StorageTek Automated Cartridge System Library Software

SCSI Reference Guide

Release 8.5

E96384-02

April 2019

ORACLE

StorageTek Automated Cartridge System Library Software SCSI Reference Guide, Release 8.5

E96384-02

Copyright © 2019, Oracle and/or its affiliates. All rights reserved.

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish, or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this is software or related documentation that is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, then the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

This software or hardware is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications that may create a risk of personal injury. If you use this software or hardware in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure its safe use. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software or hardware in dangerous applications.

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Opteron, the AMD logo, and the AMD Opteron logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

This software or hardware and documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

Contents

3 SCSI Commands

List of Figures

Preface

This guide is intended for service representatives, hardware engineers, software engineers, and operating system designers and developers responsible for implementing StorageTek's version of the small computer system interface (SCSI) over Fibre Channel interface (FCP) for Oracle's Automated Cartridge System Library System (ACSLS) 8.x.

This guide contains information about the small computer system interface, including SCSI characteristics, library features, SCSI bus operations, SCSI commands, status byte data, and sense data. This guide also contains information about the Fibre Channel interface, including Fibre Channel operations, command implementations, topologies, cables, and connectors.

Note: This guide does not describe the SCSI bus controls and commands or the Fibre Channel operations and commands for the tape drives in the library.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc.

Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info or visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs if you are hearing impaired.

1

Overview

This chapter describes the small computer system interface (SCSI) and the Fibre Channel interface (FC) for ACSLS 8.x. This manual does not describe the Fibre Channel interface to the tape drives.

SCSI Bus Interface

The libraries' SCSI interface conforms to SCSI specifications and is accepted by:

- American National Standards Institute (ANSI X3.131)
- European Computer Manufacturing Association (ECMA-111)
- Federal Information Processing Standard (FIPS-131)
- International Standards Organization (ISO-9316)

Overview

The small computer system interface operates locally as an input and output (I/O) bus that uses a common command set to transfer controls and data to all devices. The main purpose of this interface, called the SCSI bus, is to provide host computer systems with connections to a variety of peripheral devices, including disk subsystems, tape subsystems, printers, scanners, optical devices, communication devices, and libraries.

The SCSI bus design for the library provides a peer-to-peer, I/O interface that supports up to 16 devices and accommodates multiple hosts.

Peer-to-peer interface communication can be from:

- Host to host
- Host to peripheral device
- Peripheral device to peripheral device

SCSI terms defining communication between devices on the SCSI bus include:

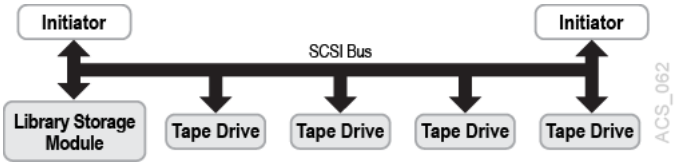
- Initiator is the device that requests an operation.
- Target is the device that performs the operation requested.

Some targets are control units that can access one or more physical or virtual peripheral devices addressable through the control unit. These peripheral devices are called logical units and are assigned specific addresses or logical unit numbers (LUNs).

The library supports SCSI-3 commands.

The library and the tape drives have separate connections for attachment to the SCSI bus. Daisy-chain cables are available to interconnect devices on the SCSI bus but keep the total cable length to a minimum. Figure 1–1 is an example of a library and four tape drives that are daisy-chained to two initiators (or hosts). It is recommended that the drives be connected to a separate SCSI bus from the library.

Figure 1–1 Example of a Library Configuration on the SCSI Bus



Benefits

A small computer system interface also provides these benefits:

- Low overhead
- High transfer rates
- A high-performance buffered interface
- Conformance to industry standards
- Plug compatibility for easy integration
- Error recovery, parity, and sequence checking provides high reliability
- Provisions in the command set for vendor-unique fields
- Standard or common command sets with an intelligent interface that provides device independence

Implementation

Implementation of the SCSI bus for the library supports:

- 8-bit wide transfers, asynchronous; 16-bit wide selection
- Disconnect and reselect
- Multiple initiator
- Hard resets
- Single-ended LVD
- SCSI-3, 68-pin P-cable

Implementation for the library does not support:

- Soft resets
- Command queuing
- Command linking
- Asynchronous event notification
- Extended contingent allegiance

Fibre Channel Standard

StorageTek's implementation of Fibre Channel conforms to the American National Standards Institute (ANSI), National Committee for Information Technology Standards (NCITS) formerly X3

Overview

- Serial connection
- Copper (electrical) or fiber (optical) transmissions
- Multiple protocols (such as SCSI, IP, HIPPI, IPI-3)
- Information transparent
- 100 MB/s data transfer rates (and higher)
- Scalable for media rates, distance, media, and protocols

Benefits

In 1994, the Fibre Channel Physical and Signaling Interface (FC-PH), or ANSI X3.230-1994, was completed, differing from every other architecture at the time. This specification married the strengths of channels, including high throughput and low overhead, with the strengths of networks, including flexibility, long distance capability, and high connectivity.

Implementation

Library:

- Arbitrated loop
- FCP (SCSI-3) command set for medium changer devices
- Class 3 level of service
- Private Loop operation
- Public Loop operation
- Direct fabric attach operation
- Hard-assigned port addresses (AL-PA)
- Basic and extended link services
- Connections to an external hub (or switch)
- Data transfer rates of 100 MB/s
- Standard approved length shortwave fibre optic cables
- Multimode laser operating at 780 nanometers (shortwave) non–OFC

Hub:

- Multiple ports
- Standard approved length fibre optic and copper cables
- Multimode laser operating at 780 nanometers (shortwave) non–OFC
- Single mode laser operating at 1300 nanometers (longwave)
- Cascading hub attachments

- Gigabit Interface Converter (GBIC) connections in the hub

Switch:

- Attachment to FL_Ports is supported.

2

ACSLS Logical Libraries

The ACSLS Logical Library (referred to in this document simply as “logical library”) is a subset of one or more connected physical libraries (drives and volumes). It is currently presented over two interfaces: one is the SCSI and the other is the ACSLS Graphical User Interface (referred to in this document simply as “GUI”). This document covers the SCSI/FCP interface and mentions the GUI only where it has impact on the SCSI interface. For more information on the management of logical libraries, refer to the ACSLS documentation.

The ACSLS system (referred to in this document simply as the “system”) presents each logical library as a SCSI Media Changer (SMC) device. Each device appears as a separate LUN on a Fibre Channel (FC) target port contained on the system. Initiator mode FCP SCSI applications (referred to in this document simply as hosts or host applications) attach to the system through a FC SAN and communicate with the logical library using the SCSI commands described in this document. Also attached to the system are one or more physical libraries. A physical library can be any type of library supported by the system. This may include both SCSI and non-SCSI (HLI) libraries. A logical library uses some or all of the resources of one or more physical libraries. A logical library cannot span more than one physical library unless the physical libraries are connected together with a pass through mechanism. The system presents each logical library as a single SCSI library on its own LUN even if the logical library has been configured to use resources from more than one physical library. The system provides LUN masking so that each host sees only the logical libraries that have been configured for it. Only one host connection per logical library is allowed. With this restriction, reservations and reservation conflicts are not possible and are therefore not described in this document.

A logical library is created by a System Administrator (referred to in this document simply as the “administrator”) using the GUI. The resources of the library are mapped by the system to real resources of the associated physical library (s). This is described in more detail under Elements of a Logical Library below. From the perspective of the SCSI interface, a logical library behaves very much the same as a real SCSI Media Changer, but there are some differences. High level descriptions of these differences are described in this chapter. For detailed description of each command see SCSI Commands.

Elements of a Logical Library

Like a real SCSI library, a logical library consists of the following elements:

- One hand element
- One or more import/export elements
- Zero or more drive elements

- One or more storage elements

The hand element, storage elements, and import/export elements are all logical entities; they do not have corresponding physical resources in the physical library. Drive elements, however, do correspond one to one to a real physical drive in the physical library. Below is a description of each element and the considerations that a host application may need to understand in order to properly control a logical library.

Hand Element

All Logical libraries have one hand element at SCSI element address 0. This is a logical entity only, i.e. it does not correspond to any physical hand. A Read Element Status can be issued for this address but it will always appear to be empty. The source or destination of a Move Medium command cannot be the hand element. This is consistent with the response given for the Device Capabilities Page of the Mode Sense command.

Import/Export Elements

Each logical library has a configurable number of consecutive import/export elements starting at SCSI element address 10. The maximum number of import/export elements that can be configured is 490. These elements do not correspond to physical cells in the physical library. The actual number of elements that are configured can be queried using the Mode Sense(6) command.

