of sensors:

- Digital
- Analog

For each sensor in the library, there is a corresponding log parameter that shows the value for that sensor. For the digital sensors, a 1 in the Parameter Value field indicates the sensor corresponding to the log parameter is on; a 0 indicates the sensor is off. For the analog sensors, the value in the Parameter Value field indicates the state of the sensor. Analog sensor values may be negative numbers.

Digital Sensors

Table 7-4 indicates the state of the digital sensors of the library.

Table 7-4 Log parameters for digital sensors

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Door Closed	0	0	1	0	0	0	0	1
Key Lock	1	0	1	0	0	0	0	1
Gripper Home	2	0	1	0	0	0	0	1
Cart. Seated	3	0	1	0	0	0	0	1
Reserved[a]	4	0	1	0	0	0	0	1
Drum Index	5	0	1	0	0	0	0	1
Entry/Exit Port Home	6	0	1	0	0	0	0	1
Entry/Exit Port Limit	7	0	1	0	0	0	0	1
Drive Door 1	8	0	1	0	0	0	0	1
Drive Door 2	9	0	1	0	0	0	0	1
Drive Door 3	10	0	1	0	0	0	0	1
Drive Door 4	11	0	1	0	0	0	0	1
Drive Door 5	12	0	1	0	0	0	0	1
Drive Door 6	13	0	1	0	0	0	0	1
Reserved[a]	14-23	0	1	0	0	0	0	1
Reserved[a]	24	0	1	0	0	0	0	1
Power Distribution Fan Fail	25	0	1	0	0	0	0	1
Drive 1 Fan Fail	26	0	1	0	0	0	0	1
Drive 2 Fan Fail	27	0	1	0	0	0	0	1
Drive 3 Fan Fail	28	0	1	0	0	0	0	1
Drive 4 Fan Fail	29	0	1	0	0	0	0	1
Drive 5 Fan Fail	30	0	1	0	0	0	0	1
Drive 6 Fan Fail	31	0	1	0	0	0	0	1
Reserved[a]	32-41	0	1	0	0	0	0	1
Top Power Supply Fail	42	0	1	0	0	0	0	1
Bottom Power Supply Fail	43	0	1	0	0	0	0	1

[a] A value of 0 is returned for reserved parameters.

Analog Sensors

Table 7-5 indicates the state of the analog sensors in the library.

Table 7-5 Log parameters for the analog sensors

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Temperature (°C)[a]	100	0	1	0	0	0	0	2
+ 12 V (12,000 mV)	101	0	1	0	0	0	0	2
–12 V (–12,000 mV)	102	0	1	0	0	0	0	2
+ 24 V (24,000 mV)	103	0	1	0	0	0	0	2
+ 5 V (5,000 mV)	104	0	1	0	0	0	0	2
Humidity[a]	105	0	1	0	0	0	0	2

[a] Requires an optional weather board in the library. If the card is not installed, the library returns 0000h for these parameters.

History of Events Log Page (Page Code 32h)

The History of Events log page returns a history of recent events that occurred in the library. The library's history buffer contains 300 entries. The library is able to send up to 250 events from the history buffer in response to each LOG SENSE command; therefore, it takes two LOG SENSE commands to receive all 300 entries from the buffer.

Each of the library's events is a string that consists of two fields:

- A description of the event
- A time stamp indicating the time and date the event occurred

Each event is 80 bytes of ASCII characters and is divided as follows:

- Bytes 0 through 4 specify the offset from the most recent history event (000).
- Bytes 5 through 16 specify the process and line number in the process from which the history message originated.
- Bytes 17 through 57 provide a description of the history event.
- Bytes 58 through 75 specify the time and date of the history event.
- Bytes 76 through 80 specify an internal firmware sequence number.

Figure 7-1 shows an example from a dump over the serial port of a typical history of events for the library.

```
                         C O M M A N D   H I S T O R Y
                         ==============================

IDX From:   Line   Event Description:                          Time:      Date:    Seq
--- -----   -----  ------------------------------------------:--:--    --/--/-- ------
000 STATI   0164   Status Ret: SNS=0x0 ASC=0x00 ASQ=0x00       11:33:36   02-15-97 00574
001 RLS     0127   Release Command, Elem=0  ResId=0            11:33:36   02-15-97 00573
002 ISCSI   0978 Selected w/ATN, HostId=6, 1stMsg=0xc0         11:33:36   02-15-97 00572
003 STATI   0164   Status Ret: SNS=0x0 ASC=0x00 ASCQ=0x00      11:33:05   02-15-97 00571
004 ISCSI   0768   Reconnected to Host 6                       11:33:05   02-15-97 00570
005 ISCSI   1423   Attempting Reconnect to Host 6              11:33:05   02-15-97 00569
006 MOVE    1042   Move from 2 to 7 complete                   11:33:05   02-15-97 00562
007 PUT     0569   Put finished with 0 retries                 11:33:05   02-15-97 00559
008 PUT     0272   Put to slot 7 at lservo = 7165              11:33:02   02-15-97 00558
009 SERVO   0490   Go to 7160                                  11:33:01   02-15-97 00550
010 PICK    0246   Pick from slot 2                            11:32:58   02-15-97 00544
011 SERVO   0490   Go to 3380                                  11:32:57   02-15-97 00539
012 MOVE    0306   Move Cartridge from 2 to 7                  11:32:55   02-15-97 00532
013 MSGI    0132   Disconnecting to Process Command            11:32:55   02-15-97 00525
014 SMOVE   0163   Move Cmd, Source=2  Dest=7                  11:32:55   02-15-97 00524
015 ISCSI   0978 Selected w/ATN, HostId=6, 1stMsg=0xc0         11:32:55   02-15-97 00523
016 STATI   0164   Status Ret: SNS=0x0 ASC=0x00 ASCQ=0x00      11:32:37   02-15-97 00522
017 RESRV   0134   Reserve Unit Cmd                            11:32:37   02-15-97 00521
018 ISCSI   0978 Selected w/ATN, HostId=6, 1stMsg=0xc0         11:32:37   02-15-97 00520
019 STATI   0164   Status Ret: SNS=0x0 ASC=0x00 ASCQ=0x00      11:32:19   02-15-97 00519
020 DATAI   0142   Sending 24 Data Bytes to Host               11:32:18   02-15-97 00518
021 MDSNS   0138   Mode Sns Cmd, PC=0 PCode=0x1d Alloc=24      11:32:18   02-15-97 00517
022 ISCSI   0978 Selected w/ATN, HostId=6, 1stMsg=0xc0         11:32:18   02-15-97 00516
023 STATI   0164   Status Ret: SNS=0x0 ASC=0x00 ASCQ=0x00      11:32:07   02-15-97 00515
024 MDSEL   0427   Processing Element Address Page             11:32:07   02-15-97 00514
025 DATAO   0145   Receiving 24 Data Bytes from Host           11:32:07   02-15-97 00513
026 MDSEL   0153   Mode Select Cmd, SP=1 Param Length=24       11:32:07   02-15-97 00512
027 ISCSI   0978 Selected w/ATN, HostId=6, 1stMsg=0xc0         11:32:07   02-15-97 00511
028 STATI   0164   Status Ret: SNS=0x0 ASC=0x00 ASCQ=0x00      11:31:57   02-15-97 00510
029 DATAI   0142   Sending 18 Data Bytes to Host               11:31:57   02-15-97 00509
030 RQSNS   0185   Sense Data: SNS=0x6 ASC=0x29 ASCQ=0x00      11:31:57   02-15-97 00508
031 RQSNS   0153   Request Sense Cmd, Alloc Length=18          11:31:57   02-15-97 00507
032 ISCSI   0978 Selected w/ATN, HostId=6, 1stMsg=0xc0         11:31:57   02-15-97 00506
033 STATI   0164   Status Ret: SNS=0x2 ASC=0x29 ASCQ=0x00      11:31:55   02-15-97 00505
034 TUR     0154   Can’t Exec Cmd, Unit Attn Cond              11:31:55   02-15-97 00504
035 TUR     0110   Test Unit Ready Command                     11:31:55   02-15-97 00503
036 ISCSI   0985 Selected Without ATN, HostId=6                11:31:55   02-15-97 00502
037 PWRUP   1021   Power up complete                           11:31:41   02-15-97 00501
038 PWRUP   0872   Motion control i/f: SCSI          1         11:31:41   02-15-97 00496
039 SERVO   0490   Go to 250                                   11:31:38   02-15-97 00487
040 SERVO   0412   Home Grip                                   11:31:38   02-15-97 00468
041 SERVO   0490   Go to 12370                                 11:31:35   02-15-97 00419
```

Figure 7-1 Sample history of events

Each log parameter for the History of Events log page has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Parameter Code							
01								(LSB)
02	0	1	0	0	0	0	0	1
03	Parameter Length (50h)							
04 ⋮ 83	*80 characters of event*							

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the index of the history record: 0 is the index of the most recent event, –1 is the index of the next most recent, and so on. The library keeps 300 of the most recent events (indexed 0 through –299).

The event history that the library maintains includes information about SCSI commands and phases, motion commands, retries and errors, diagnostics, and system status.

Element Statistics Page (Page Code 33h)

The Element Statistics page returns cumulative statistics, such as the total number of puts to the element, the total number of times the library had to retry a put operation to the element, and the total number of times the library had to retry a pick operation from the element. These values are stored in nonvolatile memory for each element.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the library returns in the Parameter Code field of the Element Statistics page. This value specifies the first element (starting Element Address) for which information is returned.

An Element Statistics page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Note: The Parameter Pointer specified in the CDB indicates the starting element address and must be a valid element address for the library.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Parameter Code (Element Address)							
01								(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (8h)							
04 ⋮ 07	Total Puts							
08	Total Put Retries							
09								
10	Total Pick Retries							
11								

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the element address for which statistical information is being provided. The element address may have been set by the MODE SELECT command.

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Element Statistics page.

Total Puts – Bytes 04 through 07

The Total Puts field indicates the total number of puts to the element location indicated by the element address. The total number of puts is stored in volatile memory.

Total Put Retries – Bytes 08 and 09

The Total Put Retries field indicates the total number of times the library had to retry a put operation to the element indicated by element address. The total number of put retries is stored in volatile memory.

Total Pick Retries – Bytes 10 and 11

The Total Pick Retries field indicates the number of times the library had to retry a pick operation from the element indicated by the element address. The total number of pick retries is stored in volatile memory.

Cartridge Scan Retries Page (Page Code 34h)

The Cartridge Scan Retries page returns the total number of times the library had to retry scanning the cartridge located in the element. This value is stored in nonvolatile memory for each cartridge and is reset whenever the library is reset, powered-on, or the door is opened.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the library returns in the Parameter Code field of the Cartridge Scan Retries page. This value specifies the first element (starting Element Address) for which information is returned.

A Cartridge Scan Retries page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Note: The Parameter Pointer specified in the CDB indicates the starting element address and must be a valid element address for the library.

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td colspan="8" rowspan="2">(MSB)
Parameter Code
(Element Address)
(LSB)</td></tr>
<tr><td>01</td></tr>
<tr><td>02</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>03</td><td colspan="8">Parameter Length (2h)</td></tr>
<tr><td>04</td><td colspan="8" rowspan="2">Total Scan Retries</td></tr>
<tr><td>05</td></tr>
</table>

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the element address for which statistical information is being provided. The element address is set by the MODE SELECT command.

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Cartridge Scan Retries page.

Total Scan Retries – Bytes 04 and 05

The Total Scan Retries field indicates the total number of times the library had to retry scanning the cartridge that is now located in the element indicated by the element address. Scan retries move with the cartridge and are reset each time the library is reset, powered-on, or when the door is opened.

Element Position Page (Page Code 35h)

The Element Position page returns the axis positions of the specified element in the library. These values are stored in nonvolatile memory for each element.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the library returns in the Parameter Code field of the Element Position page. This value specifies the first element (starting Element Address) for which information is returned.

An Element Position page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Note: The Parameter Pointer specified in the CDB indicates the starting element address and must be a valid element address for the library.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code (Element Address)				
01								(LSB)
02	0	1	0	0	0	0	0	0
03				Parameter Length (8h)				
04				Vertical Axis Position				
05								
06				Reach Axis Position				
07								
08				Drum Axis Position				
09								
10				Horizontal Axis Position				
11								

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the element address for which statistical information is being provided. The element address may have been set by the MODE SELECT command.

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Element Position page.

Vertical Axis Position – Bytes 04 and 05

The Vertical Axis Position field indicates the distance the robot has to move along the vertical axis from its home position to the specified element.

Reach Axis Position – Bytes 06 and 07

The Reach Axis field indicates the distance the robot has to move from its home position to touch the data cartridge magazine or a cartridge in the magazine.

Note: If the specified element is a tape drive or the robot, a value of 0 is returned for this field.

Drum Axis Position – Bytes 08 and 09

The Drum Axis Position field indicates the distance the drum has to rotate from the home position for a given element to be accessed by the robot. The drum home position is zero. A full rotation is 50360 units. For example, elements in magazine 3 are reported as 25180.

Note: If the specified element is a tape drive or an entry/exit port element, a value of 0 is returned for this field.

Horizontal Axis Position – Bytes 10 and 11

The Horizontal Axis field indicates the distance the robot has to move along the horizontal axis from its home position to the specified element (Drive 1 through Drive 6).

Drive Counters Page (Page Code 36h)

The Drive Counters page returns cumulative statistics for each tape drive, including the total number of loads, the total number of push retries, the total number of reloads, the total number of double picks, and the total number of recover repicks. The values for each tape drive are stored in nonvolatile memory.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the library returns in the Parameter Code field of the Drive Counters page. This value specifies the first element (starting Element Address) for which information is returned, and must be a valid Data Transfer Element Address.

A Drive Counters page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Note: The Parameter Pointer specified in the CDB indicates the starting element address and must be a valid element address for the library.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code (Element Address)				
01								(LSB)
02	0	1	0	0	0	0	0	0
03				Parameter Length (14h)				
04 ⋮ 07				Total Loads				
08 ⋮ 11				Total Push Retries				
12 ⋮ 15				Total Reloads				
16 ⋮ 19				Total Double Picks				
20 ⋮ 23				Total Recover Repicks				

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the element address of the tape drive for which statistical information is being provided. The element address may have been set by the MODE SELECT command.

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Drive Counters page.

Total Loads – Bytes 04 through 07

The Total Loads field indicates the total number of successful cartridge loads for the tape drive indicated by the element address. The total number of loads is saved in nonvolatile memory.

Total Push Retries – Bytes 08 through 11

The Total Push Retries field indicates the total number of times the library had to retry pushing a cartridge into the tape drive indicated by the element address. The total number of push retries is saved in nonvolatile memory.

Push retries result when the robot cannot push a cartridge into the tape drive because it did not reach the required position on the reach axis.

Total Reloads – Bytes 12 through 15

The Total Reloads field indicates the number of times the library had to repeat a load procedure for the tape drive indicated by the element address. The total number of reloads is saved in nonvolatile memory.

A reload operation occurs when the tape drive indicates that the drive handle can still be operated after a cartridge has been loaded into the tape drive and the drive handle closed. The library then unloads the cartridge from the tape drive, opens the handle, removes the cartridge from the tape drive, reloads the cartridge, and closes the handle.

Total Double Picks – Bytes 16 through 19

The Total Double Picks field indicates the number of times the library had to pull a cartridge a short distance out of the tape drive in order to pick it from the tape drive. The total number of double picks is saved in nonvolatile memory.

A double pick occurs when the tape drive does not eject the cartridge far enough for the robot to grab it.

Total Recover Repicks – Bytes 20 through 23

The Total Recover Repicks field indicates the number of times the library had to use a recover repick operation to pick a cartridge from the tape drive indicated by the element address. The total number of recover repicks is saved in nonvolatile memory.

A recover repick operation occurs when robot attempts to pick a cartridge from the tape drive but cannot pull the cartridge from the tape drive. The library then reloads the cartridge, closes the drive handle, unloads the cartridge, opens the drive handle, and repicks the cartridge.

7.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 7-2 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

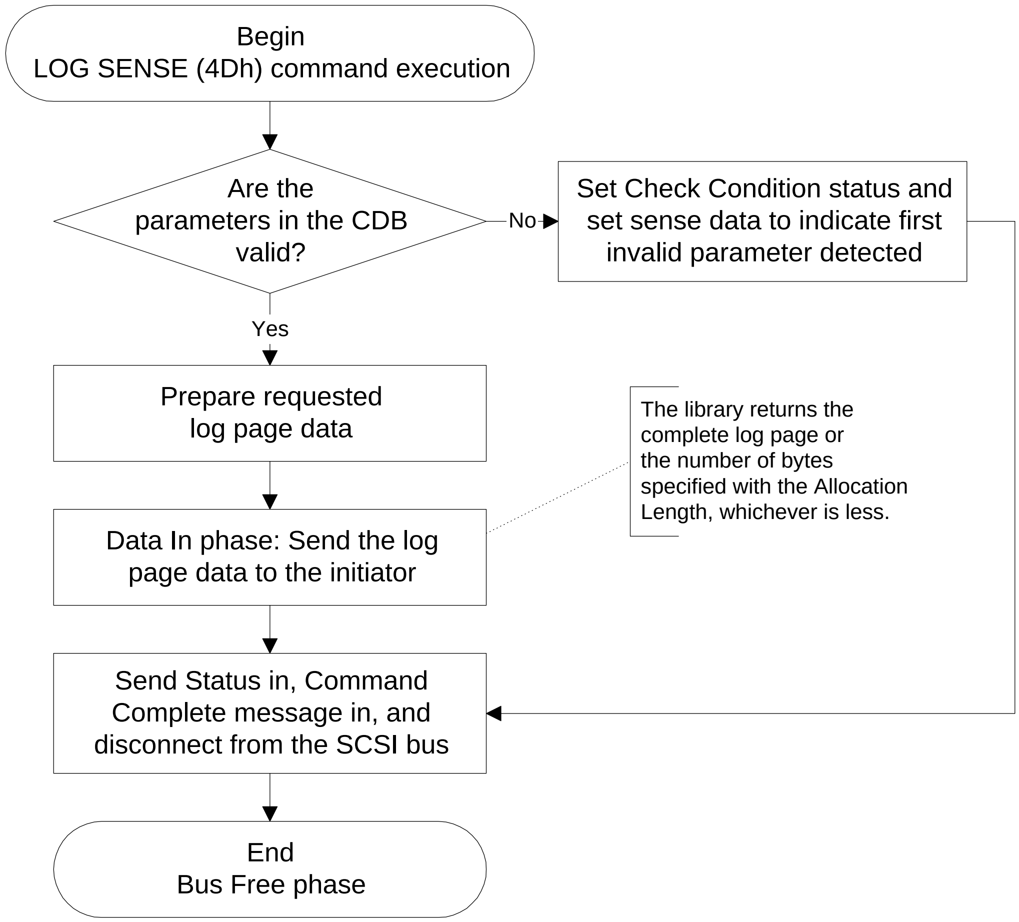

Figure 7-2 LOG SENSE command execution

7.5 Command Status

The library returns a status byte after processing the LOG SENSE command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 7-6 for sense data).

Table 7-6 Invalid parameters in the LOG SENSE CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	0h	1	1	1	–	–	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	0h	1	1	1	7	0002h	The PC field is incorrect. It must be set to 01b.
5h	24h	0h	1	1	1	5	0002h	Invalid page code.
5h	24h	0h	1	1	0	0	0005h	Invalid parameter pointer.

Notes

8 MODE SELECT (15h)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>01</td><td colspan="3">Logical Unit Number</td><td>PF</td><td colspan="3">Reserved</td><td>SP</td></tr>
<tr><td>02</td><td colspan="8" rowspan="2">Reserved</td></tr>
<tr><td>03</td></tr>
<tr><td>04</td><td colspan="8">Parameter List Length</td></tr>
<tr><td>05</td><td>0</td><td>0</td><td colspan="4">Reserved</td><td>0</td><td>0</td></tr>
</table>

8.1 About This Command

The MODE SELECT command enables you to specify operating parameters for the library. These parameters configure the library upon power-up or a reset condition. You provide the parameters in a parameter list that can include the following:

- 4 bytes for the Parameter List Header (required)
- 4 bytes for the Configuration page
- 12 bytes for the Tape Alert page
- 20 bytes for the Element Address Assignment page
- 84 bytes for the LCD Mode page

> ➤ **Important** The values sent to the library apply to all initiators in a multi-initiator environment. If an initiator issues a MODE SELECT command that changes any current or saved operating parameters, the library returns a Check Condition status with a sense key of Unit Attention (6h) and an ASC and ASCQ of Mode Parameters Changed (2Ah and 01h, respectively) to all other initiators that issue a request to the library.

Notes:

- Before issuing any MODE SELECT commands, issue a MODE SENSE (1Ah) command with the PC field set to 1h and the Page Code field set to 3Fh to determine which pages of mode parameters are supported, which parameters within the pages are changeable, and the supported length of each page. See Chapter 9 for more information about the MODE SENSE command.
- When you issue a MODE SELECT command, the parameters are not changed until the library has verified that the new values are valid. If any value is not valid, the library returns the appropriate error (see Section 8.4) and does not change the MODE SELECT parameters.

8.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

PF (Page Format) – Byte 01, Bit 4

This field specifies the page format used by the library. The library supports the page format specified by SCSI-2. This value must be 1.

SP (Saved Page) – Byte 01, Bit 0

The library supports the saved page function. The values for this field are as follows:

0 – Current configuration values are changed to the values sent to the library. Saved values stored in nonvolatile memory are not affected.

1 – Current configuration values specified by this command are saved in nonvolatile memory and are used for subsequent operations.

Parameter List Length – Byte 04

This field indicates the length of the entire parameter list. The parameter list length is equal to the length of one Parameter List Header (4 bytes) plus the lengths of all pages to be transferred. Table 8-1 lists the page lengths. If no pages are to be transferred, specify 0 for the Parameter List Length field.

Note: A parameter list length of 4 is not valid. When you send the Parameter List Header, you must send at least one page with it.

Table 8-1 MODE SELECT page lengths

Page	Length (in bytes)
Configuration page	4 (04h)
Tape Alert page	12 (0Ch)
Element Address Assignment page	20 (14h)
LCD Mode page	84 (54h)

For example, if you want to transfer the Configuration page, set the parameter list length to 8 (08h):

	4 bytes	(Parameter List Header length)
+	4 bytes	(Configuration page length)
	8 bytes	

If you want to transfer the Configuration page, the Tape Alert page, the Element Address Assignment page, and the LCD Mode page, set the parameter list length to 120 (78h):

4 bytes	(Parameter List Header length)
20 bytes	(Element Address Assignment page length)
12 bytes	(Tape Alert page length)
4 bytes	(Configuration page length)
+ 84 bytes	(LCD Mode page length)
124 bytes	

Parameter List Header

If you send one or more parameter pages with the MODE SELECT command, you must send a Parameter List Header. Do not send the Parameter List Header if you are sending no parameter pages.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02								
03								

All fields of the Parameter List Header are reserved. You must specify a value of 0 for each field.

Configuration Page (Page Code 00h)

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (00h)					
01	Parameter Length (02h)							
02	Reserved		Parity	Barcode	Reserved			
03	Maximum Parity Retries							

Page Code – Byte 00, Bits 5 through 0

This field identifies the Configuration page. The value of this field is 00h.

Parameter Length – Byte 01

This field indicates the length, in bytes, of the Configuration parameter list. The valid value for this field is 02h, which indicates that there are two additional bytes of parameter data that follow this byte.

Parity – Byte 02, Bit 5

This bit enables or disables SCSI bus parity checking, as follows:

0 – Disable bus parity checking
1 – Enable bus parity checking

This feature is factory set in nonvolatile memory. The factory default is 1.

Note: You can also set parity checking with the LCD parity option. When you use the operator panel to set the parity option, the library saves the setting as the new MODE SELECT saved value.

The most recent setting of this bit takes precedence: that is, if you previously saved a MODE SELECT value of 1 (enable parity checking) and then use the operator panel to change the setting to 0 (disable), the new setting of 0 takes precedence over the previous setting.

Bar code – Byte 02, Bit 4

This bit enables or disables bar code scanning during power-on initialization, as follows:

0 – Disable bar code scanning during initialization
1 – Enable bar code scanning during initialization

When enabled, the library reads the bar code label on each cartridge at the same time it checks for the presence of each cartridge during power-on initialization. The factory default is 0.

Maximum Parity Retries – Byte 03

This field specifies the maximum number of times the library will retry the Message Out phase, Command Out phase, or Data Out phase when a parity error occurs. The valid values for this field are 0 through 255, where 0 means that no retries are performed. The factory default value for this field is 1.

Tape Alert Page (Page Code 1Ch)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td colspan="2">Reserved</td><td colspan="6">Page Code (1Ch)</td></tr>
<tr><td>01</td><td colspan="8">Page Length</td></tr>
<tr><td>02</td><td>Perf</td><td colspan="3">Reserved</td><td>DExcpt</td><td>Test</td><td>RSVD</td><td>LogErr</td></tr>
<tr><td>03</td><td colspan="4">Reserved</td><td colspan="4">MRIE</td></tr>
<tr><td>04
⋮
07</td><td colspan="8">Interval Timer</td></tr>
<tr><td>08
⋮
11</td><td colspan="8">Report Count/Test Flag Number</td></tr>
</table>

Page Code – Byte 00, Bits 5 through 0

Identifies the page being transferred. The valid value is 1Ch (Tape Alert page).

Page Length – Byte 01

Indicates the number of bytes in the Tape Alert page that follow this byte. The valid value is 0Ah.

Perf – Byte 02, Bit 7

The library does not support this field. The valid value is 0.

DExcpt (Disable Exception Reporting) – Byte 02, Bit 3

Determines how the library handles the reporting of informational exception operations, as follows:

0 – The library reports informational exceptions using the method specified by the MRIE field.

1 – The library disables all informational exception operations. The MRIE field is ignored (default setting).

Test – Byte 02, Bit 2

Determines whether the library generates false informational exception conditions, as follows:

0 – The library does not generate any false informational exception conditions (default setting).

1 – The library generates a false informational exception condition based on the MRIE and the Report Count /Test Flag Number field. The Test Flag Number field in the LOG SENSE Tape Alert page indicates which flag is set. The Test bit is cleared after the false exception has been reported.

If both the Test and DExcpt bits are set to 1, then the MODE SELECT command will result in Check Condition status with the sense key set to Illegal Request (5h).

LogErr – Byte 02, Bit 0

The library does not support this field. The valid value is 0.

MRIE – Byte 03, Bits 3 through 0

Indicates the method used by the library to report informational exception conditions, as follows:

0 – The library does not report informational exception conditions (default setting).

6 – The library only reports an informational exception condition upon request. In response to an unsolicited REQUEST SENSE command, an informational exception condition is indicated by a sense key of 0h (No Sense). The ASC and ASCQ fields are set to 5Dh and 00h, respectively.

Interval Timer – Bytes 04 through 07

The library does not support this field. The valid value is 0.

Report Count/ Test Flag Number – Bytes 08 through 11

When the Test bit (byte 02, bit 2) is set to 0, the valid value for this field is 0.

When the Test bit is set to 1 and the Test Flag Number is non-zero, the library generates or clears a test informational exception condition based on the MRIE field. The value of the Test bit reported by the MODE SENSE command remains at 0. The test action is based on the value of the Test Flag Number, as shown in Table 8-2:

Table 8-2 Test action in response to a Test Flag Number

Test Flag Number	Test Action
1 to 64	The Tape Alert flag specified is set on the Tape Alert log page.
–1 to –64	The Tape Alert flag specified is cleared on the Tape Alert log page.
7FFFh	All supported flags are set on the Tape Alert log page.

When the Test bit is set, setting the Test Flag Number to 0 is not supported and results in Check Condition status with the sense key set to Illegal Request (5h) and the ASC and ASCQ fields set to 26h and 02h.

Element Address Assignment Page (Page Code 1Dh)

This section describes the fields for the Element Address Assignment page and the values you can specify for these fields. Refer to "Assigning Element Addresses" on page 8-11, for an explanation of element addresses.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (1Dh)					
01	Page Length							
02	(MSB)		Medium Transport Element Address					
03								(LSB)
04	(MSB)		Number of Medium Transport Elements					
05								(LSB)
06	(MSB)		First Storage Element Address					
07								(LSB)
08	(MSB)		Number of Storage Elements					
09								(LSB)
10	(MSB)		First Import/Export Element Address					
11								(LSB)
12	(MSB)		Number of Import/Export Elements					
13								(LSB)
14	(MSB)		First Data Transfer Element Address					
15								(LSB)
16	(MSB)		Number of Data Transfer Elements					
17								(LSB)
18	Reserved							
19								

Page Code – Byte 00, Bits 5 through 0

This field identifies the Element Address Assignment page. The value of this field must be 1Dh.

Page Length – Byte 01

This field indicates the length, in bytes, of the Element Address Assignment parameter list. The valid value for this field is 12h (18), which indicates that there are an additional 18 bytes of parameter data that follow this byte.

Medium Transport Element Address – Bytes 02 and 03

This field identifies the address of the robot. The default value for this field is 1F5h (501).

Number of Medium Transport Elements – Bytes 04 and 05

This field identifies the number of robots within the library. The library has only one robot. The valid value for this field is 1.

First Storage Element Address – Bytes 06 and 07

This field identifies the starting address of the cartridge storage locations. The default starting address is 00h (0). When assigning new addresses, you assign the first number to the fixed cartridge slot and the library automatically assigns the others sequentially.

Number of Storage Elements – Bytes 08 and 09

This field identifies the maximum number of cartridge storage locations within the library. The library has 31, 61, or 91 storage locations, comprised of 6, 12, or 18 data cartridge magazines containing 5 storage slots each and the fixed cartridge slot. The valid value for this field is 1Fh (31), 3Dh (61), or 5Bh (91).

The number of storage elements cannot be changed using the MODE SELECT command. Instead, the number of storage slots (30, 60, or 90) is specified through the LCD. Changing the number causes the library to automatically renumber the element indexes and perform a recalibration to update the position of each storage element.

First Import/Export Element Address – Bytes 10 and 11

This field identifies the address of the first import/export element in the entry/exit port. The default value for this field is 191h (401).

Number of Import/Export Elements – Bytes 12 and 13

This field identifies the total number of locations used for importing and exporting cartridges to and from the cartridge storage areas. Since the entry/exit port can move up to five cartridges at one time, the valid value for this field is 5.

First Data Transfer Element Address – Bytes 14 and 15

This field identifies the starting address of the installed tape drives. The default starting address is 1C3h (451).

Number of Data Transfer Elements – Bytes 16 and 17

This field identifies the number of tape drives installed. The valid value for this field is 0, 1, 2, 3, 4, 5 or 6.

Note: The actual number of tape drives installed cannot be changed by this field because the library automatically determines the number of tape drives during power-up. It is not an error to specify a value that is different from the actual number of tape drives installed, as long as that value is 0, 1, 2, 3, 4, 5, or 6. If the value is not 0, 1, 2, 3, 4, 5, or 6, the library returns Check Condition status with the sense key set to Illegal Request.

Assigning Element Addresses

An *element* is a way of classifying various components in the library. Element addresses reference specific physical locations in the library. The library contains four element types: the robot, cartridge slots, the import/export elements, and the tape drives (known as the medium transport, storage, import/export, and data transfer elements, respectively). Each element requires an address so that it can be identified during a SCSI command operation. The library has default addresses assigned to each element. Figure 8-1, Figure 8-2, and Figure 8-3 show the default element addresses for the library with 31, 61, or 91 storage elements, respectively.

If you want to change the addresses of the library's elements, use the Element Address Assignment page. In this page, you assign a starting address for each element type (robot, cartridge slots, import/export elements, and tape drives) and then specify the total number of elements of that type. The element addresses for the cartridge slots, import/export elements, and tape drives will be numbered consecutively, with the first address for that type being the starting element address that you specify.

- Because the library supports the saved page function, you can save the element address values by setting the SP bit in the CDB to 1. These values configure the library upon power-up or a reset condition.

➤ **Important** For the starting element addresses, you can specify any 16-bit binary number, with the following conditions:

- Element addresses must not overlap.
- Addresses for the storage elements must be consecutive. The highest address you can assign for the first storage element is FFA5h. (This causes the last storage element to be numbered FFFFh.)
- Addresses for the data transfer elements must also be consecutive. The highest address you can assign for the first data transfer element is FFF9h.

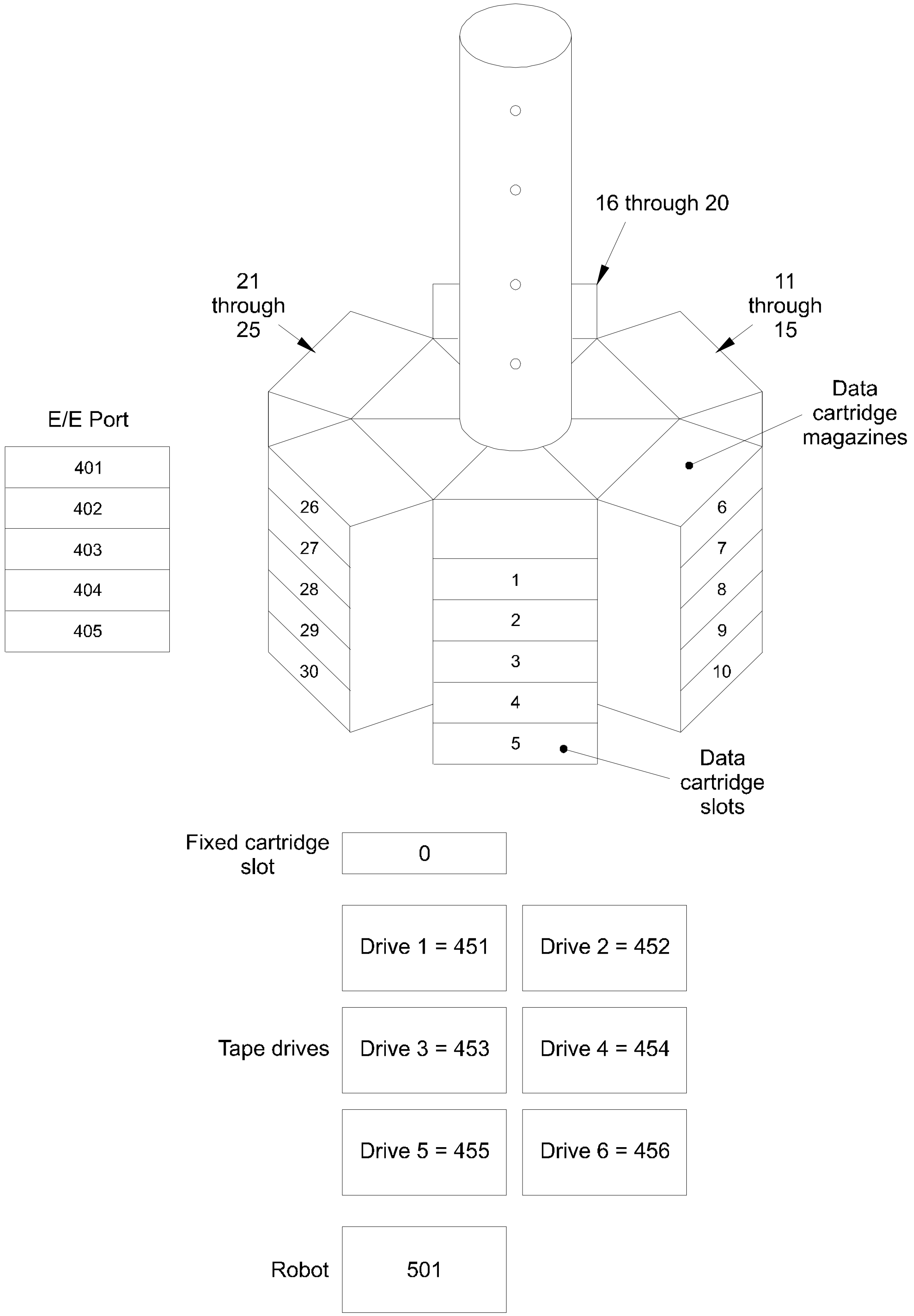

Figure 8-1 Default element addresses (element indexes) for the Exabyte 690D with 31 data storage elements (6 data cartridge magazines)

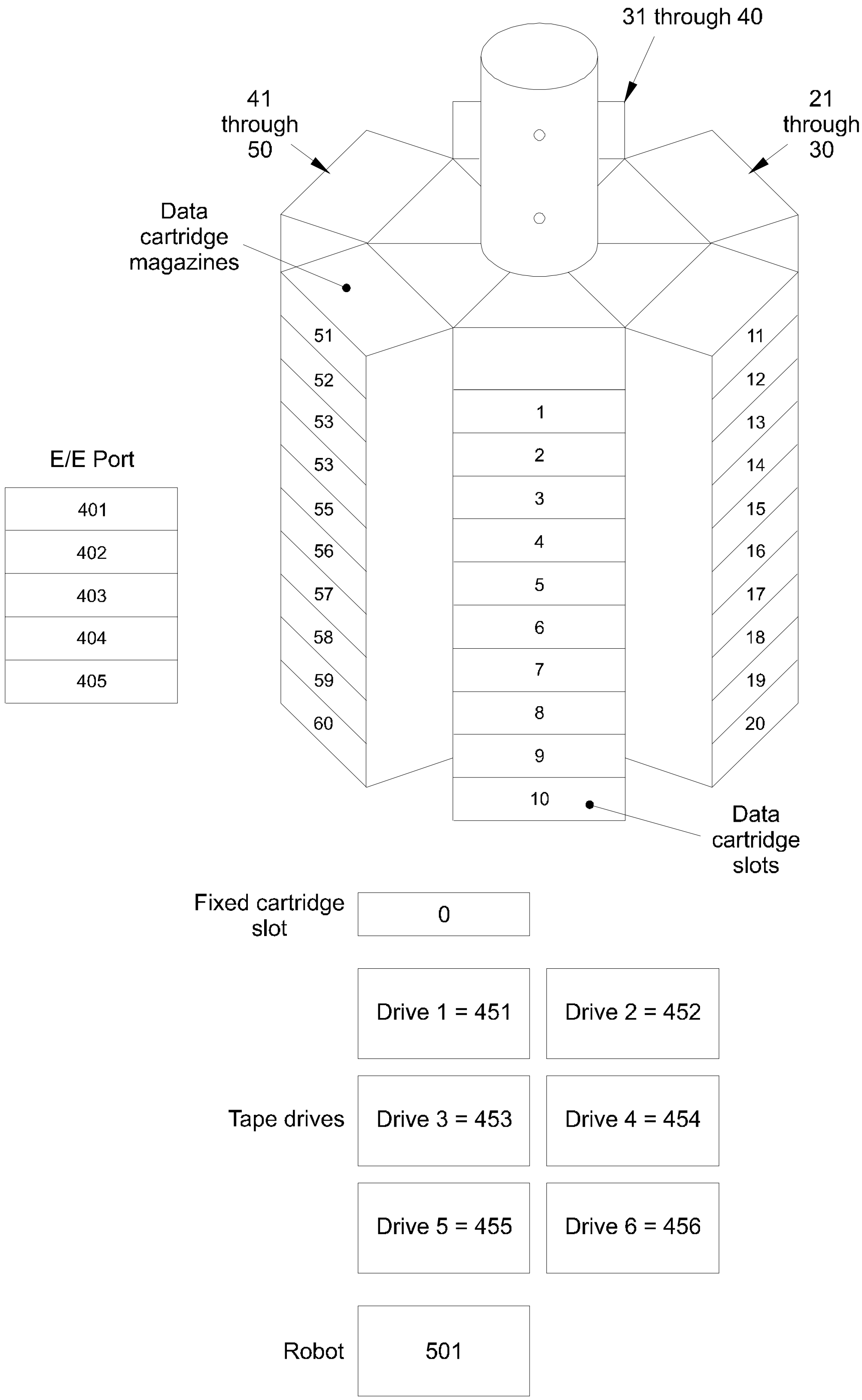

Figure 8-2 Default element addresses (element indexes) for the Exabyte 690D with 61 data storage elements (12 data cartridge magazines)

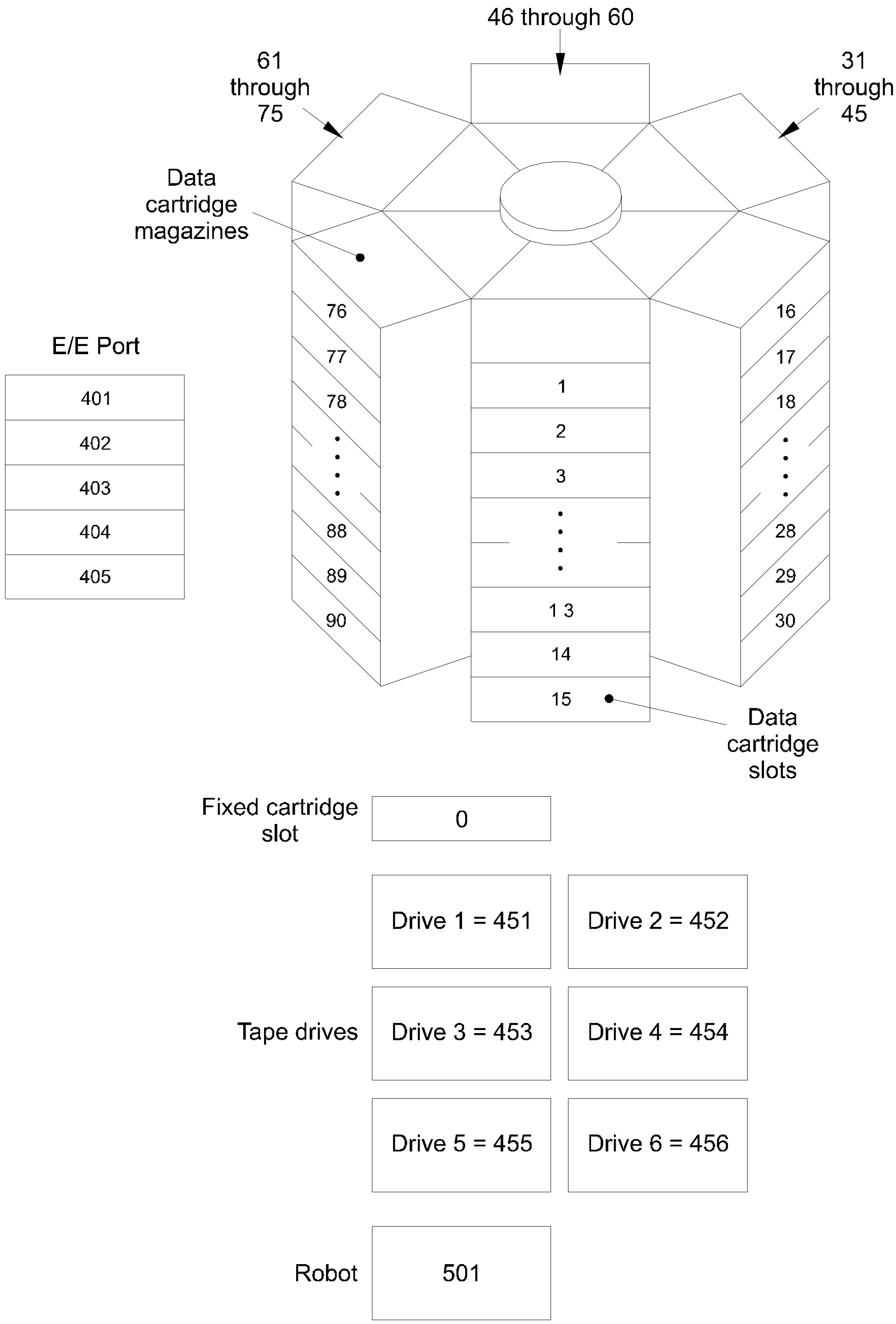

Figure 8-3 Default element addresses (element indexes) for the Exabyte 690D with 91 data storage elements (18 data cartridge magazines)

LCD Mode Page (Page Code 22h)

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (22h)					
01	Parameter Length (52h)							
02	LCD Security Valid	LCD Security	Keypad Passthru Mode Valid	Keypad Passthru Mode	Write Line 1	Write Line 2	Write Line 3	Write Line 4
03	Reserved							
04 ⋮ 23	Display Line 1							
24 ⋮ 43	Display Line 2							
44 ⋮ 63	Display Line 3							
64 ⋮ 83	Display Line 4							

Page Code – Byte 00, Bits 5 through 0

This field identifies the LCD Mode page. The value of this field is 22h.

Parameter Length – Byte 01

This field indicates the length, in bytes, of the LCD Mode page. The valid value for this field is 52h (82), which indicates that 82 bytes of data follow this byte.

LCD Security Valid – Byte 02, Bit 7

This bit indicates whether a change to LCD security is being requested. When LCD security is enabled, access to certain LCD menu options is prevented. The settings for this bit are as follows:

0 – LCD security is not being changed. The value of the LCD Security bit (byte 02, bit 6) should be ignored.

1 – LCD security is being changed according to the value of the LCD Security bit (byte 02, bit 6).

LCD Security – Byte 02, Bit 6

When the LCD Security Valid bit (byte 02, bit 7) is 1, the LCD Security bit enables or disables LCD security. The settings for this bit are as follows:

0 – Disable LCD security (factory default)
1 – Enable LCD security

When LCD security is enabled, access to the following LCD activities is prevented:

- Changing the control mode
- Changing SCSI IDs
- Changing SCSI parity checking
- Performing operator panel diagnostics
- Calibrating the library
- Using the options for cleaning the tape drives
- Setting the library's serial number
- Changing the setting of the 480 Emulation option
- Changing the setting of the Verify Chksums option

A user trying to access the operator panel menu options for these activities receives an error message.

Note: You can also enable LCD security from the operator panel using a password. (Refer to *Exabyte 690D Library Installation and Operation* for information.) Whichever method you use to enable LCD security (operator panel or MODE SELECT), you must use the same method to disable LCD security. That is, if you enable LCD security through the operator panel, you must disable it through the operator panel. Similarly, if you enable LCD security using a MODE SELECT command, you must disable it with MODE SELECT.

Keypad Passthru Mode Valid – Byte 02, Bit 5

This bit indicates whether a change to the Keypad Passthru Mode is being requested. When Keypad Passthru Mode is enabled, the library no longer responds to commands entered from the operator panel. Instead, the host can issue a MODE SENSE command to get information about what keys were pressed.

0 – Keypad Passthru Mode is not being changed. The value of the Keypad Passthru Mode bit (byte 02, bit 4) should be ignored.

1 – Keypad Passthru Mode is being changed. The value of the Keypad Passthru Mode bit (byte 02, bit 4) is valid.

Keypad Passthru Mode – Byte 02, Bit 4

With the Keypad Passthru Mode Valid bit (byte 02, bit 5) is 1, the Keypad Passthru Mode bit enables or disables Keypad Passthru Mode. The settings for this bit are as follows:

0 – Disable Keypad Passthru Mode (factory default)
1 – Enable Keypad Passthru Mode

Write Line 1 – Byte 02, Bit 3

This field determines the type of text that appears on Display Line 1 of the LCD Status Screen (bytes 04 through 23 of the LCD Mode page), as follows:

0 – Library default text.
1 – Text you specify for Display Line 1.

Write Line 2 – Byte 02, Bit 2

This field determines the type of text that appears on Display Line 2 of the LCD Status Screen (bytes 24 through 43 of the LCD Mode page), as follows:

0 – Library default text.
1 – Text you specify for Display Line 2.

Write Line 3 – Byte 02, Bit 1

This field determines the type of text that appears on Display Line 3 of the LCD Status Screen (bytes 44 through 63 of the LCD Mode page), as follows:

0 – Library default text.
1 – Text you specify for Display Line 3.

Write Line 4 – Byte 02, Bit 0

This field determines the type of text that appears on Display Line 4 of the LCD Status Screen (bytes 64 through 83 of the LCD Mode page), as follows:

0 – Library default text.
1 – Text you specify for Display Line 4.

Display Line 1 – Bytes 04 through 23

This field enables you to specify text to display on the first user-writable line of the LCD Status Screen, shown in Figure 8-4. You can use up to 20 characters for this text. If you use fewer than 20 characters, at least one byte following the text must be a 00h.

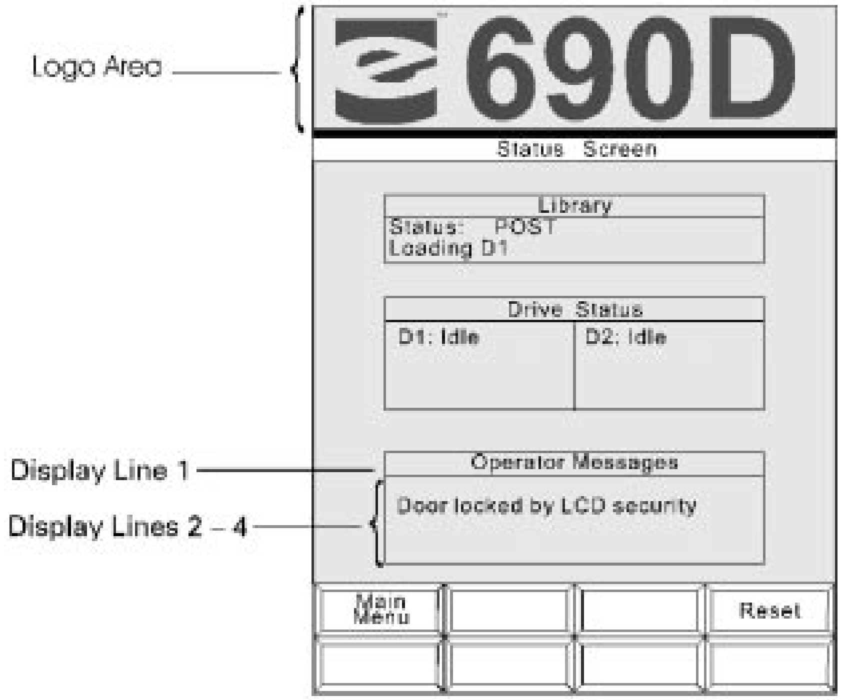

Figure 8-4 Exabyte 690D LCD Status Screen

Notes:

- To replace the default logo shown at the top of the library's LCD with a custom logo, use the WRITE BUFFER command, as described on page 24-2.
- If you leave Write Line 1 (byte 02, bit 3) set to 0, and set Write Lines 2 through 4 (byte 02, bits 2 through 0) to 1, Display Line 1 displays the heading "Operator Message." If you set Write Line 1 to 1, then the text you specify for Display Line 1 overwrites the "Operator Message" heading.
- If you operate the library in 480 Emulation mode, the operation of Display Lines 1 through 4 changes, as follows:
  - Display Lines 1 and 2 replace the area at the top of the LCD where the Exabyte 690D logo normally appears. The information displayed for these two lines changes as shown in Table 8-3.

- Display Lines 3 and 4 appear in the operator messages window of the Status screen. If you set Write Line 3 or 4 to 1, then the text you specify overwrites corresponding line in the operator message window of the Status screen.

Table 8-3 Effect of Write Line 1 and 2 settings on Display Lines 1 and 2 when using the 480 Emulation option

If Write Line 1 is set to...	If Write Line 2 is set to...	Display Line 1 displays...	Display Line 2 displays...
0 (default)	0 (default)	Exabyte 690D logo	
0	1	Exabyte 690D	Text you specify for bytes 24 through 43 of the LCD Mode Page.
1	0	Text you specify for bytes 04 through 23 of the LCD Mode Page.	VER x.yy.zz hh:mm:ss
1	1	Text you specify for bytes 04 through 23 of the LCD Mode Page.	Text you specify for bytes 24 through 43 of the LCD Mode Page.

Display Line 2 – Bytes 24 through 43

This field enables you to specify text to display on the second user-writable line of the LCD Status Screen. You can use up to 20 characters for this text. If you use fewer than 20 characters, at least one byte following the text must be a 00h.

Display Line 3 – Bytes 44 through 63

This field enables you to specify text to display on the third user-writable line of the LCD Status Screen. You can use up to 20 characters for this text. If you use fewer than 20 characters, at least one byte following the text must be a 00h.

Display Line 4 – Bytes 64 through 83

This field enables you to specify text to display on the fourth user-writable line of the LCD Status Screen. You can use up to 20 characters for this text. If you use fewer than 20 characters, at least one byte following the text must be a 00h.

8.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed (see Chapter 3).

Figure 8-5 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in both the CDB and MODE SELECT data. Table 8-4 shows the sense data reported for invalid parameters in the CDB and in the MODE SELECT data.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase or if parity errors are detected on the MODE SELECT data.

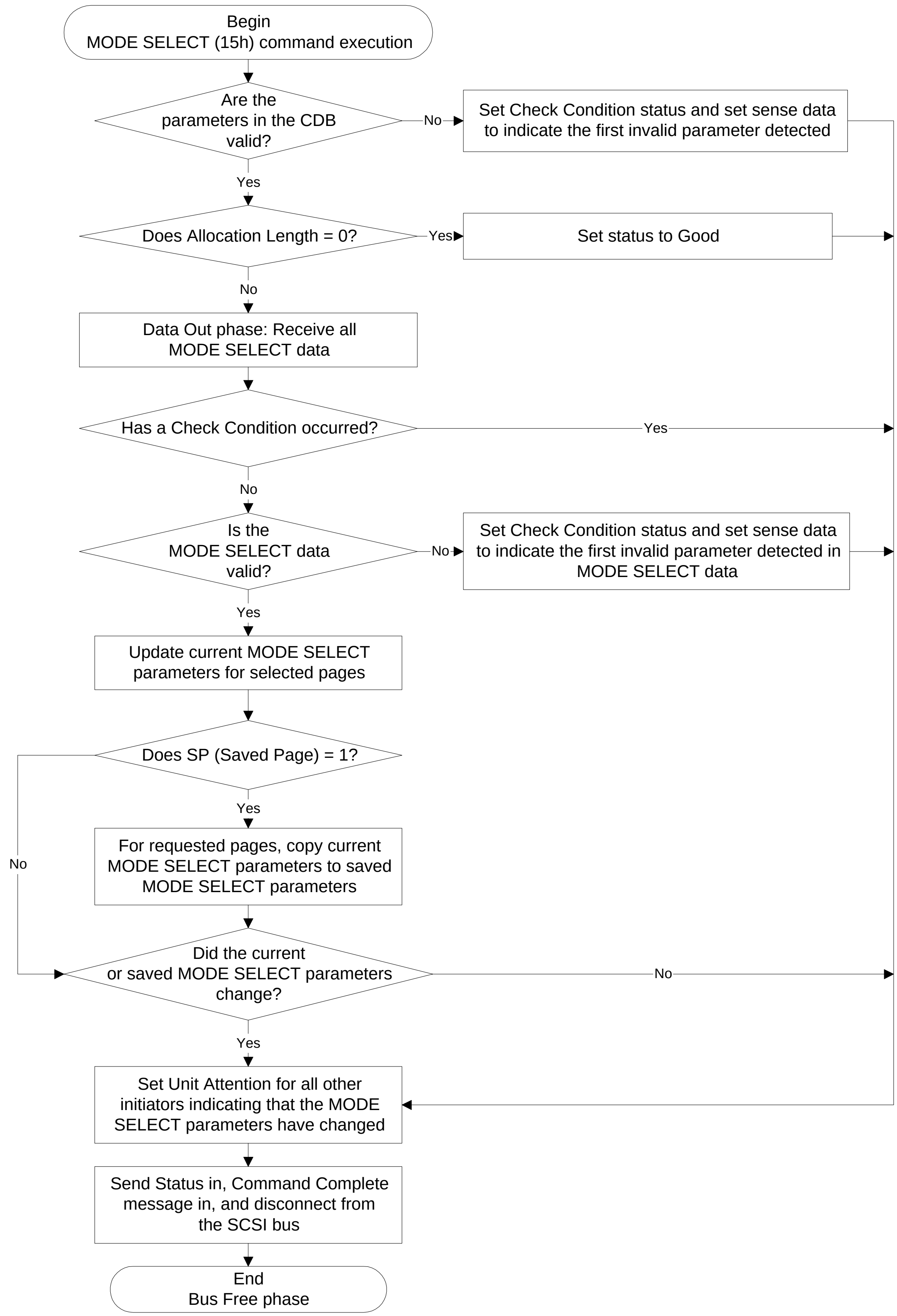

Figure 8-5 MODE SELECT command execution

8.4 Command Status

The library returns a status byte after processing the MODE SELECT command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors (that is, when the requested MODE SELECT parameters have been copied over the current MODE SELECT settings and, if requested, the saved MODE SELECT settings).

Busy

The library returns Busy status when it is processing a command for a different initiator or when the library is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status for the following reasons:

- The library is reserved by a different initiator.
- One or more of the library's elements are reserved by a different initiator and an attempt is made to change any element address.

See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 8-4 for sense data).
- The library detects an unrecoverable parity error while receiving the MODE SELECT data.
- A parameter in the MODE SELECT data is invalid (see Table 8-4 for sense data).

Table 8-4 Invalid parameters in the MODE SELECT CDB and mode data

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0004h	Invalid Parameter List Length.
5h	24h	00h	1	1	1	4h	0001h	Invalid PF (page format).
5h	26h	00h	1	0	0	0	a	Invalid values in the Parameter List Header. All values must be 0. The value of the field pointer is the value of the first field that contains a non-zero value (00, 01, 02, or 03).
5h	26h	00h	1	0	1	5h	a	Invalid Page Code.
5h	26h	00h	1	0	1	7h	a	Reserved bits set in the first byte of one of the MODE SELECT pages.
5h	26h	00h	1	0	0	0	a	Invalid Page Length.
5h	26h	00h	1	0	0	0	a	Reserved bits set in the reserved fields 22 or 23 (bytes 18 or 19 of the Element Address Assignment page).
5h	26h	02h	1	0	0	0	a	Address overlap. The field pointer is set to the value representing the field in the Element Address Assignment page that caused the address overlap, as follows: 0006h – Medium Transport Element Address 000Ah – Storage Element Address

Table 8-4 Invalid parameters in the MODE SELECT CDB and mode data (*continued*)

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	26h	02h	1	0	0	0	[a]	Invalid number of transport elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of medium storage elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of import/export elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of data transfer elements.
5h	26h	02h	1	0	0	0	[a]	Invalid first import/export address.
5h	26h	02h	1	0	0	0	[a]	Storage element addresses are not consecutive.

[a] Field pointer depends on the order in which the pages are sent.

9 MODE SENSE (1Ah)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	0
01	Logical Unit Number			RSVD	DBD	Reserved		
02	PC		Page Code					
03	Reserved							
04	Allocation Length							
05	0	0	Reserved				0	0

9.1 About This Command

The MODE SENSE command enables the library to report its operating mode parameters to the initiator. The initiator can request one or all pages of mode parameters. Each response includes four bytes for the Parameter List Header, followed by the specified number of bytes for each page:

- 4 bytes for the Configuration page
- 12 bytes for the Tape Alert page
- 20 bytes for the Element Address Assignment page
- 4 bytes for the Transport Geometry Descriptor page
- 20 bytes for the Device Capabilities page
- 84 bytes for the LCD Mode page

Using the MODE SELECT (15h) command, you can change the values of all of these parameters, except the Transport Geometry Descriptor page and the Device Capabilities page.

9.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

DBD (Disable Block Descriptors) – Byte 01, Bit 3

The library ignores this bit.

PC (Page Control) – Byte 02, Bits 7 and 6

This field defines the type of parameters that are to be returned for the MODE SENSE command. Specify one of the following values:

0 – Current values Indicates that the library should return the current parameter values. The current values returned 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 or reset.
- The default values, if saved values are not available.

1 – Changeable values Indicates that the library should return the changeable parameter masks. The pages you request are returned and indicate which parameters you can change. All bits of parameters that you can change are set to 1. All bits of parameters that you cannot change are set to 0. The Page Code and Parameter List Length fields contain actual values.

Note: Before issuing a MODE SELECT command, issue a MODE SENSE command with the PC field set to 1 and the Page Code field set to 3Fh. This will allow you to determine the supported pages, the changeable parameters within the pages, and the supported length of each page.

2 – Default values Indicates that the library should return the default values. The pages you request are returned, with each supported parameter set to its default value. Parameters not supported by the library are set to 0.

3 – Saved values Indicates that the library should return the saved values. The pages you request are returned, with each supported parameter set to its saved value. Parameters not supported by the library are set to 0.

Note: For a PC value of 3, if no page has been saved, the library returns default values.

Page Code – Byte 02, Bits 5 through 0

This field allows you to specify which page the library should return. Specify one of the following values:

00h – Configuration page
1Ch – Tape Alert page
1Dh – Element Address Assignment page
1Eh – Transport Geometry Descriptor page
1Fh – Device Capabilities page
22h – LCD Mode page
3Fh – All pages (in the above order)

Allocation Length – Byte 04

This field allows you to specify the length of the parameter list the library will return. The maximum length you need to specify to receive all pages is 148 (94h) bytes.

The library terminates the Data In phase when the number of bytes specified by the Allocation Length have been transferred or when all available MODE SENSE data have been transferred to the initiator, whichever is less.

9.3 What the Library Returns

This section describes the mode data page structure and the pages that the library supports. The MODE SENSE command returns the single mode data page specified in the Page Code field of the CDB. Each mode data page begins with a four-byte parameter list header, followed by zero or more variable-length mode data parameters defined for the specified page.

Parameter List Header

Bit / Byte	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Reserved							
02								
03								

Mode Data Length – Byte 00

This field indicates the number of bytes of parameter information the library is returning as a result of this command, excluding the Mode Data Length byte, but including the three additional Parameter List Header bytes.

Configuration Page (Page Code 00h)

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (00h)					
01	Parameter Length (02h)							
02	Reserved		Parity	Barcode	Reserved			
03	Maximum Parity Retries							

PS (Page Savable) – Byte 00, Bit 7

This field specifies that the library is capable of saving this page to nonvolatile memory. The value returned for this field is 1.

Page Code – Byte 00, Bits 5 through 0

This field identifies the Configuration page. The value returned for this field is 00h.

Parameter Length – Byte 01

The Page Length is 02h, which indicates that there are an additional 2 bytes of data that follow this byte.

Parity – Byte 02, Bit 5

This field indicates whether SCSI bus parity checking is enabled or disabled with the MODE SELECT (15h) parameters, as follows:

0 – SCSI bus parity checking disabled
1 – SCSI bus parity checking enabled

The factory default is 1. You can change this field with the MODE SELECT command.

Note: Parity checking can also be set with the LCD parity option. See Chapter 2 for more information.

Barcode – Byte 02, Bit 4

This bit indicates whether barcode scanning during power-on initialization is enabled or disabled, as follows:

0 – Disable
1 – Enable

When enabled, the library reads the barcode label on each cartridge at the same time it checks for the presence of each cartridge during power-on initialization. The factory default is 0. You can change this field with the MODE SELECT command.

Maximum Parity Retries – Byte 03

This field indicates the maximum number of times the library will retry the message out phase, command out phase, or data out phase when a parity error occurs. The valid values for this field are 0 through 255, where 0 means that no retries are performed. The factory default value for this field is 1. You can change this field with the MODE SELECT command.

Tape Alert Page (Page Code 1Ch)

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Ch)					
01	Page Length							
02	Perf	Reserved			DExcpt	Test	RSVD	LogErr
03	Reserved				MRIE			
04 ⋮ 07	Interval Timer							
08 ⋮ 11	Report Count/Test Flag Number							

PS (Page Savable) – Byte 00, Bit 07

This field specifies that the library is capable of saving this page to nonvolatile memory. The value returned for this field is 1.

Page Code – Byte 00, Bits 5 through 0

Identifies the page being transferred. The valid value is 1Ch (Tape Alert page).

Page Length – Byte 01

Indicates the number of bytes in the Tape Alert page that follow this byte. The valid value is 0Ah.

Perf – Byte 02, Bit 7

The library does not support this field. The valid value is 0.

DExcpt (Disable Exception Reporting) – Byte 02, Bit 3

Determines how the library handles the reporting of informational exception operations, as follows:

0 – The library reports informational exceptions using the method specified by the MRIE field.

1 – The library disables all informational exception operations. The MRIE field is ignored (default setting).

Test – Byte 02, Bit 2

The valid value for this field is always 0.

LogErr – Byte 02, Bit 0

The library does not support this field. The valid value is 0.

MRIE – Byte 03, Bits 3 through 0

Indicates the method used by the library to report informational exception conditions, as follows:

0 – The library does not report informational exception conditions (default setting).

6 – The library only reports an informational exception condition upon request. In response to an unsolicited REQUEST SENSE command, an informational exception condition is indicated by a sense key of 0h (no sense). The ASC and ASCQ fields are set to 5Dh and 00h, respectively.

Interval Timer – Bytes 04 through 07

The library does not support this field. The valid value is 0.

Report Count/Test Flag Number – Bytes 08 through 11

The valid value for this field is always 0.

Element Address Assignment Page (Page Code 1Dh)

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Dh)					
01	Parameter Length (12h)							
02	(MSB) Medium Transport Element Address							
03								(LSB)
04	(MSB) Number of Medium Transport Elements							
05								(LSB)
06	(MSB) First Storage Element Address							
07								(LSB)
08	(MSB) Number of Storage Elements							
09								(LSB)
10	(MSB) First Import/Export Element Address							
11								(LSB)
12	(MSB) Number of Import/Export Elements							
13								(LSB)
14	(MSB) First Data Transfer Element Address							
15								(LSB)
16	(MSB) Number of Data Transfer Elements							
17								(LSB)
18	Reserved							
19								

For the element-specific field definitions in the following list, refer to Table 1-3 and to Chapter 8.

PS (Page Savable) – Byte 00, Bit 7

The value returned for this field is 1, which indicates that the library can save this page to nonvolatile memory.

Page Code – Byte 00, Bits 5 through 0

This field identifies the Element Address Assignment page. The value returned for this field is 1Dh.

Parameter Length – Byte 01

The value returned for this field is 12h (18), which indicates that there are an additional 18 bytes of element address data that follow this byte.

Medium Transport Element Address – Bytes 02 and 03

This field indicates the address of the robot. The default address is 1F5h (501). You can change this address with the MODE SELECT (15h) command.

Number of Medium Transport Elements – Bytes 04 and 05

This field indicates the number of robots within the library. The library has only one robot, so the value returned for this field is 1. This value cannot be changed.

First Storage Element Address – Bytes 06 and 07

This field indicates the starting address of the cartridge storage locations. The default starting address is 00h (0). You can change this address with the MODE SELECT (15h) command.

Number of Storage Elements – Bytes 08 and 09

This field indicates the maximum number of cartridge storage locations within the library. The library has 31, 61, or 91 storage locations, comprised of 6, 12, or 18 data cartridge magazines containing 5 storage slots each and the fixed cartridge slot. The valid value for this field is 1Fh (31), 3Dh (61), or 5Bh (91).

The number of storage elements cannot be changed using the MODE SELECT command. Instead, the number of storage slots (30, 60, or 90) is specified through the LCD. Changing the number causes the library to automatically renumber the element indexes and perform a recalibration to update the position of each storage element.

First Import/Export Element Address – Bytes 10 and 11

This field indicates the address of the first import/export element in the entry/exit port. The value for this field is 191h (401). You can change this address with the MODE SELECT (15h) command.

Number of Import/Export Elements – Bytes 12 and 13

This field indicates the total number of locations used for importing and exporting cartridges to and from the cartridge storage areas. Since the entry/exit port can move up to five cartridges at one time, the valid value for this field is 5. This value cannot be changed.

First Data Transfer Element Address – Bytes 14 and 15

The default value returned for this field is 1C3h (451). You can change this address with the MODE SELECT (15h) command.

Note: The Data Transfer Element Address returned will reflect the address of Drive 1, regardless of whether the tape drive is installed. Use the READ ELEMENT STATUS command to determine the address of the first installed tape drive.

Number of Data Transfer Elements – Bytes 16 and 17

This field indicates the number of tape drives installed. The valid value for this field is 0, 1, 2, 3, 4, 5 or 6. This value cannot be changed.

Note: The library automatically determines the number of tape drives during power-up.

Transport Geometry Descriptor Page (Page Code 1Eh)

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Eh)					
01	Parameter Length (02h)							
02	Reserved							Rotate
03	Member Number in Transport Element Set							

PS (Page Savable) – Byte 00, Bit 7

The value returned for this field is 0, which indicates that the library cannot save this page to nonvolatile memory.

Page Code – Byte 00, Bits 5 through 0

This field identifies the Transport Geometry Descriptor page. The value returned for this field is 1Eh.

Parameter Length – Byte 01

This field indicates the number of additional bytes of transport geometry descriptor data that follow the header. Each descriptor consists of two bytes of information. The library has only one transport mechanism (robot), so the value returned for this field is 02h.

Rotate – Byte 02, Bit 0

This field indicates the ability of the transport mechanism to handle two-sided media. The library uses only one-sided media, so the value returned for this field is 0.

Member Number in Transport Element Set – Byte 03

This field indicates the specific transport element in the system to which this descriptor is applied. The library has only one transport element, so the value returned for this field is 0.

Device Capabilities Page (Page Code 1Fh)

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Fh)					
01	Parameter Length (12h)							
02	Reserved				DT 1	I/E 1	ST 1	MT 1
03	Reserved							
04	Reserved				MT→DT 1	MT→I/E 1	MT→ST 1	MT→MT 0
05	Reserved				ST→DT 1	ST→I/E 1	ST→ST 1	ST→MT 1
06	Reserved				I/E→DT 1	I/E→I/E 1	I/E→ST 1	I/E→MT 1
07	Reserved				DT→DT 1	DT→I/E 1	DT→ST 1	DT→MT 1
08 ⋮ 19	Reserved							

DT – Data transfer element (tape drive)
I/E – Import/export element (entry/exit port)
MT – Media transport element (robot)
ST – Storage element (cartridge location)

0 – move not supported
1 – move supported

PS (Page Savable) – Byte 00, Bit 7

The value returned for this field is 0, which indicates that the library cannot save this page to nonvolatile memory.

Page Code – Byte 00, Bits 5 through 0

This field identifies the page code for the Device Capabilities page. The value returned for this field is 1Fh.

Parameter Length – Byte 01

The Parameter Length is 12h (18), which indicates that there are an additional 18 bytes of device capabilities data that follow this byte.

DT (Data Transfer Element/Tape Drive) – Byte 02, Bit 3

The value returned for this field is 1, which indicates that the tape drive can store cartridges. (A cartridge in a tape drive, either loaded or ejected, is considered “stored” in the tape drive.)

I/E (Import/Export Element) – Byte 02, Bit 2

The value returned for this field is 1, which indicates that the entry/exit port can store cartridges.

ST (Storage Element) – Byte 02, Bit 1

The value returned for this field is 1, which indicates that the cartridge storage locations can store cartridges.

MT (Media Transport) – Byte 02, Bit 0

The value returned for this field is 1, which indicates that the robot can store cartridges.

MT → DT – Byte 04, Bit 3

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the robot and the destination is a tape drive.

MT → I/E – Byte 04, Bit 2

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the robot and the destination is the import/export element.

MT → ST – Byte 04, Bit 1

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the robot and the destination is a cartridge storage location.

MT → MT – Byte 04, Bit 0

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the robot and the destination is the robot.

ST → DT – Byte 05, Bit 3

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is a tape drive.

ST → I/E – Byte 05, Bit 2

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is the import/export element.

ST → ST – Byte 05, Bit 1

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is a cartridge storage location.

ST → MT – Byte 05, Bit 0

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is the robot.

I/E → DT – Byte 06, Bit 3

The value returned for this field is1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is a tape drive.

I/E → I/E – Byte 06, Bit 2

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the import/export element.

I/E → ST – Byte 06, Bit 1

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is a cartridge storage location.

I/E → MT – Byte 06, Bit 0

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the robot.

DT → DT – Byte 07, Bit 3

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a tape drive.

DT → I/E – Byte 07, Bit 2

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the import/export element.

DT → ST – Byte 07, Bit 1

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a cartridge storage location.

DT → MT – Byte 07, Bit 0

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the robot.

LCD Mode Page (Page Code 22h)

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (22h)					
01	Parameter Length (52h)							
02	RSVD	LCD Security	Key Press Valid	RSVD	Write Line 1	Write Line 2	Write Line 3	Write Line 4
03	Key Press							
04 ⋮ 23	Display Line 1							
24 ⋮ 43	Display Line 2							
44 ⋮ 63	Display Line 3							
64 ⋮ 83	Display Line 4							

PS – Byte 00, Bit 07 (Page Savable)

This field specifies that the library is capable of saving this page to nonvolatile memory. The value returned for this field is 1.

Parameter Length – Byte 01

The Page Length is 52h (82) which indicates that there are an additional 82 bytes of data that follow this byte.

LCD Security – Byte 02, Bit 6

This bit indicates whether LCD security is enabled. When LCD security is enabled, access to certain LCD menu options from the front panel is prevented (see page 8-17). The values for this bit are as follows:

0 – LCD security is not enabled (factory default)
1 – LCD security is enabled

Key Press Valid – Byte 02, Bit 5

This bit indicates whether the Keypad Passthru Mode is enabled. If Keypad Passthru Mode is enabled, then this bit also indicates whether the Key Press field (byte 03) is valid. The values for this bit are as follows:

0 – Keypad Passthru Mode is disabled. The Key Press field is invalid.
1 – Keypad Passthru Mode is enabled. The Key Press field is valid.

Write Line 1 – Byte 02, Bit 3

This field indicates the text used for the first user-writable line of the display, as follows:

0 – Library default text.

1 – Text you specified in bytes 04 through 23 of the LCD Mode page from the last MODE SELECT command.

The factory default is 0. You can change this field with the MODE SELECT command.

Write Line 2 – Byte 02, Bit 2

This field indicates the text used for the second user-writable line of the display, as follows:

0 – Library default text.

1 – Text you specified in bytes 24 through 43 of the LCD Mode page from the last MODE SELECT command.

The factory default is 0. You can change this field with the MODE SELECT command.

Write Line 3 – Byte 02, Bit 1

This field indicates the text used for the third user-writable line of the display, as follows:

0 – Library default text.

1 – Text you specified in bytes 44 through 63 of the LCD Mode page from the last MODE SELECT command.

The factory default is 0. You can change this field with the MODE SELECT command.

Write Line 4 – Byte 02, Bit 0

This field indicates the text used for the fourth user-writable line of the display, as follows:

0 – Library default text.

1 – Text you specified in bytes 64 through 83 of the LCD Mode page from the last MODE SELECT command.

The factory default is 0. You can change this field with the MODE SELECT command.

Key Press – Byte 03

When the Key Press Valid bit (byte 02, bit 5) is 1, this field contains the oldest key press from the operator panel. Key presses are stored in a first-in, first-out (FIFO) buffer. When a key press value is returned in this field, that value is removed from the buffer. The values for this field are as follows:

0 – No key pressed
1 – Key 1 pressed
2 – Key 2 pressed
3 – Key 3 pressed
4 – Key 4 pressed
5 – Key 5 pressed
6 – Key 6 pressed
7 – Key 7 pressed
8 – Key 8 pressed

The keys on the operator panel keypad are numbered from left to right, with Key 1 being the upper left key.

Display Line 1 – Bytes 04 through 23

This field indicates the text that the library displays for the first user-writable line of the LCD when the Write Line 1 field is set to 1.

Notes:

- If Write Line 1 (byte 02, bit 3) is 0 and Write Lines 2 through 4 (byte 02, bits 2 through 0) are 1, then Display Line 1 displays the heading "Operator Message." If Write Line 1 is 1, then the text you specified for Display Line 1 overwrites the "Operator Message" heading.

- If you operate the library in 480 Emulation mode, the operation of Display Lines 1 through 4 change. See page 8-20 for detailed information about the impact on the LCD of using the 480 Emulation option.

Display Line 2 – Bytes 24 through 43

This field indicates the text that the library displays for the second user-writable line of the LCD when the Write Line 2 field is set to 1.

Display Line 3 – Bytes 44 through 63

This field indicates the text that the library displays for the third user-writable line of the LCD when the Write Line 3 field is set to 1.

Display Line 4 – Bytes 64 through 83

This field indicates the text that the library displays for the fourth user-writable line of the LCD when the Write Line 4 field is set to 1.

9.4 How the Library Executes This Command

This section describes how the library executes the MODE SENSE command. The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 9-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB.

Table 9-1 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

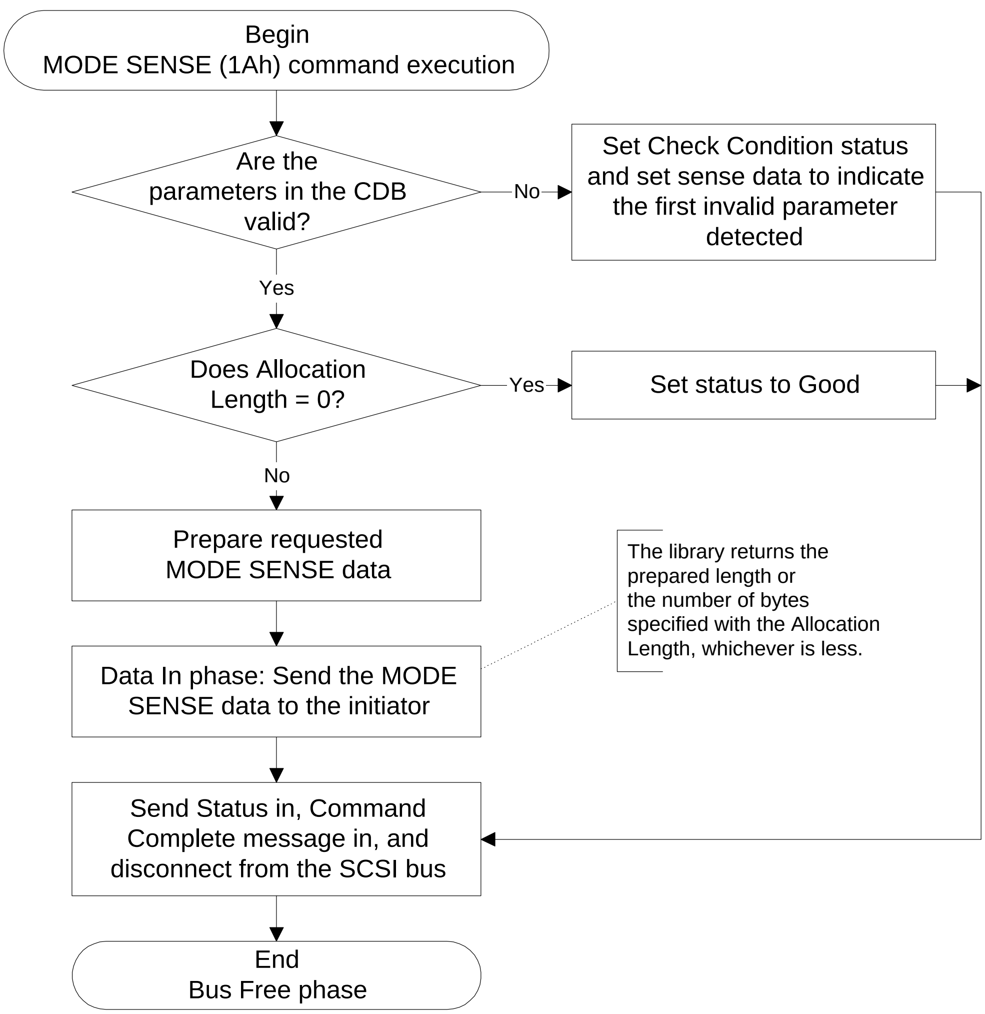

Figure 9-1 MODE SENSE command execution

9.5 Command Status

The library returns a status byte after processing the MODE SENSE command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when the library is processing a command for a different initiator or when the library is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when the library is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB is invalid (see Table 9-1 for sense data).

Table 9-1 Invalid parameters in the MODE SENSE CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00	1	1	1	3h	0001h	Invalid value in DBD field.
5h	24h	00	1	1	1	5h	0002h	Invalid Page Code.