Volume Movement

Volumes can be moved to any configured import/export element using the Move Medium command; however, the elements cannot be used as a place to store a volume. This is consistent with the response given for the Device Capabilities page of the Mode Sense command. When a volume is moved to an import/export element, it is automatically unassigned from the logical library. From the SCSI interface perspective, after the move the volume no longer exists in the logical library, however it is still present in the physical library. Read Element Status for import/export elements always report that the element is empty. Therefore, logical library, import/export elements can be conceptually thought of as one way chutes where volumes can be sent through in order to eject them from the library. In order to provide compatibility with a physical SCSI library, the next command issued following a successful Move Medium command to an import/export element causes a unit attention condition with the following sense information:

- Sense Key 6h (Unit Attention)
- ASC / ASCQ 28h / 01h (Cap Element Accessed)

Presenting this unit attention tells the host that one or more import/export elements may have been accessed manually by an administrator. In this case, if the host elects to issue a Read Element Status for the import/export element that was just used in the previous Move Medium command, it will find that the element is empty. The host application can then assume that the volume has been removed. This is the same behavior a host would experience with a physical library if the real CAP is accessed. Note, however, that issuing the Read Element Status in response to the unit attention is not necessary. If the previous Move Medium had completed successfully, a host application can safely assume that the volume has been logically ejected from the library and recovery from the unit attention can be simply to retry the Move Medium command. Import/export elements never contain a volume.

As indicated in the Mode Sense Device Capabilities Page, movement from import/export cells is not supported. Any Move Medium command that uses and import/export element for the source address will fail with:

- Sense Key 5h (Illegal Request)
- ASC / ASCQ 21h / 01h (Invalid Element)

This means that import/export elements are never used to enter volumes into a logical library. They are only used as a way for SCSI host applications to programmatically eject volumes. Volumes can only be entered directly into a logical library to available storage elements through an assignment operation performed by an administrator using the GUI. This is described in more detail under Storage Elements below.

Capacity Changes

Whenever an administrator changes the number of import/export elements configured for a logical library using the GUI, the system raises a unit attention condition with the following sense information:

- Sense Key 6h (Unit Attention)
- ASC / ASCQ 2Ah / 01h (Mode Parameters Changed)

Host applications must issue Mode Sense to determine the new number of import/export elements available.

Prevent/Allow Considerations

With a real SCSI library, the Prevent/Allow Medium Removal command allows a host to lock and unlock access to a physical CAP. Since a logical library does not have a physical CAP (it has logical import/export elements but they do not correspond to a physical CAP) this command is supported for compatibility purposes and will always succeed. It is essentially a NOOP.

Storage Elements

Each logical library has a configurable number of consecutive storage elements starting at SCSI element address 1000. The maximum number of storage elements that can be configured is 64,535. Note that a logical library's storage element count can be configured to be greater than or less than the physical library (s) cell count. These elements are logical and do not correspond directly to physical cells of the physical library. Volumes can be moved to any unoccupied storage element using the Move Medium command. Even if the source of the move is an occupied storage element, no robotic movement occurs, only the association between the logical SCSI element address and the actual physical location of the volume in the physical library is updated. If movement is to or from a valid drive element, robotic activity does occur in the physical library since logical library drives correspond one for one with physical drives. See Drive Elements for more details.

Assigning and Unassigning Volumes

When a logical library is created by the administrator using the GUI, all storage elements are initially empty. To populate volumes into the empty storage elements an administrator must perform an assignment operation using the GUI. Likewise, to remove volumes from occupied storage elements the administrator may perform an unassign operation. Volumes can also be logically removed via the Move Medium command when the destination is an import/export element. See Import/Export Elements.

Each time a volume is either assigned to or unassigned from a logical library, the system raises a unit attention condition on the interface for the next SCSI command received as follows:

- Sense Key 6h (Unit Attention)
- ASC / ASCQ 28h / 00h (Not Ready-to-Ready Transition)

This emulates the behavior of a physical library when an operator opens the door and either manually adds or removes volumes directly to/from storage elements. When the door is closed, the physical library re-inventories its contents and presents a Not-Ready-To-Ready Unit Attention when it has finished. For logical libraries, this happens instantly after assign or unassign operations. After receiving this unit attention a host application should issue Read Element Status for all storage elements to determine the current contents of the logical library.

Volume Movement

When a volume is moved from a storage element (via the Move Medium command) to another location, the action carried out by the system depends on the destination element type as follows:

- Hand element - not allowed.
- Import/export element - the action carried out is as described under Import/Export Elements above.
- Drive element - the volume is moved from the associated physical library storage location to the physical drive in the physical library that corresponds to the SCSI element address specified in the command.
- Storage element - no robotic movement takes place, only the volumes associated SCSI Element address is changed.

Capacity Changes

Whenever an administrator successfully changes the number of storage elements configured for a logical library (using the GUI), and that change does not result in any volumes changing their SCSI element address, the system raises a unit attention condition on the interface for the next SCSI command received as follows:

- Sense Key 6h (Unit Attention)
- ASC / ASCQ 2Ah / 01h (Mode Parameters Changed)

Host applications must issue Mode Sense to determine the new number of storage elements available but can safely assume that the current volume inventory has not changed locations.

If the change to the number of configured storage elements does cause volumes to be logically moved to different storage elements (this can happen if the capacity is decreased causing volumes to be logically moved to other unused storage elements), the system raises two unit attention conditions for the next two commands received as follows:

- Sense Key 6h (Unit Attention)
- ASC / ASCQ 28h / 00h (Not Ready-To-Ready Transition)
- ASC / ASCQ 2Ah / 01h (Mode Parameters Changed)

In this case a client application should issue both a Mode Sense command (to determine the new number of storage elements available) and a Read Element Status to determine the contents of each storage element. If the client application ignores this

unit attention and continues to use information about the library that it had obtained previously, subsequent commands may fail unexpectedly; therefore, it is important that a client application reconcile both the configuration and inventory of the library after receiving the Not Ready-to-Ready Transition and Mode Parameters Changed unit attentions.

Drive Elements

Each logical library has a configurable number of drive elements starting at element address 500. The maximum number of drive elements that can be configured is 500. The response to a Read Element Status always includes an entry for every drive element currently configured; however, each drive element may or may not be associated with a physical drive. If the element is not currently associated with a physical drive the ED bit (byte 9, bit 3) is set to 1 and the Access bit (byte 2, bit 3) is set to 0 in the Read Element Status response.

Capacity Changes

Initially, the number of drive elements is set when the logical library is created. Subsequently, this number can be changed by the administrator (using the GUI). If this number is changed, the system raises a unit attention condition on the interface for the next SCSI command received as follows:

- Sense Key 6h (Unit Attention)
- ASC / ASCQ 2Ah / 01h (Mode Parameters Changed)

If the count is decreased and results in any association change (between drive element address and physical drive) then the system precedes the Mode Parameters Changed unit attention with:

- Sense Key 6h (Unit Attention)
- ASC/ASCQ 28h / 00h (Not Ready-To-Ready Transition)

If the host only receives the Mode Parameters Changed unit attention then it should issue Mode Sense to determine the new number of drive elements available. It can assume that no element address associations have changed. However, if the Not-Ready-To-Ready unit attention is received, the host should be sure to update its drive configuration with current information obtained via Read Element Status.

Adding and Removing Drives

Physical drives can be added or removed from a logical library by the administrator using the GUI. When a drive is added, it is automatically assigned to the next available drive element address starting with the lowest address. When a drive is removed, the system disassociates the physical drive from the drive element (the ED bit will be set to 1 and the Access bit set to 0 in a Read Element Status response) but the number of drive elements (as reported by Mode Sense) remains unchanged. No unit attention conditions are raised.

Drive Failures

A drive failure condition (as perceived by the host application) will result from any one of the following actions:

- The drive is varied offline by the administrator.
- The drive is removed from the logical library by the administrator.
- The drive is physically powered off or disconnected.

- The drive is experiencing a physical hardware failure.

All of the above conditions result in the following:

The descriptor entry in the Read Element Status response has the Except bit (byte 1, bit 2) set to 1 and the Access bit set to 0 and the ASC/ASCQ fields (bytes 4 and 5) are set to 04h / 02h (Hardware Error, Tape Drive).

A Move Medium command that addresses the drive will fail with:

- Sense Key 4h (Hardware Failure)
- ASC/ASCQ 40h / 02h (Hardware Error, Tape Drive)

Command Support

Logical libraries do not support all SMC commands. Commands that deal primarily with physical hardware are not supported, i.e. Mode Sense (10). Some commands are supported but don't actually do anything (i.e., Initialize Element Status). Other commands are supported but only for a subset of the possible response pages, i.e. Mode Sense (6). The intent is to provide command emulation that will allow for a wide adoption of logical libraries with little or no change to host applications. Unsupported commands will fail with Check Condition Sense Key 05h (Illegal Request), ACS / ACSQ 20h / 00h (Invalid Command). The commands listed below are ones that may behave differently then they would for a real library.

Inquiry

The Inquiry data for a logical library is unique, i.e., it does not report that it is a known real library type. Also, the device identification page uses a NAA type 6 format using the logical library unique serial number as part of the vendor specific extension. This provides a way for clients to uniquely identify a library regardless of which target port the device is presented on.

Serial numbers for logical libraries consist of 12 ascii numbers. The format is SSSSSSSSNNNN where:

- SSSSSSSS is the unique software serial number of the system
- NNNN is the number of the library partition within the system (0-9999)

If an Inquiry command is received from a host initiator on a lun that is not currently mapped to a logical library, Inquiry returns a response with the Peripheral Qualifier set to 011b and Peripheral Device Type set to 1fh. Lun mapping is established by an administrator using the GUI.

Mode Sense (6)

The Mode Sense (6) command supports the Element Address Assignment (1Dh) and Device Capabilities (1Fh) pages only.