10 MOVE MEDIUM (A5h)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>01</td><td colspan="3">Logical Unit Number</td><td colspan="5">Reserved</td></tr>
<tr><td>02</td><td colspan="8" rowspan="2">(MSB)
Transport Element Address
(LSB)</td></tr>
<tr><td>03</td></tr>
<tr><td>04</td><td colspan="8" rowspan="2">(MSB)
Source Address
(LSB)</td></tr>
<tr><td>05</td></tr>
<tr><td>06</td><td colspan="8" rowspan="2">(MSB)
Destination Address
(LSB)</td></tr>
<tr><td>07</td></tr>
<tr><td>08</td><td colspan="8" rowspan="2">Reserved</td></tr>
<tr><td>09</td></tr>
<tr><td>10</td><td colspan="7">Reserved</td><td>Invert</td></tr>
<tr><td>11</td><td colspan="2">EEPos</td><td colspan="4">Reserved</td><td>0</td><td>0</td></tr>
</table>

10.1 About This Command

The MOVE MEDIUM command requests that the robot (CHM) move a cartridge from a source element location (address) to a destination element location (address). If the destination is a tape drive, the library will insert the cartridge.

For the valid source element and destination element combinations for the MOVE MEDIUM command, refer to the Device Capabilities page of the MODE SENSE data (see page 9-12).

Note: If you use this command to move a cartridge from a tape drive and the cartridge is still inside the tape drive, the library waits 5 seconds and retries the move operation. If the cartridge is still in the tape drive at that point, the library returns Check Condition status with the sense key set to Illegal Request. The ASC is 3Bh and the ASCQ is 90h, as described in Table 10-6. The 5-second retry allows for the slight delay that can occur after a tape drive indicates that it has unloaded the tape but before the cartridge is fully unloaded.

10.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Transport Element Address – Bytes 02 and 03

This field is checked for the value set by the MODE SELECT (15h) command. It should contain 0 or the element address of the robot.

Source Address – Bytes 04 and 05

This field specifies the element address from which the cartridge is to be taken. This can be a storage location, the robot, a tape drive, or an import/export element (a slot in the entry/exit port).

Destination Address – Byte 06 and 07

This field specifies the element address where the cartridge is to be placed. This can be a storage location, a tape drive, or an import/export element (a slot in the entry/exit port).

Invert – Byte 10, Bit 0

The library does not support the Invert function. The valid value for this field is 0.

EEPos (Entry/Exit Position) – Byte 11, Bits 6 and 7

You can control the entry/exit port on the library from the operator panel or with this command. The EEPos field instructs the MOVE MEDIUM command to extend or retract the entry/exit port. The settings for this field are shown in Table 10-1.

Table 10-1 Valid settings for the EEPos field

Bit 7	Bit 6	Definition
0	0	No entry/exit port operation
0	1	Extend the entry/exit port
1	0	Retract the entry/exit port
1	1	Illegal Request

When this field is set to a valid value other than 00b (that is, 01b or 10b), the Source Address and Destination Address fields must both contain the element address of the entry/exit port.

If this field is set to 11b, the library returns Check Condition status with the sense key set to Illegal Request, the ASC set to 24h, and the ASCQ set to 00h.

It is not an error to attempt to extend or retract the entry/exit port when it is already in the requested position.

10.3 Effects on the Cartridge Inventory

The cartridge inventory is updated after the robot completes a cartridge move operation, whether or not the cartridge move was successful. The various outcomes of a requested move operation are explained below:

- A cartridge move operation was requested and completed successfully (the source address contained a cartridge, the destination address was empty, and the cartridge was moved). See Table 10-2 for information about how the cartridge inventory is updated.

Table 10-2 Effect on the cartridge inventory of a successful move operation

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	0	1
Occupied Valid	1	1
Label	blanks	copied from source
Label Valid	0	copied from source
Label Error	0	copied from source
Label Scan Retries	0	copied from source
Send Volume Match	0	copied from source
Tape Drive Accessible	1	0
Pick Retries	updated if retried	no change
Put Retries	no change	updated if retried
Total Puts	no change	incremented
Source Address	255	source element index

- A cartridge move operation is requested and the robot finds the source address empty. The library does not attempt to move a cartridge if the cartridge inventory indicates that the source is empty (the Occupied flag is set to 0 and Occupied Valid flag is set to 1). See Table 10-3 for information about how the cartridge inventory is updated.

Table 10-3 Effect on the cartridge inventory of a move operation when the source is empty

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	0	no change
Occupied Valid	1	no change
Label	blanks	no change
Label Valid	0	no change
Label Error	0	no change
Label Scan Retries	0	no change
Send Volume Match	0	no change
Tape Drive Accessible	no change	no change
Pick Retries	no change	no change
Put Retries	no change	no change
Total Puts	no change	no change
Source Address	255	no change

- A cartridge move operation is requested and the robot finds that the destination address contains a cartridge. Table 10-4 describes how the cartridge inventory is updated.

Note: The library does not perform the move operation if the cartridge inventory indicates that the destination is occupied and the Occupied Valid flag is set to 1.

Table 10-4 Effect on the cartridge inventory of a move operation when the destination is full

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	1	1
Occupied Valid	1	1
Label	no change	no change
Label Valid	no change	no change
Label Error	no change	no change
Label Scan Retries	no change	no change
Send Volume Match	no change	no change
Tape Drive Accessible	1	no change
Pick Retries	updated if retried	no change
Put Retries	updated if retried	no change
Total Puts	incremented	no change
Source Address	no change	no change

- A cartridge move operation was requested with the same source and destination address. This type of operation is requested when the occupied status of a location is questionable (the Occupied Valid flag is set to 0). The library does not attempt to move a cartridge if the Occupied Valid flag is set to 1 for the source and destination address and the location is a storage location. Table 10-5 describes how the cartridge inventory is updated.

Table 10-5 Effect on the cartridge inventory of a move operation when the source and destination are the same

This cartridge inventory field...	......is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	no change
Label Valid	0	no change
Label Error	0	no change
Label Scan Retries	0	no change
Send Volume Match	0	no change
Tape Drive Accessible	no change	0
Pick Retries	no change	updated if retried
Put Retries	no change	updated if retried
Total Puts	no change	incremented
Source Address	255	element index

10.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

If a cartridge move operation is requested, the library must validate the source and destination for the move, as shown in Figure 10-1 and Figure 10-2. After the library validates the source and destination for the move, the library executes the move operation, as shown in Figure 10-3.

If an entry/exit port extend or retract operation is requested, the library executes the move operation as shown in Figure 10-4.

As shown in Figure 10-3 and Figure 10-4, the library validates the parameters in the CDB. Table 10-6 shows the sense data reported for invalid parameters in the CDB and also shows the sense data for various move errors.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

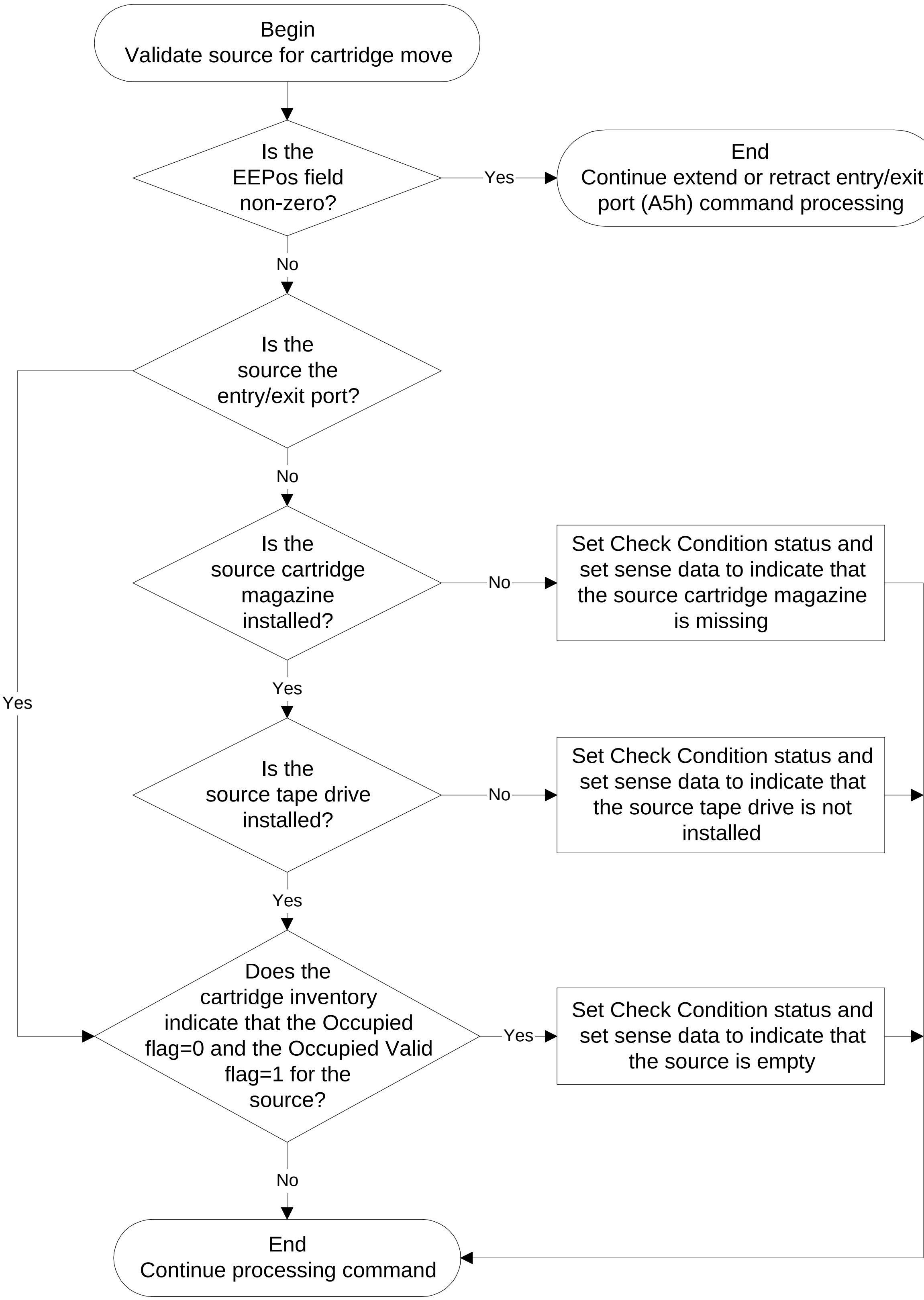

Figure 10-1 MOVE MEDIUM command execution — source validation

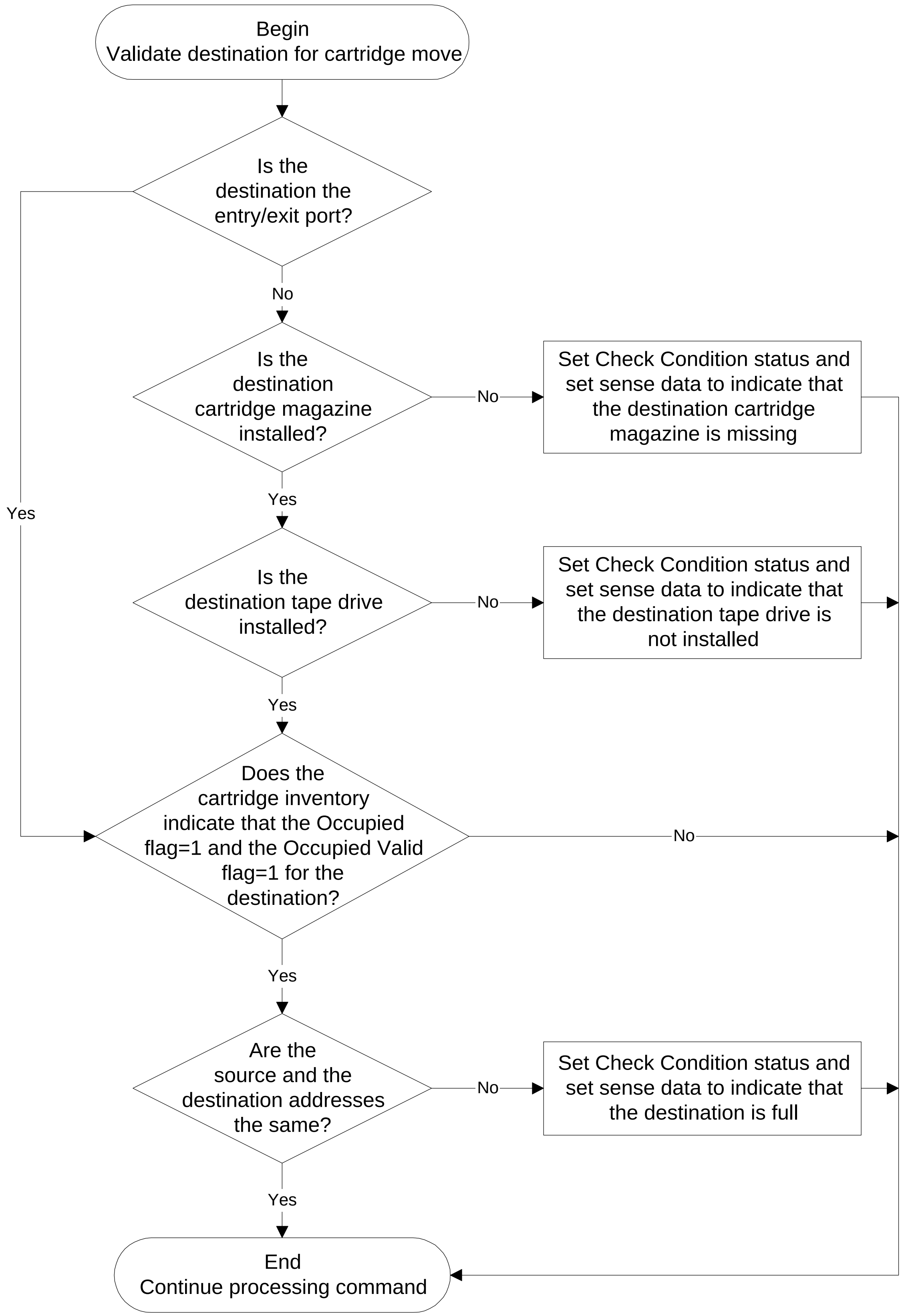

Figure 10-2 MOVE MEDIUM command execution — destination validation

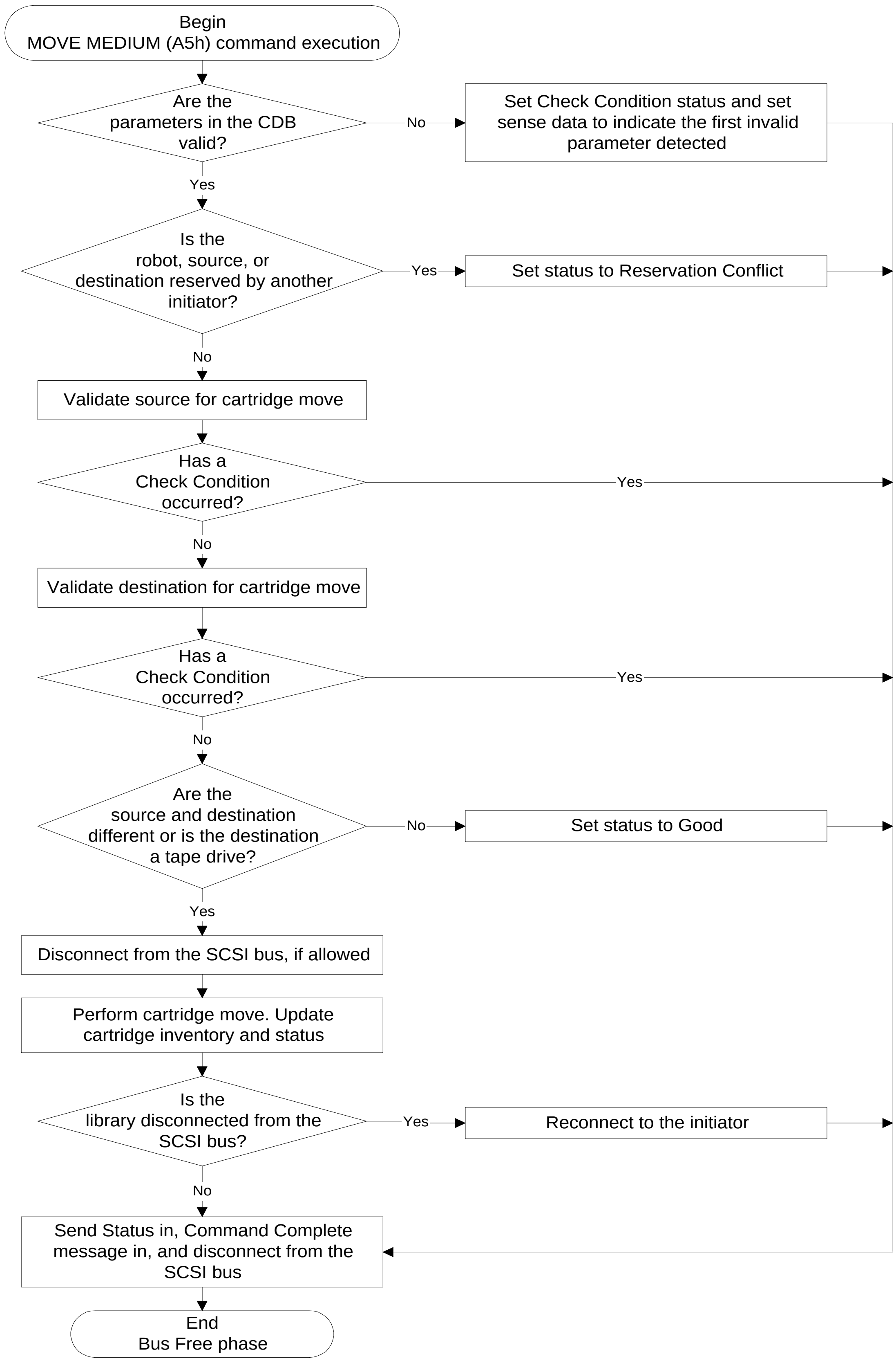

Figure 10-3 MOVE MEDIUM command execution — cartridge move

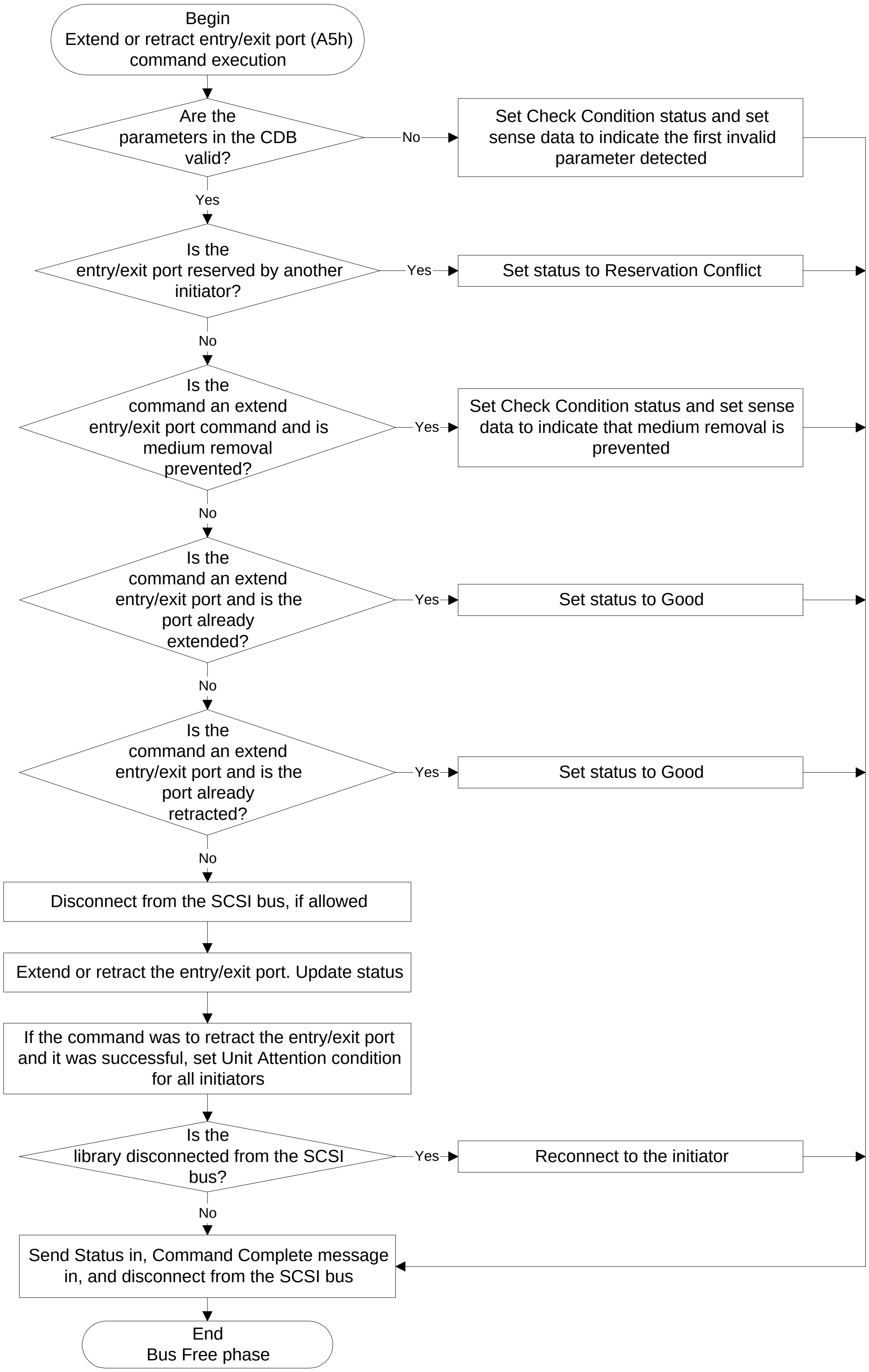

Figure 10-4 MOVE MEDIUM command execution — entry/exit port extend or retract

10.5 Command Status

The library returns a status byte after processing the MOVE MEDIUM command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator or when an element involved in a requested move operation is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The library has experienced an unrecoverable hardware error.
- A reserved bit is set to 1 in the CDB.
- The library is not ready because the door is open or it is operating in LCD mode or Console mode.

- A parameter in the CDB is invalid (see Table 10-6 for sense data).
- The information in the cartridge inventory indicates that the requested cartridge move operation cannot be performed.
- After the library attempts to move a cartridge, it finds that the source is empty or the destination is occupied.
- The library encounters a problem while trying to move a cartridge. For example, it encounters a place (put) error while moving a cartridge.

Table 10-6 Invalid parameters in the MOVE MEDIUM CDB and move errors

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	0	0002h	Invalid transport element address.
5h	21h	01h	1	1	0	0	0004h	Invalid source element address.
5h	21h	01h	1	1	0	0	0006h	Invalid destination element address.
5h	24h	00	1	1	1	0	000Ah	Invalid Invert field.
5h	24h	00	1	1	1	7	000Bh	Invalid EEPos field.
5h	3Bh	0Dh	0	0	0	0	0	Destination element occupied.
5h	3Bh	0Eh	0	0	0	0	0	Source element empty.
5h	3Bh	87h	0	0	0	0	0	Cartridge stuck in tape drive.
5h	3Bh	90h	0	0	0	0	0	Source cartridge is loaded inside the tape drive and is not accessible.
5h	80h	05h	0	0	0	0	0	Source tape drive not installed.
5h	80h	06h	0	0	0	0	0	Destination tape drive not installed.

11 POSITION TO ELEMENT (2Bh)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	1	0	1	0	1	1
01	Logical Unit Number			Reserved				
02	(MSB) Transport Element Address							
03								(LSB)
04	(MSB) Destination Element Address							
05								(LSB)
06	Reserved							
07								
08	Reserved							Invert
09	0	0	Reserved				0	0

11.1 About This Command

The POSITION TO ELEMENT command allows you to request that the robot be positioned to a specific element location (address).

The robot is positioned so that no additional movement on any axis is required to access the cartridge at that location for a MOVE MEDIUM (A5h) command. Use this command with an application that may require a pause before issuing a MOVE MEDIUM command. The time that you save with the POSITION TO ELEMENT command is valuable if you would normally have to wait for the robot to move to the element when you issue the MOVE MEDIUM command.

11.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Transport Element Address – Bytes 02 and 03

This field is checked for the value set by the MODE SELECT (15h) command. It should contain 0 or the element address of the robot.

Destination Element Address – Bytes 04 and 05

This field allows you to specify the address of the element where the robot is to be positioned.

Notes: Use the robot as the destination address if you want the library to position the robot in the park position (located in front of Tape Drive 1). The park position moves the robot out of the way so you can access cartridges in the data cartridge magazines and tape drives.

Invert – Byte 08, Bit 0

The library does not support the Invert function, so you must specify a value of 0 for this bit.

11.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 11-1 shows the steps that the library takes when executing the POSITION TO ELEMENT command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB. Table 11-1 shows the sense data reported for invalid parameters in the CDB. It also shows the sense data for various position errors.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

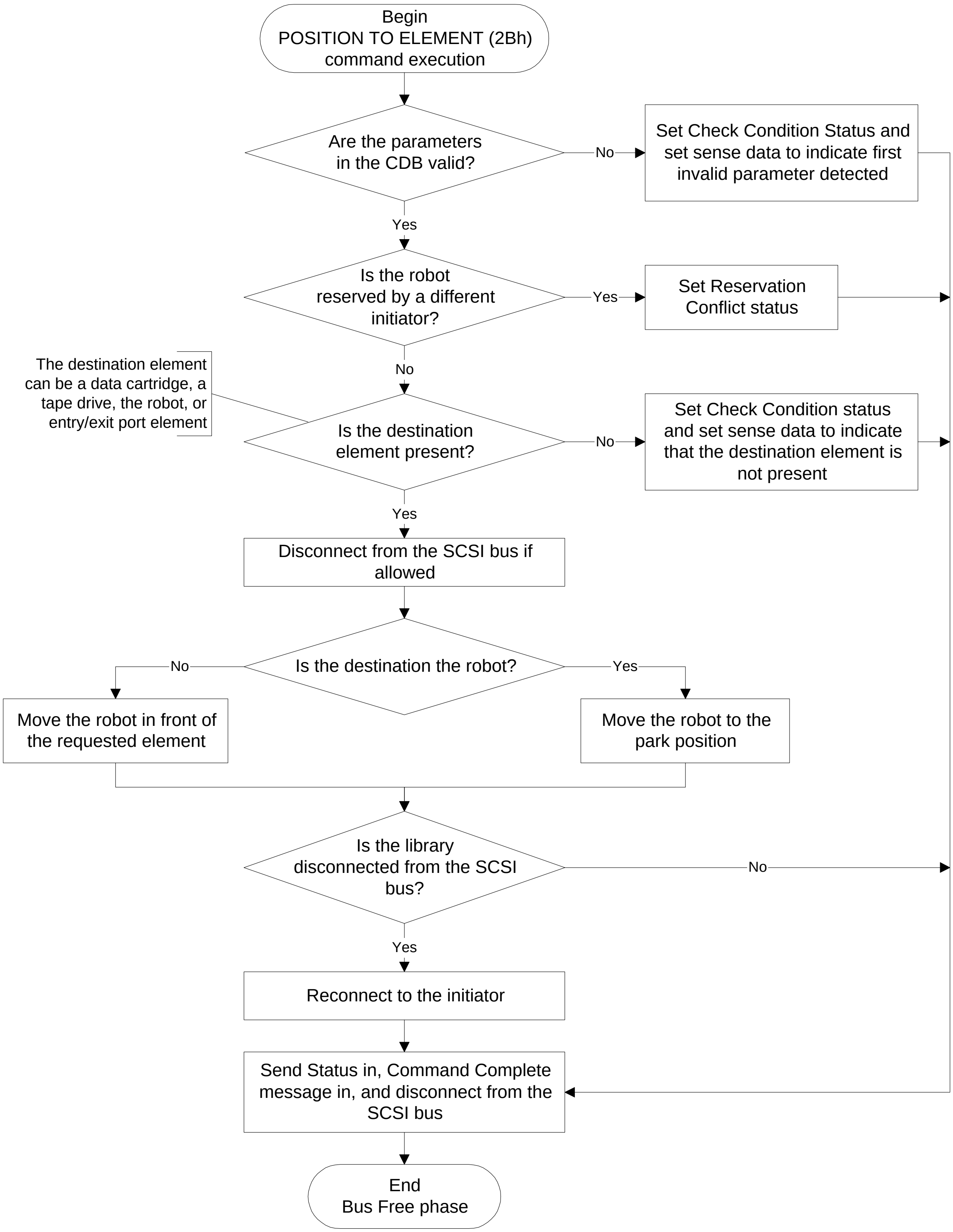

Figure 11-1 POSITION TO ELEMENT command execution

11.4 Command Status

The library returns a status byte after processing the POSITION TO ELEMENT command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it or the robot is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The library has experienced an unrecoverable hardware error.
- The library is not ready because the door is open or it is operating in LCD mode or Console mode.
- The destination is a tape drive and the tape drive is not installed.

- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 11-1 for sense data).
- The library encounters a problem during the position operation.

Table 11-1 Invalid parameters in POSITION TO ELEMENT CDB and position errors

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	—	0002h	Invalid transport element address.
5h	21h	01h	1	1	0	—	0004h	Invalid destination element address.
5h	21h	01h	1	1	1	0	0008h	Invalid Invert field.
5h	80h	04h	0	0	0	0	0000h	Destination magazine is not installed.
5h	80h	06h	0	0	0	0	0000h	Destination tape drive is not installed.

12 PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>01</td><td colspan="3">Logical Unit Number</td><td colspan="5">Reserved</td></tr>
<tr><td>02</td><td colspan="8" rowspan="2">Reserved</td></tr>
<tr><td>03</td></tr>
<tr><td>04</td><td colspan="7">Reserved</td><td>Prevent</td></tr>
<tr><td>05</td><td colspan="2">P/A Options</td><td colspan="4">Reserved</td><td>0</td><td>0</td></tr>
</table>

12.1 About This Command

The PREVENT/ALLOW MEDIUM REMOVAL command requests that the library enable or disable access to the cartridge storage area, extending the entry/exit port, or both. If you use this command to disable access to the cartridge storage area, the library activates the front door interlock mechanism and prevents it from being released even when the door is unlocked using the key.

If you use this command to prevent the entry/exit port from being extended, the library prevents extending the entry/exit port with any command. The library also prevents the following LCD operations that require entry/exit port extension:

- Extend/Retract E/E
- Insert Cartridge
- Remove Cartridge
- Self Test
- Cycle E/E

If at least one initiator has issued this command to prevent cartridge removal or entry/exit port access, no other initiators can perform these functions even if the initiator has reserved the entire library.

12.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Prevent – Byte 04, Bit 00

The valid values for this field are as follows:

0 – Allow removal of cartridges through the front door, the entry/exit port, or both.

1 – Prevent removal of cartridges through the front door, the entry/exit port, or both.

The Prevent bit works in combination with the P/A Options field (byte 05, bits 7 and 6). When it receives a PREVENT/ALLOW MEDIUM REMOVAL command with the Prevent bit set to 1, the library uses the P/A Options field to determine the activities that are prevented. For example, if you set the Prevent bit to 1 and the P/A Options field is 11b, the library activates the front door interlock mechanism to prevent the door from being opened.

When the Prevent bit is set to 1, the library prevents removal of cartridges until one of the following occurs:

- All initiators that have issued PREVENT MEDIUM REMOVAL commands issue ALLOW MEDIUM REMOVAL commands with the Prevent bit set to 0. (The value in the P/A Options field determines the activities that are allowed.)
- The SCSI bus is reset, which automatically resets the library.
- The library is powered off and back on again or reset (see Section 2.3 on page 2-3).

P/A Options – Byte 05, Bits 6 and 7

The P/A Options field specifies the activities that you want to prevent or allow with the Prevent bit. The bits for the P/A Options field are as follows:

Bit / Byte	7	6
05	P/A 1	P/A 2

The valid combinations for the P/A 1 and P/A 2 bits are described in Table 12-1.

Table 12-1 P/A Options field values

P/A 1	P/A 2	Activity prevented or allowed
0	0	Opening the front door and extending the entry/exit port
0	1	Invalid (results in Check Condition status)
1	0	Extending the entry/exit port only
1	1	Opening the front door only

12.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 12-1 shows the steps that the library takes when executing the PREVENT/ALLOW MEDIUM REMOVAL command through the Bus Free phase.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

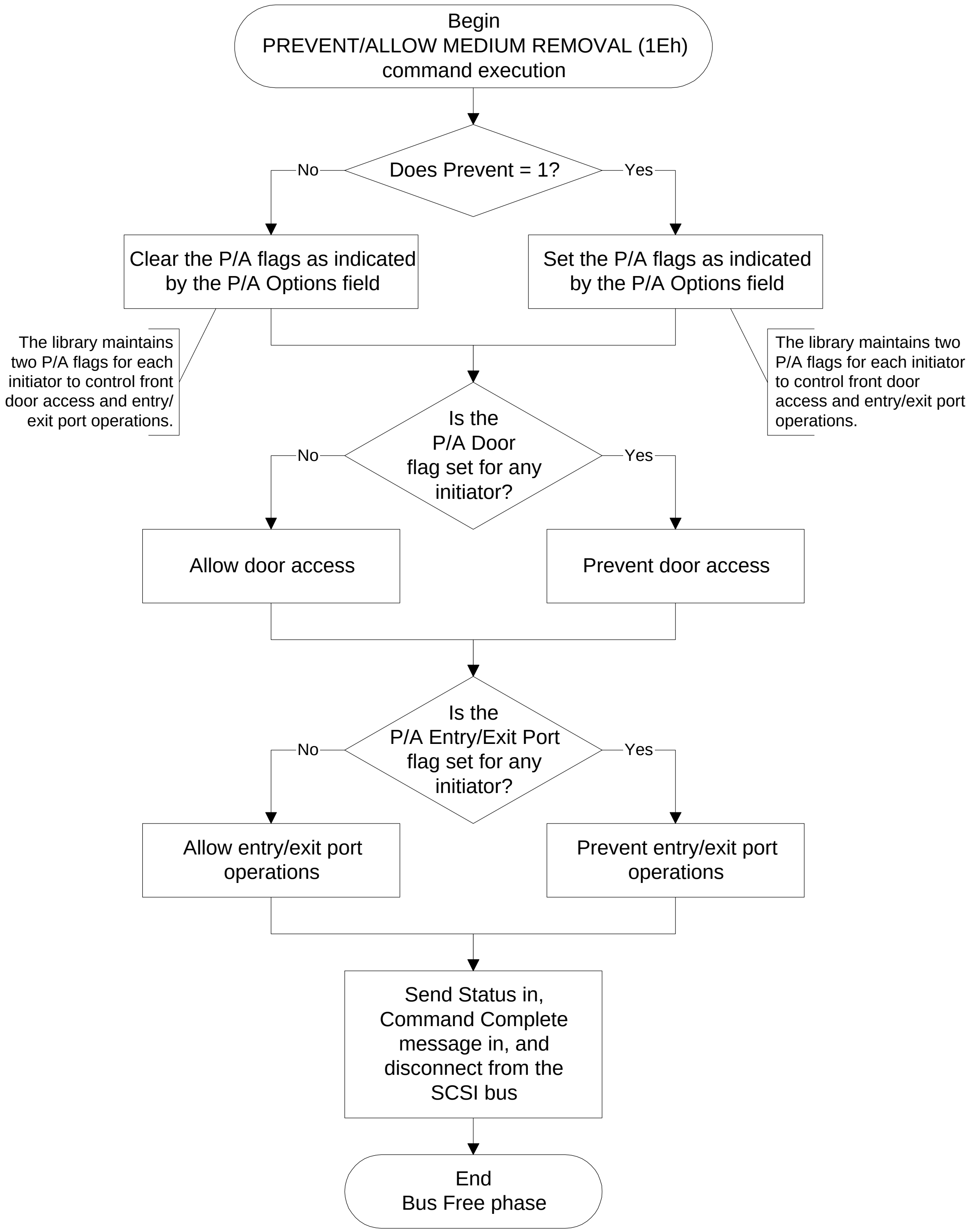

Figure 12-1 PREVENT/ALLOW MEDIUM REMOVAL command execution

12.4 Command Status

The library returns a status byte after processing the PREVENT/ALLOW MEDIUM REMOVAL command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator and a request is made to prevent medium removal. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status when:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.

- The value in the P/A Options field is invalid (see Table 12-2 for sense data).

Table 12-2 Invalid parameters in the PREVENT/ALLOW MEDIUM REMOVAL CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	01h	1	1	0	6h	0005h	Invalid value for the P/A 2 bit in the P/A Options field.

13 READ BUFFER (3Ch)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>01</td><td colspan="3">Logical Unit Number</td><td colspan="2">Reserved</td><td colspan="3">Mode</td></tr>
<tr><td>02</td><td colspan="8">Buffer ID</td></tr>
<tr><td>03</td><td colspan="8" rowspan="3">(MSB)
Buffer Offset
(LSB)</td></tr>
<tr><td>04</td></tr>
<tr><td>05</td></tr>
<tr><td>06</td><td colspan="8" rowspan="3">(MSB)
Allocation Length
(LSB)</td></tr>
<tr><td>07</td></tr>
<tr><td>08</td></tr>
<tr><td>09</td><td>0</td><td>0</td><td colspan="4">Reserved</td><td>0</td><td>0</td></tr>
</table>

13.1 About This Command

The READ BUFFER command is used to copy the library's microcode or LCD logo data across the SCSI bus to the initiator. This command is used with the WRITE BUFFER (3Bh) command to copy either the microcode or the LCD logo data from one library to another library.

To copy microcode or LCD logo data from one library to another library, follow these steps:

1. Issue one or more READ BUFFER commands to transfer the microcode image or the LCD logo data across the SCSI bus to the initiator.

   Note: The READ BUFFER command does not transfer the library configuration options or the MODE SELECT defaults to the initiator.

2. Issue one or more WRITE BUFFER commands to download microcode or LCD logo data. For information about using the WRITE BUFFER command, refer to Chapter 24.

13.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Mode – Byte 01, Bits 2 through 0

The Mode field determines the type of operation to be performed. The library supports the following operations:

001b – Read microcode image from the EEPROM
010b – Read the LCD logo data from the LCD logo buffer

Buffer ID – Byte 02

This field must be 0.

Buffer Offset – Bytes 03 through 05

This field specifies the offset into the library memory buffer specified by the Mode field (byte 1, bits 2 through 0), as follows:

- When reading the LCD logo buffer, the valid value for this field is any number from 0 to 1982 (7BEh).

- When reading the firmware buffer in the EEPROM, the valid value for this field is any number between 0 and 0F0000h (983,040).

Allocation Length – Bytes 06 through 08

This field specifies the number of bytes to be transferred by the current READ BUFFER command. If the number of bytes specified is larger than the buffer size, only the number of bytes in the buffer will be returned.

13.3 Exceptions and Error Conditions

The following exceptions and error conditions can occur with the READ BUFFER command.

Hardware or SCSI Bus Error

If a hardware or SCSI bus error occurs while the data is being transferred from the library to the initiator, the library terminates the command and returns Check Condition status. The sense key is set to Aborted Command (Bh). If this occurs, retry the operation.

13.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from executing. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 13-1 shows the steps that the library takes when executing the READ BUFFER command through the Bus Free phase. As shown in the figures, the library validates the parameters in the CDB. Table 13-1 shows the sense data reported for invalid parameters in the CDB. It also shows the sense data returned if errors are encountered.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase or if parity errors are detected on the new firmware.