Note: A logical library does not support element storage for I/E elements and an I/E element cannot be the source of a Move Medium command. The Move Medium command will fail with CHECK_ CONDITION, SenseKey Illegal Request (5h), and ACS/ASCQ Invalid Element (2 1/01h)

Move Medium

Move Medium commands that do not involve a drive element complete much faster for a logical library than for a physical library.

Move Medium to/from drive elements cause real robotic activity in the physical library. The time required before completion of the move is reported depends on the Fast Load setting at the time the command is received (this setting is found under "Preferences" in the ACSLS GUI).

Move Medium commands to/from import export elements behave differently than a real library. These differences are described in Import/Export Elements.

Prevent/Allow Medium Removal

Since a logical library does not contain a physical CAP, this command is supported for compatibility but always returns “success”.

Read Element Status

The format of the Primary Volume Tag Information field can be in one of four formats, 6 character, 8 character suffix, and 8 character prefix. The format to be used is an attribute of the logical library that can be set by the administrator using the GUI. This is described in detail under the VolTag field of the ReadElementStatus CDB in the “SCSI Commands” chapter.

Report LUNs

The system presents each logical library as a separate LUN on one of the systems’ fibre channel target ports. The system provides LUN masking by allowing only specified initiators access to logical libraries. Initiators are identified using their FC world wide port name (WWPN). Using the GUI, an administrator must establish a mapping between an initiator (I), a target port (T), and a LUN (L). These mappings are saved by the system so that the logical library will always be presented on the same target port and LUN for the initiator. Each initiator is given its own LUN space starting with LUN 0. It is important to note that logical libraries can appear on LUNs other than 0. The first library mapped to an initiator will be assigned LUN 0, the next (on the same target port) will be assigned LUN 1 and so on.

The Report LUNs command will report the LUNs available to the requesting initiator. The command response includes the LUN number for each logical library that has been mapped for the requesting initiator. The LUN numbers are not guaranteed to be consecutive.

Whenever a mapping change is made by an administrator using the GUI, the system raises the following unit attention to the affected initiator:

- Sense Key 6h (Unit Attention)
- ACS / ACSQ 3Fh / 0Eh (Report LUNS Data Has Changed)

Request Sense

Logical libraries use an FC-2 conforming transport that provides autosense. This means that sense data for a failed command is always returned with a Check Condition status in the command response and is never saved by the target. Therefore, Request Sense will always return Sense Data with a Sense Key set to No Sense and ASC/ASCQ fields set to 0. The Request Sense command still documents all the Sense Data that can be returned from the other commands.

Reserve/Release

The Reserve and Release commands are purposely not supported in ACSLS 8.2. Each logical library can be mapped to a maximum of one initiator. Therefore, every logical library is exclusively owned by a single initiator and Reserve / Release would have no meaning. These commands are rejected with CHECK_CONDITION.

Tape Drives and Media Types Supported

A logical library can contain any of the drives and media that can reside in any of the SL series of StorageTek libraries (SL500, SL8500, or SL3000). Note that drives and media that a logical library can support is a superset of all the drive and media types supported by these libraries. An individual logical library would only ever contain a subset of these types. Drives and media (volumes) are allocated to a logical library by the administrator using the GUI. For a list of tape drives and tape media supported, as well as tape drive and media compatibility, see the ACSLS Product Information Guide.

3

SCSI Commands

This chapter describes SCSI command structures for a logical library.

Implementation Requirements

The initiator sends commands to the target using command descriptor blocks (CDBs). The command descriptor blocks contain a format that includes:

- Operation code
- Command parameters
- Control byte

Note: The library is SCSI-3 compliant.

For some commands, a list of parameters accompanies the request during the Data Out phase. For all commands, if there is an invalid parameter in the command descriptor block, then the device terminates the command without altering the medium.

Command Descriptor Blocks

Initiators use command descriptor blocks (CDBs) to communicate commands to the targets. The library supports three types of command descriptor blocks:

- 6-byte commands
- 10-byte commands
- 12-byte commands

The structure for all command descriptor blocks is:

- The first byte contains a Group code that provides 8 groups of commands and the Command Code that provides 32 command codes for each group.
- The second byte in all command descriptor blocks starts the command parameters.
- Any additional bytes contain command parameters.
- The last byte in all command descriptor blocks contains the control byte.

6-Byte Command Descriptor Block

Figure 3–1 6-Byte Command Descriptor Block

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Group Code (of operation code)			Command Code (of operation code)				
1	Command Parameters							
2 to 4	Command Parameters							
5	Control Byte							

ACS_031

10-Byte Command Descriptor Block

Figure 3–2 10-Byte Command Descriptor Block

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Group Code (of operation code)			Command Code (of operation code)				
1	Command Parameters							
2 to 8	Command Parameters							
9	Control Byte							

ACS_032

12-Byte Command Descriptor Block

Figure 3–3 12-Byte Command Descriptor Block

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Group Code (of operation code)			Command Code (of operation code)				
1	Command Parameters							
2 to 10	Command Parameters							
11	Control Byte							

ACS_033

Control Byte

The control byte is the last byte of every command descriptor block.

Figure 3–4 Control Byte

	Bit							
Byte	7	6	5	4	3	2	1	0
5, 9, or 11	Vendor Specific		Reserved			NACA (0)	Flag (0)	Link (0)

ACS_034

Vendor Specific
Provides additional information about the device or for a command.

NACA
The normal auto contingent allegiance bit controls the rules for handling an auto contingent condition caused by a command. This bit is set to 0 to indicate that if a contingent allegiance condition occurs, the command will return a check condition.

Flag (not supported)
This bit causes an interrupt in the initiator allowing a device to respond with intermediate status. This bit is not supported and should be 0.

Link (not supported)
Allows devices that support command linking to continue the I/O process. This bit is not supported and should be 0.

Initialize Element Status (07h)

The host uses the Initialize Element Status command (07h) to request an inventory of the cartridge tapes held in the library. The library accepts this command for compatibility, but does not perform any action. The command descriptor block is validated even though the command is not used. An initiator can obtain inventory information for the library by using the Read Element Status command.

Figure 3–5 Descriptor Block - Initialize Element Status (07h)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (07h)							
1 to 4	Reserved (00h)							
5	Control Byte (00h)							

ACS_035

Initialize Element Status with Range (37h)

The Initialize Element Status With Range command (37h) is a request from the host to perform an inventory of a portion of the cartridge tapes within the library. The library accepts this command for compatibility, but does not perform any action.

The library performs an audit of and maintains the inventory upon power up. The library also performs an audit after some one has opened and closed the front door.

The command descriptor block is validated even though the command is not used. No checks are made of ignored fields (see below).

An initiator can obtain inventory information for the library by using the Read Element Status command.

Figure 3–6 Descriptor Block - Initialize Element Status with Range (37h)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (37h)							
1	Reserved (00h)						Fast	Range
2 to 3	Element Address							
4 to 5	Reserved (00h)							
6 to 7	Number of Elements							
8	Reserved (00h)							
9	Control Byte (00h)							

ACS_036

Fast
Ignore this field.

Range
Ignore this field.

Element Address
Ignore this field.

Number of Elements
Ignore this field.

Inquiry Command (12h)

The Inquiry command (12h) requests that the library send to the initiator information regarding the library's parameters.

> **Note:** The Inquiry command returns check condition status only when the requested data cannot be returned. This command will not clear any pending unit attention conditions.

Figure 3–7 Descriptor Block - Inquiry Command (12h)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Reserved (00h)						CmdDt (0)	EVPD (0 or 1)
2	Page Code (00h, 80h, or 83h)							
3 to 4	Allocation Length							
5	Control Byte (00h)							

ACS_037

CmdDt
The library returns a value of 0, indicating command support data is not supported.

EVPD
The enable vital product data bit indicates the type of inquiry data the initiator is requesting. Supported values are:

- 0 = Request for normal inquiry data
- 1 = Request for vital support product data page

Page Code
If the EVPD value is 0, this field must be 00h.

If the EVPD value is 1, this field must be:

- 00h = Supported vital product pages
- 80h = Unit serial number page
- 83h = Device identification page (Fibre only)

Allocation Length
The allocation length field specifies the number of bytes the initiator has allocated for data returned from the Inquiry command.

A value of 0 indicates that no inquiry data is to be transferred. This condition is not considered 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 data length for the normal inquiry data the library returns is 24h (36d) bytes. The data length for page 0 is 07h (7d). The data length for the unit serial number page (80h) is 0fh (15d) bytes. The data length for the device identification page (83h) is 18h (24d).

Normal Inquiry Data Definition

For the Inquiry command, the library returns 24h (36d) bytes of data in the format shown below.

Error Conditions: The library returns Check Condition status for the Inquiry command only when a severe error occurs. To recover from a Check Condition status report on the Inquiry command, verify that the Inquiry CDB is OK, and retry the Inquiry command.

Figure 3–8 Descriptor Block - Normal Inquiry Data Definition

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB (1)	Reserved (0)						
2	Version (05h)							
3	Reserved (0)		NACA (0)	HiSup (1)	Response Data Format (2)			
4	Additional Length (n-4)							
5	SCCS (0)	ACC (0)	ALUA (0)		3PC (0)	Reserved (0)		
6	BQue (0)	EncServ (0)	VS (0)	MultiP (1)	MChngr (0)	Reserved (0)		
7	RelAdr (0)	Reserved (0)			LINKED (0)	Reserved (0)	CmdQue (0)	SftRe (0)
8 to 15	Vendor Identification							
16 to 31	Product Identification							
32 to 35	Product Revision Level							

ACS_038

Peripheral Qualifier
The library returns a value of 000b, which indicates that the library is a single logical unit number (LUN). If a logical library is not currently mapped to the lun, this field is set to 011b.

Peripheral Device Type
The library returns a value of 8h, which indicates that the library is a medium changer device. If a logical library is not currently mapped to the lun, this field is set to 1fh.

RMB
Removable Medium; a value of 1 indicates the medium is removable.

Device-Type Modifier
A value of 0 indicates there are no modifiers for the library.

Version
The library returns a value of 5h, which indicates compliance to SCSI-3.

NormACA
The Normal Auto Contingent Allegiance (NACA) bit controls the rules for handling an auto contingent condition caused by a command.

The library returns a value of 0, indicating it does not support setting the NACA bit to one.

HiSup
The library returns a value of 1, indicating it uses the hierarchical addressing model to assign LUNs to logical units.

Response Data Format
A value of 2 indicates the data found is in accordance with the SCSI-3 specification.

Additional Length
A value of 1fh indicates there are 24h (36) bytes of Inquiry data available to the initiator.

SCCS
The library returns a value of 0, indicating the library does not contain an embedded storage array controller component.

ACC
The library returns a value of 0, indicating it does not contain an access control coordinator that may be addressed through this logical unit.

ALUA
The library returns a value of 0 for the asymmetrical logical unit access field, indicating asymmetric logical unit access is not supported.

3PC
The library returns a value of 0, indicating third-party commands are not supported.

BQUE
The library returns a value of 0, indicating basic queuing is not supported.

VS
Vendor Specific bit is set to 0, indicating there is no vendor-specific information with this command.

MultiP
The library returns a value of 0, indicating multi-port attachments are not supported.

MChngr
The library is not embedded in or attached to a medium transport element and returns a value of 0.

RelAdr
The library returns a value of 0 for the relative addressing bit, indicating relative addressing is not supported.

LINKED
The library returns a value of 0 for the LINKED command bit, indicating linked commands are not supported.

CmdQue
The library returns a value of 0, indicating Command Queing is not supported.

SftRe
The library returns a value of 0, indicating Soft Reset is not supported.

Vendor Identification
Contains the ASCII character sequence “SUN” followed by blanks. If the specified logical unit is not supported, this field contains all blanks.

Product Identification
This field contains the ASCII character sequence “ACSLS-SCSI” followed by blanks.

Product Revision Level
For ACSLS, the initial product revision level is 1000.

Supported Pages Definition

The library returns 7d bytes of supported page data in the format shown below.

Figure 3–9 Descriptor Block - Supported Pages Definition

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (00h)							
2	Reserved (00h)							
3	Additional Page Length (03h)							
4	Supported Pages (00h)							
5	Supported Pages (80h)							
6	Supported Pages (83h)							

ACS_039

Peripheral Qualifier
The library returns a value of 000b, which indicates that the library is a single logical unit number (LUN). If a logical library is not currently mapped to the LUN, this field is set to 011b.

Peripheral Device Type
The library returns a value of 8h, which indicates that the library is a medium changer device. If a logical library is not currently mapped to the LUN, this field is set to 1fh.

Page Code
Identifies the page as the supported pages (00h).

Page Length
Indicates that three vital pages are supported (03h).

Supported Page
The first supported page value is set to:

- 00h = Indicates the first vital page is page 0 (current page)
- 80h = Indicates the second vital page ("Unit Serial Number Page Definition" on page 3-8)
- 83h = Indicates the third vital page ("Device Identification Page (Fibre Only)" on page 3-9)

Unit Serial Number Page Definition

Figure 3–10 Descriptor Block - Unit Serial Number Page Definition

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (80h)							
2	Reserved (00h)							
3	Additional Page Length (0Ch)							
4 to 15	Unit Serial Number							

ACS_040

Peripheral Qualifier
The library returns a value of 000b, which indicates that the library is a single logical unit number (LUN). If a logical library is not currently mapped to the lun, this field is set to 011b.

Peripheral Device Type
The library returns a value of 8h, which indicates that the library is a medium changer device. If a logical library is not currently mapped to the lun, this field is set to 1fh.

Page Code
This field is set to 80h, identifying the page as the unit serial number page.

Additional Page Length
This field is set to 0Ch, the number of bytes in the product serial number.

Unit Serial Number
Serial numbers for logical libraries consist of 12 ASCII numeric (0-9) characters that uniquely identify the library. The format is SSSSSSSSNNN where:

- SSSSSSSS is the unique software serial number of the system.
- NNNN is the ID of the logical library partition within the system (0-9999).

Device Identification Page (Fibre Only)

The library returns 24 bytes of device identification page data (page 83h) in the format shown below.

Figure 3–11 Descriptor Block - Device Identification Page (Fibre Only)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (83h)							
2	Reserved							
3	Additional Page Length (n-3=14h)							
4	Reserved				Code Set (1h)			
5	Reserved		Association (0h)		Identifier Type (3h)			
6	Reserved							
7	Identifier Length (10h)							
8	NAA (6h)							
9 to 10	IEEE Company ID (00104Fh)							
11								
12 to 15	Vendor Specific ID (0000004A6h)							
16 to 23	Vendor Specific ID Extension							

ACS_041

VPD page 83h returns a NAA type 6 IEEE Registered Extended identifier to uniquely identify the logical library.

Code Set
1h = Identifier field contains binary values

Association
0h = Identifier field is associated with the addressed logical unit

Identifier Type
3h = Identifier field contains an NAA type identifier that is compatible with a Name_ Identifier defined in FC-FS

Identifier Length
10h = NAA type 6h identifier, IEEE Registered Extended, has a fixed length of 16 bytes

IEEE Company ID
This field contains the 24 bit canonical form Object Unique Identifier (OUI) for StorageTek assigned by the IEEE, i.e. 00104Fh.

Vendor Specific ID
The VSID encoding is 0000004A6h, which is the hexadecimal representation of the company unique product code within StorageTek for StorageTek ACSLS 8.x, i.e. 1190d.

Vendor Specific ID Extension
This field contains a hexadecimal encoding of the serial number. Each character of the serial number is represented in a 4 bit nibble. For example, a library with serial number "000012400002" the VSID Extension encoding would be 0000000012400002h.

Log Sense Command (4Dh) — Not Supported

This command is not supported.

Mode Select 6-byte (15h) and Mode Select 10-byte (55h) — Not Supported

These commands are not supported.

Mode Sense 6 (1Ah)

The Mode Sense 6 command (1A) enables the library to report its operating mode parameters to the initiator. The initiator can request one page or all pages of the mode parameters.

The Mode Sense (6) command only supports the Element Address Assignment (1Dh) and Device Capabilities (1Fh) pages. A library can be dynamically changed by the administrator using the GUI. Such changes include:

- increasing or decreasing the number of storage elements
- increasing or decreasing the number of import / export elements
- adding or removing drives

Whenever the administrator makes any of these changes, the system presents a Unit Attention to the client application with the following sense information:

- Sense Key 6h (Unit Attention) ASC / ASCQ 2Ah / 01h (Mode Parameters Changed)

Upon receipt of this Unit Attention, the client application should re-configure the library by using information returned by the Mode Sense command.

Figure 3–12 Descriptor Block - Mode Sense 6 (1Ah)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Reserved (00h)				DBD (1)	Reserved (0)		
2	Page Control		Page Code					
3	SubPage Code (00h)							
4	Allocation Length							
5	Control Byte (00h)							

ACS_042

DBD (Disable Block Descriptors)
Set to 1 to indicate that block descriptor should not be returned.

Page Control
Defines the type of parameters to be returned for the Mode Sense command, values include:

- 0h (00b) = Current Values: The library returns the current parameter values. Since Mode Select is not supported, the current values will always be equal to the default values.
- 1h (01b) = Changeable Values: Not supported. The command terminates with Check Condition status and sense key of Illegal Request (5h) and ASC set to Invalid Field in CDB (24h).
- 2h (10b) = Default Values: The library returns the default values. Since Mode Select is not supported, the default values will always be equal to the current values.
- 3h (11b) = Saved Values: The library returns the saved values. Not supported. The command terminates with Check Condition status and sense key of Illegal Request (5h) and ASC set to Invalid Saving Parameters Not Supported (39h).

Page Code
Specifies which pages the library returns, including:

- 1Dh = Element Address Assignment page
- 1Fh = Device Capabilities page
- 3Fh = All pages (in the above order)

SubPage Code
Not supported.

Allocation Length
Specifies the length of the parameter list the library returns. The maximum length is 2Ch (44d) bytes.The length varies based on the Page Code selected:

- 4 bytes for the parameter list header (always present)
- 20 additional bytes for the Element Address Assignment page
- 20 additional bytes for the Device Capabilities page

The library transfers the number of bytes specified by the Allocation Length or the available Mode Sense data, whichever is less.

Mode Sense Parameter Header

Figure 3–13 Descriptor Block - Mode Sense Parameter Header

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Mode Data Length							
1 to 2	Reserved							
3	Block Descriptor Length (00h)							

ACS_043

Mode Data Length
The bytes of parameter information available regardless of the allocation length. This value excludes the Mode Data Length byte, but includes three additional bytes (for Mode Sense 6-byte) or six additional bytes (for Mode Sense 10-byte) and the length of any mode pages that follow.