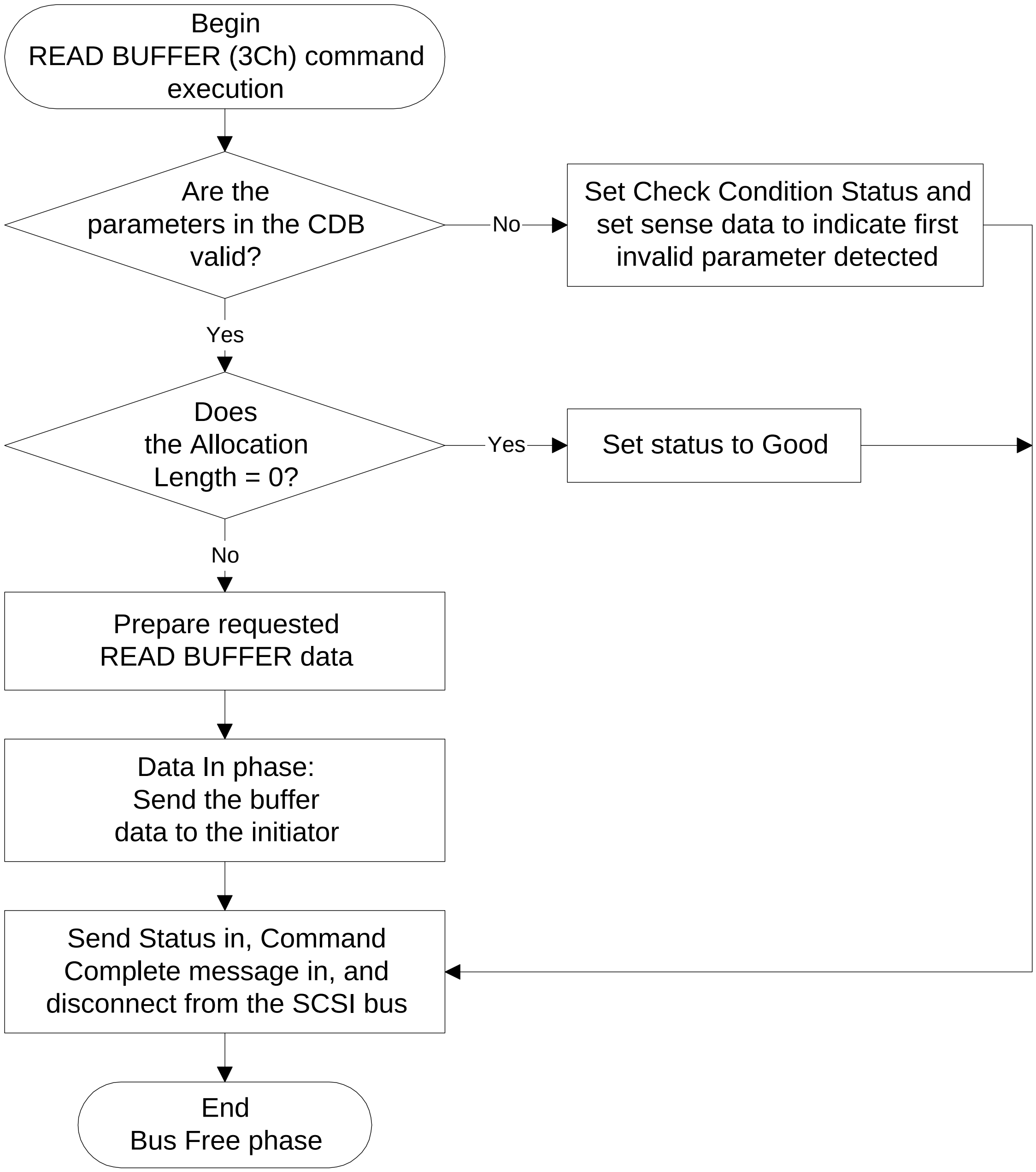

Figure 13-1 READ BUFFER command execution

13.5 Command Status

The library returns a status byte after processing the READ BUFFER command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when the library is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved or any of its elements are reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurred while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB or firmware.
- The command was issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit was set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 13-1 for sense data).

- A Console write firmware or read firmware operation is already in progress when the library receives the READ BUFFER command.

Table 13-1 Invalid parameters in the READ FIRMWARE CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	0	0	0003h	Invalid buffer offset.
5h	3Fh	87h	0	0	0	0	0000h	Cannot execute the READ BUFFER command because a Console write firmware operation is in progress.
5h	3Fh	88h	0	0	0	0	0000h	Cannot execute the READ BUFFER command because a Console read firmware operation is in progress.

14 READ ELEMENT STATUS (B8h)

Bit / Byte	7	6	5	4	3	2	1	0
00	1	0	1	1	1	0	0	0
01	Logical Unit Number			VolTag	Element Type Code			
02	(MSB) Starting Element Address							
03								(LSB)
04	(MSB) Number of Elements							
05								(LSB)
06	Reserved							
07	(MSB) Allocation Length							
08								
09								(LSB)
10	Reserved							
11	0	Drive Req	Reserved				0	0

14.1 About This Command

The READ ELEMENT STATUS command requests that the library return the status of its elements. This command returns the data created as a result of the INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command. For more information about these commands, see Chapter 4 and Chapter 5.

14.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

VolTag – Byte 01, Bit 4

This bit indicates whether you want the library to return volume tag (bar code label) information in response to this command, as follows:

0 – Do not return volume tag (bar code label) information
1 – Return volume tag (bar code label) information

Element Type Code – Byte 01, Bits 3 through 0

This field specifies the particular element types you want the library to report on. The library supports the following Element Type Codes:

0h – All element types
1h – Medium Transport Element (robot)
2h – Storage Element (cartridge slots)
3h – Import/Export Elements (entry/exit port)
4h – Data Transfer Element (tape drives)

For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.

Starting Element Address – Bytes 02 and 03

This field indicates the element address at which to start the transfer of data. Only elements with addresses greater than or equal to the starting address are reported. Element descriptor blocks are not generated for undefined element addresses.

Note: The Starting Element Address must be a valid address for the library, but does not have to be an address of the type requested in the Element Type Code. The library only returns element descriptors for the elements of the requested element type within the range defined by the Starting Element Address and Number of Elements fields.

Number of Elements – Bytes 04 and 05

This field specifies the maximum number of element descriptors to be returned. This is an actual number of element descriptors to be returned, not an element address range.

The library returns element descriptors of the requested element type starting with the first element address equal to or greater than the value in the Starting Element Address field.

Allocation Length – Bytes 07 through 09

This field specifies the length in bytes of the space that you are allocating for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until *one* of the following conditions is met:

- All available element descriptors have been returned.
- The number of element descriptors specified in the Number of Elements field has been returned.
- The number of bytes of complete element descriptors specified in the Allocation Length field has been returned.
- The remaining allocation length is smaller than the next complete element descriptor to be returned.

Drive Req – Byte 11, Bit 6

This bit indicates whether the library appends a one-byte tape drive type to the standard data transfer element descriptor, as follows:

0 – Do not append the tape drive type
1 – Append the tape drive type

14.3 What the Library Returns

Element Status Data

This header is returned once for each READ ELEMENT STATUS command received by the library.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) First Element Address Reported							
01								(LSB)
02	(MSB) Number of Elements Reported							
03								(LSB)
04	Reserved							
05	(MSB) Byte Count of Report Available							
06								
07								(LSB)

First Element Address Reported – Bytes 00 and 01

This field indicates the smallest element address found that meets the CDB requirements.

Number of Elements Reported – Bytes 02 and 03

This field indicates the total number of elements that meet the CDB requirements. The library returns element descriptors for these elements if you specified a sufficient Allocation Length.

Byte Count of Report Available – Bytes 05 through 07

This field indicates the total number of bytes of element status page data available that meet the CDB requirements. This value is not adjusted to match the value that you specified for the Allocation Length field in the CDB.

Element Status Page

The library returns one Element Status page for each group of element descriptors of the same type (that is, it returns one page for each of the following: robot, cartridge storage locations, tape drives, and entry/exit port locations). The Element Status page is returned only if there is at least one complete Element Descriptor.

Bit / Byte	7	6	5	4	3	2	1	0
00	Element Type Code							
01	PVolTag	AVolTag	Reserved					
02	(MSB) Element Descriptor Length							
03								(LSB)
04	Reserved							
05	(MSB) Byte Count of Descriptor Data Available							
06								
07								(LSB)

Element Type Code – Byte 00

This field indicates the specific element type (see page 14-2) being reported by the element descriptor.

PVolTag – Byte 01, Bit 7

This field indicates if primary volume tag (bar code label) information is present, as follows:

0 – Volume tag bytes are omitted from the element descriptors
1 – Volume tag information is present

AVolTag – Byte 01, Bit 6

The library does not support alternate volume tags. The value reported for this field is 0.

Element Descriptor Length – Bytes 02 and 03

This field indicates the total number of bytes contained in a single element descriptor, as follows:

- If the descriptor being returned is for either the medium transport element (the robot), a storage element (data cartridge), or an import/export element, the length is either 52 bytes (if the VolTag bit is 1) or 16 bytes (if the VolTag bit is 0).

- If the descriptor being returned is for a data transfer element (a tape drive), the element descriptor length changes depending on the setting of the VolTag and Drive Req bits, as shown in Table 14-1.

Table 14-1 Element descriptor length for the data transfer element

VolTag	Drive Req	Element Descriptor Length (bytes)
0	0	16
0	1	17
1	0	52
1	1	53

Byte Count of Descriptor Data Available – Bytes 05 through 07

This field indicates the total number of bytes of element descriptor data available for the elements of this element type that meet the CDB requirements. This value is the Element Descriptor Length multiplied by the number of element descriptors. This value is not adjusted to match the value that you specified in the Allocation Length field of the CDB.

Element Descriptors

The following sections contain the field definitions for the four types of element descriptors for the library:

- **Medium transport element**: The robot
- **Storage elements**: Each slot in the data cartridge magazines and the fixed cartridge slot
- **Data transfer elements**: The tape drives
- **Import/Export Elements:** The data cartridges in the entry/exit port

Each element descriptor includes the element address and status flags. Each element descriptor can also contain sense code information as well as other information, depending on the element type.

Notes:

- The element descriptors for the elements are very similar, with the exception of a few of the fields. Note the differences in bytes 02, 06, and 07 for the element descriptors.
- The library does not support alternate volume tags. This information is not included in any of the element descriptors.

Medium Transport Element Descriptor

The medium transport element is the robot. The library contains one robot.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved					Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ⋮ 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ⋮ 51	Reserved (field moved up if Primary Volume Tag Information field is omitted)							

Element Address – Bytes 00 and 01

This field contains the element address of the medium transport element (robot).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the robot, as follows:

0 – The robot is in a normal state.

1 – The robot is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This field indicates if the robot contains a cartridge. The possible values for this field are as follows:

0 – The robot does not contain a cartridge.
1 – The robot contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the robot is in an abnormal state, this field contains the value 83h. Refer to Table 14-3 on page 14-25 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 14-3 on page 14-25, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Element Address field (bytes 10 and 11) is invalid.
1 – The Source Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The library uses single-sided media and does not support inverting of the media. The information reported for this field is 0.

Source Element Address – Bytes 10 and 11

This field shows the address of the last element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 14-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the robot. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

Storage Element Descriptor

Each of the slots in the cartridge magazines and the fixed cartridge slot is a storage element. The library contains 6, 12, or 18 data cartridge magazines with five cartridge slots each, and one fixed cartridge slot, for a total of 31, 61, or 91 cartridge slots.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Element Address							
11								(LSB)
12 ⋮ 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ⋮ 51	Reserved (field moved up if Primary Volume Tag Information field is omitted)							

Element Address – Bytes 00 and 01

This field contains the address of the cartridge storage location (cartridge slot).

Access – Byte 02, Bit 3

This bit indicates whether the robot can access the cartridge at that location. The storage location is accessible if the cartridge magazine is installed. Accessibility is reported as follows:

0 – The cartridge magazine is not accessible (not installed).
1 – The cartridge magazine is accessible (installed).

Note: The fixed cartridge slot is always accessible.

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the cartridge slot, as follows:

0 – The cartridge slot is in a normal state.

1 – The cartridge slot is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates whether the cartridge slot contains a cartridge, as follows:

0 – The slot does not contain a cartridge.
1 – The slot contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the Except bit is set to 1, this field contains the value 83h. Refer to Table 14-3 on page 14-25 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 14-3 on page 14-25, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Element Address field (bytes 10 and 11) is invalid.
1 – The Source Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

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

Source Element Address – Bytes 10 and 11

This field shows the address of the last element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 14-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the storage location. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

Import/Export Element Descriptor

Each of the slots in the entry/exit port data cartridge magazine is an import/export element. The entry/exit port contains one data cartridge magazine with five cartridge slots, for a total of five import/export elements.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved		InEnab	ExEnab	Access	Except	Imp/Exp	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Element Address							
11								(LSB)
12 ⋮ 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ⋮ 51	Reserved (field moved up if Primary Volume Tag Information field is omitted)							

Element Address – Bytes 00 and 01

This field contains the address of the import/export element.

InEnab – Byte 02, Bit 5

This field indicates that the entry/exit port supports retracting the cartridge magazine into the storage area of the library, where the robot can access the cartridges. The value reported for this field is 1.

ExEnab – Byte 02, Bit 4

This field indicates that the entry/exit port supports extending the cartridge magazine out of the storage area of the library. The robot cannot access the cartridge magazine when it is in the extended entry/exit port. The value reported for this field is 1.

Access – Byte 02, Bit 3

This bit indicates whether the robot can access the import/export element, as follows:

0 – The import/export element is not accessible. (The entry/exit port is extended or the magazine is not installed. The Additional Sense Code and the Additional Sense Code Qualifier fields contain additional information.)

1 – The import/export element is accessible. (The entry/exit port is retracted.)

Except – Byte 02, Bit 2

This bit indicates the current state of the import/export element, as follows:

0 – The import/export element is in a normal state.

1 – The import/export element is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Imp/Exp – Byte 02, Bit 1

This field indicates how the cartridge was placed in the entry/exit port, as follows:

0 – The robot placed the cartridge in the entry/exit port.
1 – An operator placed the cartridge in the entry/exit port.

Full – Byte 02, Bit 0

This field indicates if the import/export element contains a cartridge. The possible values for this field are as follows:

0 – The import/export element does not contain a cartridge.
1 – The import/export element contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the Except bit is set to 1, this field contains the value 83h. Refer to Table 14-3 on page 14-25 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 14-3 on page 14-25, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Element Address field (bytes 10 and 11) is invalid.
1 – The Source Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

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

Source Element Address – Bytes 10 and 11

This field shows the address of the last element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 14-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the entry/exit port slot. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

Data Transfer Element Descriptor

The data transfer elements are tape drives. The library can contain up to six tape drives.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01	Element Address (LSB)							
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	NotBus	RSVD	IDValid	LUValid	RSVD	Logical Unit Number		
07	SCSI Bus Address							
08	Reserved							
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11	Source Storage Element Address (LSB)							
12 ⋮ 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
48 ⋮ 51	Reserved (field moved up if Volume Tag Information field is omitted)							
52	Tape Drive Type (omitted if Drive Req = 0) (field moved up if Volume Tag Information field is omitted)							

Element Address – Bytes 00 and 01

This field contains the address of the data transfer element (a tape drive).

Access – Byte 02, Bit 3

This bit indicates whether the robot can pick or place a cartridge at the specified tape drive location. The cartridge is accessible if it is ejected from the tape drive at that location. Accessibility is reported as follows:

0 – The tape drive location may not be accessible (the operate handle LED is not illuminated, a cartridge is loaded in the tape drive, or the tape drive's status is unknown).

1 – The tape drive location is accessible (the operate handle LED is illuminated, a cartridge is protruding from the tape drive, or the drive is empty).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the tape drive, as follows:

0 – The tape drive is in a normal state.

1 – The tape drive is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates if the tape drive contains a cartridge, as follows:

0 – The tape drive does not contain a cartridge.
1 – The tape drive contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the tape drive is in an abnormal state, this field contains the value 83h. Refer to Table 14-3 on page 14-25 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 14-3 on page 14-25, along with the corrective action to take for each abnormal state.

NotBus – Byte 06, Bit 7

This bit is not supported by the library. The value reported for this bit is 0.

IDValid – Byte 06, Bit 5

This bit indicates that the SCSI Bus Address field (byte 07) contains valid information as follows:

0 – The SCSI Bus Address field is not valid because a tape drive is not installed at this location.

1 – The SCSI Bus Address field is valid because a tape drive is installed at this location.

LUValid – Byte 06, Bit 4

This bit indicates that the Logical Unit Number field (byte 06, bits 2 through 0) contains valid information as follows:

0 – The Logical Unit Number field is not valid because a tape drive is not installed at this location.

1 – The Logical Unit Number field is valid because a tape drive is installed at this location.

Logical Unit Number – Byte 06, Bits 2 through 0

The value reported for this field is 0.

SCSI Bus Address – Byte 07

The value reported for this field is the tape drive's SCSI ID.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.

1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The library uses single-sided media and does not support inverting the media. The value reported for this bit is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the address of the last storage element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 14-5) is set to 1, the Primary Volume Tag Information field contains the volume tag (bar code label) information of the element being reported by this element descriptor. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

Tape Drive Type – Byte 52

When the Drive Req bit (see page 14-3) is set to 1, the Tape Drive Type field indicates the type of tape drive installed at the specified location, as follows:

6 – Quantum DLT 7000 installed

ASC and ASCQ Values for Abnormal States

Table 14-2 contains a list of the ASC and ASCQ values that will appear in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. Table 14-2 also indicates the corrective action for each abnormal state. The Except field of an element descriptor indicates if the element is in an abnormal state.

Table 14-2 ASC and ASCQ values for abnormal element conditions

ASC	ASCQ	Description	Action
83h	00h	Label questionable	The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command.
83h	01h	Cannot read bar code label or invalid checksum value	Replace the label as described in *Exabyte 690D Library Installation and Operation*. If the error still occurs and the label is correctly placed, contact your vendor. For specifications for the bar code labels that can be used with the library, refer to the *Exabyte Bar Code Label Specification for DLT Cartridges*.
83h	02h	No magazine is installed	A data cartridge magazine in the entry/exit port or the cartridge storage area has been removed. Install a magazine or ignore the error.
83h	03h	Label and full status questionable	The library was powered on or the front door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command. **Note:** If the element is a tape drive that is empty or contains a data cartridge (not ejected), issuing an INITIALIZE ELEMENT STATUS or INITIALIZE ELEMENT STATUS WITH RANGE will not change the questionability of the full status. You may want to issue an UNLOAD command to the tape drive to determine whether the tape drive is full or empty.
83h	04h	Tape drive not installed	There is no tape drive installed. Install a tape drive or ignore the error.
83h	09h	No bar code label	If the cartridge does not have a bar code label, place a label on the cartridge as described in *Exabyte 690D Library Installation and Operation*. If there is a bar code label and it is placed correctly, contact your vendor. For specifications for the bar code labels that can be used with the library, refer to the *Exabyte Bar Code Label Specification for DLT Cartridges*.

14.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 14-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB. Table 14-3 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

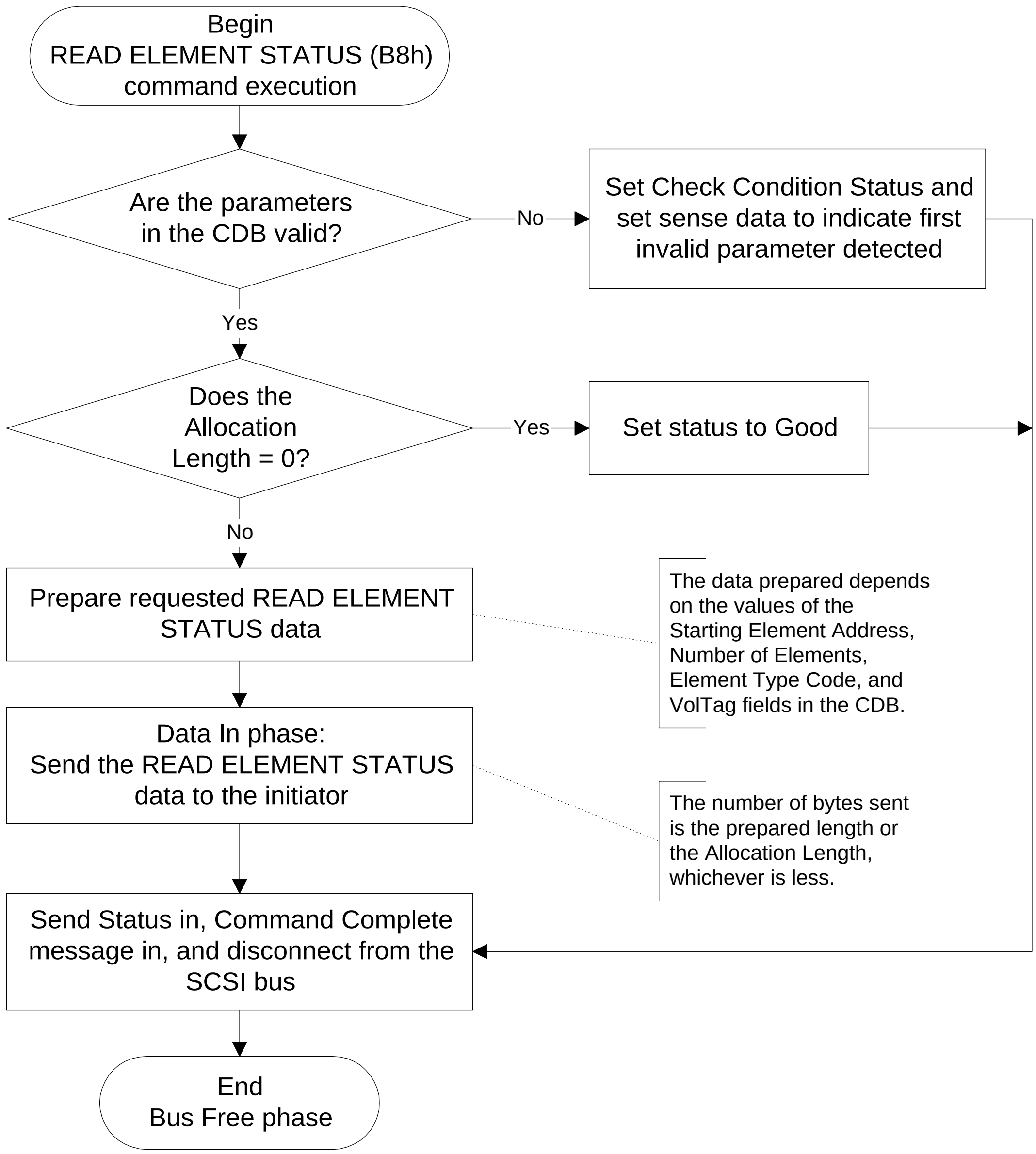

Figure 14-1 READ ELEMENT STATUS command execution

14.5 Command Status

The library returns a status byte after processing the READ ELEMENT STATUS command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- The library is not ready because the door is open or it is operating in LCD mode or Console mode.
- A parameter in the CDB is invalid (see Table 14-3 for sense data).

Table 14-3 Invalid parameters in the READ ELEMENT STATUS CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	0	0002h	Invalid starting element address.
5h	24h	00	1	1	1	3h	0001h	Invalid element type code.

Notes

15 READ FIRMWARE (D0h)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>01</td><td colspan="3">Logical Unit Number</td><td colspan="5">Reserved</td></tr>
<tr><td>02
⋮
05</td><td colspan="8">Firmware Offset</td></tr>
<tr><td>06
⋮
09</td><td colspan="8">(MSB)
Allocation Length
(LSB)</td></tr>
<tr><td>10</td><td colspan="8">Reserved</td></tr>
<tr><td>11</td><td>0</td><td>0</td><td colspan="4">Reserved</td><td>0</td><td>0</td></tr>
</table>

15.1 About This Command

The READ FIRMWARE command is an Exabyte-unique command that allows you to transfer firmware data from the library's flash EEPROM to the host. The library processes this command when it is executing the flash code. It takes approximately three minutes to read all of the firmware from the flash EEPROM.

15.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Firmware Offset – Bytes 02 through 05

This field specifies the offset into the library's flash EEPROM. Any number between 0 and 0F0000h is valid.

Allocation Length – Bytes 06 through 09

This field specifies the number of bytes that will be transferred from the library's flash EEPROM, starting at the firmware offset. Specify an allocation length of 0F0000h (983,040) bytes and a firmware offset of 0 to receive all of the flash code.

15.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 15-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB.

Table 15-1 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

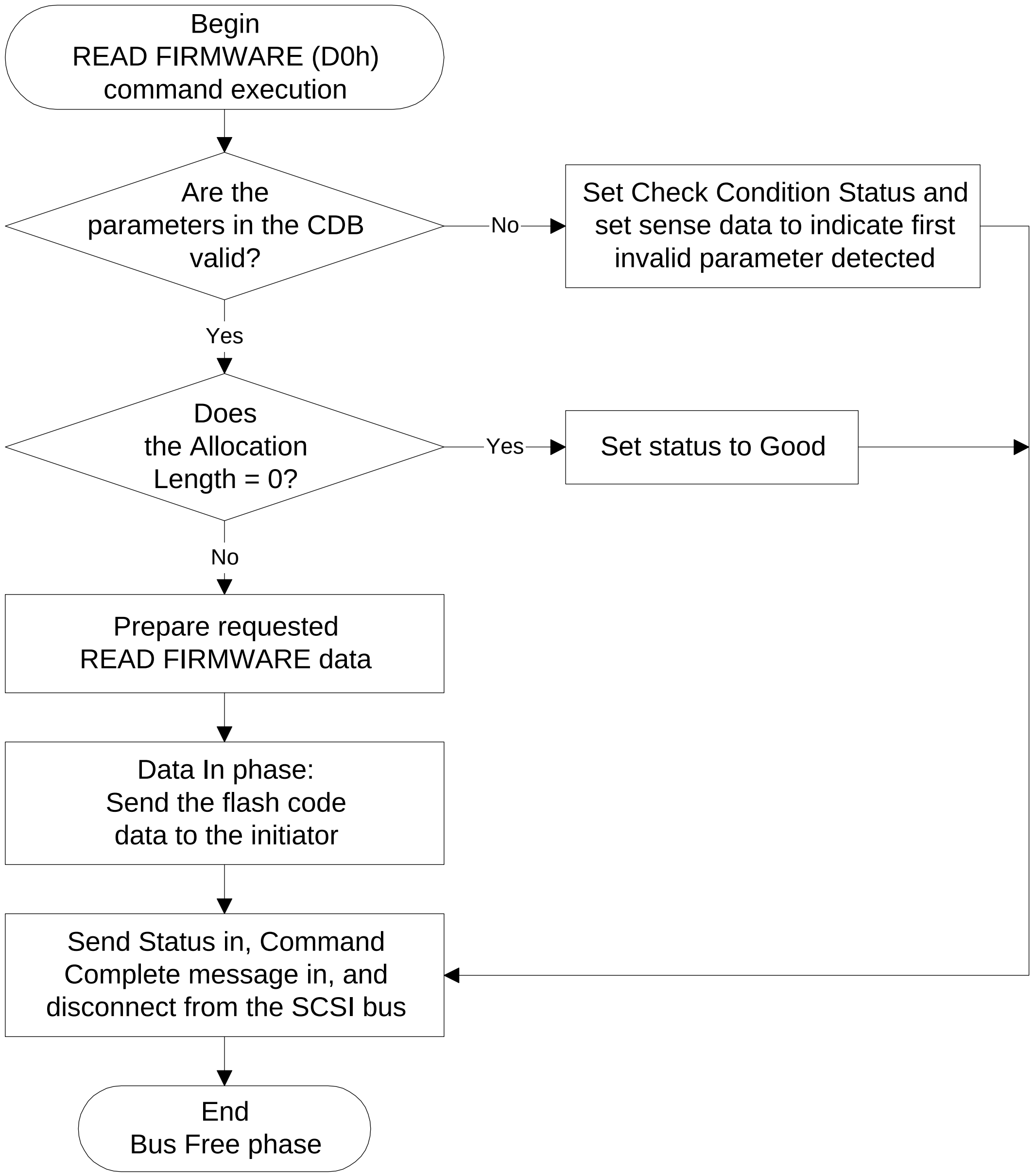

Figure 15-1 READ FIRMWARE command execution

15.4 Command Status

The library returns a status byte after processing the READ FIRMWARE command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when the library is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command was issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit was set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 15-1 for sense data).

- A Console write or read firmware operation is already in progress when the library receives the READ FIRMWARE command (see Table 15-1 for sense data).

Table 15-1 Invalid parameters in the READ FIRMWARE CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	0	0	0002h	Invalid firmware offset.
5h	3Fh	87h	0	0	0	0	0000h	Cannot execute the READ FIRMWARE command because a Console write firmware operation is in progress.
5h	3Fh	88h	0	0	0	0	0000h	Cannot execute the READ FIRMWARE command because a Console read firmware operation is in progress.

Notes

16 RECEIVE DIAGNOSTIC RESULTS (1Ch)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03	(MSB) Allocation Length							
04								(LSB)
05	0	0	Reserved				0	0

16.1 About This Command

The RECEIVE DIAGNOSTIC RESULTS command requests that the library return data obtained by the execution of the SEND DIAGNOSTIC (1Dh) command. The RECEIVE DIAGNOSTIC RESULTS command returns count comparisons on the diagnostic test you requested using the SEND DIAGNOSTIC command.

Note: In a multi-initiator environment, you should reserve the entire library using the RESERVE (16h) command before you request diagnostic data. Do not issue the RELEASE (17h) command until after you have successfully obtained data with the RECEIVE DIAGNOSTIC RESULTS command. You should issue commands in the following order:

1. RESERVE (16h) for the entire library
2. SEND DIAGNOSTIC (1Dh)
3. RECEIVE DIAGNOSTIC RESULTS (1Ch)
4. RELEASE (17h)

If you issue a RECEIVE DIAGNOSTIC RESULTS command without first sending a SEND DIAGNOSTIC command or if you requested a self test with the SEND DIAGNOSTIC command, the library returns Good status without any diagnostic data.

16.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Allocation Length – Bytes 03 and 04

This field allows you to specify the number of bytes that you are allocating for diagnostic data. If you do not want the library to transfer diagnostic data, set this field to 0.

The library terminates the Data In phase either when the number of bytes specified by the Allocation Length field have been transferred or when all available diagnostic data has been transferred, whichever is less.

16.3 What the Library Returns

Supported Diagnostics Page (Page Code 00h)

The Supported Diagnostics Page lists all diagnostic page codes that the library implements in ascending order, beginning with page code 00h.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB) Page Length							
03	Page Length (LSB)							
04	Supported Diagnostics (00h)							
05	Home gripper fingers (80h)							
06	Home CHM (81h)							
07	Cycle pick/place cartridge (82h)							
08	Cycle gripper fingers (83h)							
09	Cycle reach axis (84h)							
10	Cycle vertical axis (85h)							
11	Cycle drum axis (86h)							
12	Cycle door solenoid (87h)							
13	Cycle entry exit port (88h)							
14	Cycle horizontal axis (89h)							
15	Reserved							

Page Code – Byte 00

This field identifies this as the Supported Diagnostics page. The value for this field is 00h.

Page Length – Bytes 02 and 03

This field specifies the number of bytes that follow in this page. The value for this field is Ch (12).

Supported Page List – Bytes 04 through 12

These bytes list the diagnostic pages supported by the library. See Table 21-2 for complete descriptions of the diagnostic tests corresponding to these pages.

Diagnostic Page Format (Page Codes 80h through 89h)

Page codes 80h through 89h all return diagnostic data in the page format shown below.

Bit Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB) Parameter List Length (02h)							
03								(LSB)
04	Requested Test Count							
05	Completed Test Count							

Page Code – Byte 00

This field indicates the page for which data is being returned. Valid values for this field are 80h through 89h.

Parameter List Length – Bytes 02 and 03

This field indicates the number of bytes that follow this field. The value for this field is 02h.

Requested Test Count – Byte 04

This field indicates the number of times you requested the library to perform the diagnostic test. This value corresponds to the Test Count field in the Parameter List of the SEND DIAGNOSTIC command.

Completed Test Count – Byte 05

This field specifies the number of times the library performed the requested diagnostic test. If this value differs from the value in the Requested Test Count field, the library was unable to complete the test the requested number of times.

Note: See Chapter 21 (SEND DIAGNOSTIC command) for a list of diagnostic tests and the valid number of times that you can perform each test with one command.

16.4 How the Library Executes This Command

This section describes how the library executes the RECEIVE DIAGNOSTIC RESULTS command. The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 16-1 shows the steps that the library takes when executing the command through the Bus Free phase.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library response to ATN with a Message Out phase.

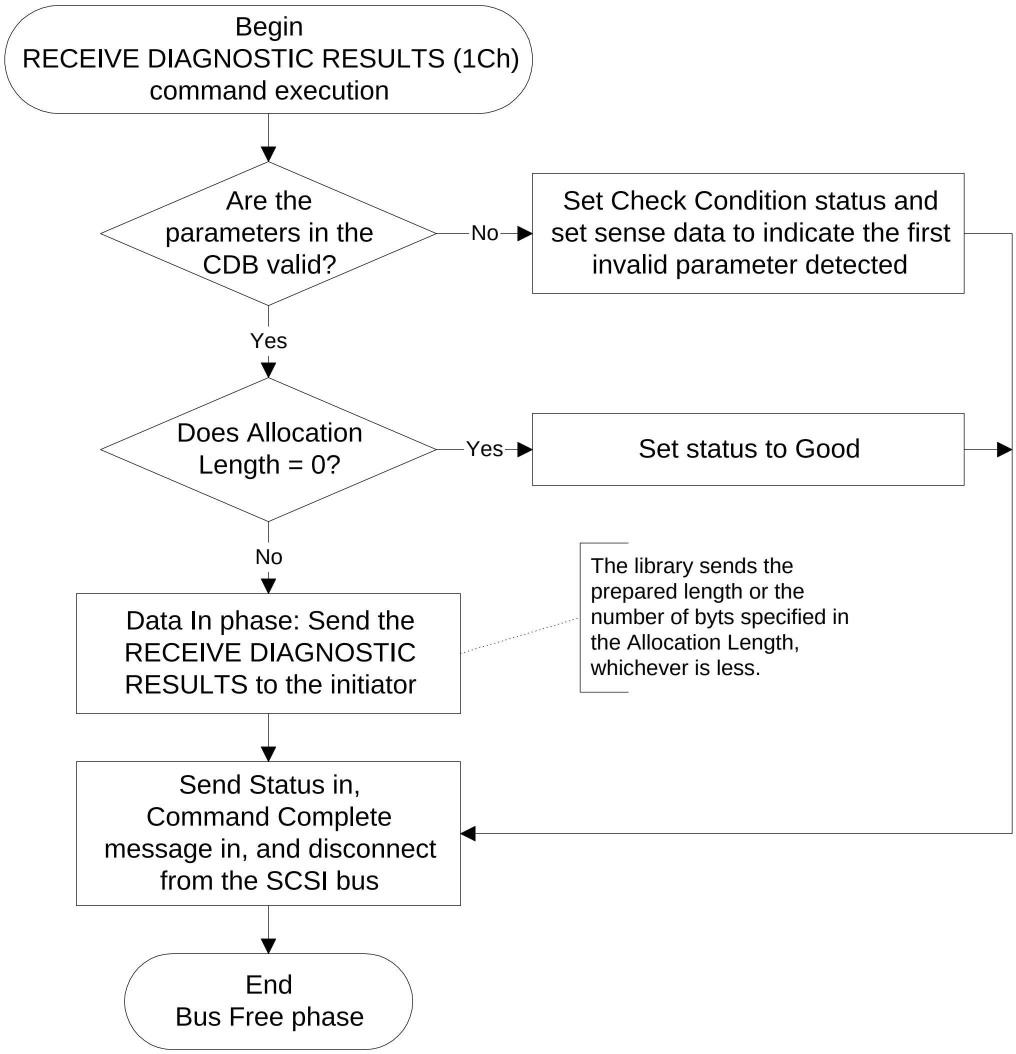

Figure 16-1 RECEIVE DIAGNOSTIC RESULTS command execution

16.5 Command Status

The library returns a status byte after processing the RECEIVE DIAGNOSTIC RESULTS command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.

Notes

17 RELEASE (17h)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	1
01	Logical Unit Number			3rdPty	Third Party Device ID			Element
02	Reservation Identification							
03	Reserved							
04								
05	0	0	Reserved				0	0

17.1 About This Command

The RELEASE command enables you to release reservations of the library or elements of the library that you made with the RESERVE (16h) command. For information on the RESERVE command, see Chapter 20. For default element addresses for the library, refer to the figures on page 1-7 through page 1-9.

Releasing an unreserved library or unreserved elements of the library is not an error.

Only the initiator that reserved the library or library elements can release the reserved library or elements. If another initiator attempts to release a reserved library or element, the library returns Good status and does not release the library or element.

17.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must always be 0.

3rdPty – Byte 01, Bit 4

The library does not support third party operations, so the value for this field must be 0.

Third Party Device ID – Byte 01, Bits 3 through 1

The library does not support third party reservations, so the value for this field must be 0.

Element – Byte 01, Bit 0

The valid values for this field are as follows:

0 – Release the library or any reserved elements from reserved status

1 – Release the reserved elements associated with the Reservation Identification (byte 02) from reserved status

Reservation Identification – Byte 02

This field specifies a value established by the initiator to identify the specific reservation request (see Chapter 20). If the Element field (byte 01, bit 0) is 0, this field is ignored.

17.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 17-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB. Table 17-1 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

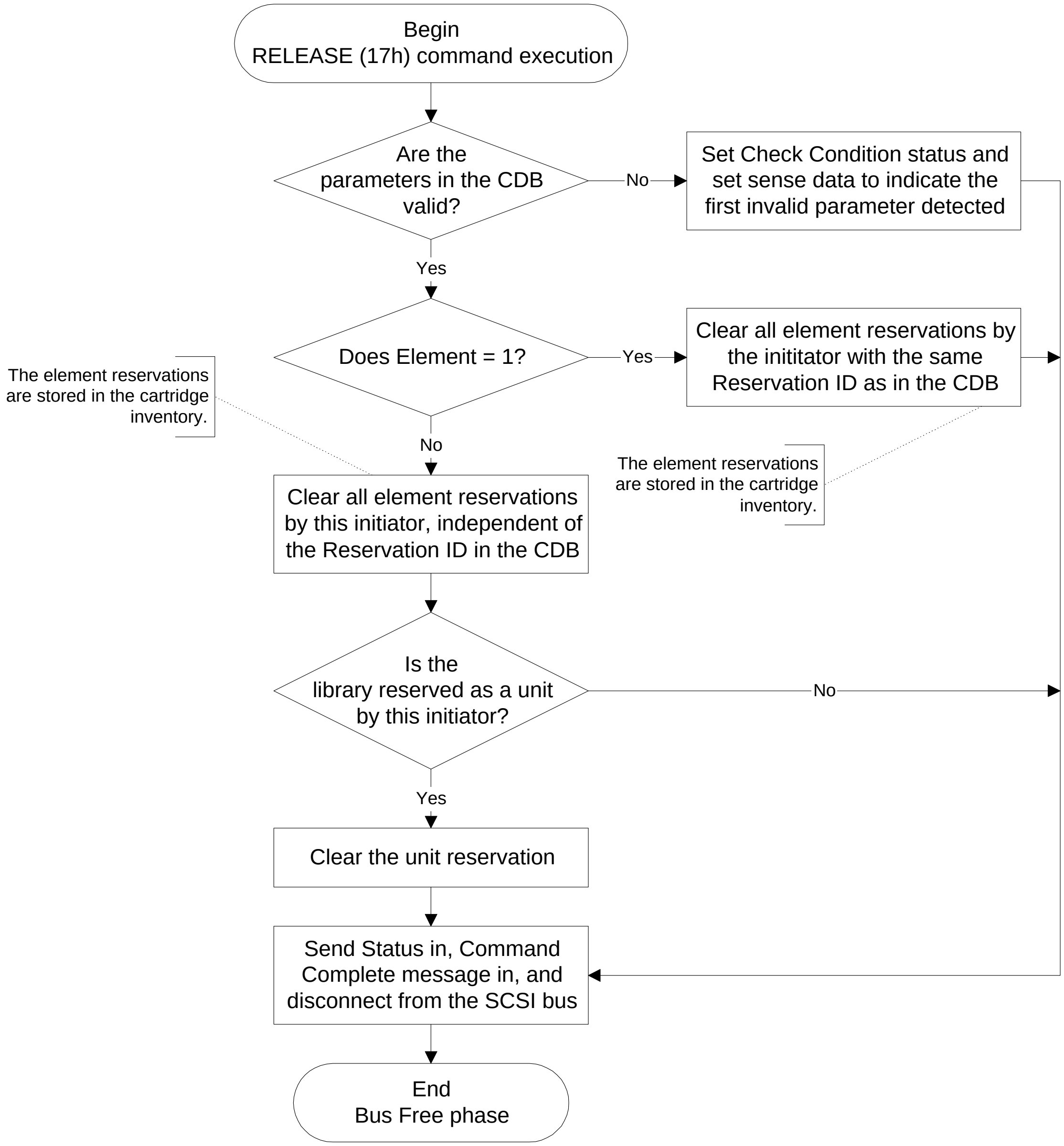

Figure 17-1 RELEASE command execution

17.4 Command Status

The library returns a status byte after processing the RELEASE command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library never returns Reservation Conflict status for the RELEASE command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 17-1 for sense data).