Block Descriptor Length
00h = the library does not support block descriptors.

Element Address Assignment Page

Figure 3–14 Descriptor Block - Element Address Assignment Page

	Bit							
Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (1Dh)					
1	Page Length (12h)							
2 to 3	First Medium Transport Element Address							
4 to 5	Number of Medium Transport Elements							
6 to 7	First Storage Element Address							
8 to 9	Number of Storage Elements							
10 to 11	First Import/Export Element Address							
12 to 13	Number of Import/Export Elements							
14 to 15	First Data Transfer Element Address							
16 to 17	Number of Data Transfer Elements							
18 to 19	Reserved (00h)							

ACS_044

PS (Parameters Savable)
Specifies that the library cannot save this page to non-volatile memory and returns a value of 0.

Page Code
Identifies the Element Address Assignment mode page and returns a value of 1Dh.

Parameter Length
Indicates the amount of element address data following this byte and returns a value of 12h.

First Medium Transport Element Address
Identifies the address of the robot and returns a value of 0h.

Number of Medium Transport Elements
Identifies the number of hands within the library and returns a value of 0001h.

First Storage Element Address
Identifies the starting address of the cartridge tape storage cells. The default starting address is 3E8h (100d).

Number of Storage Elements
The number of data cartridge cells in the library or partition. The total number of cartridge tape storage cells depends on how the library is configured.

First Import/Export Element Address
Identifies the address of the first Import/Export element. The default starting address is 000Ah (10d).

Number of Import/Export Elements
Identifies the total number of import/export cells.

First Data Transfer Element Address
Identifies the address of the first tape transport installed in the library. The default address is 1F4h (500d).

Number of Data Transfer Elements
Identifies the number of tape drives in the library, and the library returns the configured count.

Device Capabilities Page

- DT — Data Transfer Element (drive)
- I/E — Import/Export Element (CAP cells)
- ST — Storage Element (cartridge storage cell)
- MT — Medium transport (robot hand)

Figure 3–15 Descriptor Block - Device Capabilities Page

	Bit							
Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved	Page Code (1Fh)					
1	Page Length (12h)							
2	Reserved				StorDT (1)	StorI/E (0)	StorST (1)	StorMT (0)
3	Reserved							
4	Reserved				MT > DT (0)	MT > I/E (0)	MT > ST (0)	MT > MT (0)
5	Reserved				ST > DT (1)	ST > I/E (1)	ST > ST (1)	ST > MT (0)
6	Reserved				I/E > DT (0)	I/E > I/E (0)	I/E > ST (0)	I/E > MT (0)
7	Reserved				DT > DT (1)	DT > I/E (1)	DT > ST (1)	DT > MT (0)
8 to 11	Reserved							
12	Reserved				MT <> DT (0)	MT <> I/E (0)	MT <> ST (0)	MT <> MT (0)
13	Reserved				ST <> DT (0)	ST <> I/E (0)	ST <> ST (0)	ST <> MT (0)
14	Reserved				I/E <> DT (0)	I/E <> I/E (0)	I/E <> ST (0)	I/E <> MT (0)
15	Reserved				DT <> DT (0)	DT< > I/E (0)	DT <> ST (0)	DT <> MT (0)
16 to 19	Reserved							

ACS_045

PS (Parameters Savable)
The library returns 0.

Page Code
1Fh = The Device Capabilities mode page.

Page Length
12h = 18 bytes of device capabilities data to follow.

StorDT
1 = A tape drive can function as element storage.

StorI/E
1 = A CAP cell can function as element storage.

StorST
1 = A cartridge cell can function as element storage.

StorMT
0 = The robot hand cannot function as element storage. You cannot use the robot as the source or destination of a move.

MT > DT, MT > I/E, MT > ST, MT > MT, ST > MT, I/E > MT, DT > MT
0 = The robot hand (MT) cannot be the source or destination of a move.

ST > DT, ST > I/E, ST > ST, I/E > DT, I/E > I/E, I/E > ST, DT > DT, DT > I/E, DT > ST
1 = Tape drives (DT), CAP cells (I/E), and cartridge cells (ST) are valid sources or destinations for a move.

All <> Parameters
0 = The library does not support the exchange medium command.

Mode Sense 10-byte (5Ah) — Not Supported

This command is not supported.

Move Medium (A5h)

The Move Medium command (A5h) moves a cartridge tape from one specific element location to another specific element location. The Mode Sense command provides a matrix with the valid source and destination element combinations for the Move Medium command.

Medium movement occurs only for moves which involve a tape drive. All other move types are logical and do not cause real robotic activity.

> **Note:** Moves to import/export elements cause the medium to be immediately (logically) removed from the library. This means that import / export cells cannot be used as a place to store a volume. A Read Element Status command for an import/export element will always return a response of "empty". Also the command will fail with SenseKey Illegal Request (5h) and ACS/ASCQ Invalid Element (21/01h) if the source element address is an import/export element.

The ACSLS Fast Load setting controls how completion of the move command is reported when the destination element is a tape drive.

With Fast Load enabled, a success status is returned once the operation has been validated and accepted by ACSLS, but before cartridge movement begins. If some

error should occur during movement, ACSLS does not report that information. The client is responsible for identifying when the volume has been loaded and is usable, and for timing out the request in the case of any error.

With Fast Load disabled (the default setting), success status is not returned until the physical library has reported that the movement is complete. However, if an error should occur during movement, ACSLS reports that information to the client.

Please note that physical libraries may provide their own Fast Load option, which can affect the time required before ACSLS would return a success status (but only when ACSLS Fast Load is disabled). When ACSLS Fast Load is enabled, the library setting would have no effect on client notification.

Figure 3–16 Descriptor Block - Move Medium (A5h)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	Reserved (00h)							
2 to 3	Transport Element Address							
4 to 5	Source Element Address							
6 to 7	Destination Element Address							
8 to 9	Reserved (00h)							
10	Reserved (00h)							Invert (0)
11	Move Option		Control Byte (00h)					

ACS_046

Transport Element Address
This field defines the robot element to use and should contain the element address 00h. A value of 00h indicates use of the default hand. If any other value is entered it will be ignored.

Source Element Address
This field is the element address from which the cartridge tape is to be removed. This may be a storage cell or a tape drive.

Destination Element Address
This field is the element address where the cartridge tape is to be placed. This may be a storage cell, a CAP cell, or a tape drive.

Invert
The library does not support this function and requires a value of 0.

Move Option
These two bits define optional operations associated with the Move Medium command.

- 00 = The library performs a normal move medium operation
- 10 = The library performs a mount operation with write protect enabled. That is, the user can read the data on the cartridge but cannot write to the cartridge.

  This option is valid only when the destination element address is a data transfer element. If the destination data transfer element (tape drive) does not support this feature or fails to acknowledge the write-protected mount option, the mount fails. In either case, the library returns the Hardware Error sense key (04) with an ASC of 40 and an ASCQ of 02 (Drive Error).

- 11 = The data transfer element specified in the source element field performs a rewind, followed by a unload operation and then the move medium operation.

  This option is valid only when the source element address is a data transfer element. Use this option with care because it might interfere with operations being performed on the data path of the data transfer element.

Persistent Reserve In (5Eh) — Not Supported

This command is not supported.

Persistent Reserve Out (5Fh) — Not Supported

This command is not supported.

Position to Element (2Bh)

The Position to Element command (2Bh) moves the virtual hand to the specified element. For the library, the command is supported but does not perform any action.

Figure 3–17 Descriptor Block - Position to Element (2Bh)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Reserved (00h)							
2 to 3	Transport Element Address							
4 to 5	Destination Element Address							
6 to 7	Reserved (00h)							
8	Reserved (00h)							Invert (0)
9	Control Byte (00h)							

ACS_047

Transport Element Address
This field defines the hand element to use and should contain the element address of the hand or 00h (0d). A value of 00h (0d) indicates use of the default hand.

Destination Element Address
This field defines the address of the element where the hand is to be positioned.

Invert
The library does not support this function and requires a value of 0.

Prevent/Allow Medium Removal (1Eh)

The Prevent/Allow Medium Removal command (1Eh) requests that the library enable or disable operator panel access to the cartridge access port (CAP). Since a logical library does not contain a physical CAP, this command is supported for compatibility but does not perform any action.

Figure 3–18 Descriptor Block - Prevent/Allow Medium Removal (1Eh)

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

ACS_048

Prevent Bit

0 = The library allows operator panel access to unlock and open the indicated CAP.

1 = The library prevents access to the indicated CAP.

Read Element Status (B8h)

The Read Element Status command (B8h) requests that the library return the status of the elements in the library.

Figure 3–19 Descriptor Block - Read Element Status (B8h)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Reserved (00h)			VolTag	Element Type Code			
2 to 3	Starting Element Address							
4 to 5	Number of Elements							
6	Reserved (00h)						CurData	DvcID
7 to 9	Allocation Length							
10	Reserved (00h)							
11	Control Byte (00h)							

ACS_049

Vol Tag

0 = Volume Tag information is not reported

1 = Volume Tag information is reported

Volume Tag information can be returned in more than one format. All formats are left justified and padded with ASCII blanks through byte 32, bytes 33-36 are zero. The library does not support sequence numbers. The format to be used is configured using the GUI. Configurable formats include:

- **6-character** — format `vvvvvv`, where:
  `vvvvvv` is the ascii volser
- **8-character Suffixed** — format `vvvvvvdt` or `vvvvvvbt`, where:
  `vvvvvv` is the ascii volser
  `d` is the media domain
  `b` is the an ascii blank
  `t` is the media type
- **8-character Prefixed** — format `dtvvvvvv` or `btvvvvvv`, where:
  `d` is the media domain
  `b` is the an ascii blank
  `t` is the media type
  `vvvvvv` is the ascii volser

- **Open Format** — the complete bar code as reported by the backing physical library.

Element Type Code

0h = All Element Types reported. The element types are reported in ascending element address order, beginning with the first element greater than or equal to the Starting Element Address.

1h = Medium Transport Element (hand)

2h = Storage Element (cartridge tape storage cells)

3h = Import/Export Element (CAP cells and PTP cells)

4h = Data Transfer Element (tape drive)

Starting Element Address

This field specifies the minimum element address to report. Only elements with an element address greater than or equal to the Starting Element Address are reported.

Element descriptor blocks are not generated for undefined element addresses.

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.

Number of Elements

This field represents the maximum number of element descriptors to be transferred. This is an actual number of element descriptors to be transferred, not an element address range.

Cur Data

0 = Library operations are normal, and library mechanics may become active if needed to gather element static data.

1 = The library is responding with data only; no mechanical operations are active. The CurData bit is effectively ignored by the library. The library will perform or not perform mechanical operations to obtain proper information at its discretion independently of the setting of this bit.

DvcID

0 = The library will not return device identification information.

1 = The library will return device identification information only for data transfer elements.

Allocation Length

This field specifies the length in bytes of the space allocated by the initiator for the transfer of element descriptors. Only complete element descriptors are transferred. Element descriptors are transferred until one of the following conditions is met:

- All available element descriptors of the type specified in the Element Type Code have been transferred.
- The number of element descriptors specified in the Number of Elements field have been transferred.
- There is less allocation length space available than required for the next complete element descriptor or header to be transferred.

Read Element Status Data

The library returns data for a Read Element Status command with an eight-byte Element Status Data header, followed by one to four element pages, one page per element type.

A page consists of an eight-byte Element Status Page header, followed by one or more Element Descriptors. The format of the descriptor is based on the element type reported in this page. Each element type receives a separate Element Descriptor format.

Data can be truncated based on the length specified in the allocation field.

Element Status Data Header Definition

The library sends this header once for each Read Element Status command.

Figure 3–20 Descriptor Block - Element Status Data Header Definition

	Bit							
Byte	7	6	5	4	3	2	1	0
0 to 1	First Element Address Reported							
2 to 3	Number of Elements Available							
4	Reserved (00h)							
5 to 7	Byte Count of Report Available (all pages, *n* - 7)							
8 to *n*	Element Status Page							

ACS_050

First Element Address Reported
This field indicates the lowest element address found of the type specified in the Element Type Codes and greater than or equal to the Starting Element Address.

Number of Elements Available
This field indicates the number of elements found of the type specified in the Element Type Codes and greater than or equal to the Starting Element Address. This number is adjusted to be less than or equal to the count specified in the Number of Elements field in the Read Element Status command.

Byte Count of Report Available
This field indicates the number of bytes of element status data available for all elements meeting the requirements of the Read Element Status command. This count does not include the Element Status Data header bytes. This value is not adjusted to match the allocation length from the command.

Element Status Page Header

The library sends this header once for each type of element descriptors.

Figure 3–21 Descriptor Block - Element Status Page Header

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Reserved				Element Type Code			
1	PVolTag	AVolTag (0)	Reserved (0)					
2 to 3	Element Descriptor Length							
4	Reserved (00h)							
5 to 7	Byte Count of Report Available (all pages, *n* - 7)							
8 to *n*	Element Descriptor							

ACS_051

Element Type Code
See "Element Type Code" on page 3-18 .

PVolTag
0 = Volume Tag information has not been requested. The data is omitted from the element descriptors.

1 = Volume Tag information has been requested to be reported and is present.

AVolTag
The library does not support alternative volume tags (AVolTag) and returns a value of 0.

Element Descriptor Length
This field indicates the total number of bytes contained in a single element descriptor.

Byte Count of Descriptor Data Available
This field indicates the total number of bytes of element descriptor data available for the elements of this element type that meet the requirements of the Read Element Status command. This count does not include the Element Status Page header bytes. This value is not adjusted to match the allocation length.

Element Descriptors
See below.

Element Descriptors

The following sections contain the field definitions for the four types of library elements, which are:

- Medium Transport Element (the hand)
- Storage Element (cartridge tape storage cells)
- Import/Export Element (CAP cells and PTP cells)
- Data Transfer Element (tape drives)

Each element descriptor includes the element address and status flags. Each element descriptor might also contain sense key information as well as other information, depending on the element type.

The element descriptors for the four types of elements are similar, with the exception of a few fields. Note the differences in Bytes 02, 06, and 07 for the four 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

Medium transport elements are robotic components capable of physically moving cartridges. The Medium Transport Element Descriptor defines the robot characteristics.

Figure 3–22 Medium Transport Element Descriptor

Byte		Bit							
PVolTag=0	PVolTag=1	7	6	5	4	3	2	1	0
0 to 1	0 to 1	Element Address							
2	2	Reserved (00h)					Except	Reserved	Full
3	3	Reserved (00h)							
4	4	Additional Sense Code							
5	5	Additional Sense Code Qualifier							
6 to 8	6 to 8	Reserved (00h)							
9	9	SValid	Invert (0)	Reserved (00h)		ED	Medium Type		
10 to 11	10 to 11	Source Storage Element Address							
--	12 to 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
12	48	Reserved (0h)				Code Set (0)			
13	49	Reserved (0h)				Identifier Type (0)			
14	50	Reserved (00h)							
15	51	Identifier Length (0)							
16	52	Media Domain							
17	53	Media Type							
18 to 19	54 to 55	Reserved (00h)							

ACS_052

Storage Element Descriptor

Storage elements are the main cartridge tape storage cells of the library.The Storage Element Descriptor describes a storage cell.

Figure 3–23 Storage Element Descriptor

Byte		Bit							
PVolTag=0	PVolTag=1	7	6	5	4	3	2	1	0
0 to 1	0 to 1	Element Address							
2	2	Reserved (00h)				Access (1)	Except	Reserved	Full
3	3	Reserved (00h)							
4	4	Additional Sense Code							
5	5	Additional Sense Code Qualifier							
6 to 8	6 to 8	Reserved (00h)							
9	9	SValid	Invert (0)	Reserved (00h)		ED	Medium Type		
10 to 11	10 to 11	Source Storage Element Address							
--	12 to 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
12	48	Reserved (0h)				Code Set (0)			
13	49	Reserved (0h)				Identifier Type (0)			
14	50	Reserved (00h)							
15	51	Identifier Length (0)							
16	52	Media Domain							
17	53	Media Type							
18 to 19	54 to 55	Reserved							

ACS_053

Import/Export Element Descriptor

Import/Export elements are the CAP and/or Pass-thru cells of the library. The Import/Export Element Descriptor describes a CAP cell.

Figure 3–24 Import/Export Element Descriptor

Byte		Bit							
PVolTag=0	PVolTag=1	7	6	5	4	3	2	1	0
0 to 1	0 to 1	Element Address							
2	2	OIR	CMC	InEnab (0)	ExEnab(1)	Access	Except	ImpExp	Full
3	3	Reserved (00h)							
4	4	Additional Sense Code							
5	5	Additional Sense Code Qualifier							
6 to 8	6 to 8	Reserved (00h)							
9	9	SValid	Invert (0)	Reserved (00h)		ED	Medium Type		
10 to 11	10 to 11	Source Storage Element Address							
--	12 to 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
12	48	Reserved (0h)				Code Set (0)			
13	49	Reserved (0h)				Identifier Type (0)			
14	50	Reserved (00h)							
15	51	Identifier Length (0)							
16	52	Media Domain							
17	53	Media Type							
18 to 19	54 to 55	Reserved (00h)							

ACS_054

Data Transfer Element Descriptor

Data transfer elements are the tape drives in the library. The Data Transfer Element Descriptor Definitions page describes a tape drive.