Table 17-1 Invalid parameters in the RELEASE CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00	1	1	1	4h	0001h	Error in 3rdPty field.
5h	24h	00	1	1	1	3h	0001h	Error in Third Party Device ID field.

18 REQUEST SENSE (03h)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	1	1
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04	Number of Bytes Allocated							
05	0	0	Reserved				0	0

18.1 About This Command

The REQUEST SENSE command requests that the library transfer sense data to the initiator. The library provides sense data in only the Error Code 70h, extended sense data format. The library returns a total of 18 bytes of sense data to the initiator.

The sense data is constructed and saved on a per-initiator and requested LUN basis. The library preserves sense data for all initiators until the data is retrieved by the REQUEST SENSE command or until the library receives any other command for the same I_T_L nexus (initiator-target-LUN connection).

Sense data is available under the following circumstances:

- The previous command to the specified I_T_L nexus terminated with Check Condition status.

- The previous command to the specified I_T_L nexus terminated with an unexpected bus free error.

- The REQUEST SENSE command was issued to an unsupported LUN. In this case, the library does not return Check Condition status and returns the following sense data:

Sense key	Illegal Request (5h)
ASC	Logical unit not supported (25h)
ASCQ	0

If no sense data is available for the specified I_T_L nexus, the library returns the following sense data:

Sense key	No Sense (0h)
ASC	No additional sense information (00h)

18.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Number of Bytes Allocated – Byte 04

This field indicates the number of bytes that the initiator has allocated for returned sense data. The library provides a total of 12h (18) bytes of sense data.

18.3 What the Library Returns

The library returns the standard extended sense bytes, as described below.

Bit / Byte	7	6	5	4	3	2	1	0
00	RSVD	1	1	1	0	0	0	0
01	0							
02	0	0	0	RSVD	Sense Key			
03	(MSB)							
⋮	Information Bytes							
06								(LSB)
07	Additional Sense Length							
08	(MSB)							
⋮	Command Specific Information							
11								(LSB)
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15	SKSV	(MSB)						
16		Sense Key Specific						
17								(LSB)

Sense Key – Byte 02, Bits 3 through 0

Table 18-1 contains descriptions of the sense key values supported by the library. For a list of the conditions that cause each sense key setting, refer to Appendix C.

Table 18-1 Sense key descriptions

Hex Value	Sense Key	Description
0h	No Sense	Indicates that there is no specific sense key information to be reported for the library.
2h	Not Ready	Indicates that the library is not ready to perform robot motion commands.
4h	Hardware Error	Indicates that the library detected a hardware failure while performing the command or during a self-test. Operator intervention may be required.
5h	Illegal Request	Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for a command, or the library is in the wrong mode to execute the command.
6h	Unit Attention	Indicates that the cartridge inventory may have been violated.
Bh	Aborted Command	Indicates that the library aborted the command. The initiator may be able to recover by trying the command again.

Information Bytes – Bytes 03 through 06

The library does not support this sense field and returns 0.

Additional Sense Length – Byte 07

This byte indicates the total number of sense bytes that follow this byte. The value returned is 0Ah.

Command Specific Information – Bytes 08 through 11

This field is not supported by the library. The value returned is 0.

Additional Sense Code (ASC) – Byte 12

This field, together with the Additional Sense Code Qualifier (byte 13), denotes a specific error condition. For a list of these error conditions, refer to Appendix C.

Additional Sense Code Qualifier (ASCQ) – Byte 13

This field, together with the Additional Sense Code (byte 12), denotes a specific error condition. For a list of these error conditions, refer to Appendix C.

Field Replaceable Unit Code – Byte 14

This field is not supported by the library. The value returned is 0.

SKSV (Sense Key Specific Valid) – Byte 15, Bit 7

When this bit is set to 1, the information in the Sense Key Specific field is valid. The SKSV field can be set to 1 only for a sense key of Illegal Request (5h).

Sense Key Specific – Byte 15, Bits 6 through 0; Bytes 16 and 17

When the SKSV bit is set to 1, the information contained in this field indicates which field in the CDB or parameter list of a command caused the Check Condition status. This field, valid only for a sense key of Illegal Request (5h), is defined as follows:

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

C/D (Command/Data) – Byte 15, Bit 6 Indicates whether the Check Condition status resulted from an illegal parameter in either the command descriptor block (Command) or the parameter list (Data) of a particular command, as follows:

0 – The Check Condition status resulted from an illegal parameter in the parameter list (Data)

1 – The Check Condition status resulted from an illegal parameter in the command descriptor block (Command)

BPV (Bit Pointer Valid) – Byte 15, Bit 3 Indicates whether the value in the Bit Pointer field is valid, as follows:

0 – The value contained in the Bit Pointer is not valid

1 – The value contained in the Bit Pointer (byte 15, bits 2 through 0) is valid

The value in the Bit Pointer field is valid when the field of the CDB or parameter list that caused the error is less than one byte long.

Bit Pointer – Byte 15, Bits 2 through 0 Specifies the bit of the byte identified by the Field Pointer (bytes 16 and 17). When a multiple-bit field is in error, the Bit Pointer contains the value of the most significant bit of the field. The most significant bit of a multiple-bit field is the bit with the highest bit number. For example, if a field consists of bits 5, 4, and 3, the most significant bit is bit 5.

Field Pointer – Bytes 16 and 17 Contains the number of the byte in which the error occurred. Byte numbers start at 00. When a multiple-byte field is in error, the Field Pointer contains the value of the most significant byte of the field. The most significant byte of a multiple-byte field is the byte with the lowest byte number. For example, if a field consists of bytes 02, 03, and 04, the most significant byte is byte 02.

Priorities of Sense Bytes

Multiple errors may occur during the processing of a single SCSI command. The sense key reflects the last error that occurred. For example, if a message error occurs after an unrecoverable hardware error, the library handles the errors in the following manner:

- The message error is reported.
- The hardware error is preserved, and the next motion command issued by any host terminates with Check Condition status.
- A subsequent REQUEST SENSE command reports the hardware error.

Sense Byte Pending Status

When the library reports Check Condition status in response to a command from an initiator, the library retains the sense byte pending status, including error information and Check Condition status for the initiator, until one of the following occurs:

- Error information is reset by the next command execution for the same initiator.
- Error information is reset by a reset or power-on condition.

18.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 18-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB.

Note: This section describes the normal processing of the REQUEST SENSE command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

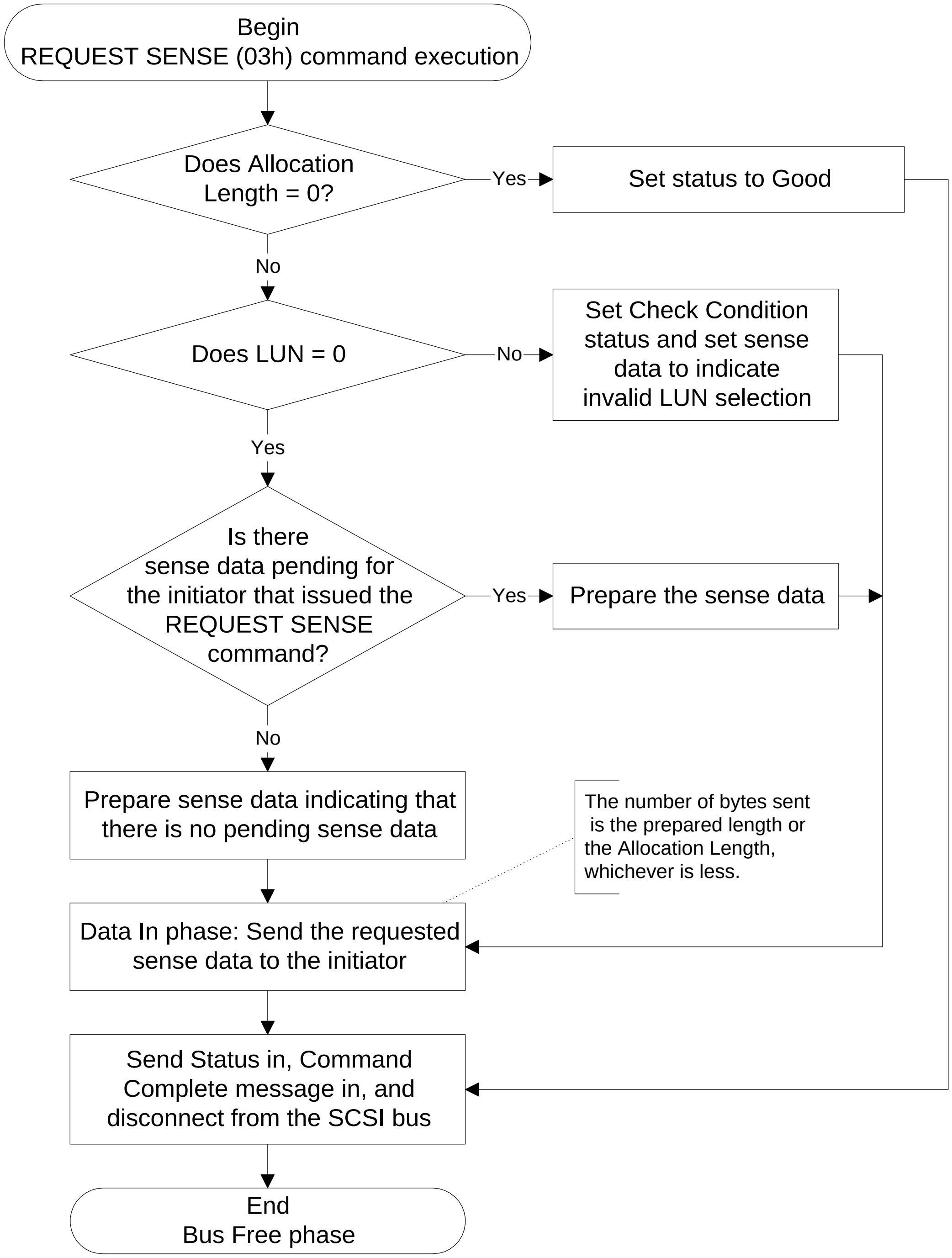

Figure 18-1 REQUEST SENSE command execution

18.5 Command Status

The library returns a status byte after processing the REQUEST SENSE command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library never returns Busy status for the REQUEST SENSE command.

Reservation Conflict

The library never returns Reservation Conflict status for the REQUEST SENSE command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- A reserved bit is set to 1 in the CDB.

Notes

19 REQUEST VOLUME ELEMENT ADDRESS (B5h)

Bit / Byte	7	6	5	4	3	2	1	0
00	1	0	1	1	0	1	0	1
01	Logical Unit Number			VolTag	Element Type Code			
02	(MSB) Starting Element Address							
03								(LSB)
04	(MSB) Number of Elements							
05								(LSB)
06	Reserved							
07	(MSB) Allocation Length							
08								
09								(LSB)
10	Reserved							
11	0	0	Reserved				0	0

19.1 About This Command

The REQUEST VOLUME ELEMENT ADDRESS command requests that the library return the element descriptors created as a result of the SEND VOLUME TAG (B6h) command. Data is returned in element address order. For information about the SEND VOLUME TAG command, see Chapter 22.

Note: In a multi-initiator environment, you should reserve the entire library using the RESERVE (16h) command before you request element descriptors. Do not issue the RELEASE (17h) command until after you have successfully obtained data with the REQUEST VOLUME ELEMENT ADDRESS command. You should issue commands in the following order:

1. RESERVE (16h) for the entire library
2. SEND VOLUME TAG (B6h)
3. REQUEST VOLUME ELEMENT ADDRESS (B5h)
4. RELEASE (17h)

19.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

VolTag – Byte 01, Bit 4

This field indicates whether you want the library to return the volume tag (bar code label) information searched for by the SEND VOLUME TAG (B6h) command. Volume tag information is obtained when the library scans the bar code label affixed to each cartridge in the library. The valid values for this field are as follows:

0 – Do not report volume tag information
1 – Report volume tag information

Note: For specifications for the bar code labels that can be used with the library, refer to the *Exabyte Bar Code Label Specification for DLT Cartridges*.

Element Type Code – Byte 01, Bits 3 through 0

This field specifies the element types you want the library to report on. The library supports the following Element Type Codes:

0h – All element types
1h – Medium transport element (robot)
2h – Storage element (cartridge magazine slots and fixed slot)
3h – Import/export element (entry/exit port)
4h – Data transfer elements (tape drives)

For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.

Starting Element Address – Bytes 02 and 03

This field indicates the element address at which to start the transfer of data. Only elements with addresses greater than or equal to the starting address are reported. Element descriptor blocks are not generated for undefined element addresses.

Note: The Starting Element Address must be a valid address for the library, but does not have to be an address of the type requested in the Element Type Code. The library only returns element descriptors for the elements of requested element type within the range defined by the Starting Element Address and Number of Elements fields.

Number of Elements – Bytes 04 and 05

This field represents the actual number of element descriptors to be returned. This is an actual number of element descriptors to be returned, not an element address range.

The library returns element descriptors of the requested element type, starting with the first element address equal to or greater than the value in the Element Address field. All element descriptors are returned for the number of element descriptors specified in this field, or the number of element descriptors available, whichever is less.

It is not an error to specify FFFFh as a value for this field if you want the library to return all available elements.

Allocation Length – Bytes 07 through 09

The Allocation Length specifies the total available length in bytes you are allocating for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until *one* of the following conditions is met:

- The library has returned all available element descriptors.
- The library has returned the number of element descriptors specified in the Number of Elements field.
- The library has returned the number of bytes specified in the Allocation Length field.
- There is less allocation length space available than the next complete element descriptor to be returned.

19.3 What the Library Returns

Volume Element Address Header

The library returns one Volume Element Address Header for each REQUEST VOLUME ELEMENT ADDRESS command that it receives.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) First Element Address Reported							
01								(LSB)
02	(MSB) Number of Elements Reported							
03								(LSB)
04	Reserved			Send Action Code				
05	(MSB) Byte Count of Report Available							
06								
07								(LSB)

First Element Address Reported – Bytes 00 and 01

This field indicates the address of the first element that has a bar code label that matches the template sent by the SEND VOLUME TAG (B6h) command.

Number of Elements Reported – Bytes 02 and 03

This field indicates the total number of element descriptors available to be transferred to the initiator. The status of these elements is returned if a sufficient Allocation Length value was specified in the CDB.

Send Action Code – Byte 04, Bits 4 through 0

This field contains the action code in the SEND VOLUME TAG command that created the data. The library supports a Send Action Code of 5h.

Byte Count of Report Available – Bytes 05 through 07

This field indicates the total number of bytes of information available to be transferred to the initiator. This value is not adjusted to match the Allocation Length.

Element Status Page

The library returns one Element Status page for each group of element descriptors of the same type.

Bit / Byte	7	6	5	4	3	2	1	0
00	Element Type Code							
01	PVolTag	AVolTag	Reserved					
02	(MSB) Element Descriptor Length							
03								(LSB)
04	Reserved							
05	(MSB) Byte Count of Descriptor Data Available							
06								
07								(LSB)

Element Type Code – Byte 00

This field indicates the specific element type (see page 19-3) being reported by the element descriptor.

PVolTag – Byte 01, Bit 7

This field indicates if primary volume tag (bar code label) information is present, as follows:

0 – Volume tag bytes are omitted from the element descriptors
1 – Volume tag information is present

AVolTag – Byte 01, Bit 6

The library does not support alternate volume tags. The value reported for this field is 0.

Element Descriptor Length – Bytes 02 and 03

This field indicates the total number of bytes contained in a single element descriptor.

Byte Count of Descriptor Data Available – Bytes 05 through 07

This field indicates the total number of bytes of element descriptor data available for the elements of this element type that meet the CDB requirements. This value is not adjusted to match the value that you specified for the Allocation Length field. This value is the Element Descriptor Length multiplied by the number of element descriptors.

Element Descriptors

The following sections contain the field definitions for the types of elements in the library:

- **Medium transport element:** The robot.
- **Storage elements:** Each slot in the cartridge magazines and the fixed cartridge slot.
- **Import/export element:** The entry/exit port.
- **Data transfer elements:** The tape drives.

Each element descriptor includes the element address and status flags. Each element descriptor may also contain sense code information as well as other information, depending on the element type.

Notes:

- The element descriptors for the types of elements are very similar, with the exception of a few of the fields. Note the differences in bytes 06 and 07.
- The library does not support alternate volume tags. This information is not included in any of the element descriptors.

Medium Transport Element Descriptor

The medium transport element is the robot. The library contains one robot.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved					Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ⋮ 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ⋮ 51	Reserved (field moved up if Primary Volume Tag Information field is omitted)							

Element Address – Bytes 00 and 01

This field contains the element address of the medium transport element (robot).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the robot, as follows:

0 – The robot is in a normal state.

1 – The robot is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This field indicates whether the robot contains a cartridge. Since no match could have been made if there were no cartridge present, the value for this field is always 1.

Additional Sense Code (ASC) – Byte 04

If the robot is in an abnormal state, this field contains the value 83h. Refer to Table 19-1 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 19-1, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

This bit is set as follows:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.
1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The library uses single-sided media and does not support inverting of the media. The information reported for this field is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the address of the last element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 19-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the robot. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

Storage Element Descriptor

Each of the slots in the cartridge magazines and the fixed cartridge slot is a storage element. The library can contain 6, 12, or 18 data cartridge magazines with five cartridge slots each, and one fixed cartridge slot, for a total of 31, 61, or 91 cartridge slots.

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td colspan="8" rowspan="2">(MSB)
Element Address
(LSB)</td></tr>
<tr><td>01</td></tr>
<tr><td>02</td><td colspan="4">Reserved</td><td>Access</td><td>Except</td><td>RSVD</td><td>Full</td></tr>
<tr><td>03</td><td colspan="8">Reserved</td></tr>
<tr><td>04</td><td colspan="8">Additional Sense Code</td></tr>
<tr><td>05</td><td colspan="8">Additional Sense Code Qualifier</td></tr>
<tr><td>06</td><td colspan="8" rowspan="3">Reserved</td></tr>
<tr><td>07</td></tr>
<tr><td>08</td></tr>
<tr><td>09</td><td>SValid</td><td>Invert</td><td colspan="6">Reserved</td></tr>
<tr><td>10</td><td colspan="8" rowspan="2">(MSB)
Source Element Address
(LSB)</td></tr>
<tr><td>11</td></tr>
<tr><td>12
⋮
47</td><td colspan="8">Primary Volume Tag Information
(field omitted if PVolTag = 0)</td></tr>
<tr><td>48
⋮
51</td><td colspan="8">Reserved
(field moved up if Primary Volume Tag Information field is omitted)</td></tr>
</table>

Element Address – Bytes 00 and 01

This field contains the element address of the storage element (cartridge storage slot or fixed cartridge slot).

Access – Byte 02, Bit 3

This bit indicates whether the robot can access the cartridge. The cartridge storage location is accessible if the cartridge magazine is installed. Accessibility is reported as follows:

0 – The cartridge magazine is not accessible (not installed).
1 – The cartridge magazine is accessible (installed).

Note: The fixed cartridge slot is always accessible.

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the cartridge slot, as follows:

0 – The cartridge slot is in a normal state.

1 – The cartridge slot is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates whether the slot contains a cartridge. Since no match could have been made if there was no cartridge present, the value for this bit is always 1.

Additional Sense Code (ASC) – Byte 04

If the slot is in an abnormal state, this field contains the value 83h. Refer to Table 19-1 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 19-1, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

This bit is set as follows:

0 – The Source Element Address field (bytes 10 and 11) is invalid.
1 – The Source Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The library uses single-sided media and does not support inverting of the media (recording on both sides of the tape). The value reported for this bit is 0.

Source Element Address – Bytes 10 and 11

This field shows the address of the last element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 19-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in this storage location. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

Import/Export Element Descriptor

Each of the slots in the entry/exit port data cartridge magazine is an import/export element. The entry/exit port contains one data cartridge magazine with five cartridge slots, for a total of up to five import/export elements.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved		InEnab	ExEnab	Access	Except	Imp/Exp	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Element Address							
11								(LSB)
12 ⋮ 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ⋮ 51	Reserved (field moved up if Primary Volume Tag Information field is omitted)							

Element Address – Bytes 00 and 01

This field contains the address of the cartridge slot in the entry/exit port.

InEnab – Byte 02, Bit 5

This field indicates that the entry/exit port supports retracting the cartridge magazine into the storage area of the library, where the robot can access the cartridges. The value reported for this field is 1.

ExEnab – Byte 02, Bit 4

This field indicates that the entry/exit port supports extending the cartridge magazine out of the storage area of the library. The robot cannot access the cartridge magazine when it is in the extended entry/exit port. The value reported for this field is 1.

Access – Byte 02, Bit 3

This bit indicates whether the robot can access the import/export element, as follows:

0 – The import/export element is not accessible. (The entry/exit port is extended.)

1 – The import/export element is accessible. (The entry/exit port is retracted.)

Except – Byte 02, Bit 2

This bit indicates the current state of the import/export element, as follows:

0 – The import/export element is in a normal state.

1 – The import/export element is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Imp/Exp – Byte 02, Bit 1

This field indicates how the cartridge was placed in the entry/exit port, as follows:

0 – The robot placed the cartridge in the entry/exit port.
1 – An operator placed the cartridge in the entry/exit port.

Full – Byte 02, Bit 0

This field indicates if the import/export element contains a cartridge. The possible values for this field are as follows:

0 – The import/export element does not contain a cartridge.
1 – The import/export element contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the Except bit is set to 1, this field contains the value 83h. Refer to Table 14-3 on page 14-25 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 14-3 on page 14-25, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Element Address field (bytes 10 and 11) is invalid.
1 – The Source Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

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

Source Element Address – Bytes 10 and 11

This field shows the address of the last element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 14-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the entry/exit port slot. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

Data Transfer Element Descriptor

The data transfer element is the tape drive. The library contains up to six tape drives.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	NotBus	RSVD	IDValid	LUValid	RSVD	Logical Unit Number		
07	SCSI Bus Address							
08	Reserved							
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ⋮ 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
48 ⋮ 51	Reserved (field moved up if Volume Tag Information field is omitted)							

Element Address – Bytes 00 and 01

This field contains the address of the data transfer element (a tape drive).

Access – Byte 02, Bit 3

This bit indicates whether the robot can pick or place a cartridge at the tape drive location. The cartridge is accessible if it is unloaded from the tape drive at that location. Accessibility is reported as follows:

0 – The tape drive location may not be accessible (a cartridge was last reported in the tape drive but is not currently unloaded).

1 – The tape drive location is accessible (a cartridge is unloaded and waiting to be picked, or the tape drive is empty).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the tape drive, as follows:

0 – The tape drive is in a normal state.

1 – The tape drive is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates if the tape drive contains a cartridge. Since a match could have been made only if there was a cartridge present, the value for this bit is always 1.

Additional Sense Code (ASC) – Byte 04

If the tape drive is in an abnormal state, this field contains the value 83h. Refer to Table 19-1 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 19-1, along with the corrective action to take for each abnormal state.

NotBus – Byte 06, Bit 7

This bit is not supported by the library. The value reported for bit is 0.

IDValid – Byte 06, Bit 5

This bit indicates that the SCSI Bus Address field (byte 07) contains valid information as follows:

0 – The SCSI Bus Address field is not valid because a tape drive is not installed at this location.

1 – The SCSI Bus Address field is valid because a tape drive is installed at this location.

LUValid – Byte 06, Bit 4

This bit indicates that the Logical Unit Number field (byte 06, bits 2 through 0) contains valid information as follows:

0 – The Logical Unit Number field is not valid because a tape drive is not installed at this location.

1 – The Logical Unit Number field is valid because a tape drive is installed at this location.

Logical Unit Number – Byte 06, Bits 2 through 0

The value reported for this field is 0.

SCSI Bus Address – Byte 07

The value reported for this field is the tape drive’s SCSI ID.

SValid – Byte 09, Bit 7

This bit is set as follows:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.

1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The library uses single-sided media and does not support inverting of the media (recording on both sides of the tape). The value reported for this bit is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the addresses of the last storage element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described in page 19-5) is set to 1, the Primary Volume Tag Information field contains the volume tag information of the cartridge in this tape drive. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

ASC and ASCQ Values for Abnormal States

Table 19-1 contains a list of the ASC and ASCQ values that appear in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. Table 19-1 also indicates the corrective action for each abnormal state. The Except field of an element descriptor indicates if the element is in an abnormal state.

Table 19-1 ASC and ASCQ values for abnormal element conditions

ASC	ASCQ	Description	Action
83h	00h	Label questionable	The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command.
83h	03h	Label and full status questionable	The library was powered on or the front door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command.

19.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 19-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in the CDB. Table 19-2 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

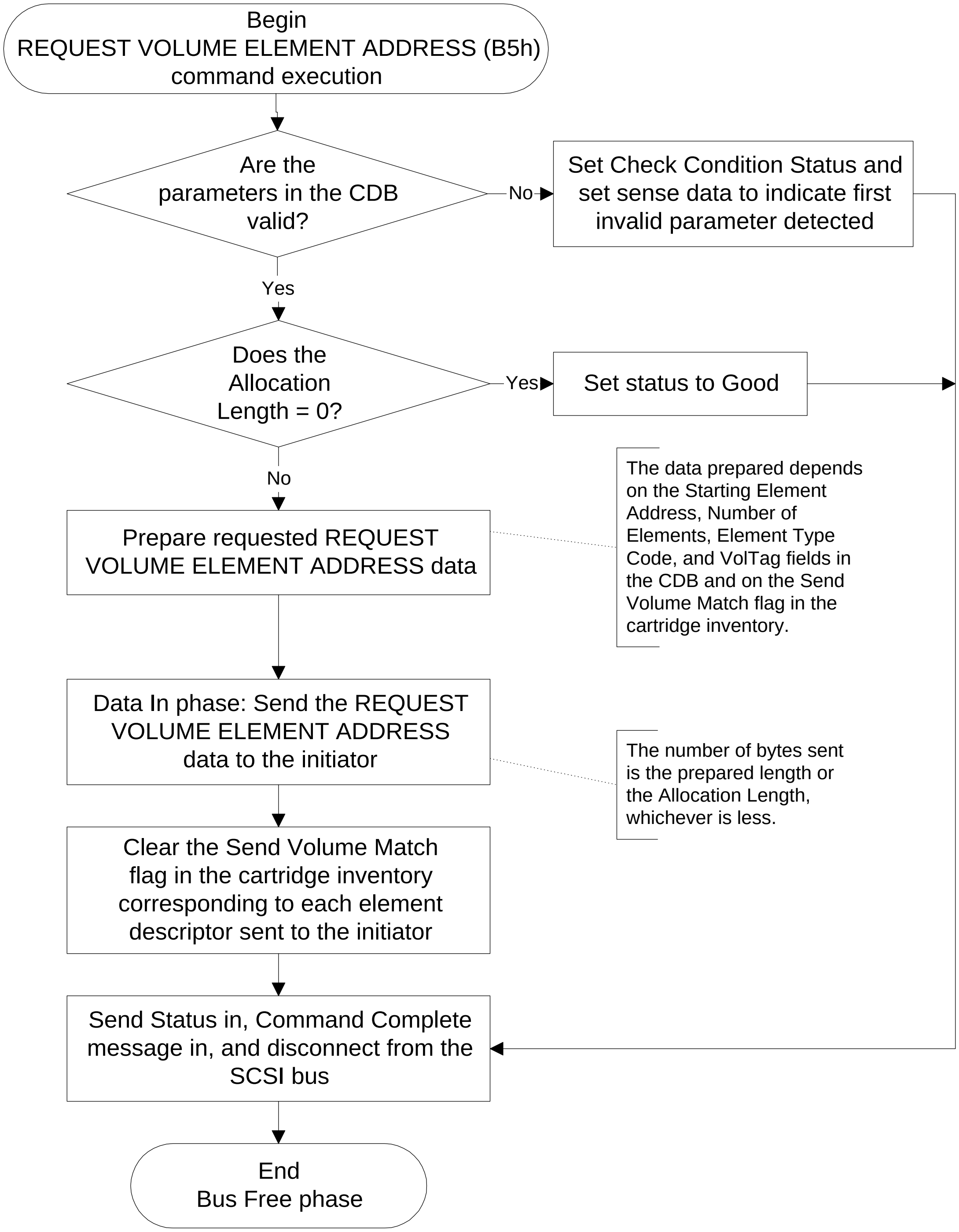

Figure 19-1 REQUEST VOLUME ELEMENT ADDRESS command execution

19.5 Command Status

The library returns a status byte after processing the REQUEST VOLUME ELEMENT ADDRESS command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- The library is not ready because the door is open or it is operating in LCD mode or Console mode.
- A parameter in the CDB is invalid (see Table 19-2 for sense data).

Table 19-2 Invalid parameters in the REQUEST VOLUME ELEMENT ADDRESS CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	0	0002h	Invalid starting element address.
5h	24h	00h	1	1	1	3h	0001h	Invalid element type code.

Notes

20 RESERVE (16h)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Logical Unit Number			3rdPty	Third Party Device ID			Element
02	Reservation Identification							
03	(MSB) Element List Length							
04	Element List Length (LSB)							
05	0	0	Reserved				0	0

20.1 About This Command

The RESERVE command allows the initiator to perform two types of reservations:

- Unit reservation — reserves the library as a whole.
- Element reservation — reserves specific elements of the library, including storage elements (the cartridge storage slots or the fixed cartridge slot), the tape drives, the robot, and the entry/exit port.

Reservations can be released with a RELEASE (17h) command from the same initiator, a reset, or a power-on of the library.

To modify or supersede a previous element reservation, issue a RESERVE command with the same Reservation Identification. If the superseding reservation does not result in any reservation conflicts or error conditions, the library releases the previous reservation and completes the new reservations. A unit reservation of the library will supersede any previous element reservations by the same initiator.

Notes:

- If the library is reserved as a unit, the library processes only the following commands from another initiator:

  - INQUIRY
  - RELEASE
  - REQUEST SENSE
  - ALLOW MEDIUM REMOVAL

  All other commands result in a Reservation Conflict (18h) status.

- If an initiator has reserved at least one element, another initiator cannot do the following:

  - Issue a MODE SELECT command that changes any element addresses. If the library receives such a command, it returns a Reservation Conflict (18h) status to the initiator.

  - Move a cartridge to or from that element.

  - Issue a WRITE BUFFER or WRITE FIRMWARE command to load new flash code.

- If an initiator has reserved the robot, the library returns Reservation Conflict (18h) status to the following commands from another initiator:

  - INITIALIZE ELEMENT STATUS
  - INITIALIZE ELEMENT STATUS WITH RANGE
  - MOVE MEDIUM
  - POSITION TO ELEMENT
  - SEND DIAGNOSTICS (except Page Code 00h, Supported pages; and Page Code 87h, Cycle door solenoid)

20.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

3rdPty – Byte 01, Bit 4

The library does not support third party reservations, so the value for this field must be 0.

Third Party Device ID – Byte 01, Bits 3 through 1

The library does not support third party reservations, so the value for this field must be 0.

Element – Byte 01, Bit 0

This field specifies whether you are reserving the entire library or a series of library elements, as follows:

0 – Reserve the entire library.

1 – Reserve a series of elements, identified by the Reservation Identification field (byte 02) and specified by the Element List Descriptor.

Reservation Identification – Byte 02

This field allows you to assign an identification number to a reservation request that reserves a series of elements. You can assign any one-byte number you want. You can use this number with the RELEASE (17h) command to release the same series of elements (see Chapter 17 for more information).

Element List Length – Bytes 03 and 04

This field specifies the total length in bytes of the element list descriptors that you are sending. Each element list descriptor is 6 bytes, so the valid values for this field are 0, 6, and increments of 6.

The maximum value for this field is 618 (103 × 6), where 103 is the maximum number of elements in the library and 6 is the number of bytes required for each element list descriptor.

If the Element field (byte 01, bit 0) is 0, this field is ignored.

If the Element field (byte 01, bit 0) is 1 and the value for the Element List Length field is 0, no elements are reserved.

Element List Descriptor

After sending the RESERVE CDB, you send zero or more Element List Descriptors to reserve specific library elements.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02	(MSB) Number of Elements							
03								(LSB)
04	(MSB) Element Address							
05								(LSB)

Number of Elements – Bytes 02 and 03

This field allows you to specify the number of elements to be reserved. If you specify 0 for this field, all elements starting at the Element Address (bytes 04 and 05) through the last element address for the library are reserved.

Element Address – Bytes 04 and 05

This field allows you to specify the element or the starting address of a series of elements to be reserved. See the figures on page 1-8 through page 1-9 for the default element addresses for the library.

20.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

The actions that the library takes for the RESERVE command depend on whether the request is for a unit reservation or an element reservation. Figure 20-1 shows the action that the library takes for a request to reserve the entire library as a unit. Figure 20-2 shows the action that the library takes for a request to reserve an element or group of elements.

As shown in Figure 20-1 and Figure 20-2, the library validates the parameters in the CDB and the element descriptor data. Table 20-1 shows the sense data reported for invalid parameters in the CDB and in the element descriptor data.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase.

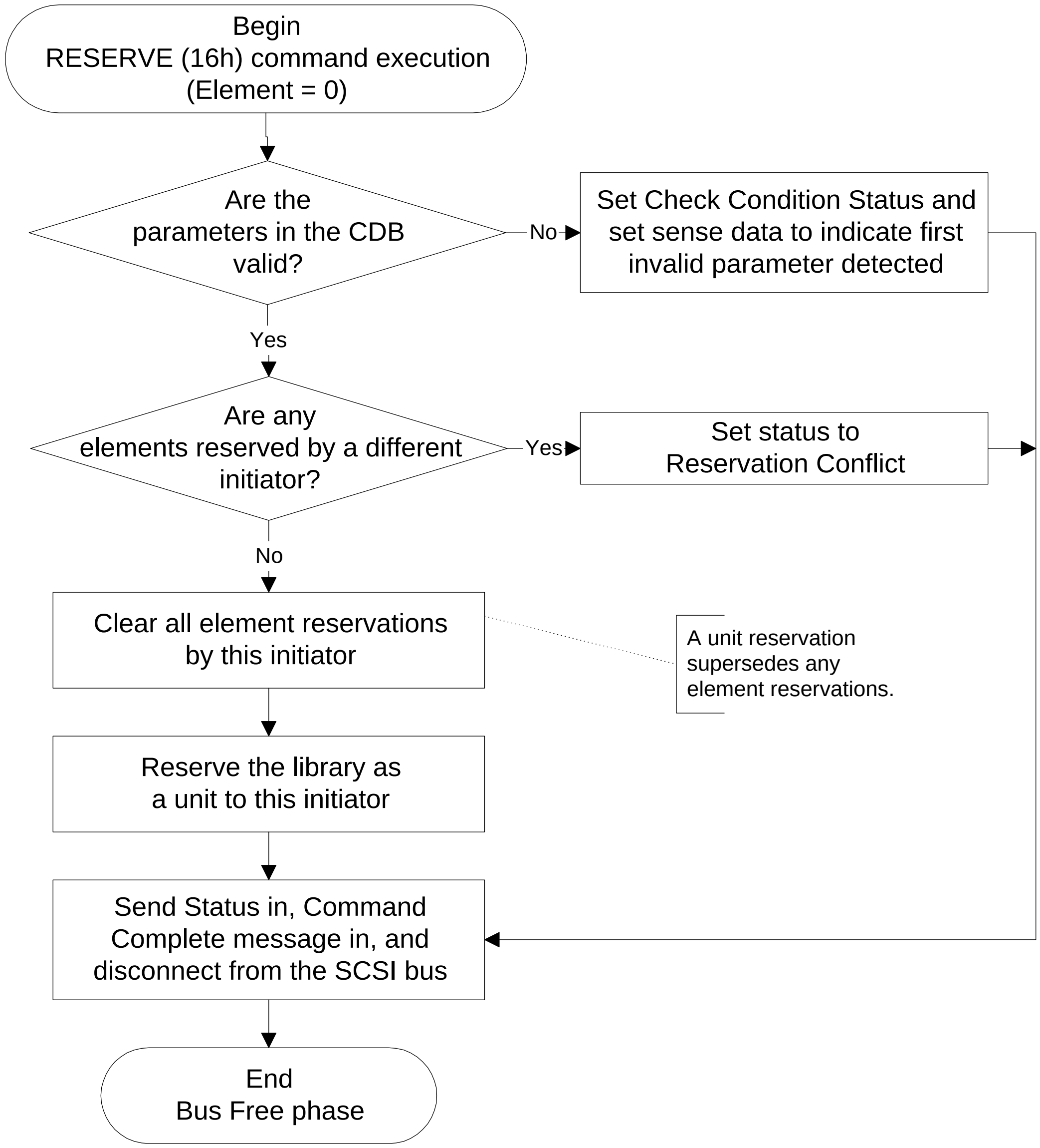

Figure 20-1 RESERVE command execution – unit reservation

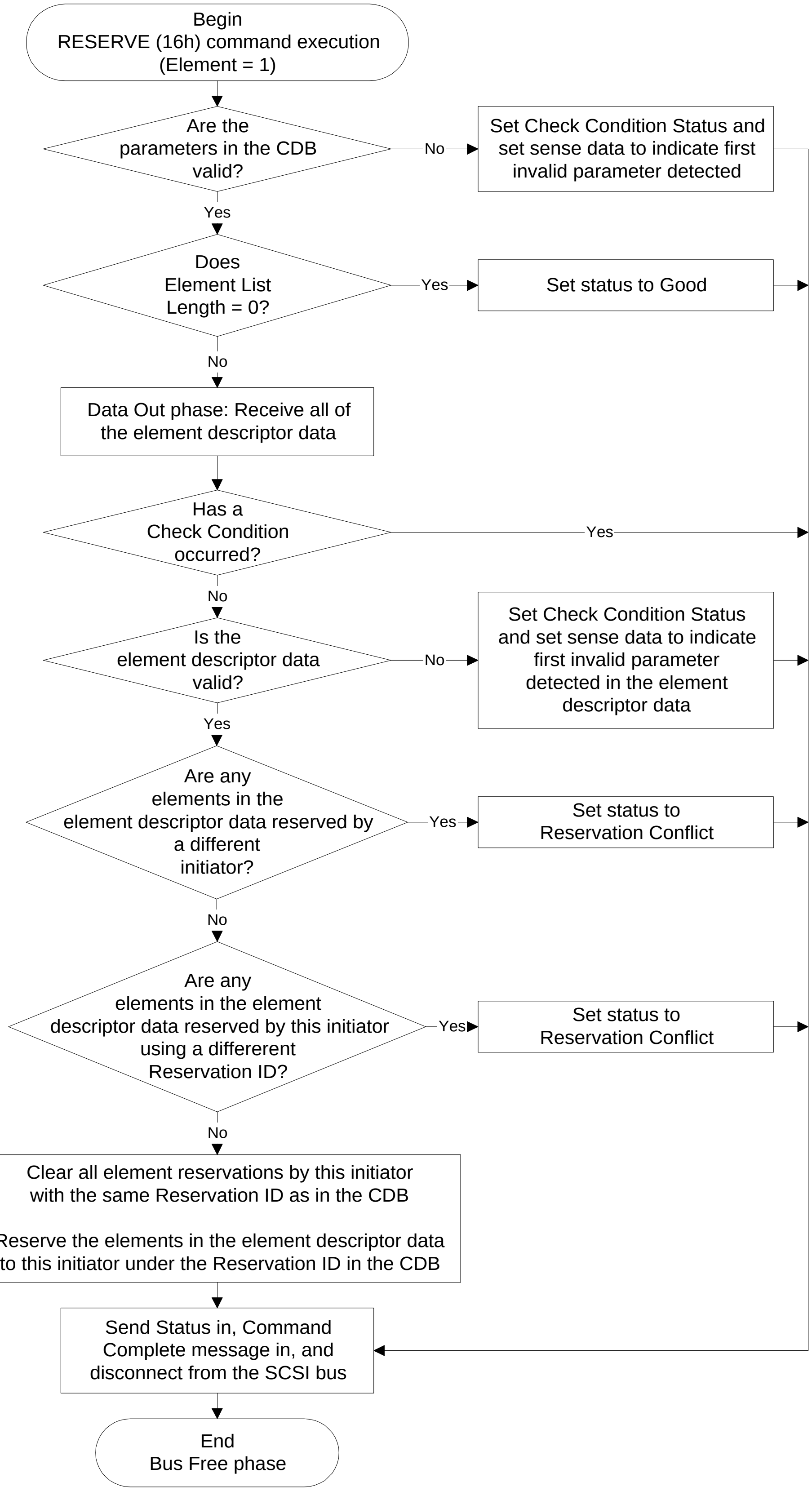

Figure 20-2 RESERVE command execution – element reservation

20.4 Command Status

The library returns a status byte after processing the RESERVE command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when:

- The library is reserved by a different initiator
- An initiator attempts to reserve an element that is reserved by a different initiator
- An initiator attempts to reserve an element it has already reserved under a different Reservation Identification

If an element address has already been reserved by another initiator, none of the requested elements is reserved, Reservation Conflict (18h) status is returned to the initiator, and the sense key is set to No Sense (0h).