Figure 3–25 Data Transfer Element Descriptor (DvcID = 0)

Byte		Bit							
PVolTag=0	PVolTag=1	7	6	5	4	3	2	1	0
0 to 1	0 to 1	Element Address							
2	2	Reserved (0h)				Access	Except	Reserved	Full
3	3	Reserved (00h)							
4	4	Additional Sense Code							
5	5	Additional Sense Code Qualifier							
6 to 8	6 to 8	Reserved (00h)							
9	9	SValid	Invert (0)	Reserved (00h)		ED	Medium Type		
10 to 11	10 to 11	Source Storage Element Address							
--	12 to 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
12	48	Reserved (0h)				Code Set (0)			
13	49	Reserved (0h)				Identifier Type (0)			
14	50	Reserved (00h)							
15	51	Identifier Length (0)							
16	52	Media Domain							
17	53	Media Type							
18	54	Transport Domain							
19	55	Transport Type							
20 to 51	56 to 87	Transport Serial Number							

ACS_055

Figure 3–26 Data Transfer Element Descriptor (DvcID = 1)

Byte		Bit							
PVolTag=0	PVolTag=1	7	6	5	4	3	2	1	0
0 to 1	0 to 1	Element Address							
2	2	Reserved (0h)				Access	Except	Reserved	Full
3	3	Reserved (00h)							
4	4	Additional Sense Code							
5	5	Additional Sense Code Qualifier							
6 to 8	6 to 8	Reserved (00h)							
9	9	SValid	Invert (0)	Reserved (00h)		ED	Medium Type		
10 to 11	10 to 11	Source Storage Element Address							
--	12 to 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
12	48	Reserved (0h)				Code Set (2)			
13	49	Reserved (0h)				Identifier Type (1)			
14	50	Reserved (00h)							
15	51	Identifier Length (*n*)							
16 to 16+*n*-1	52 to 52+*n*-1	Identifier (Drive ASCII Serial Number)							
32 - *n* bytes	32 - *n* bytes	Identifier Pad							
48	84	Media Domain							
49	85	Media Type							
50	86	Transport Domain							
51	87	Transport Type							

ACS_056

Element Descriptor Definitions

Element Address
The address of the element (robot hand, cartridge cell, CAP cell, drive, or empty drive slot).

OIR
0 = No operator intervention required to make the CAP accessible

1 = Operator intervention required to make the CAP accessible

CMC
0 = The import/export element is a CAP. The cartridge will not leave the library when prevented by the Prevent/Allow Medium Removal (1Eh) command.

InEnab
1 = The CAP supports importing cartridges.

ExEnab
1 = The CAP supports exporting cartridges.

Access
0 = The robot cannot access the element. For Import/Export elements, this can occur when the CAP is open or a CAP magazine was removed. For Data transfer elements, this can occur when a cartridge is loaded in a drive.

1 = The robot can access the element

Except
0 = The element is in a normal state

1 = The element is in an abnormal state. The Additional Sense Code (ASC) and the Additional Sense Code Qualifier (ASCQ) fields contain information regarding the abnormal state. Other fields in the descriptor might be invalid and should be ignored.

ImpExp
0 = The robot placed the cartridge in the CAP for an export operation.

1 = An operator placed the cartridge in the CAP for an import operation.

Full
0 = The element does not contain a cartridge

1 = The element contains a cartridge

ASC (Additional Sense Code)
This field is valid only if the Except bit is set. In the case of an exception, it contains an ASC as defined for Request Sense data.

ASCQ (Additional Sense Code Qualifier)
This field is valid only if the Except bit is set. In the case of an exception, it contains an ASCQ as defined for Request Sense data.

Condition	ASC Value	ASCQ Value
CAP Open	3Ah	02h
Empty Drive Slot (no drive installed)	3Bh	1Ah
Drive Hardware Error	40h	02h

SValid
0 = The Source Element Address and Invert fields are not valid.

1 = The Source Element Address and Invert fields are valid.

Invert (not supported)
0 = The library does not support multi-sided media.

ED
0 = The element is enabled.

1 = The element is disabled (for example an open CAP, a drive hardware error, or empty drive slot).

Medium Type
The type of medium currently present in the element as determined by the medium changer.

0h = Unspecified - the medium changer cannot determine the medium type.

1h = Data Medium

2h = Cleaning Medium

Source Storage Element Address
This field is valid only if the SValid field is 1. This field provides the address of the last storage element this cartridge occupied. The element address value may or may not be the same as this element.

Primary Volume Tag Information

When PVolTag is 1, the library returns volume tag information. When PVolTag is 0, the library omits volume tag information.

The Primary Volume Tag field contains the null-terminated ASCII barcode label on the tape cartridge. If the label on the cartridge tape is not readable or if the element is empty, the Primary Volume Tag field is filled with 36 bytes of zeros. The "Volume Label Format" controls the presentation of the volser in the Primary Volume Tag field. The library supports the following settings:

- Full Label
- No Type Checking
- Prepend Last Two Characters
- Trim Last Character
- Trim Last Two Characters
- Trim First Two Characters
- Trim First Character

For more information, see the SL4000 GUI help.

Code Set

0h = Reserved (not supported) for the Medium Transport Element, Storage Element, Import/Export Element, or Data Transfer Element (DvcID = 0) descriptors.

2h = The identifier contains ASCII graphic codes (code values 20h through 7Eh) for Data Transfer Element (DvcID = 1) descriptor.

Identifier Type

The format and assignment authority for the identifier.

0h = The library returns vendor specific data.

Identifier Length

The combined length of the Identifier and the Identifier Pad.

00h = The library returns 0 bytes of identifier data in the descriptors for Medium Transport Elements, Storage Elements, Import/Export Elements, or Data Transfer Elements (DvcID = 0).

20h = The library returns 32 bytes of identifier data for the Data Transfer Element (DvcID = 1).

Identifier (for Data Transfer Element DvcID = 1 Only)

The ASCII Serial Number for the tape drive associated with this data transfer element.

Identifier Pad (for Data Transfer Element DvcID = 1 Only)

Contains ASCII blanks. The number of blanks depends on the length of the Identifier field. The combined length of the Identifier field and the Identifier Pad is 32 bytes.

Media Domain

43h ('C') = The element contains a cleaning cartridge.

4Ch ('L') = The element contains an LTO cartridge.

54h ('T') = The element contains a T10000 cartridge.

FFh = The media domain cannot be determined or the element is empty.

Media Type

FFh = The media type cannot be determined or the element is empty.

If the Media Domain is 43h (C):

- C = The element contains a T10000 Version 2 cleaning cartridge
- L = The element contains a T10000 Universal cleaning cartridge.
- T = The element contains a T10000 Version 1 cleaning cartridge.
- U = The element contains a Universal LTO cleaning cartridge.

If the Media Domain is 4Ch (L):

- 3 = The element contains a 400 GB Generation 3 LTO cartridge.
- 4 = The element contains an 800 GB Generation 4 LTO cartridge.
- 5 = The element contains a 1.5 TB Generation 5 LTO cartridge.
- 6 = The element contains a 2.5 TB Generation 6 LTO cartridge.
- 7 = The element contains a 6 TB Generation 7 LTO cartridge.
- 8 = The element contains a 12 TB Generation 8 LTO cartridge.
- T = The element contains a 400 GB Generation 3 LTO WORM cartridge.
- U = The element contains an 800 GB Generation 4 LTO WORM cartridge.
- V = The element contains a 1.5 TB Generation 5 LTO WORM cartridge.
- W = The element contains a 2.5 TB Generation 6 LTO WORM cartridge.
- X = The element contains a 6 TB Generation 7 LTO WORM cartridge.
- Y = The element contains a 12 TB Generation 8 LTO WORM cartridge.

If the Media Domain is 54h (T):

- 1 = The element contains a T10000 Version 1 cartridge.
- 2 = The element contains a T10000 Version 2 cartridge.
- S = The element contains a T10000 Version 1 Sport cartridge.
- T = The element contains a T10000 Version 2 Sport cartridge.

Transport Domain

4Ch (L) = The drive supports LTO cartridges.

54h (T) = The drive supports T10000 cartridges.

FFh = The element domain cannot be determined.

Transport Type

FFh = The type cannot be determined.

If the Transport Domain is 4Ch (L):

- 3Bh = HP Generation 5 LTO drive
- 3Ch = IBM Generation 5 LTO drive
- 3Dh = HP Generation 6 LTO drive.
- 3Eh = IBM Generation 6 LTO drive.
- 2Dh = IBM Generation 7 LTO drive.
- 2Eh = IBM Generation 8 LTO drive.

If the Transport Domain is 54h (T):

- 0Dh = StorageTek T10000A drive.
- 0Eh = StorageTek T10000A drive in 3590 emulation mode.
- 18h = StorageTek T10000A Encrypting drive.
- 19h = StorageTek T10000A Encrypting drive in 3590 emulation mode.
- 1Ah = StorageTek T10000B drive.
- 1Bh = StorageTek T10000B drive in 3590 emulation mode.
- 1Ch = StorageTek T10000B Encrypting drive.
- 1Dh = StorageTek T10000B Encrypting drive in 3590 emulation mode.
- 22h = StorageTek T10000C drive.
- 23h = StorageTek T10000C drive in 3590 emulation mode.
- 24h = StorageTek T10000C Encrypting drive.
- 25h = StorageTek T10000C Encrypting drive in 3590 emulation mode.
- 26h = StorageTek T10000D drive.
- 27h = StorageTek T10000D drive in 3590 emulation mode.
- 28h = StorageTek T10000D Encrypting drive.
- 29h = StorageTek T10000D Encrypting drive in 3590 emulation mode.
- 2Ah = StorageTek T10000D Fibre Channel over Ethernet.
- 2Bh = StorageTek T10000D Fibre Channel over Ethernet Encrypting drive.

Transport Serial Number

The 32-byte ASCII serial number for the drive.

For drives with a serial number less than 32 bytes, the library left-justifies the value by returning ASCII blanks for the unused less-significant bytes. If the serial number is not available from a drive that should support an ASCII serial number, the library returns all ASCII blanks.

Release 6-byte (17h) and Release 10-byte (57h) — Not Supported

These commands are not supported.

Report LUNs (A0h)

The Report LUNs command (A0) returns to the initiator the known LUNs to which the initiator can send commands. Each LUN returned represents a logical library. Only LUN 0 is supported in the library.

Figure 3–27 Descriptor Block - Report LUNs (A0h)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (A0h)							
1	Reserved (00h)							
2	Select Report							
3 to 5	Reserved (00h)							
6 to 9	Allocation Length							
10	Reserved (00h)							
11	Control Byte (00h)							

ACS_057

Allocation Length
This field specifies the number of bytes that the initiator has allocated for data to be returned from the Report LUNs command.

The Allocation must be at least 16 bytes. If it is less, a check condition is returned with the sense key set to illegal request and the additional sense data set to invalid field in the command descriptor block (CDB).

Select Report
This field specifies the type of logical unit addresses that shall be reported.

00h = The LUN addresses reported shall be limited to the following addressing methods: LUN addressing method, Peripheral device addressing method, and flat space addressing method.

02h = All LUNS accessible to the initiator for this port are accessible

Report LUNs Data Definition

The target device returns the following data for the Report LUNs command.

Figure 3–28 Descriptor Block - Report LUNs Data Definition

	Bit							
Byte	7	6	5	4	3	2	1	0
0 to 3	LUN list length (n-7)							
4 to 7	Reserved (00h)							
8 to 15	First LUN							
...	...							
n-7 to n	Last LUN							

ACS_058

LUN list length
The target device returns a LUN list length of n-7. Each LUN returned represents a logical library. If no logical libraries have been mapped for the requesting initiator, LUN 0 is still returned.

Request Sense (03h)

The Request Sense command (03) requests the library transfer sense data to the initiator.

Logical libraries use an FC-2 conforming transport that provides autosense. This means that sense data for a failed command is always returned with a Check Condition status in the command response and is never saved by the target. Therefore,

Request Sense will always return Sense Data with a Sense Key set to No Sense and ASC/ASCQ fields set to 0.

However, all Sense Keys and associated ASC/ASCQ fields that can be returned by other commands are documented here.

Figure 3–29 Descriptor Block - Request Sense (03h)

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Operation Code (03h)							
1	Reserved (00h)							Desc (0)
2 to 3	Reserved (00h)							
4	Allocation Length							
5	Control Byte (00h)							

ACS_059

Desc
The Desc bit indicates which sense data format shall be returned.

The library returns a value of 0, indicating fixed format sense data is returned.

Allocation Length
This field specifies the number of bytes that the initiator has allocated for returned sense data. The library provides a maximum of 14h (20d) bytes of sense data.

Request Sense Data Definitions

Figure 3–30 Descriptor Block - Request Sense Data Definitions

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Valid (0)	Error Code (70h)						
1	Segment Number (00h)							
2	Reserved (0)				Sense Key			
3 to 6	Information (00h)							
7	Additional Sense Length (0Ch)							
8 to 11	Command Specific Information (00h)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Field Replaceable Unit Code (00h)							
15	SKSV	C/D	Reserved (0)		BPV (0)	Bit Pointer (0h)		
16 to 17	Field Pointer							
18 to 19	Reserved							

ACS_060

Valid
0 = The library does not return data in the Information field.

Error Code
70h = The library returns only current errors.

Segment Number
00h = The library does not support segment numbers.

Sense Key
Describes the error, along with ASC and ASCQ. See Additional Sense Codes and Qualifiers.

0h = No Sense, indicating a successful command.

2h = Not Ready

3h = Medium Error

4h = Hardware Error

5h = Illegal Request

6h = Unit Attention

Bh = Aborted Command

Information
00h = The library does not support this field.

Additional Sense Length
0Ch = Indicates there are 12d bytes of additional sense bytes to follow. This value is not truncated to reflect the actual transfer length.

Command Specific Information
00h = The library does not support this field.

Additional Sense Code (ASC)
Describes the error. See Additional Sense Codes and Qualifiers.

Additional Sense Code Qualifier (ASCQ)
Describes the error. See Additional Sense Codes and Qualifiers.

Field Replaceable Unit Code
00h = The library does not support this field.

SKSV (Sense Key Specific Valid)
1 = The C/D and field pointer are valid

0 = Ignore the C/D and field pointer

C/D (Command/Data)
0 = The check condition status resulted from illegal parameter in the parameter list.

1 = The check condition status resulted from illegal parameter in the CDB.

BPV (Bit Pointer Valid)
0 = The library does not support this field.

Bit Pointer
0h = The library does not support this field.

Field Pointer
The number of the byte where the error occurred. When a multiple-byte field is in error, the Field Pointer contains the value of the most significant byte of the field, which is lowest byte number. Byte numbers start at 00.

Additional Sense Codes and Qualifiers

- Not Ready Sense Key Code (2h)

- Hardware Error Sense Key Code (4h)
- Illegal Request Sense Key Code (5h)
- Unit Attention Sense Key Code (06h)
- Aborted Command Sense Key Code (0Bh)

Not Ready Sense Key Code (2h)

The library generates a Not Ready error code if you send a command when the library is in a not ready state.

Description	Sense Key	ASC	ASCQ
Not Ready, Maintenance Mode	2h	04h	81h

Not Ready, Maintenance Mode

The library was placed in maintenance mode from the operator panel or user interface. The logical library is offline.

Hardware Error Sense Key Code (4h)

The library generates a Hardware Error if it detects a hardware or firmware error during command execution.

Description	Sense Key	ASC	ASCQ
Hardware Error, Tape Drive	4h	40h	02h
Hardware Error, Internal Target Failure	4h	44h	00h

Hardware Error, Tape Drive

An operation to the drive failed. The problem could be the tape drive or the interface between the library and tape drive.

Hardware Error, Internal Target Failure

The library generates a hardware error when an unexpected condition is detected by ACSLS software that controls the SCSI interface. This error is used for arbitrary limitations of the software.

Illegal Request Sense Key Code (5h)

Any illegal parameters in the CDB or parameter list for a particular command generates an Illegal Request sense key.

In some cases, additional information is available in Byte 15 of the sense data, which includes the sense-key-specific-value (SKSV) and command/data (C/D) fields. This information indicates the byte in the command descriptor block or the parameter list that is in error. If available, the SKSV bit in the sense data is set to 1.

Description	Sense Key	ASC	ASCQ	SKSV
Invalid Command Operation Code	5h	20h	00h	Yes
Invalid Element Address	5h	21h	01h	No
Invalid Field in CDB	5h	24h	00h	Yes
Logical Unit Not Supported	5h	25h	00h	No

Description	Sense Key	ASC	ASCQ	SKSV
Incompatible Medium	5h	30h	00h	No
Saving Parameters Not Supported	5h	39h	00h	Yes
Medium Not Present, Drive Not Unloaded	5h	3Ah	00h	No
Destination Element Full	5h	3Bh	0Dh	No
Source Element Empty	5h	3Bh	0Eh	No

Unit Attention Sense Key Code (06h)

The library generates a Unit Attention sense key for all initiators if the library needs to inform the host of an asynchronous event.

Description	Sense Key	ASC	ASCQ
Not Ready-to-Ready Transition	06h	28h	00h
CAP Element Accessed	06h	28h	01h
Mode Parameters Changed	06h	2Ah	01h
Reservations Preempted	06h	2Ah	03h
Reservations Released	06h	2Ah	04h
Registrations Preempted	06h	2Ah	05h
LUNs Data Has Changed	06h	3Fh	0Eh

Not Ready to Ready Transition

The library transitioned to a Ready state from a Not Ready state. The library sends this unit attention to all initiators.

CAP Element Accessed

The operator opened and closed the CAP. The library sends this unit attention to all initiators. You can issue a Read Element Status command to obtain an updated inventory (see Read Element Status (B8h).

Mode Parameters Changed

The operator added or removed elements from a partition. Send a Read Element Status (B8h) command to obtain an updated inventory. Send a Mode Sense command with Element Address page code to request the current count of each element type.

Persistent Reservations/Registrations Preempted or Released

A different initiator issued a Persistent Reservation Out command that cleared the registration for this initiator or cleared a reservation that affects this initiator.

LUNs Data Has Changed

The LUN configuration for the initiator has changed. The library sends this unit attention when the operator adds or removes a LUN connection from a partition for the initiator.

Aborted Command Sense Key Code (0Bh)

The library generates an Aborted Command error code when a SCSI command is aborted.

Description	Sense Key	ASC	ASCQ
Command Overlap	0Bh	4Eh	00h

Command Overlap
The library detected another command from an initiator while one was already in process.

Request Volume Element Address (B5h) — Not Supported

This command is not supported.

Reserve 6-byte (16h) and Reserve 10-byte (56h) — Not Supported

This command is not supported.

Send Diagnostic (1Dh) — Not Supported

This command is not supported.

Send Volume Tag (B6h) — Not Supported

This command is not supported.

Test Unit Ready (00h)

The Test Unit Ready command (00h) allows the initiator to determine if the library is powered-on and ready to accept additional commands. This is not a request for a library self-test.

The Test Unit Ready command returns a Good status if the library is ready to accept additional commands. This command also returns a Check Condition if the library is not ready or if there are pending Unit Attentions.

Figure 3–31 Descriptor Block - Test Unit Ready (00h)

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

ACS_061

Write Buffer (3Bh) — Not Supported

This command is not supported.