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving either the CDB or the element descriptor data.

- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB or element descriptor data is invalid (see Table 20-1 for sense data).

Table 20-1 Invalid parameters in the RESERVE CDB and element descriptor data

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0003h	Invalid Element List Length.
5h	24h	00h	1	1	1	4h	0001h	Error in 3rdPty field.
5h	24h	00h	1	1	1	3h	0001h	Error in Third Party Device field.
5h	26h	00h	1	0	0	0	0000h[a]	Reserved field not 0.
5h	26h	00h	1	0	0	0	0001h[a]	Reserved field not 0.
5h	26h	02h	1	0	0	0	0004h[a]	Invalid element address.
5h	26h	02h	1	0	0	0	—[b]	Overlapped element address in element list descriptor.

[a] You can send more than one Element List Descriptor at a time. Add six to this field pointer value for each subsequent descriptor.

[b] The Field Pointer depends on the number of element descriptors sent.

Notes

21 SEND DIAGNOSTIC (1Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	1
01	Logical Unit Number			PF	RSVD	SelfTest	DevOfl	UnitOfl
02	Reserved							
03	Parameter List Length							
04								
05	0	0	Reserved				0	0

21.1 About This Command

The SEND DIAGNOSTIC command instructs the library to perform a predefined self-test or to perform individual diagnostic procedures that you specify in the parameter list of this command. After the library has completed the diagnostic test or procedures, you can receive the results by issuing the RECEIVE DIAGNOSTIC RESULTS (1Ch) command.

If disconnect is allowed, the library disconnects from the SCSI bus when it performs any diagnostic tests.

Note: In a multi-initiator environment, you should reserve the entire library using the RESERVE (16h) command before you request diagnostic data. Do not issue the RELEASE (17h) command until after you have successfully obtained data with the RECEIVE DIAGNOSTIC RESULTS command. You should issue commands in the following order:

1. RESERVE (16h) for the entire library
2. SEND DIAGNOSTIC (1Dh)
3. RECEIVE DIAGNOSTIC RESULTS (1Ch)
4. RELEASE (17h)

If you issue a RECEIVE DIAGNOSTIC RESULTS command without first sending a SEND DIAGNOSTIC command or if you requested a self test with the SEND DIAGNOSTIC command, the library returns Good status without any diagnostic data.

21.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

PF (Page Format) – Byte 01, Bit 4

The value for this field must always be 1 to indicate that the SEND DIAGNOSTIC parameters conform to the page structure as specified in SCSI-2.

SelfTest – Byte 01, Bit 2

This bit indicates whether the library should perform the diagnostic test specified in the parameter list or a standard self-test, as follows:

0 – Perform the diagnostic test specified in the parameter list.
1 – Perform the standard self-test.

When the SelfTest bit is set to 1, the library performs a standard self-test, as follows:

Home the gripper fingers The gripper fingers are closed and then opened to the home position.

Home the CHM The robot is moved to the home position on the reach axis.

Cycle the reach axis The robot is moved to the center of the vertical axis and then extended toward the cartridge magazine and back to the home position on the reach axis one time.

Cycle the horizontal axis The robot is moved to the home position on the horizontal axis (which is in front of Drive 1). Then, it is moved to a position in front of Drive 2 and returned back to the home position.

Cycle the vertical axis The robot is moved to the home position on the vertical axis. Then, it is moved to the top of the vertical axis and returned back to the home position.

Home the drum The drum moves to position cartridge magazine 3 in front of the robot.

Cycle drum axis The drum is positioned in the home position with data cartridge magazine 0 in front of the robot. The drum then rotates 180 degrees to position data cartridge magazine 3 in front of the robot. The cycle completes when the drum continues to rotate in the same direction and returns data cartridge magazine 0 to the front of the robot (the drum home position).

Cycle entry/exit port The entry/exit port extends fully and then retracts to the home position.

DevOfl (Device Offline) – Byte 01, Bit 1

Since diagnostic tests must be performed when the library is online, the valid value for this bit is 0.

UnitOfl (Unit Offline) – Byte 01, Bit 0

Since the library is a single logical unit, the valid value for this bit is 0.

Parameter List Length – Bytes 03 and 04

This field specifies the length in bytes that you are transferring to the library. Table 21-1 lists the valid values for this field.

Table 21-1 Parameter List Length valid values

When the SelfTest Bit is...	The Parameter List Length must be...	Description
0	0	No data is transferred. Good status is returned.
	4	A 4-byte parameter list follows.
	6	A 6-byte parameter list follows.
1	0	No data is transferred. Good status is returned.

If the parameter list length results in the truncation of a page, the library returns Check Condition status with the sense key set to Illegal Request and an ASC value indicating Invalid Field in the CDB.

SEND DIAGNOSTIC Parameter List

To request that the library perform a diagnostic test other than its standard self test, set the SelfTest bit in the CDB to 0 and use the parameter list to specify the test that you want to perform. The value that you specified in the Parameter List Length field determines the length of the parameter list that you can send. Two lengths are available: 4 and 6 bytes.

This section describes the format of the parameter list and the types of tests that you can request. Although you can request only one test for each SEND DIAGNOSTIC command, you can request that the library perform some of the tests multiple times.

If the library returns Good status to the SEND DIAGNOSTIC command, you can use the RECEIVE DIAGNOSTIC RESULTS command to obtain the results of the specified test.

The format of the 4-byte parameter list is as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB) Page Length							
03								(LSB)

Page Code – Byte 00

The Page Code must be 0. This specifies that the library should return all supported diagnostic page codes for the next RECEIVE DIAGNOSTIC RESULTS command.

Page Length – Bytes 02 and 03

This field must be 0 to indicate that no bytes follow.

The format of the 6-byte parameter list is as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB) Parameter List Length (02h)							
03								(LSB)
04	Test Parameters							
05	Test Count							

Page Code – Byte 00

The Page Code specifies the test that you want to perform. See Table 21-2 for a list of the valid values for the Page Code field and a description of the available tests.

Parameter List Length – Bytes 02 and 03

This field must be 02h to indicate that two bytes follow this field.

Test Parameters – Byte 04

This field specifies a cartridge location for the Cycle pick/place cartridge test. If you specified 82h for the Page Code field, enter a value between 0 and 90 (a cartridge storage location or the fixed slot) to indicate the element address of the cartridge on which you want to perform the pick/place cycle.

If you specified any other Page Code, enter a value of 0 for this field.

Test Count – Byte 05

The Test Count field specifies the number of times you want to perform the test that you specified in the Page Code field. See Table 21-2 for a list of the valid values for the Test Count field.

Table 21-2 Diagnostic tests available for the library

Page Code	Test Count	Test Name	Description
80h	1	Home gripper fingers	The gripper fingers are closed and then opened to the home position. This test is designed to position the gripper fingers in the home position.
81h	1	Home CHM	The robot is moved to the home position on the reach axis.
82h	1–255	Cycle pick/place cartridge	The robot picks the cartridge at the element address specified in the parameter field and places it back in the same location. If the location is the tape drive, the library returns Check Condition status.
83h	1–255	Cycle gripper fingers	The gripper fingers are closed and then opened to the home position.

Table 21-2 Diagnostic tests available for the library (*continued*)

Page Code	Test Count	Test Name	Description
84h	1–255	Cycle reach axis	The library checks to see if there is a cartridge in the gripper. If a cartridge is present, the library returns Check Condition status. If no cartridge is present, the robot is moved to the center of the vertical axis and then extended toward the cartridge magazine and back to the home position on the reach axis one time.
85h	1–255	Cycle vertical axis	The robot is moved to the home position on the vertical axis. Then, it is moved to the top of the vertical axis and returned back to the home position.
86h	1-255	Cycle drum axis	The drum is positioned in the home position with data cartridge magazine 0 in front of the robot. The drum then rotates 180 degrees to position data cartridge magazine 3 in front of the robot. The cycle completes when the drum continues to rotate in the same direction and returns data cartridge magazine 0 to the front of the robot (the drum home position).
87h	1–255	Cycle door solenoid (audio test)	The door solenoid is turned off and then back on. The test ends with the door solenoid turned on. This is an audio test because you listen to the door solenoid to make sure that it is turning on and off.
88h	1–255	Cycle entry/exit port	The entry/exit port extends fully and then retracts to the home position.
89h	1–255	Cycle horizontal axis	The robot is moved to the home position on the horizontal axis (which is in front of Drive 1). Then, it is moved to a position in front of Drive 2 and returned back to the home position.

21.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 21-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in both the CDB and the vendor specific data. Table 21-3 shows the sense data reported for invalid parameters in the CDB and in the vendor specific page of this command.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to attention by going to the Message Out phase or if parity errors are detected in the vendor data.

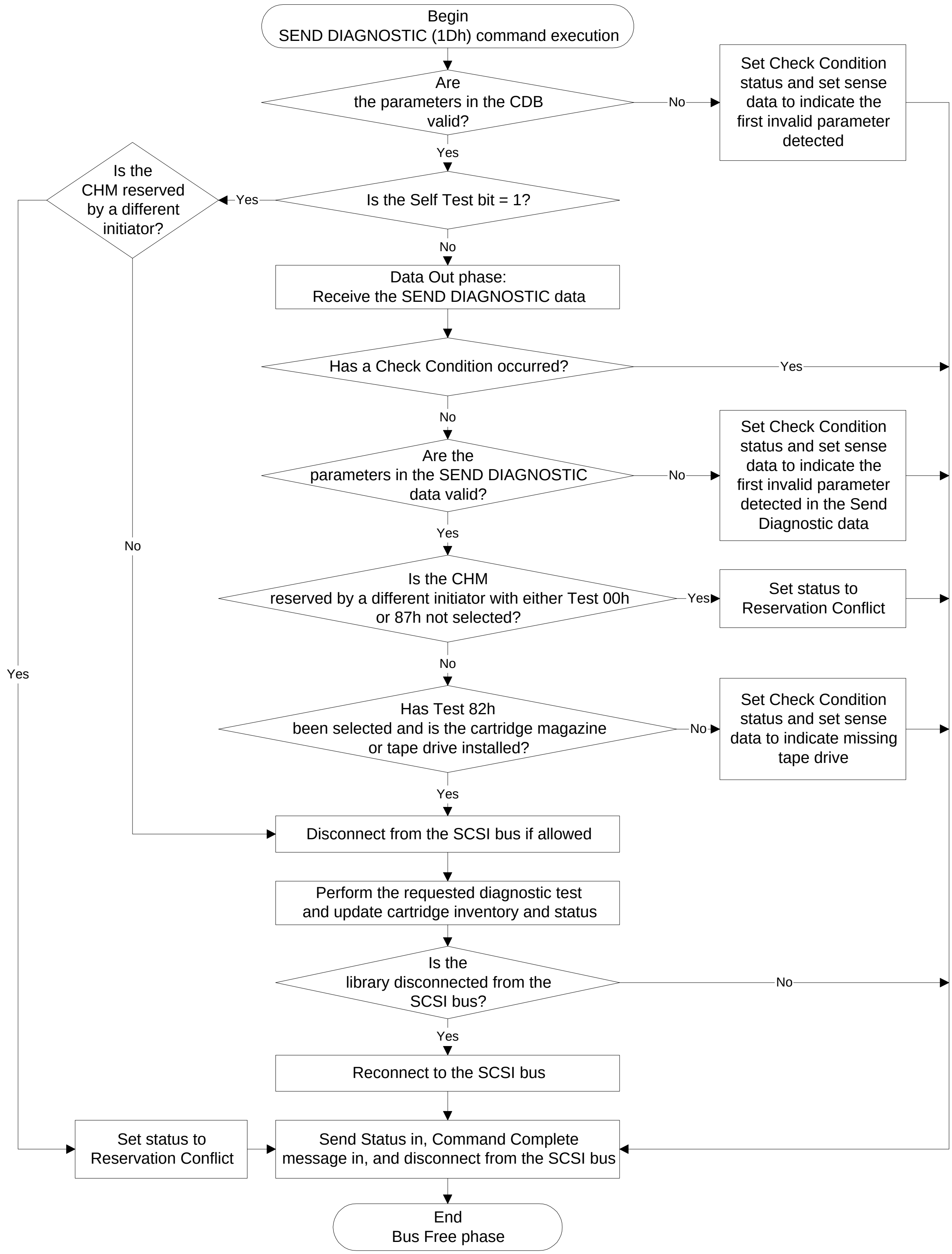

Figure 21-1 SEND DIAGNOSTIC command execution

21.4 Command Status

The library returns a status byte after processing the SEND DIAGNOSTIC command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator or when an element involved in the requested diagnostic is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB or the parameter list.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The library is not ready because the door is open, or it is operating in LCD mode or Console mode.
- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB or Send Diagnostic Parameter List is invalid (see Table 21-3 for sense data).
- The library encounters a hardware problem while trying to perform the requested test.

Table 21-3 Invalid parameters in the SEND DIAGNOSTIC CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0003h	Invalid Parameter List Length.
5h	24h	00h	1	1	1	4	0001h	Invalid Page Format field.
5h	24h	00h	1	1	1	1	0001h	Invalid value in DevOfl field.
5h	24h	00h	1	1	1	0	0001h	Invalid value in UnitOfl field.
5h	26h	00h	1	0	0	0	0000h	Invalid Page Code.
5h	26h	00h	1	0	0	0	0001h	Invalid Reserved byte in the Parameter List.
5h	26h	00h	1	0	0	0	0002h	Invalid Page Length.
5h	26h	02h	1	0	0	0	0004h	Invalid Test Parameter.
5h	26h	02h	1	0	0	0	0005h	Invalid Test Count.
5h	3Bh	0Eh	0	0	0	0	0000h	Source location for move is empty.
5h	53h	02h	0	0	0	0	0000h	Media removal prevented, test cannot be performed (applies to Page Code 87h, cycle door solenoid, cycle entry/exit port, and SelfTest only)
5h	80h	01h	0	0	0	0	0000h	The robot is holding a cartridge. You must remove the cartridge before performing the requested test.
5h	80h	03h	0	0	0	0	0000h	The source data cartridge magazine does not exist.
5h	80h	04h	0	0	0	0	0000h	The destination data cartridge magazine does not exist.
5h	80h	05h	0	0	0	0	0000h	The source tape drive does not exist.
5h	80h	06h	0	0	0	0	0000h	The destination tape drive does not exist.

Notes

22 SEND VOLUME TAG (B6h)

<table>
<tr><th>Bit
Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>00</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>01</td><td colspan="3">Logical Unit Number</td><td>RSVD</td><td colspan="4">Element Type Code</td></tr>
<tr><td>02</td><td colspan="8" rowspan="2">(MSB)
Starting Element Address
(LSB)</td></tr>
<tr><td>03</td></tr>
<tr><td>04</td><td colspan="8">Reserved</td></tr>
<tr><td>05</td><td colspan="3">Reserved</td><td colspan="5">Send Action Code</td></tr>
<tr><td>06</td><td colspan="8" rowspan="2">Reserved</td></tr>
<tr><td>07</td></tr>
<tr><td>08</td><td colspan="8" rowspan="2">(MSB)
Parameter List Length
(LSB)</td></tr>
<tr><td>09</td></tr>
<tr><td>10</td><td colspan="8">Reserved</td></tr>
<tr><td>11</td><td>0</td><td>0</td><td colspan="4">Reserved</td><td>0</td><td>0</td></tr>
</table>

22.1 About This Command

The SEND VOLUME TAG command requests that the library scan the bar code labels affixed to the cartridges and compare this volume tag information with a template sent as part of a parameter list to this command. To obtain the results of the scan performed by this command, use the REQUEST VOLUME ELEMENT ADDRESS (B5h) command.

Notes:

- In a multi-initiator environment, you should reserve the entire library using the RESERVE (16h) command before you use the SEND VOLUME TAG command. Do not issue the RELEASE (17h) command until after you have successfully obtained data with the REQUEST VOLUME ELEMENT ADDRESS command. You should issue the commands in the following order:

  1. RESERVE (16h) for the entire library
  2. SEND VOLUME TAG (B6h)
  3. REQUEST VOLUME ELEMENT ADDRESS (B5h)
  4. RELEASE (17h)

- The library supports only the volume tag information scanned on the bar code label on the cartridges.

- The library does not allow the modification of volume tag information once it has been read from the bar code label.

- The library will not match the label of a cartridge with the Volume Identification Template Field in the Send Volume Tag Parameter List if any of the following errors occur while it is scanning the cartridge:

  - Cannot read bar code label
  - Cartridge magazine not present
  - Tape drive not installed
  - No bar code label

  Refer to Table 22-1 for a description of each of these errors.

22.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Element Type Code – Byte 01, Bits 3 through 0

This field defines the elements to be scanned for a match to the template contained in the parameter list, as follows:

0h – All Element Types
1h – Medium Transport Element (robot)
2h – Storage Element (cartridge slots and fixed slot)
3h – Import/Export Element (entry/exit port)
4h – Data Transfer Element (tape drives)

For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.

Starting Element Address – Byte 02 and 03

This field specifies the minimum element address at which to start the search for volume tag information that matches the template in the parameter list (see page 22-4). Only elements with addresses greater than or equal to the Starting Element Address are searched.

Note: The Starting Element Address must be a valid address for the library, but does not have to be an address of the type requested in the Element Type Code. Only the elements of the requested element type are searched.

Send Action Code – Byte 05, Bits 4 through 0

This field defines the specific function to be performed by this command. The library supports a Send Action Code of 5h (translate, search all primary volume tags, and ignore sequence numbers).

Parameter List Length – Bytes 07 through 09

This field specifies the length of the parameter list following this command. The minimum length of the parameter list is 32 bytes (20h). The maximum length is 40 bytes (28h).

SEND VOLUME TAG Parameter List

Bit Byte	7	6	5	4	3	2	1	0
00 ⋮ 31	Volume Identification Template Field							
32 ⋮ 39	Reserved							

Volume Identification Template Field – Bytes 00 through 31

This field contains 32 bytes of volume identification information, which the library compares to the volume tag (bar code) information stored in nonvolatile memory. Only the first eight bytes are valid. Any additional bytes must be 0 (null). The template is considered terminated after the first 0 byte is detected. This field may contain the following characters:

? (3Fh) – This character matches any single character at that position within the field.

* (2Ah) – This character is a wild card that matches any characters from that point on in that field. All characters past the "*" in the field are ignored.

Examples of valid templates are as follows:

Template	Matches
123?5678	12305678 12315678 and so on
123*5678	123_____ (Any information starting with "123"; 5678 is ignored)

22.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 22-1 shows the steps that the library takes when executing the command through the Bus Free phase. As shown in the figure, the library validates the parameters in both the CDB and in the volume tag data. Table 22-1 lists the sense data reported for invalid parameters in the CDB and in the volume tag data.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional errors and processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase or if parity errors are detected on the volume tag data.

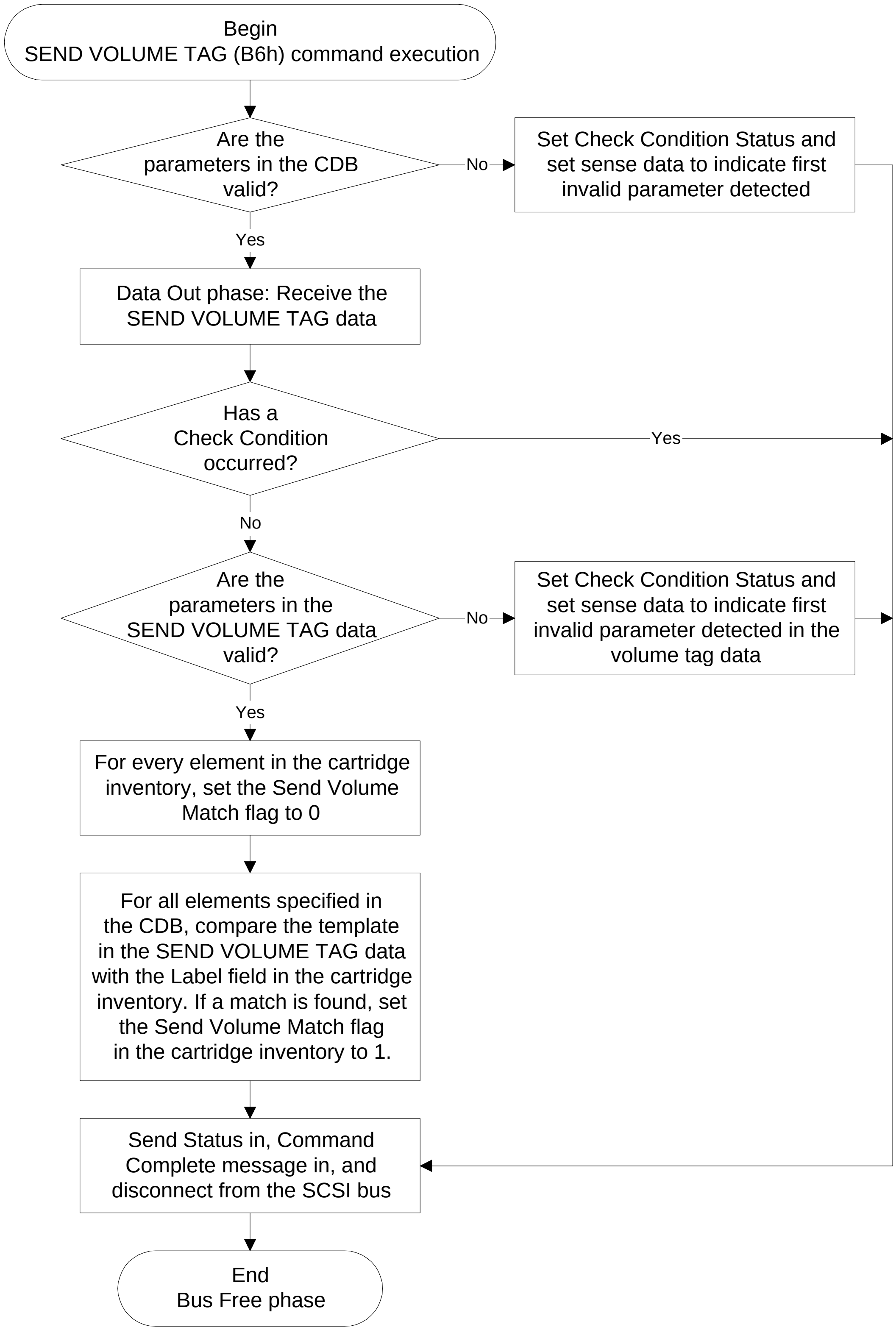

Figure 22-1 SEND VOLUME TAG command execution

22.4 Command Status

The library returns a status byte after processing the SEND VOLUME TAG command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB or the volume tag data.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB or parameter list, or a parameter in the CDB or parameter list is invalid.
- The library is not ready because the door is open, or it is operating in LCD mode or Console mode.

Table 22-1 Invalid parameters in the SEND VOLUME TAG CDB and parameter list

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0008h	Invalid Parameter List Length.
5h	21h	01h	1	1	0	0	0002h	Invalid Starting Element Address.
5h	24h	00h	1	1	1	3	0001h	Invalid Element Type Code.
5h	24h	00h	1	1	1	4	0005h	Invalid Send Action Code.
5h	26h	00h	1	0	0	0	—[a]	Invalid reserved field in parameter list.

[a] The field pointer is set to the first reserved field in the parameter list that contains a non-zero value (that is, 8, 9, 10, . . . , 38, 39).

23 TEST UNIT READY (00h)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	0	0	Reserved				0	0

23.1 About This Command

The TEST UNIT READY command allows the initiator to determine if the library is ready to accept all other commands, including motion commands. This is not a request for a library self-test, which occurs at power-on. If the library is ready to accept any command without returning Check Condition, Reservation Conflict, or Busy status, this command returns Good status.

Note: The library does not check to see if a different initiator has any elements reserved. If an element is reserved by a different initiator, the library returns Reservation Conflict status for the next command after the TEST UNIT READY command.

23.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

23.3 How the Library Executes This Command

The library returns Good status for the TEST UNIT READY command if it is able to process the command without errors. After the library determines the status to return, it does the following:

1. The library goes to the Status In phase and returns either Good, Check Condition, Busy, or Reservation Conflict status to the initiator (see Section 23.4).

2. After the initiator has accepted the status byte, the library goes to the Message In phase, sends the Command Complete message to the initiator, and goes to the Bus Free phase.

23.4 Command Status

The library returns a status byte after processing the TEST UNIT READY command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The library has experienced an unrecoverable hardware error.
- The library is not ready because the door is open, it is operating in LCD mode or Console mode, or the entry/exit port is extended.
- A reserved bit is set to 1 in the CDB.

Notes

24 WRITE BUFFER (3Bh)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	1	0	1	1
01	Logical Unit Number			Reserved		Mode		
02	Buffer ID							
03	(MSB)							
04	Buffer Offset							
05								(LSB)
06	(MSB)							
07	Parameter List Length							
08								(LSB)
09	WBF	0	Reserved				0	0

24.1 About This Command

The WRITE BUFFER command allows you to transfer data over the SCSI bus into the library's memory. The library stores this data either as firmware in flash EEPROM or as LCD logo data in non-volatile memory.

Note: If new firmware becomes available, you can obtain a copy (in machine-readable form) from Exabyte's web site (http://www.exabyte.com).

Modifying the LCD logo data

You can use the WRITE BUFFER command to replace the default logo shown at the top of the library's LCD with a custom logo. The data for the logo must be in standard BMP file format with the following attributes:

- Logo dimensions are 240 bits wide × 60 bits high
- Data includes a standard header (as defined for the standard BMP file format in Microsoft Windows™ 3.0 or later)
- Image is black and white, one bit per pixel
- File is uncompressed

➤ **Important** The LCD can only display the logo graphic as a low resolution, black and white image.

Note: To make other changes to the default display on the library's LCD, use the MODE SELECT command, as described on page 8-20.

Updating the library firmware

You can update the library firmware using the WRITE BUFFER command. If the initiator has less than 1 MB of buffer space available, you may want to issue more than one WRITE BUFFER command. By setting the WBF bit (byte 09, bit 7) to 1, you can specify that you are using a sequence of WRITE BUFFER commands to upgrade the firmware.

Be sure to heed the cautions on the next page when issuing the WRITE BUFFER command to update the firmware stored in the library's flash EEPROM.

CAUTION

- The WRITE BUFFER command allows you to load new firmware over the SCSI bus into the library's flash EEPROM. It is not intended to be used for testing library functionality (that is, do not issue this command unless you are actually loading new firmware).
- Do not load firmware from one model of library into another. (For example, do not load firmware from an Exabyte 230D into the Exabyte 690D or vice versa.)
- Be sure that the library is reserved for the initiator's exclusive use while the WRITE BUFFER command is executing.
- Do not power off or reset the library while this command is executing.
- If the library is power cycled before the firmware download is complete, you may have to use the serial port to load the new code.
- To ensure that the WRITE BUFFER command finishes successfully, calculate the checksum of the new firmware data, as shown in Figure 24-1, and compare your calculated checksum to the checksum embedded in the new firmware data before you issue the WRITE BUFFER command. The checksum is the unsigned integer (16-bit) sum of the first 983,034 bytes (8-bit) of the new firmware data. The last 2 bytes of the new firmware data is the embedded checksum.

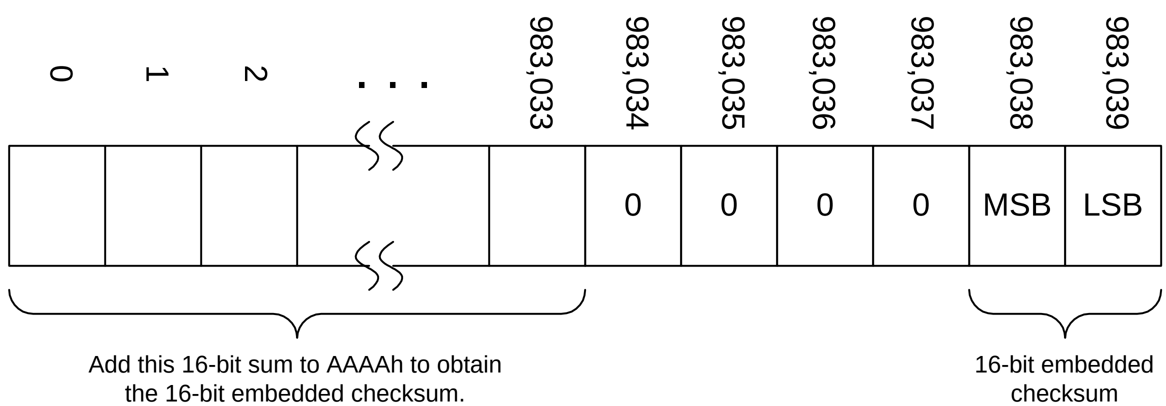

Figure 24-1 Calculating the firmware checksum

When the WRITE BUFFER command is used to update the firmware, the following actions occur:

1. The new firmware is transferred over the SCSI bus. This can be done with one or many WRITE BUFFER commands.

2. If this was not the last or only WRITE BUFFER command, the library returns Good status and goes to the Bus Free phase. Then, it waits for the next WRITE BUFFER command. Otherwise, it goes to step 4.

3. When the library receives the next WRITE BUFFER command, it repeats steps 1 and 2.

4. When the data from the last or only WRITE BUFFER command has been transferred, the library disconnects from the SCSI bus.

5. The flash EEPROM is erased and reprogrammed with the new firmware.

6. The library reconnects to the SCSI bus and returns Good status if the command was successful.

7. The cartridge inventory is erased.

8. A Unit Attention condition is set for all hosts. The sense data indicates that the firmware has changed.

9. The library performs its normal power-on self test.

After the flash EEPROM is programmed with new firmware, part of the nonvolatile memory is erased. The cartridge inventory is stored in this nonvolatile memory.

24.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Mode – Byte 01, Bits 2 through 0

The Mode field determines the type of operation to be performed. The library the following operations:

010b – Write data to the LCD logo buffer in non-volatile memory.
101b – Perform a microcode load operation.

Buffer ID – Byte 02

The value for this byte must be 0.

Buffer Offset – Bytes 03 through 05

The value you specify for the Buffer Offset field depends on whether you are issuing one WRITE BUFFER command or several WRITE BUFFER commands, as follows:

- If you are using one WRITE BUFFER command, set this field to 0.
- If you are using more than one WRITE BUFFER command, set this field to the total number of bytes sent by the previous WRITE BUFFER commands in the command sequence. This field must be set to 0 or to a multiple of 1000h (4,096) bytes.

Parameter List Length –Bytes 06 through 08

The Parameter List Length field specifies the number of bytes to be transferred by the current WRITE BUFFER command. The value you specify for this field depends on whether you are updating the firmware or the LCD logo buffer, as follows:

- If you are updating the LCD logo buffer, the valid value for this field is 1982 (7BEh), which indicates that 1,982 bytes of logo data follow.

- If you are updating the firmware, you may issue one or more WRITE BUFFER commands, as follows:
  - If you are using only one WRITE BUFFER command, the Parameter List Length is exactly 0F0000h (983,040) bytes.
  - If you are using more than one WRITE BUFFER command, make sure that you set the WBF bit to 1, then specify a multiple of 1000h (4,096) bytes for each Parameter List Length (must be greater than 0). For the last WRITE BUFFER command in the sequence, set the Parameter List Length to the remaining number of bytes to be transferred (that is, 0F0000h – [the number of previous WRITE BUFFER data bytes]) and set the WBF bit to 0.

Note: The total size of the firmware is 983,040 bytes. If the sum of the Buffer Offset and the Parameter List Length exceeds 983,040, the library returns Check Condition status.

WBF (WRITE BUFFERs Follow) – Byte 09, Bit 7

The WBF bit specifies whether the new firmware is being sent using one or more WRITE BUFFER commands, as follows:

0 – This is the only WRITE BUFFER command, or this is the last WRITE BUFFER command in a sequence.

1 – This is one of several (but not the last) WRITE BUFFER commands in a sequence.

➤ **Important** You cannot use multiple WRITE BUFFER commands to update the logo data.

For each setting of the WBF bit, the Parameter List Length field (bytes 06 through 08) specifies the number of bytes to be transferred by the current command.

24.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from executing. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 24-2 shows the steps that the library takes when executing the WRITE BUFFER command through the Bus Free phase. As shown in the figures, the library validates the parameters in the CDB. Table 24-1 shows the sense data reported for invalid parameters in the CDB. It also shows the sense data returned if errors are encountered.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase or if parity errors are detected on the new firmware.

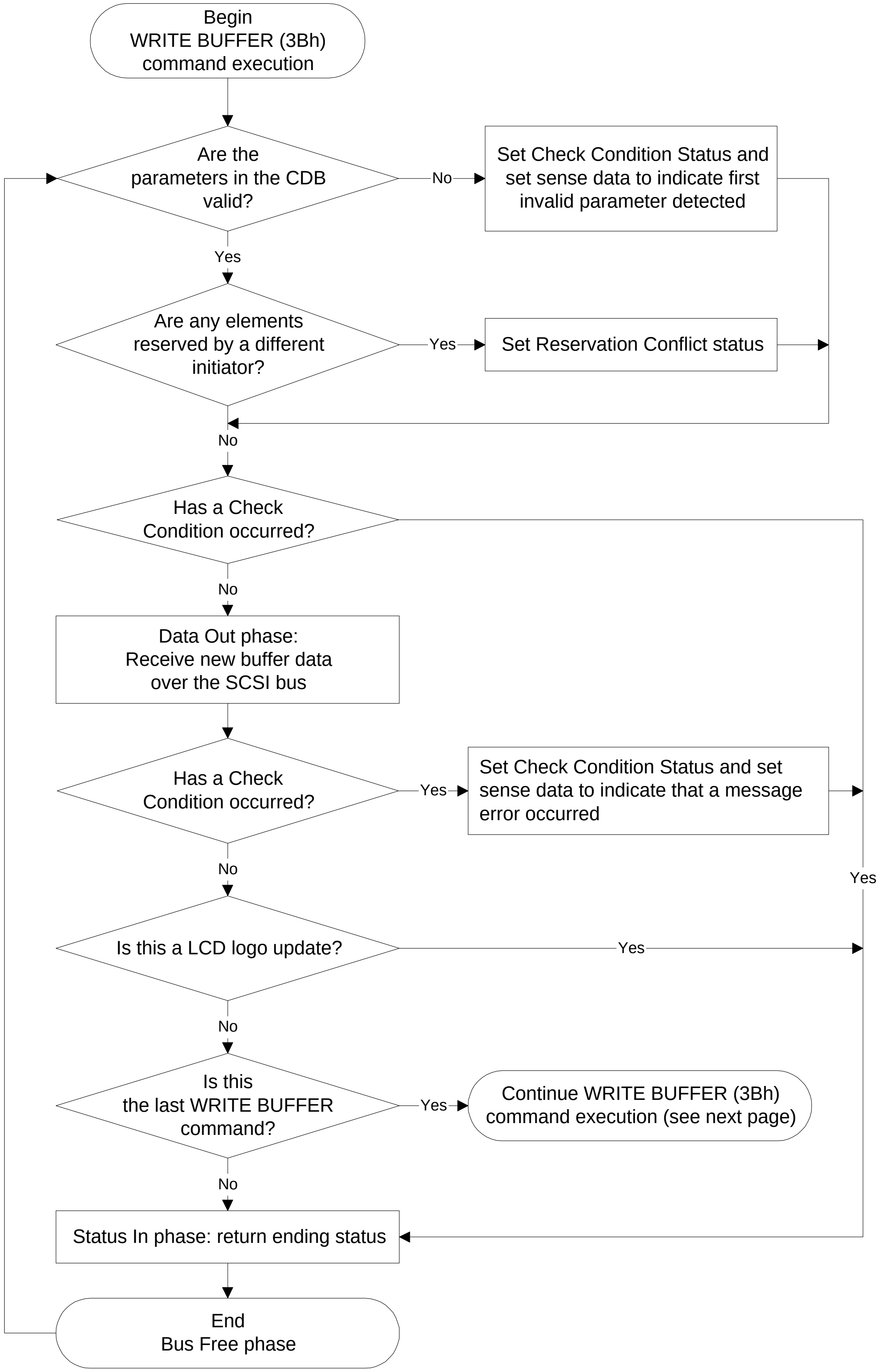

Figure 24-2 WRITE BUFFER command execution

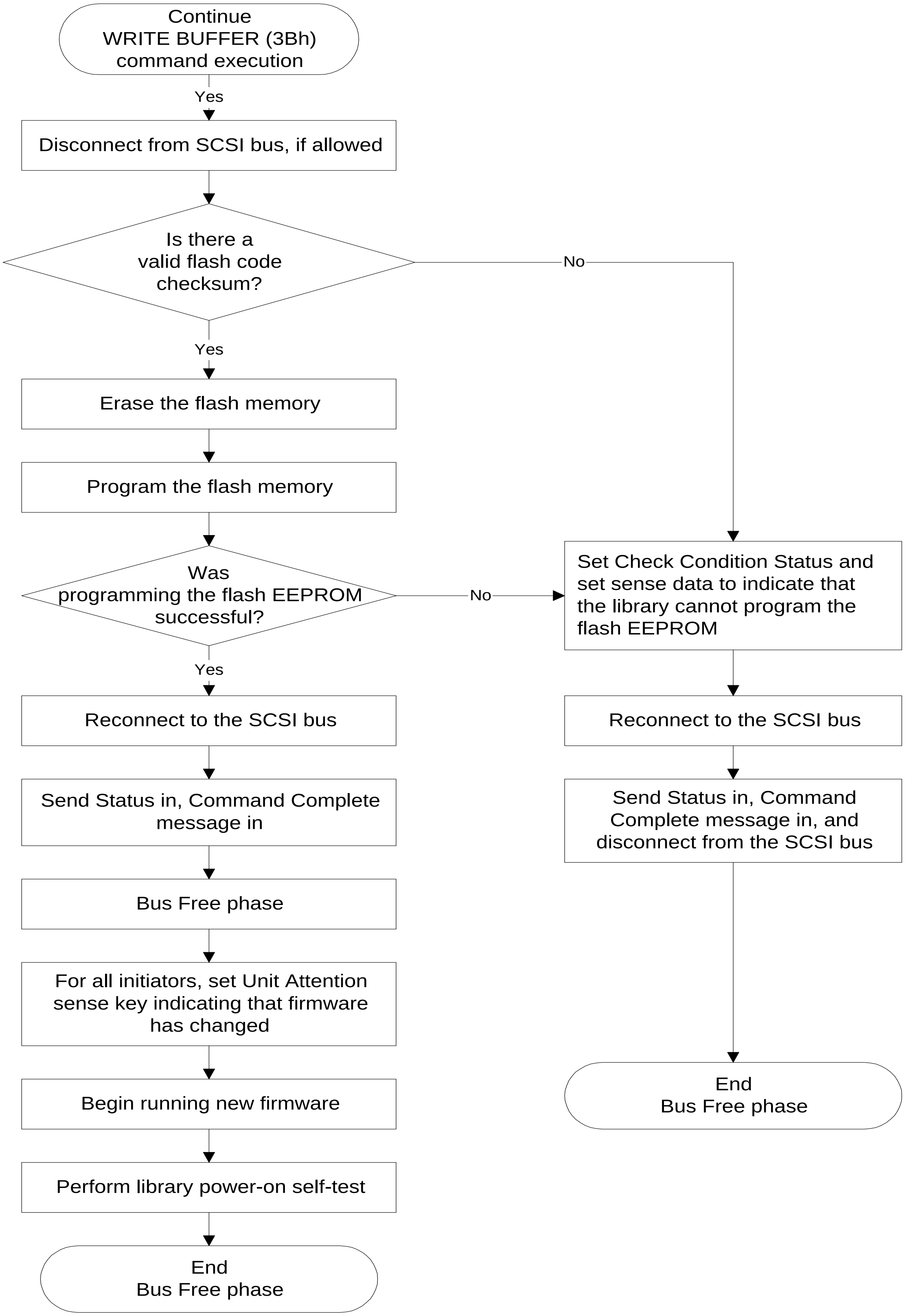

Figure 24-2 WRITE BUFFER command execution (*continued*)

24.4 Command Status

The library returns a status byte after processing the WRITE BUFFER command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when the library is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved or any of its elements are reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurred while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB or firmware.
- The command was issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit was set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 24-1 for sense data).
- The library is unable to erase the flash EEPROM.

- The library is unable to program the flash EEPROM.
- The flash code checksum is not valid after the flash EEPROM is programmed with the new firmware.
- A Console write firmware or read firmware operation is already in progress when the WRITE BUFFER command is received.

Table 24-1 Invalid parameters in the WRITE BUFFER CDB and errors in programming the flash EEPROM

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
4h	3Fh	80h	0	0	0	0	0000h	Flash code firmware write error: unable to erase flash EEPROM.
4h	3Fh	82h	0	0	0	0	0000h	Flash code firmware write error: unable to write zeros to flash EEPROM.
4h	3Fh	84h	0	0	0	0	0000h	Flash code firmware write error: unable to program flash EEPROM.
4h	3Fh	86h	0	0	0	0	0000h	Flash code firmware write error: bad flash code checksum.
5h	1Ah	00h	1	1	0	0	0006h	Invalid transfer length.
5h	26h	00h	1	0	0	0	0000h	Invalid file format in LCD logo data.
5h	3Fh	87h	0	0	0	0	0000h	Cannot execute command because Console write firmware operation is in progress.
5h	3Fh	88h	0	0	0	0	0000h	Cannot execute command because Console read firmware operation is in progress.

Notes

25 WRITE FIRMWARE (D1h)

Bit / Byte	7	6	5	4	3	2	1	0
00	1	1	0	1	0	0	0	1
01	Logical Unit Number			Reserved				
02								
⋮	Reserved							
05								
06	(MSB)							
⋮	Transfer Length							
09								(LSB)
10	Reserved							
11	0	0	Reserved				0	0

25.1 About This Command

The WRITE FIRMWARE command is an Exabyte-unique command that allows you to load new firmware across the SCSI bus into the library's flash EEPROM.

Note: If new firmware becomes available, you can obtain a copy (in machine-readable form) from Exabyte's web site (http://www.exabyte.com).

CAUTION

To ensure that the WRITE FIRMWARE command finishes successfully, calculate the checksum of the new firmware data, as shown in Figure 25-1, and compare your calculated checksum to the checksum embedded in the new firmware data before you issue the WRITE FRIMWARE command. The checksum is the unsigned integer (16-bit) sum of the first 983,034 bytes (8-bit) of the new firmware data. The last 2 bytes of the new firmware data is the embedded checksum.

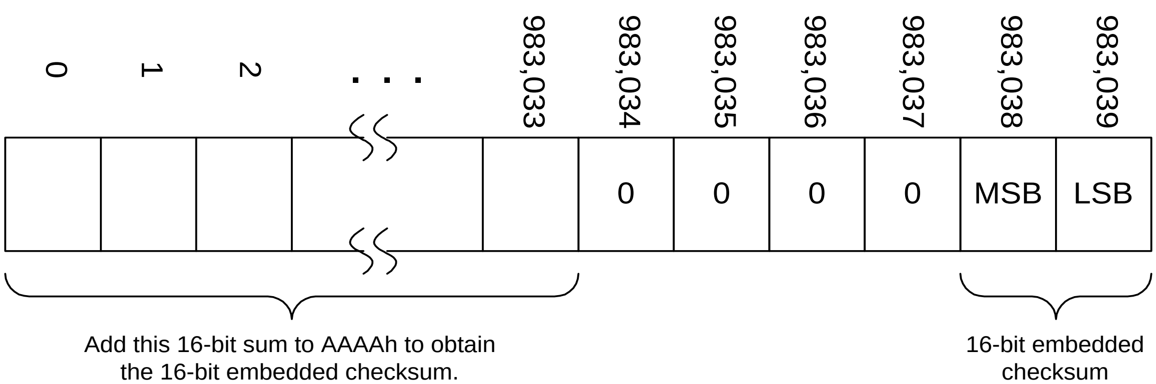

Figure 25-1 Calculating the firmware checksum

When this command is executed successfully, the following actions occur:

1. The new firmware is transferred over the SCSI bus.
2. The flash code checksum is validated.
3. The flash EEPROM is erased and reprogrammed with the new firmware.
4. Good status is returned to the initiator and the library goes to the Bus Free phase.
5. Control is passed to the new flash code.
6. The cartridge inventory is erased.
7. A Unit Attention condition is set for all hosts. The sense data indicates that the firmware has changed.
8. The library performs its normal power-on self test.

Steps 1 through 8 take approximately four minutes.

After the flash EEPROM is programmed with new firmware, part of the nonvolatile memory is erased. The cartridge inventory is stored in this nonvolatile memory.

25.2 What You Send to the Library

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must be 0.

Transfer Length – Bytes 06 through 09

This field specifies the number of bytes that will be transferred from the SCSI bus to the library's flash EEPROM. The only accepted value for this field is 0F0000h (983,040) bytes. All other values cause Check Condition status.

25.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from executing. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 25-2 shows the steps that the library takes when executing the WRITE FIRMWARE command through the Bus Free phase. As shown in the figures, the library validates the parameters in the CDB. Table 25-1 shows the sense data reported for invalid parameters in the CDB. It also shows the sense data returned if errors are encountered erasing or programming the flash EEPROM.

Note: This section describes the normal processing of the command through the Bus Free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a Message Out phase or if parity errors are detected on the new firmware.

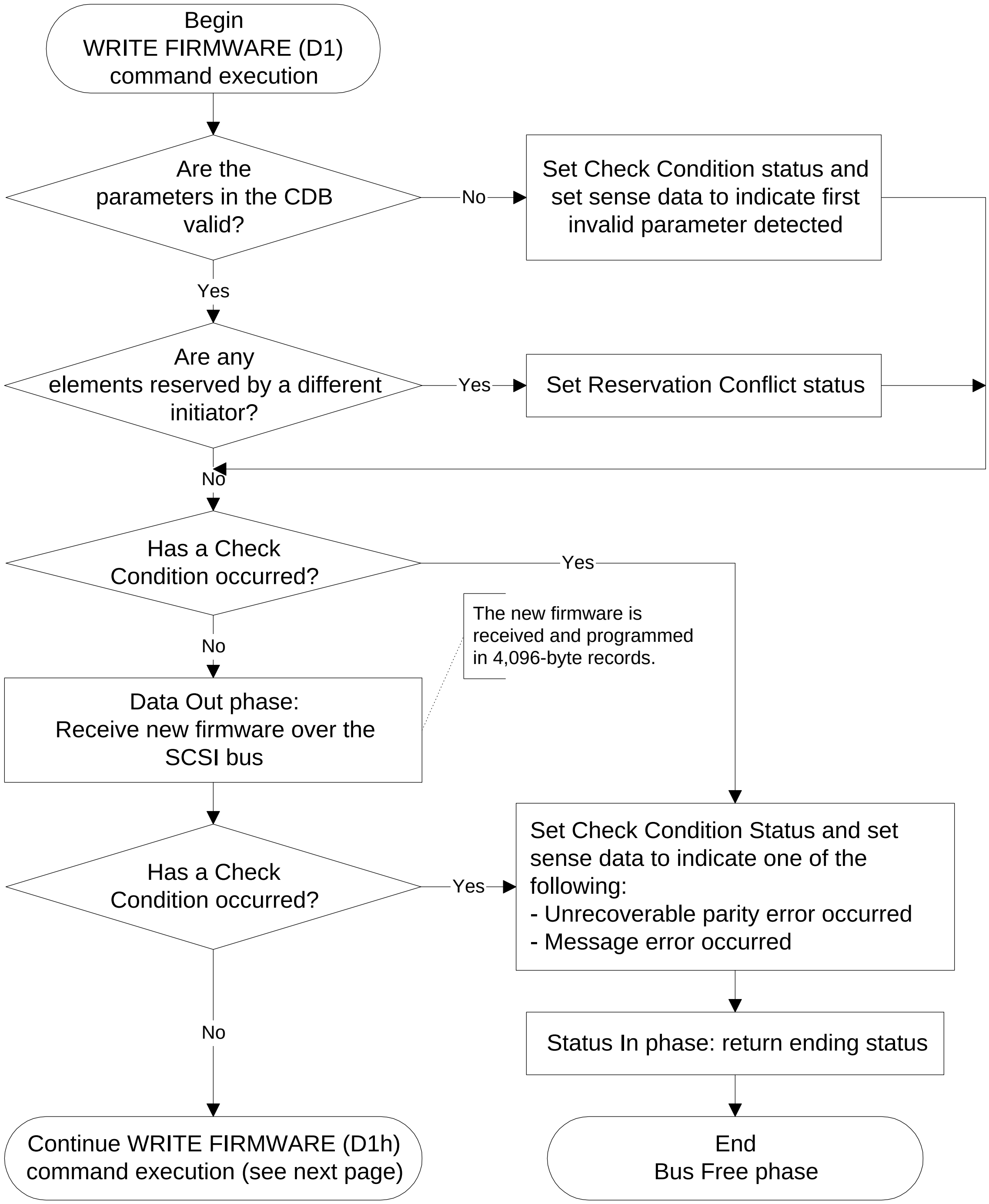

Figure 25-2 WRITE FIRMWARE command execution

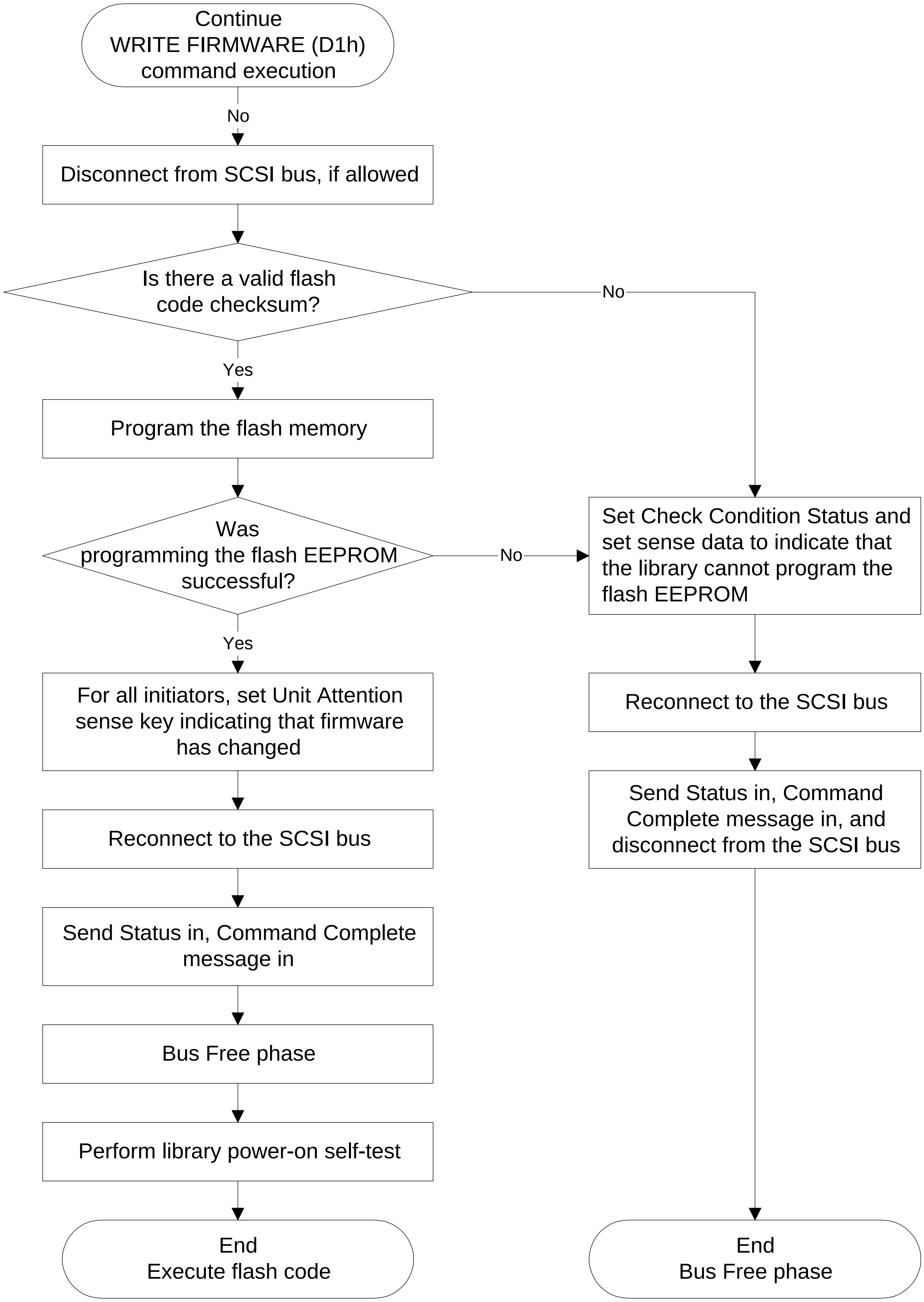

Figure 25-2 WRITE FIRMWARE command execution (*continued*)

25.4 Command Status

The library returns a status byte after processing the WRITE FIRMWARE command. This section describes when each type of status byte might be returned.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when the library is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved or any of its elements are reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurred while the library is processing the command.
- The library detects an unrecoverable parity error while receiving the CDB or firmware.
- The command was issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit was set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 25-1 for sense data).
- The library is unable to erase the flash EEPROM.

- The library is unable to write zeros to the flash EEPROM.
- The library is unable to program the flash EEPROM.
- The flash code checksum is not valid after the flash EEPROM is programmed with the new firmware.
- A Console write firmware or read firmware operation is already in progress when the WRITE FIRMWARE command is received.

Table 25-1 Invalid parameters in the WRITE FIRMWARE CDB and errors in programming the flash EEPROM

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
4h	3Fh	80h	0	0	0	0	0000h	Flash code firmware write error: unable to erase flash EEPROM.
4h	3Fh	82h	0	0	0	0	0000h	Flash code firmware write error: unable to write zeros to flash EEPROM.
4h	3Fh	84h	0	0	0	0	0000h	Flash code firmware write error: unable to program flash EEPROM.
4h	3Fh	86h	0	0	0	0	0000h	Flash code firmware write error: bad flash code checksum.
5h	1Ah	00h	1	1	0	0	0006h	Invalid transfer length.
5h	3Fh	87h	0	0	0	0	0000h	Cannot execute command because Console write firmware operation is in progress.
5h	3Fh	88h	0	0	0	0	0000h	Cannot execute command because Console read firmware operation is in progress.

A Library Error Handling

This appendix describes error handling by the library and appropriate initiator responses when error conditions are detected during different SCSI bus phases. The errors and responses are separated into two categories:

- Errors and responses related to initiators that support only the Command Complete message
- Errors and responses related to initiators that support messages in addition to the Command Complete message

A.1 Initiators That Support Only the Command Complete Message

This section describes library error handling and appropriate initiator responses during different bus phases for initiators that support only the Command Complete message.

Error Handling During the Command Out Phase

Figure A-1 on page A-3 shows the action that the library takes during the Command Out phase when the message system is not enabled. Specifically, Figure A-1 defines the action taken when:

- **The library detects a parity error in the CDB.** (The library can detect parity errors only when parity checking is enabled.)

- **The OP Code is not supported by the library.** The library attempts to read the entire CDB even if the OP Code is not supported. The library determines the number of CDB bytes to receive based on the Group Code.

  The Group Code is the upper three bits of the first CDB byte. The OP Code is the lower five bits of the first CDB byte. The Group Code specifies one of the following groups:

Group 0	Six-byte commands
Group 1	Ten-byte commands
Group 2	Ten-byte commands
Group 3	Six-byte commands
Group 4	Six-byte commands
Group 5	Twelve-byte commands
Group 6	Six-byte commands
Group 7	Ten-byte commands

Note: The library receives ten CDB bytes for the INITIALIZE ELEMENT STATUS WITH RANGE command and receives twelve bytes for the READ FIRMWARE and WRITE FIRMWARE commands.

- **The library detects an invalid initiator reselection.** Refer to Condition 4 on page 3-9 for more information about an invalid initiator reselection.

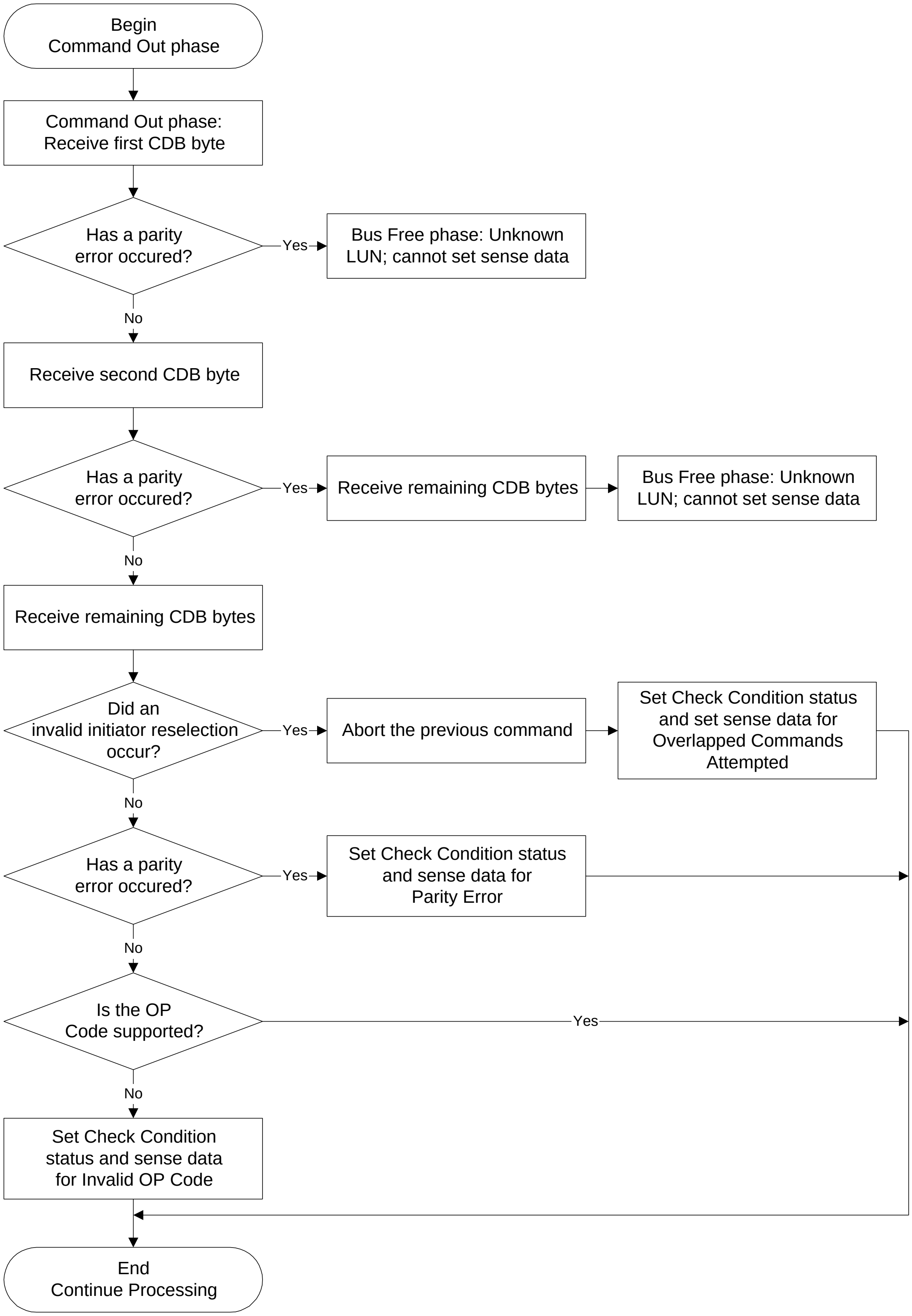

Figure A-1 Error handling during the Command Out phase (for systems that support only the Command Complete message)

Error Handling During the Data Out Phase

When parity checking is enabled, the library checks the parity of the data received during the Data Out phase. Figure A-2 describes the action that the library takes if it detects a parity error during the Data Out phase.

Note: The library can transfer 2,048 bytes at a time. If the Transfer Length specified for a particular command is greater than 2,048 bytes, the library executes the steps shown in Figure A-2 repeatedly, transferring the data in increments of the maximum buffer size until all bytes are transferred.

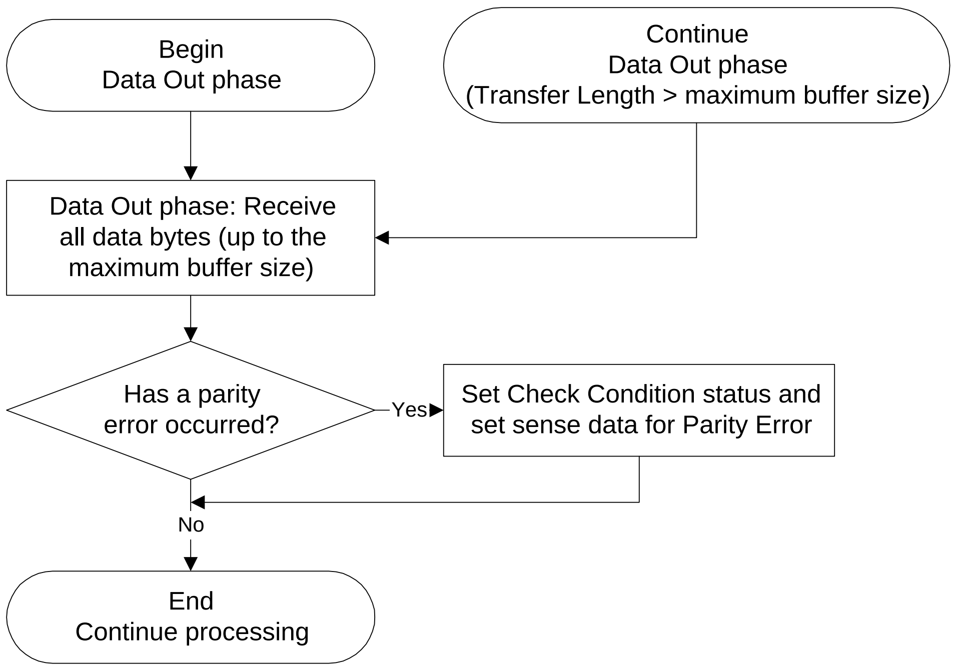

Figure A-2 Error handling during the Data Out phase (for systems that support only the Command Complete message)

Error Handling During the Data In Phase

When an initiator detects a parity error during the Data In phase, it must accept all bytes sent by the library. Unless the command was a REQUEST SENSE command, the initiator should attempt to resend the command to receive the requested data again.

If the initiator detects a parity error while receiving the data for the REQUEST SENSE command, the sense data is not recoverable.

The library preserves sense data for the initiator only until the initiator retrieves the data using the REQUEST SENSE command or until the library receives any subsequent command for the same I_T_L nexus (initiator-target-LUN connection).

If the initiator detects a parity error while receiving the data for the REQUEST VOLUME ELEMENT ADDRESS (B5h) command, the data may not be recoverable by a subsequent REQUEST VOLUME ELEMENT ADDRESS command. To receive the correct data, the initiator should reissue the SEND VOLUME TAG (B6h) command before reissuing the REQUEST VOLUME ELEMENT ADDRESS command.

Error Handling During the Status In Phase

When the initiator detects a parity error in the Status In phase, the initiator should assume that the library was returning Check Condition status. The initiator should then issue a REQUEST SENSE command and decode the sense bytes. (Even if the status byte that had the parity error was Good, Busy, or Reservation Conflict, decoding the sense data has no harmful effects on operation.)

Note: The library processes the REQUEST SENSE command even when it is busy or reserved by another initiator.

A.2 Initiators That Support Additional Messages

This section describes library error handling and appropriate initiator responses during different bus phases for initiators that support messages in addition to the Command Complete message.

Error Handling During the Message Out Phase

Figure A-3 shows the actions that the library takes during the Message Out phase. When parity checking is enabled and the library detects one or more parity errors in the message bytes it receives during a single Message Out phase, the following actions occur:

1. The library indicates its desire to retry the message by asserting the Request (REQ) signal after detecting the Attention signal has gone false and before changing to any other phase.

2. Upon detecting this condition, the initiator should resend all of the previous message bytes in the same order as previously sent during this phase.

   Note: When resending more than one message byte, the initiator should assert the Attention signal at least two deskew delays before asserting the Acknowledge signal on the first byte and should maintain the Attention signal until the last byte is sent.

3. The library acts on the messages as long as it does not detect any parity errors. However, if it detects a parity error, the library ignores all remaining messages sent under one Attention condition.

4. The library continues to retry the Message Out phase as long as the Maximum Parity Retries is not exceeded and until it does not detect any parity errors or until the initiator aborts the current command or resets the library. The Maximum Parity Retries can be set by the MODE SELECT (15h) command (the factory default is 1 retry).

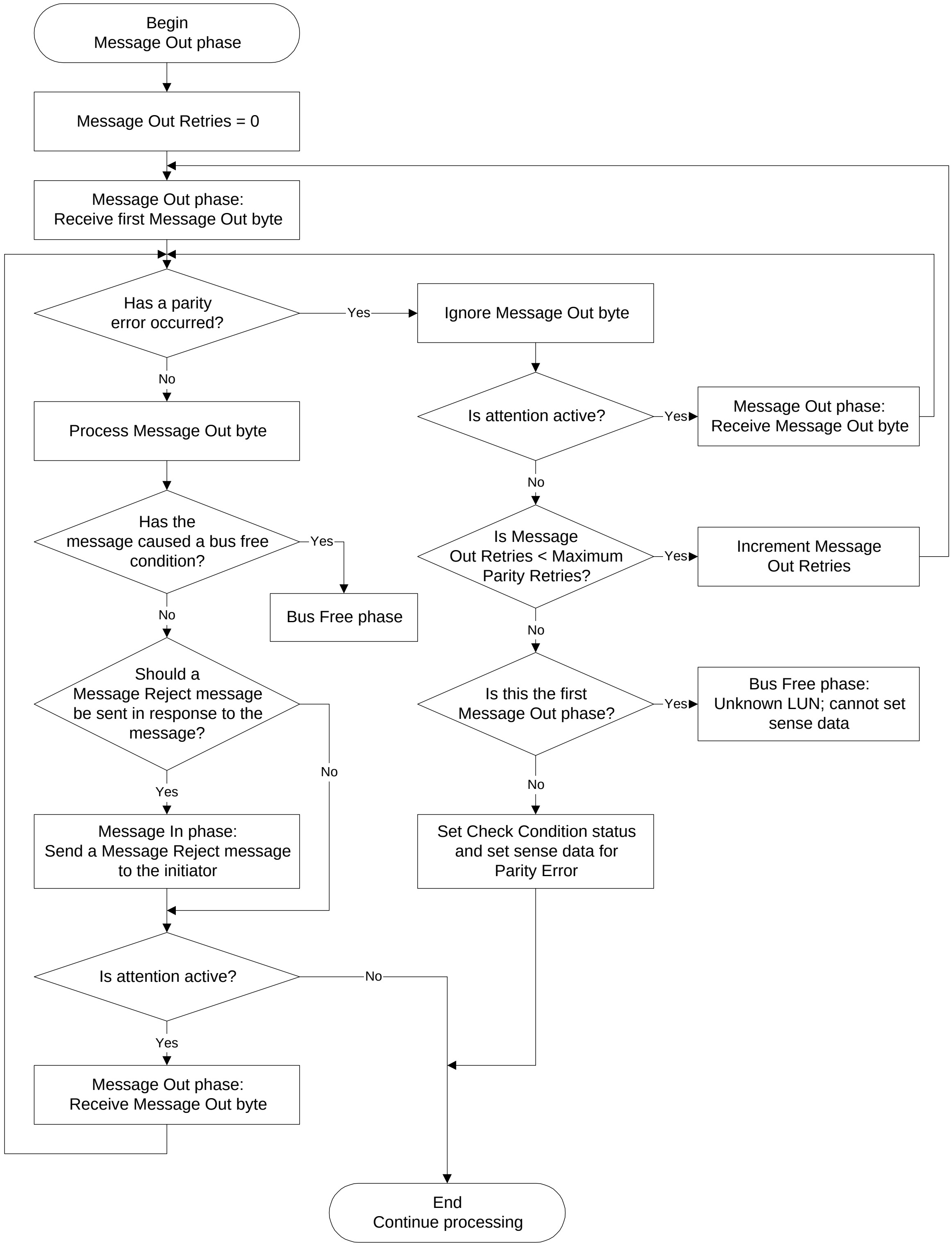

Figure A-3 Error handling during the Message Out phase (for systems that support additional messages)

Error Handling During the Message In Phase

If the initiator detects a parity error during the Message In phase, the initiator should respond by sending a Message Parity Error (09h) message to the library. Upon receiving the Message Parity Error message, the library resends the message. The library will resend the message as many times as requested by the initiator.

Error Handling During the Command Out Phase

Figure A-4 shows the action taken by the library during the Command Out phase when the message system is enabled. Specifically, Figure A-4 defines the action the library takes when:

- **The library detects a parity error in the CDB.** (Parity errors are only detected when parity checking is enabled.)
- **A Check Condition occurs while the library tries to send the Restore Data Pointers message after detecting a parity error.**
- **The OP Code is not supported by the library.** The library attempts to read the entire CDB even if the OP Code is not supported. The library determines the number of CDB bytes to receive based on the Group Code.

  The Group Code is the upper three bits of the first CDB byte, and the OP Code is the lower five bits of the first CDB byte. The Group Code specifies one of the following groups:

Group 0	Six-byte commands
Group 1	Ten-byte commands
Group 2	Ten-byte commands
Group 3	Six-byte commands
Group 4	Six-byte commands
Group 5	Twelve-byte commands
Group 6	Six-byte commands
Group 7	Ten-byte commands

Note: The library receives ten CDB bytes for the Exabyte-unique command INITIALIZE ELEMENT STATUS WITH RANGE and twelve bytes for the READ FIRMWARE and WRITE FIRMWARE commands.

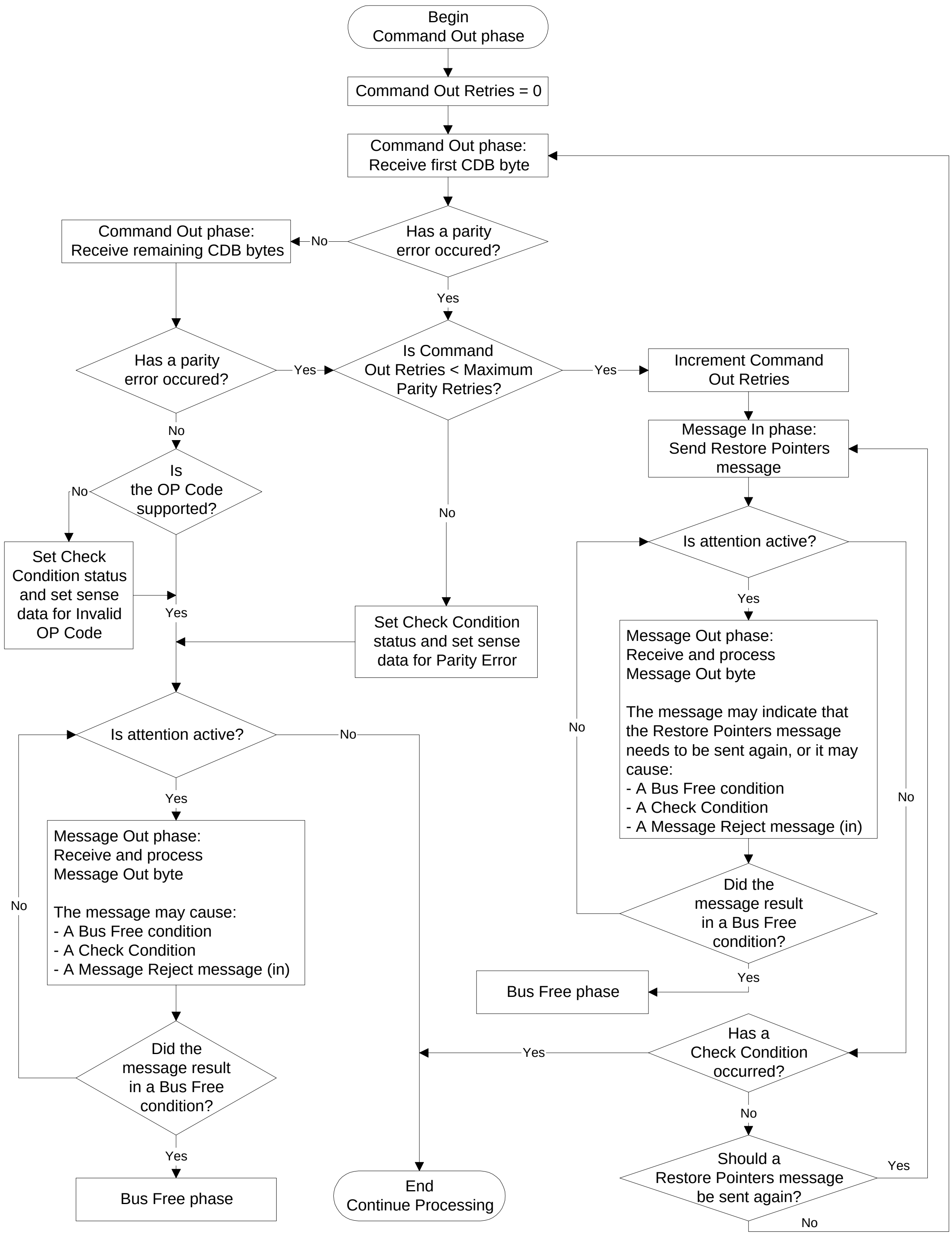

Figure A-4 Error handling during the Command Out phase (for systems that support additional messages)

Error Handling During the Data Out Phase

Figure A-5 shows the action the library takes during the Data Out phase when the message system is enabled. Specifically, Figure A-5 defines the action the library takes when:

- **The library detects parity errors in the data.** (Parity errors are only detected when parity checking is enabled.)
- **A Check Condition occurs while the library attempts to send the Restore Data Pointers message after detecting a parity error.**
- **The maximum number of parity retries is exceeded during the Data Out phase.** You can set the maximum number of parity retries with the MODE SELECT (15h) command. (The factory default is 1 retry.)

Figure A-5 also shows when the library responds to the Attention signal with a Message Out phase.

Note: The library can transfer 2,048 bytes at a time. If the Transfer Length specified for a particular command is greater than 2,048 bytes, the library executes the steps shown in Figure A-5 repeatedly, transferring the data in increments of the maximum buffer size until all bytes are transferred.

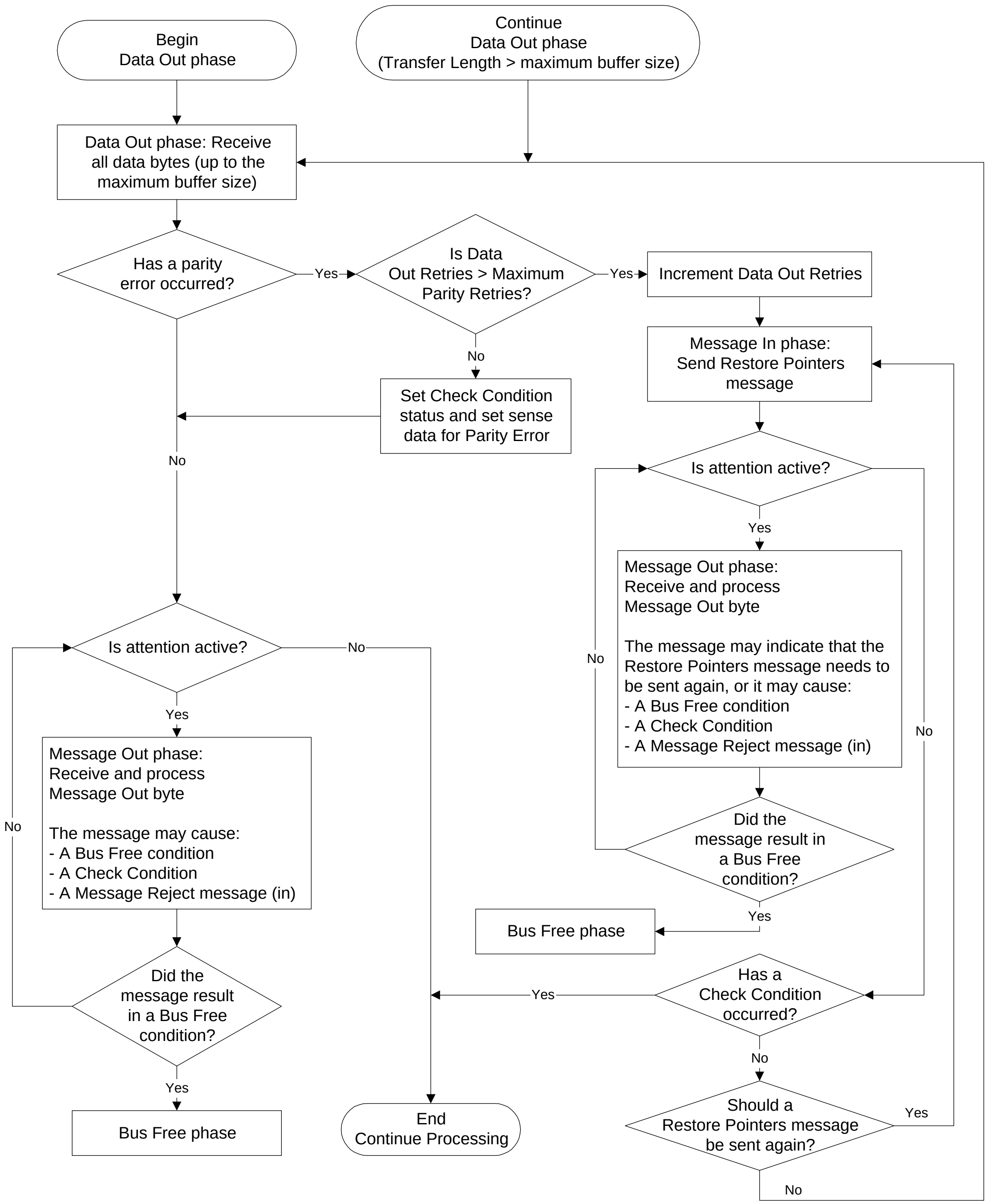

Figure A-5 Error handling during the Data Out phase (for systems that support additional messages)

Notes

B Library Message Processing

This appendix includes information about the following:

- The library's response to the Attention signal during different SCSI bus phases.
- The messages supported by the library.
- The library's response to messages from the initiator during different SCSI bus phases.

B.1 When the Library Accepts and Processes Messages

Once the initiator sends a valid Identify message during the Selection phase, the message system has been established and the library accepts and processes messages from the initiator whenever the initiator asserts the Attention signal.

Table B-1 shows when the library responds to the Attention signal for each SCSI bus phase.

Table B-1 When the library responds to the Attention signal

If the initiator asserts the Attention signal during this phase...	The library responds...
Selection	Immediately following the selection.
Command	At the end of the Command phase, after all CDB bytes have been received.
Data In	After all bytes have been sent to the initiator.
Data Out	After all bytes from the initiator have been received.
Status In	After the status byte has been sent to the initiator.
Message In	After the message has been sent to the initiator.

B.2 SCSI Messages Supported by the Library

As described in Chapter 2, the message system allows communication between an initiator and the library for physical path management. Messages allow the initiator and the library to manage error detection, data transfer retries, and the data path. One or more messages may be sent during a single message phase.

The library supports the SCSI messages listed in Table B-2. This section describes each of these messages in more detail. The messages are described in hex code order.

Table B-2 Messages supported by the library

Hex Value	Message	Direction: In (Library to initiator)	Direction: Out (Initiator to library)
00h	Command Complete	✔	
01h	Extended Messages: Synchronous Data Transfer Request (01h) Wide Data Transfer Request (03h)	✔	✔
03h	Restore Pointers	✔	
04h	Disconnect	✔	
05h	Initiator Detected Error		✔
06h	Abort		✔
07h	Message Reject	✔	✔
08h	No Operation		✔
09h	Message Parity Error		✔
0Ch	Bus Device Reset		✔
80h or C0h	Identify	✔	✔

Command Complete Message In (00h)

The library sends the Command Complete message to the initiator to indicate that the execution of the command has completed and that valid status has been sent to the initiator. After the library successfully sends this message, the bus goes to the Bus Free phase.

Extended Message In/Out (01h)

The library supports the following extended messages:

- Synchronous Data Transfer Request
- Wide Data Transfer Request

Synchronous Data Transfer Request

The Synchronous Data Transfer Request message is used to negotiate synchronous data transfer agreements. If the initiator wants to transfer data synchronously, it must negotiate a synchronous data transfer agreement with the target before transferring data.

The library does not support synchronous data transfer. When it receives a Synchronous Data Transfer Request message from the initiator, it returns a Synchronous Data Transfer Request message with a REQ /ACK offset equal to zero. This indicates that the library requires asynchronous data transfer. The successful exchange of Synchronous Data Transfer Request messages implies an agreement to asynchronous data transfer.

The format of the Synchronous Data Transfer Request Message is as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Extended Message Length (03h)							
02	Extended Message Code (01h)							
03	Transfer Period Factor							
04	REQ/ACK Offset							

Byte 01 – Extended Message Length The value for this field is 03h, indicating that there are three additional message bytes to be transferred, not including this byte.

Byte 02 – Extended Message Code The value for this field is 01h, indicating that the extended message is a Synchronous Data Transfer Request.

Byte 03 – Transfer Period Factor The value for this field is multiplied by four to determine the value of the transfer period. The library does not use this field. Instead, it returns the value received from the initiator.

Byte 04 – REQ/ ACK Offset The REQ /ACK offset is the maximum number of REQ pulses allowed to be outstanding before the leading edge of the corresponding ACK pulse is received by the library. The library returns 00h for this field, indicating that the library requires asynchronous data transfer.

Wide Data Transfer Request

The Wide Data Transfer Request Message is used to negotiate the width of the data path for data transfers between the library and the initiator. The width applies to data phases only (Data In and Data Out); all other information transfers use an eight-bit data path.

The library does not support wide data transfers. When it receives a Wide Data Transfer Request message from the initiator, it returns a Wide Data Transfer Request message with a transfer width exponent of 0 (8-bit transfer width). The successful exchange of Wide Data Transfer Request messages implies an agreement to an 8-bit data transfer width.

The agreement can be terminated immediately after the negotiation if either device asserts the Attention signal and then sends a Message Reject message.

The format of the Wide Data Transfer Request Message is as follows:

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Extended Message Length (02h)							
02	Extended Message Code (03h)							
03	Transfer Width Exponent							

Byte 01 – Extended Message Length The value for this field is 02h, indicating that there are two additional message bytes to be transferred, not including this byte.

Byte 02 – Extended Message Code The value for this field is 03h, indicating that the extended message is a Wide Data Transfer Request.

Byte 03 – Transfer Width Exponent This field determines the width of the data path for data transfers. The transfer width is 2 raised to this value in bytes. The library always returns 00h for this field. This value indicates that the library supports an 8-bit data transfer width only: $2^0 =$ 1 byte (8 bits) wide.

Restore Pointers Message In (03h)

The library sends the Restore Pointers message to direct the initiator to copy the most recently saved command, data, and status pointers for the I/O process to the corresponding active pointers. The command and status pointers are restored to the beginning of the present command and status areas. The data pointer is restored to the value at the beginning of the data area.

The library also sends the Restore Pointers message after receiving an Initiator Detected Error message following either the Status phase or Data In phase, or after detecting a parity error during the Command phase or Data Out phase. After the library successfully sends the Restore Pointers message to the initiator, the library restarts the Command, Data In, Data Out, or Status phase from the beginning.

Disconnect Message In (04h)

The library sends the Disconnect message to inform the initiator that it is about to break the present physical path and that a later reconnection is required to complete the current operation. The library disconnects by releasing the BSY signal.

This message does not cause the initiator to save the data pointer.

Note: If a catastrophic error condition has occurred during the current command, the library does not send the Disconnect message or the Command Complete message, but instead goes immediately to the Bus Free phase.

Initiator Detected Error Out (05h)

The initiator sends the Initiator Detected Error message to inform the library that an error has occurred that does not preclude the library from retrying that operation. The source of the error may either be related to previous activities on the SCSI bus or may be internal to the initiator and unrelated to any previous SCSI bus activities.

Note: Refer to Table B-3 for information about how the library handles the Initiator Detected Error message during different bus phases.

Abort Message Out (06h)

The initiator sends the Abort message to the library to clear a previously requested process for the I_T_L nexus (initiator-target-LUN connection). The library goes to the Bus Free phase immediately after it receives the Abort message. Additional action depends on the LUN, if established, as described below:

- If the library receives the Abort message after the Identify message, an I_T_L nexus is established. If the LUN is valid, all pending data and status for the issuing initiator is cleared and any previously requested process by that initiator is aborted. If the LUN is invalid, no additional action is taken.
- If the library receives the Abort message before the Identify message, only an I_T nexus is established. The library goes bus free, but no pending I/O processes will abort.

Any pending data, status, and command processing for any other initiator is unaffected by this message. For example, if the library is disconnected while processing a command for a different initiator, the processing of that command is unaffected by the Abort message.

The library aborts motion commands as soon as reasonably possible.

Note: Refer to Table B-4 for information about how the library checks for the Abort message and when it aborts the indicated motion command after receiving the Abort message.

Message Reject Message In/Out (07h)

The Message Reject message is sent by either the initiator or the library to indicate that the last message it received was inappropriate or not supported.

Note: Refer to Table B-5 for information about how the library handles the Message Reject message during different bus phases.

No Operation Out (08h)

The initiator sends the No Operation message in response to the library's request for a message when the initiator does not currently have a valid message to send.

The library does not take any action in response to the No Operation message; it accepts this message and continues processing the current command.

Message Parity Error Out (09h)

The initiator sends the Message Parity Error message to the library to indicate that the last message byte it received had a parity error.

Note: Refer to Table B-6 for information about how the library handles the Message Parity Error message during different bus phases.

Bus Device Reset Message Out (0Ch)

The initiator sends the Bus Device Reset message to direct the library to clear all I/O processes. This message forces a soft reset condition for the library.

The library goes immediately to the Bus Free phase once it successfully receives this message. As with a SCSI bus reset or power-on reset, the library sets a sense key of Unit Attention (6h) for all initiators.

Identify Message In/Out (80h or C0h)

The Identify message is sent by either the initiator or the library to establish an I_T_L nexus (initiator-target-logical unit number connection) and to enable the message system.

The initiator can send one or more Identify messages during a connection. The initiator sends more than one Identify message during a connection to change the disconnect privilege. When the library processes commands that require a lengthy amount of time, it disconnects and reconnects only once. Therefore, it is only relevant for the initiator to change the disconnect privilege before the Status In phase (for example: during the first Message Out phase, after the Command phase, or after a Disconnect message in).

The initiator may not send additional Identify messages to the library with a different LUN specified.

Note: For more information about how the library responds to the Identify message during different SCSI bus phases, refer to Table B-7 through Table B-10.

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

Bit 7 – Identify

This bit must be set to 1 to indicate this is the Identify message.

Bit 6 – DiscPriv (Disconnect Privilege)

This bit indicates whether the initiator supports the disconnect privilege, as follows:

0 – Disconnect is not allowed.
1 – Disconnect is allowed.

The library always sets this bit to 0. Only initiators indicate if they support disconnect.

Bit 5 – LUNTAR (Logical Unit Target)

This bit indicates the LUNs that you can access on this device. This bit must be set to 0 to indicate that the Identify message is directed to a logical unit.

Bits 2 through 0 – LUN (Logical Unit Number)

The only supported logical unit number for the library is 0.

Notes:

- If the LUN field is set to a value other than 0, the library returns Check Condition status to commands other than INQUIRY and REQUEST SENSE, and the sense data is set to indicate that the logical unit is not supported.

- If an INQUIRY command is directed to a LUN other than 0, the first byte of inquiry data indicates that the library is not capable of supporting a physical device on the requested LUN.

- If a REQUEST SENSE command is directed to a LUN other than 0, the sense data returned indicates that the logical unit is not supported.

B.3 How the Library Responds to Messages

The following sections explain the action that the library takes in response to each message it receives from the initiator. The tables in this section show the following:

- The bus phase that was active just before the library received the indicated message

- The action that the library takes in response to the indicated message

It is possible for the library to return Check Condition status in response to a message error. The library sends a Message Reject message instead of Check Condition status if the requested command has already been completed. A command is considered complete once the library has sent or has attempted to send ending status.

Note: For more information about command status, see Chapter 2.

Response to Unsupported Messages Out

When the library receives messages that are not supported, it sends a Message Reject message after the first invalid message byte and then continues processing the current command.

Response to Initiator Detected Error Message

Table B-3 shows how the library handles the Initiator Detected Error message during different bus phases.

Table B-3 Handling of Initiator Detected Error message

<table>
<tr><th>If the library receives an Initiator Detected Error message during this bus phase...</th><th>The library does this...</th></tr>
<tr><td>Command</td><td rowspan="2">Returns Check Condition status and sets sense data as follows:
Sense Key = Aborted Command (Bh)
ASC = Initiator Detected Error (48h)
ASCQ = 0</td></tr>
<tr><td>Data out</td></tr>
<tr><td>Data in</td><td rowspan="2">Sends a Restore Pointers message, and resends the data or status.</td></tr>
<tr><td>Status</td></tr>
<tr><td>Message out</td><td>If the library has completed the command and attempted to return status, it:
▪ Sends a Message Reject message.
▪ Does not set sense data since the command was already processed.
Otherwise, the library returns Check Condition status and sets sense data as follows:
Sense Key = Aborted Command (Bh)
ASC = Initiator Detected Error (48h)
ASCQ = 0</td></tr>
<tr><td>Message in
Msg Reject</td><td>Sends another Message Reject message.</td></tr>
<tr><td>Message in
Cmd Complete
Disconnect
Restore Ptrs
Identify</td><td>Sends a Message Reject message, and resends the last message in.</td></tr>
</table>

Response to Abort Message

Table B-4 describes when the library checks for the Abort message and when it aborts the indicated motion command after receiving the Abort message.

Note: Until it completely aborts a motion command, the library terminates all commands other than INQUIRY (12h) or REQUEST SENSE (03h) with Busy status.

Table B-4 When the library aborts motion commands

When processing this command...	The library checks for the Abort message...	...and performs the following actions
INITIALIZE ELEMENT STATUS and INITIALIZE ELEMENT STATUS WITH RANGE	Before checking each element.	If the library receives the Abort message before it has checked the next element, it aborts the operation immediately. If it receives the Abort message while it is checking an element, it aborts the operation after checking that element.
MOVE MEDIUM	Before picking the cartridge and before placing the cartridge.	If the library receives the Abort message before starting the pick operation, it does not pick the cartridge. If it receives the Abort message after starting the pick operation but before starting the place operation, it returns the cartridge to its initial location. If it receives the Abort message after placing the cartridge into its destination, it does not return the cartridge to its initial location.
POSITION TO ELEMENT	Before positioning the robot.	If the library receives the Abort message after beginning to move the robot, it completes the operation and does not return the robot to its original position.

Table B-4 When the library aborts motion commands (*continued*)

When processing this command...	The library checks for the Abort message...	...and performs the following actions
SEND DIAGNOSTIC Self Test	▪ Before beginning to home the gripper fingers. ▪ Before beginning to home the robot. ▪ Before beginning to home the drum. ▪ Before beginning to cycle the reach axis. ▪ Before beginning to cycle the vertical axis. ▪ Before beginning to cycle the horizontal axis. ▪ Before beginning to cycle the drum axis.	If the library receives the Abort message before beginning to home the gripper fingers, it aborts the self test immediately. If it receives the Abort message after beginning to home the gripper fingers, it homes the gripper fingers once, then aborts the self test. If the library receives the Abort message before beginning to home the robot, it aborts the self test immediately. If it receives the Abort message after beginning to home the robot, it homes the robot once, then aborts the self test. If the library receives the Abort message before beginning to cycle the reach axis, it aborts the self test immediately. If it receives the Abort message after beginning to cycle the reach axis, it cycles the reach axis once, then aborts the self test. If the library receives the Abort message before beginning to cycle the vertical axis, it aborts the self test immediately. If it receives the Abort message after beginning to cycle the vertical axis, it cycles the vertical axis once, then aborts the self test. If the library receives the Abort message before beginning to cycle the horizontal axis, it aborts the self test immediately. If it receives the Abort message after beginning to cycle the horizontal axis, it cycles the horizontal axis once, then aborts the self test.
SEND DIAGNOSTIC Page Code 80h: Home gripper fingers	Before beginning to home the gripper fingers.	If the library receives the Abort message before beginning to home the gripper fingers, it aborts the operation and does not home the gripper fingers. If it receives the Abort message after beginning to home the gripper fingers, it completes the operation and homes the gripper fingers.
SEND DIAGNOSTIC Page Code 81h: Home CHM	Before beginning to home the robot.	If the library receives the Abort message before starting to home the robot, it aborts the operation and does not home the robot. If it receives the Abort message after starting to home the robot, it completes the operation and homes the robot.

Table B-4 When the library aborts motion commands (*continued*)

When processing this command...	The library checks for the Abort message...	...and performs the following actions
SEND DIAGNOSTIC Page Code 82h: Cycle pick/place cartridges	Before picking the cartridge for each pick/place cycle.	If the library receives the Abort message before picking a cartridge, it aborts the operation. If it receives the Abort message while picking or placing a cartridge, it completes that pick/place cycle, then aborts the operation.
SEND DIAGNOSTIC Page Code 83h: Cycle gripper fingers	Before each cycle of the gripper.	If the library receives the Abort message before starting a gripper cycle, it aborts the operation and does not cycle the grippers. If it receives the Abort message after starting a gripper cycle, it completes that cycle, then aborts the operation.
SEND DIAGNOSTIC Page Code 84h: Cycle reach axis	Before each cycle of the reach axis.	If the library receives the Abort message before starting a cycle of the specified axis, it aborts the operation and does not cycle the specified axis. If it receives the Abort message after starting a cycle of the axis, it completes that cycle, then aborts the operation.
SEND DIAGNOSTIC Page Code 85h: Cycle vertical axis	Before each cycle of the vertical axis.	
SEND DIAGNOSTIC Page Code 86h: Cycle drum axis	Before each cycle of the drum axis.	
SEND DIAGNOSTIC Page Code 87h: Cycle door solenoids	Before each cycle of the door solenoids.	If the library receives the Abort message before starting a cycle of the door solenoids, it aborts the operation and does not cycle the door solenoids. If it receives the Abort message after starting a cycle of the door solenoids, it completes that cycle, then aborts the operation.
SEND DIAGNOSTIC Page Code 88h: Cycle entry/exit port	Before each cycle of the entry/exit port.	If the library receives the Abort message before starting a cycle of the entry/exit port, it aborts the operation and does not cycle the port. If it receives the Abort message after starting a cycle of the entry/exit port, it completes that cycle, then aborts the operation.
SEND DIAGNOSTIC Page Code 89h: Cycle horizontal axis	Before each cycle of the horizontal axis.	If the library receives the Abort message before starting a cycle of the horizontal axis, it aborts the operation and does not cycle the horizontal axis. If it receives the Abort message after starting a cycle of the horizontal axis, it completes that cycle, then aborts the operation.

Response to Message Reject Message

Table B-5 shows how the library handles the Message Reject message during different bus phases.

Table B-5 How the library handles a Message Reject message

If the library receives a Message Reject during this bus phase...	The library does this...
Command	Sends a Message Reject message.
Data out	
Data in	
Status	
Message out	
Message in Cmd Complete	Goes to the Bus Free phase.
Message in Disconnect	Does not disconnect; continues processing the command.
Message in Restore Ptrs	If the message was sent after the Status phase, the library: ▪ Sends a Message Reject message. ▪ Does not change sense data since the command is complete. ▪ Continues to the Command Complete message. If the message was sent after the Command phase or Data Out phase, the library returns Check Condition status and sets sense data as follows: Sense Key = Aborted Command (Bh) ASC = SCSI Parity Error (47h) ASCQ = 0 If the message was sent after the Data In phase, the library returns Check Condition status and sets sense data as follows: Sense Key = Aborted Command ASC = Initiator Detected Error Message Received (48h) ASCQ = 0
Message in Msg Reject	Sends a Message Reject message.
Message in Identify	Goes bus free immediately and sets sense data as follows: Sense Key = Aborted Command (Bh) ASC = Reselect Failure (45h) ASCQ = 0

Response to Message Parity Error Message

Table B-6 shows how the library handles the Message Parity Error message during different bus phases.

Table B-6 Handling of Message Parity Error message

<table>
<tr><th>If the library receives a Message Parity Error message during this bus phase...</th><th>The library does this...</th></tr>
<tr><td>Command</td><td rowspan="5">Goes bus free immediately and sets sense data as follows:
Sense Key = Aborted Command (Bh)
ASC = Message Error (43h)
ASCQ = 0</td></tr>
<tr><td>Data out</td></tr>
<tr><td>Data in</td></tr>
<tr><td>Message out</td></tr>
<tr><td>Status</td></tr>
<tr><td>Message in
Cmd Complete
Disconnect
Msg Reject
Restore Ptrs
Identify</td><td>Sends the last message again.</td></tr>
</table>

Response to Identify Message Out

Table B-7 through Table B-10 show how the library handles the Identify message from the initiator during different bus phases. The tables include information about how the library responds to the following:

- A valid first Identify message
- A subsequent Identify message with the same LUN as the first message
- A subsequent Identify message with a different LUN
- An Identify message with reserved bits 3, 4, or 5 set

Table B-7 Library action when the first Identify message is valid

If the library receives a valid Identity message during this bus phase...	The library does this...
Select	▪ Processes messages. ▪ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out. ▪ Sets the LUN field to the LUN specified in the Identify message out.

Table B-8 Handling of valid Identify message with the same LUN as for the first Identify message

<table>
<tr><th>If the library receives an Identity message during this bus phase...</th><th>The library does this...</th></tr>
<tr><td>Select</td><td rowspan="6">▪ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out.
▪ Continues processing the command as before.</td></tr>
<tr><td>Command</td></tr>
<tr><td>Data out</td></tr>
<tr><td>Data in</td></tr>
<tr><td>Status</td></tr>
<tr><td>Message out</td></tr>
<tr><td>Message in
Cmd Complete</td><td>Goes bus free.</td></tr>
<tr><td>Message in
Disconnect</td><td>▪ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out.
▪ If DiscPriv is 0, the library does not disconnect and continues processing as before.
▪ Otherwise, goes bus free.</td></tr>
<tr><td>Message in
Msg Reject
Restore Ptrs
Identify</td><td>▪ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out.
▪ Continues processing the command as before.</td></tr>
</table>

Table B-9 Handling of invalid Identify message with different LUN

If the library receives an Identify message during this bus phase...	The library does this...
Command	Goes bus free immediately and sets sense data as follows: Sense Key = Aborted Command (Bh) ASC = Message Error (43h) ASCQ = 0
Data out	
Data in	
Status	
Message out	
Message in Cmd Complete Disconnect Msg Reject Restore Ptrs Identify	

Table B-10 Handling of invalid Identify message with reserved bits 3, 4, or 5 set

If the library receives an Identify message during this bus phase...	The library does this...
Select	▪ Returns Check Condition status and sets sense data as follows: Sense Key = Illegal Request (5h) ASC = Invalid Bits in Identify message (3Dh) ASCQ = 0 ▪ Skips the Command phase and goes directly to the Status phase.
Command	▪ Returns Check Condition status and sets sense data as follows: Sense Key = Illegal Request (5h) ASC = Invalid Bits in Identify message (3Dh) ASCQ = 0 ▪ Skips any data phase and goes directly to the Status phase.
Data out	
Data in	
Status	▪ Sends a Message Reject message. ▪ Does not set sense data since the command is complete. ▪ Continues to the Message In phase to send the Command Complete message.
Message out	If the command is complete and the library has attempted to return status, it: ▪ Sends a Message Reject message. ▪ Does not set sense data, since the command is complete. Otherwise, it returns Check Condition status and sets sense data as follows: Sense Key = Illegal Request (5h) ASC = Invalid Bits in the Identify message (3Dh) ASCQ = 0

Table B-10 Handling of invalid Identify message with reserved bits 3, 4, or 5 set (*continued*)

If the library receives an Identify message during this bus phase...	The library does this...
Message in Cmd Complete	■ Sends a Message Reject message. ■ Does not set illegal sense data since the command was already processed. ■ Goes to the Bus Free phase.
Message in Disconnect	■ Does not disconnect. ■ Aborts the current operation. ■ Returns Check Condition status and sets sense data as follows: Sense Key = Illegal Request (5h) ASC = Invalid Bits in the Identify message (3Dh) ASCQ = 0 ■ Goes directly to the Status phase.
Message in Restore Ptrs Msg Reject Identify	If the command is complete and the library has attempted to return status, the library: ■ Sends a Message Reject message. ■ Does not set sense data since the command was already processed. Otherwise, the library returns Check Condition status and sets sense data as follows: Sense Key = Illegal Request ASC = Invalid Bits in the Identify message (3Dh) ASCQ = 0

Notes

C Error Codes

This appendix lists the ASCs (Additional Sense Codes) and ASCQs (Additional Sense Code Qualifiers) for library errors. The ASCs and ASCQs are associated with the sense keys returned by the library in response to a REQUEST SENSE command (see Chapter 18). The error descriptions are listed in order by ASC and ASCQ for each of the sense keys.

CAUTION

Some corrective actions advise you to reset the library. Before resetting, make sure there is no SCSI activity on any connected SCSI bus, so you do not disrupt communications.

C.1 No Sense (Sense Key 0h)

When the MRIE reporting method is set to 6 (report informational exception conditions) as described on page 8-8, the library returns a sense key of No Sense (0h) if a Tape Alert flag has been set. The ASC and ASCQ values are shown in Table C-1.

Table C-1 ASC and ASCQ values for the No Sense (0h) sense key

ASC (byte 12)	ASCQ (byte 13)	Description	Corrective action
5Dh	00h	Tape Alert data indicates a problem detected by the library self-diagnostics.	Issue a LOG SENSE command to read the Tape Alert page and determine the problem.

C.2 Not Ready (Sense Key 2h)

During a Not Ready condition, the library returns Check Condition status in response to each motion command until the Not Ready condition is removed. During this time, the sense key is set to Not Ready and the ASC and ASCQ are set to codes specifying why the library is not ready. All commands other than motion commands perform normally. Table C-2 lists Not Ready (2h) error conditions.

Table C-2 ASC and ASCQ values for the Not Ready (2h) sense key

ASC (byte 12)	ASCQ (byte 13)	Description
04h	01h	The library is performing an initialization after a reset or the door was closed.
	83h	The front door is open.
	89h	The library is in Console mode.
	8Dh	The library is in LCD mode.

C.3 Hardware Error (Sense Key 4h)

The library returns a sense key of Hardware Error (4h) when a hardware-related error occurs. After a Hardware Error occurs, the library will not accept motion commands. For each additional motion command, the library returns the same Hardware Error. For the TEST UNIT READY (00h) command, the library also responds with a Hardware Error sense key. All other commands are executed normally.

Table C-3 lists Hardware Error (4h) error conditions and indicates the LCD code that appears on the operator panel when each error occurs. The table also provides corrective actions for each error.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
04h	8Dh	77	**Interface disabled.** The library was not in the correct control mode when the operator sent a command.	▪ Make sure you have set the correct control mode. ▪ If the control mode is correct, contact your service provider.
15h	80h	10	**Dropped a cartridge.** The robot dropped a cartridge.	▪ Put the cartridge back in the magazine if you know where it belongs. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider. **CAUTION:** Do not try to put the cartridge back in the gripper.
	81h	14	**Pick failure.** The robot could not pick a cartridge because of mechanical problems.	▪ Open the door and make sure there is nothing blocking the robot or the tape drives. ▪ If the error persists, the robot may need to be replaced. Contact your service provider.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
15h (cont.)	81h	105	**Can't open handle.** The robot cannot open the tape drive door.	▪ Open the library door and look for anything that might be obstructing the robot along its reach axis. ▪ Make sure the tape drive handle is not damaged. Do not try to manually open or close the tape drive handle. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.
	83h	13	**Put failure.** The robot could not place a cartridge because of mechanical problems.	▪ Open the door and make sure there is nothing blocking the robot or the tape drives. ▪ If the error persists, the robot may need to be replaced. Contact your service provider.
	83h	38	**Cannot load drive.** The robot cannot push the cartridge far enough to load it into the tape drive.	▪ Open the door and look for anything that might be obstructing the robot along its reach axis. ▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.
	83h	103	**Can't close handle.** The robot cannot close the tape drive door.	▪ Open the library door and look for anything that might be obstructing the robot along its reach axis. ▪ Make sure the tape drive handle is not damaged. Do not try to manually open or close the tape drive handle. ▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.
	86h	19	**Pick error**. The robot could not successfully pick from a full cartridge slot.	▪ Open the door and look for anything that might be obstructing the gripper. ▪ Make sure the library and tape drives are not being used by any host, then reset the library. ▪ If the error persists, the robot may need to be replaced. Contact your service provider.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
3Bh	81h	71	**Parameter > limit.** Firmware error.	▪ Make sure the library and tape drives are not being used by any host, then reset the library. ▪ If the error persists, contact your service provider. You may be asked to supply a diagnostic listing; you may need new firmware.
	83h	74	**Cart. inaccessible.** The robot is unable to pick the cartridge from the tape drive.	The cartridge may still be loaded in the tape drive. ▪ Use the Open Tape Drive command on the operator panel to unload the tape drive (see *Exabyte 690D Installation and Operation* for instructions). ▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel.
	83h	102	**Drive not ready.** The robot cannot open the tape drive door because the tape drive has not issued a ready status.	▪ Retry the current command. ▪ If the tape drive still does not issue a ready status, make sure the library and tape drives are not being used by any host, then reset the library. ▪ If the error persists, contact your service provider.
	87h	104	**Cart. stuck in drive.** The library is unable to pick the cartridge because the cartridge is stuck in the tape drive.	▪ Push the cartridge into the tape drive and close the drive handle. ▪ Use the Open Tape Drive command to unload the cartridge and open the tape drive (see *Exabyte 690D Installation and Operation* for instructions). Remove the cartridge. ▪ If the error persists, contact your service provider.
	90h	18	**Source inside drive.** The robot could not successfully pick a cartridge because it was still loaded in the tape drive.	Use the Open Tape Drive command on the operator panel to unload the tape drive, or redirect the robot to another location.
	91h	100	**Move interrupted.** The movement of the robot was interrupted.	▪ Move the robot toward the front of the library and, if there is a cartridge in the gripper, remove the cartridge. ▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
3Bh (cont.)	0Dh	12	**Destination full.** A cartridge already exists in the destination location.	Remove the cartridge from the destination or redirect the robot to another location.
	0Eh	11	**Source empty.** There is no cartridge in the source location.	Install a cartridge in the source location or redirect the robot to another location.
3Fh	80h	—	The library is unable to erase flash EEPROM.	Contact your service provider.
	84h	—	The library is unable to program flash EEPROM.	
	86h	—	The flash EEPROM checksum was bad.	
40h	88h	72	**Front door is open.** The front door was opened before the library completed its commands; or the door solenoid is malfunctioning.	▪ Close and lock the door. ▪ If the error still appears, make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, the solenoid may need to be replaced. Contact your service provider.
	91h	21	**Grip home error.** A gripper error occurred.	▪ Open the door and look for anything that might be obstructing the gripper. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, the robot may need to be replaced. Contact your service provider.
	A0h	30	**R axis does not move.** The robot could not move along the reach axis.	▪ Open the door and look for anything that might be obstructing the gripper or the robot's path along the reach axis. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If there are no obstructions and the error persists, the robot may need to be replaced. Contact your service provider.
	A1h	31	**R axis failed home.** The robot could not return to the home position along the reach axis.	

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
40h (cont.)	A3h	36	**R LM629 reset fail.** The library could not reset the servo chip for the reach axis.	▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, the controller card may need to be replaced. Contact your service provider.
	ADh	200	**H axis does not move.** The robot could not move along the horizontal axis.	▪ Open the door and look for anything that might be obstructing the robot's path along the horizontal axis. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If there are no obstructions and the error persists, the robot may need to be replaced. Contact your service provider.
	AEh	201	**H axis has failed home.** The robot could not return to the home position along the horizontal axis.	
	AFh	206	**H LM629 reset fail.** The library could not reset the servo chip for the horizontal axis.	▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, the controller card may need to be replaced. Contact your service provider.
	B0h	40	**V axis does not move.** The robot could not move along the vertical axis.	▪ Open the door and look for anything that might be obstructing the robot's path. Also, make sure the axis belt is intact. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists and there are no obstructions and the belt is intact, the vertical axis motor or the controller card may need to be replaced. Contact your service provider.
	B1h	41	**V axis failed home.** The robot could not return to the home position on the vertical axis.	
	B3h	46	**V LM629 reset fail.** The library could not reset the servo chip for the vertical axis.	▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, the controller card may need to be replaced. Contact your service provider.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
40h (cont.)	C0h	50	**D axis does not move.** The drum could not move on its axis.	▪ Open the door and look for anything that might be obstructing the drum's rotation. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If there are no obstructions, the drum motor assembly may need to be replaced. Contact your service provider.
	C1h	51	**D axis failed home.** The library could not determine the home position on the drum.	▪ Open the door and look for anything that might be obstructing the drum's rotation. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, check to make sure that the interrupter tab on the drum is not broken or bent. The drum home sensor detects an interrupter tab that protrudes from the base of the drum at the home position. ▪ If the interrupter tab is damaged, the drum may need to be replaced. ▪ If it is not damaged, the drum home sensor may need to be replaced. Contact your service provider.
	C3h	56	**D LM629 reset fail.** The library could not reset the servo chip for the drum axis.	▪ Make sure the library and tape drives are not being used by any host, then reset the library. ▪ If the problem persists, contact your service provider.
	C5h	53	**R Axis interference.** The library cannot position the drum because the reach axis was extended too far.	▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the problem persists, contact your service provider.
	C6h	52	**Mult. drum indices.** The library found multiple drum flags and could not determine the drum home position.	Contact your service provider.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
40h (cont.)	D1h	80	**EE port failed to extend.** The Entry/exit port could not be extended.	▪ Open the door and look for anything that might be obstructing the entry/exit port. ▪ Make sure that the entry/exit port drive belt is intact. ▪ If there are no obstructions and the belt is intact, the entry/exit motor may need to be replaced. Contact your service provider.
	D2h	81	**EE port failed to return.** The Entry/exit port could not be retracted.	
	E0h	67	**Did not read BC data.** The bar code scanner cannot read the bar code label in the fixed cartridge slot because of a firmware or hardware problem.	▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, the controller card may need to be replaced. You may need to supply a diagnostic listing; you may need new firmware. Contact your service provider.
	E1h	63	**No scan; no inv info.** The inventory is questionable on single slot scan. Single cartridge scan cannot be performed when the occupied status is unknown.	▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.
	E5h	79	**R axis not retracted.** The robot did not move to home before the current servo command was attempted.	▪ Open the door and look for anything that might be obstructing the robot along its reach axis. ▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.
	E5h	76	**POS error timeout.** The robot could not reach its destination along the vertical axis.	▪ Open the door and look for anything that might be obstructing the robot's path along its vertical axis. Also, make sure the axis belt is intact. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists and there are no obstructions and the belt is intact, the vertical axis motor or the controller card may need to be replaced.
	F3h	196	**Laser not calibrated.** The laser is not properly set-up to read bar code labels.	Contact your service provider.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
40h (cont.)	F4h	108	**Missing cal target.** No calibration target.	▪ Open the door and make sure that the white, triangle-shaped target on the calibration block is visible. If the target is not visible, remove the block and reinsert is so that the target is visible. ▪ If the target is missing or damaged, replace the calibration block.
80h	01h	17	**Robot full before move.** There was a cartridge in the gripper during a power up, before a cartridge move, or before a diagnostic test.	▪ Remove the cartridge and put it back in the cartridge magazine if you know where it belongs. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.
	03h	15	**No source element; No dest. element.** No data cartridge magazine was installed at the selected location.	Install a data cartridge magazine or redirect the robot.
	04h	16		
84h	00h	75	**Internal S/W error.** Firmware error.	▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider. You may be asked to supply a diagnostic listing; you may need new firmware.
	20h	90	**Drive HW Error.** The tape drive could not perform an operation because of a hardware error.	▪ Use the Reset Tape Drive option on the operator panel to reset the tape drive. ▪ Make sure the library and tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider. You may be asked to supply a Diagnostic listing; you may need new firmware.

Table C-3 ASC and ASCQ values for the Hardware Error (4h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	LCD code	Description	Corrective action
84h (cont.)	21h	78	**Drive comm error.** The library is unable to communicate with the tape drive.	▪ If you just replaced the tape drive, make sure the tape drive cables are seated properly. ▪ Check the tape drive SCSI ID and change as necessary. ▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider. You may be asked to supply a diagnostic listing; you may need new firmware or a new controller card.
	22h	106	**Cart. stuck in drive.** During an attempt to move a cartridge from the tape drive, the drive leader did not disconnect from the tape.	▪ Push the cartridge into the tape drive and close the drive handle. Then use the Open Tape Drive command to unload the cartridge and open the tape drive (see *Exabyte 690D Installation and Operation* for instructions). Remove the cartridge. ▪ Discard the data cartridge. The tape is unusable. ▪ If the error persists, contact your service provider.
	23h	97	**Drive will not latch the cartridge.** During an attempt to move a cartridge into a tape drive, the cartridge would not stay seated in the drive to allow the door to be closed.	▪ Close, then open drive door with no cartridge in the tape drive. ▪ If the error occurs again, make sure the library and tape drive are not being used by any host, then power the library off, then on again. ▪ If the error persists, contact your service provider.
85h	10h	107	**Bad cal value.** Calibration came up with a bad value.	▪ Perform calibration again. ▪ If the error occurs again, make sure the library and the tape drives are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.
	11h	70	**Robot FRU data bad.** The library was unable to retrieve robot calibration data from the robot field replaceable unit (FRU).	▪ If you just replaced the robot, make sure the cables are seated properly. ▪ Make sure the library and tape drive are not being used by any host, then reset the library from the operator panel. ▪ If the error persists, contact your service provider.

C.4 Illegal Request (Sense Key 5h)

Table C-4 lists Illegal Request (5h) error conditions.

Table C-4 ASC and ASCQ values for the Illegal Request (5h) sense key

ASC (byte 12)	ASCQ (byte 13)	Description
1Ah	00h	The parameter list length was not valid.
20h	00h	The operation code (OP code) for the command descriptor block was invalid.
21h	01h	There was an invalid element address specified in the command descriptor block.
24h	00h	There were invalid fields in the command descriptor block.
25h	00h	The logical unit number specified in the Identify message or in the command descriptor block is not zero.
26h	00h	There was an invalid field in the parameter list.
	02h	There was an invalid parameter in the parameter list.
3Bh	0Dh	The destination element was occupied for a MOVE MEDIUM command.
	0Eh	The source element was empty for a MOVE MEDIUM command.
	83h	The library is unable to access a tape drive because the tape drive handle cannot be operated at this time.
	90h	The source cartridge is loaded inside a tape drive and is not accessible.
3Dh	00h	There were invalid bits in the Identify message. Either one of the reserved bits was nonzero or the LUNTAR field was nonzero.
3Fh	87h	Cannot execute a READ FIRMWARE, WRITE BUFFER, or WRITE FIRMWARE command; the console's write firmware operation is in progress.
	88h	Cannot execute a READ FIRMWARE, WRITE BUFFER, or WRITE FIRMWARE command; the console's read firmware operation is in progress.
53h	02h	Either the library door cannot be opened or the entry/exit port cannot be extended because the operation was prevented with a PREVENT/ALLOW MEDIUM REMOVAL command.
	80h	A cartridge in the entry/exit port was rejected because it was not inserted all the way into the magazine slot.
5Ah	00h	The tape drive has been set offline from the operator panel in preparation for service.

Table C-4 ASC and ASCQ values for the Illegal Request (5h) sense key (*continued*)

ASC (byte 12)	ASCQ (byte 13)	Description
80h	02h	Cannot execute a command because the entry/exit port is extended.
	03h	The source cartridge magazine is not installed.
	04h	The destination cartridge magazine is not installed.
	05h	The source tape drive is not installed.
	06h	The destination tape drive is not installed.
85h	02h	Cannot scan label on a cartridge in a tape drive.

C.5 Unit Attention (Sense Key 6h)

The library does not stack Unit Attention conditions. Whenever there are two or more Unit Attention conditions, the library reports only the last one encountered. A Unit Attention condition remains in effect for a particular initiator until that initiator clears it.

If the library has not returned Check Condition status for the Unit Attention condition generated, the library responds in the following manner:

- In response to a REQUEST SENSE command, the library reports a sense key of Unit Attention (the ASC and ASCQ bytes provide additional information about the condition). Then, the library clears the Unit Attention condition.
- In response to an INQUIRY command, the library performs the INQUIRY command but does not clear the Unit Attention condition.
- In response to any other command, the library returns Check Condition status for the command. The command is not performed and the Unit Attention condition is not cleared.

If the library has already returned Check Condition for the Unit Attention condition, the library responds in the following manner:

- In response to a REQUEST SENSE command, the library reports a sense key of Unit Attention (the ASC and ASCQ bytes provide additional information about the condition). Then, the library clears the Unit Attention condition.

- In response to an INQUIRY command, the library performs the INQUIRY command but does not clear the Unit Attention condition.
- In response to any other command, the library clears the Unit Attention and associated sense data. Then, the library performs the requested command.

Table C-5 lists Unit Attention (6h) error conditions.

Table C-5 ASC and ASCQ values for the Unit Attention (6h) sense key

ASC (byte 12)	ASCQ (byte 13)	Description
28h	00h	The library's door was opened and then closed.
	01h	The entry/exit port was retracted.
	89h	The library was placed in SCSI mode after it was operating in Console mode.
	8Dh	The library was placed in SCSI mode after it was operating in LCD mode.
29h	00h	A power-on, SCSI bus reset, or Bus Device Reset message occurred.
2Ah	01h	Mode parameters have been changed. Issue a MODE SENSE (1Ah) command to determine what the new mode parameters are.
3Fh	01h	New firmware was loaded.
5D	FFh	Tape Alert asynchronous notification test.

C.6 Aborted Command (Sense Key Bh)

Table C-6 lists Unit Attention (Bh) error conditions.

Table C-6 ASC and ASCQ values for the Aborted Command (Bh) sense key

ASC (byte 12)	ASCQ (byte 13)	Description
43h	00h	The library received a message at an invalid time.
45h	00h	A reselect failure occurred. The host rejected the Identify message sent by the library after the library reselected the host.
47h	00h	Either the message system was disabled and the library discovered a parity error on the SCSI bus, or the message system was enabled and the initiator rejected a Restore Data Pointers message that the library sent to recover from a parity error. Or, all parity error retries were exhausted.
48h	00h	Either the library received an Initiator Detected Error message at an inappropriate time, or the initiator rejected a Restore Data Pointers message that the library sent in response to the Initiator Detected Error message.
4Eh	00h	The library disconnected while executing a command. During this time, the same initiator that issued the command also selected the target and tried to issue another command. When this error occurs, the library terminates the current connection with Check Condition status and aborts the command in progress for that initiator.

Notes

Index

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W