L20/L40/L80 Tape Libraries

SCSI Reference Manual

STORAGETEK

L20/L40/L80 Tape Libraries

SCSI Reference Manual

Fourth Edition (March 2003)

Summary of Changes

EC released document table

EC Number	Date	Edition	Description
111515	August 2000	Initial Release	
111596	December 2000	Second	Add L40 information. Add LTO drive and cartridge information.
111597	January 2001	Third	Add L80 information.
111832	March 2003	Fourth	Added Playground Element Descriptor Definition. Added HP Ultrium 2 drive information Added L2 media type information

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Preface

This manual is intended to be used by 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) for the L20,L40 and L80 tape libraries (referred to in this manual as "the L20 library" ,"L40 library" ,"L80 library" or "the library").

This manual contains information about the small computer system interface, including SCSI characteristics, library features, SCSI bus operations, SCSI commands, status byte data, and sense data.

Note: This manual *does not* describe the SCSI bus controls and commands for the *tape drives* in the library.

■ Organization

This manual contains four chapters, one appendix, a glossary, and an index:

Chapter 1 "General Information" contains a high-level overview about the small computer system interface.

Chapter 2 "SCSI Bus Physical Description" describes both the single-ended and differential alternatives for the interface attachments.

Chapter 3 "SCSI Bus Operations" explains the seven elements that the small computer system interface uses for controlling the interface, transferring data, issuing commands, and returning status.

Chapter 4 "SCSI Commands" lists and defines the commands for the library.

Appendix A "Element Mapping" shows the cell mappings and configurations for the library.

Glossary Contains a list of terms and abbreviations.

Index Helps you locate information in this manual.

■ **Alert Messages**

Alert messages call the reader's attention to information that is especially important or that has a unique relationship to the main text or graphic.

Note: A note provides additional information that is of special interest. A note might point out exceptions to rules or procedures. A note usually, but not always, follows the information to which it pertains.

CAUTION:
A caution informs the reader of conditions that might result in damage to hardware, corruption of data, corruption of application software, or long-term health problems in people. A caution always precedes the information to which it pertains.

WARNING:
A warning alerts the reader to conditions that might result in injury or death. A warning always precedes the information to which it pertains.

■ **Conventions**

Typographical conventions highlight special words, phrases, and actions in this publication.

Item	Example	Description of Convention
Acronyms	CSA	All uppercase
Buttons	MENU	Sans serif font; capitalization follows interface (usually all uppercase)
Commands	Mode Select	Initial cap
Document titles	*System Assurance Guide*	Italic
Emphasis	*not* or *must*	Italic
File names	`fsc.txt`	Monospace font
Hypertext links	Figure 2-1 on page 2-5	Blue (prints black in hard-copy publications)
Indicators	*Open*	Italic; capitalization follows interface (usually initial caps)
Jumper names	TERMPWR	All uppercase
Keyboard keys	<Y> <Enter> or <Ctrl+Alt+Delete>	Sans serif; capitalization follows interface (usually initial caps); enclosed within angle brackets

Item	Example	Description of Convention
Menu names	Configuration Menu	Capitalization follows interface; usually title caps
Parameters and variables	Device = *xx*	Italic
Path names	`c:/mydirectory`	Monospace font
Port or connector names	SER1	Capitalization follows label on unit; otherwise, all uppercase
Positions for circuit breakers, jumpers, and switches	ON	Default font; capitalization follows interface; otherwise, all uppercase
Screen text (including screen captures, screen messages, and user input)	`downloading`	Monospace
Switch names	Power	Sans serif; capitalization follows label on unit
URLs	www.storagetek.com	Blue (prints black in hard-copy publications); underlined; split at forward slash or period

■ Related Publications

For your convenience, the following sections list publications that provide information about the interfaces and libraries mentioned in this manual. Listed publications are subject to change without notice.

SCSI

The following publications contain information related to the Small Computer System Interface (SCSI). Be sure to refer to the latest revision or edition.

Publication	Part Number
American National Standard Dictionary for Information Processing Systems	X3/TR-1-82
American National Standard Metric Practice	ANSI/IEEE 268-1982
Data Processing Equipment, CSA Standard C22.2	154-M1983
Electronic Industries Association Standards	RS-301B and RS-485
Electronic Data Processing Systems and Units	UL478
FCC Rules and Regulations *Volume 2, Subpart J, Parts 2 and 15*	http://www.fcc.gov/oet/info/rules
SCSI–3 Primary Commands (SPC–2)	T10/Project 1236D
SCSI–3 Medium Changer Commands (SMC)	T10/Project 1383D
SCSI-3 Architecture Model - 2 (SAM-2)	T10/Project 1157D
Office Equipment Safety	VDE 0686/18.81
Radio Interference Suppression	VDE 0871/18.81
Safety of Electrically Energized Office Machines	IEC 380/435
Underwriters Laboratories, Inc. Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances	UL94
TapeAlert Diagnostic Specification Document (Hewlett Packard)	http://www.hp.com/tape/tapealert/talog.html

Tape Drives

The following publications contain information about the drives supported by the L20 and L40 tape libraries.

Tape Drive Publications	Part Number
DLT7000 Tape Drive Product Manual	313134501 (StorageTek PN)
	81-60000-0x (Quantum PN)
DLT8000 Tape System Product Manual	81-60118-0x (Quantum PN)
SuperDLT Tape System Product Manual	
3580 IBM Ultrium Tape Drive Setup, Operator, and Service Guide	IBM part number: GA32.0415.xx
User's Guide for the C7369 High Performance Ultrium Tape Drive	Available from Hewlett-Packard
Seagate Viper 200 LTO Tape Drive Product Manual	Seagate part number: 100006955-xxx
DLT1 Internal Drive / DLT1e Desktop Drive Installation and Operations Guide	Benchmark part number: 000826-xx

Libraries

The following publications contain information related to the L20,L40 and L80 tape libraries.

Publication	Part Number
L20 Tape Library User's Guide	95961
European Warranty Instructions	95998
L20 CRU Instructions	96002
L40 Tape Library User's Guide	96005
L40 CRU Instructions	96006
L80 Tape Library User's Guide	
L80 CRU Instructions	

■ Additional Information

StorageTek offers several methods for you to obtain additional information. Please use one of these methods when you want to obtain the latest edition of this or any other StorageTek publication.

StorageTek's External Web Site

StorageTek's external web site provides marketing, product, event, corporate, and service information. In addition, the external web site serves as an entry point to the Customer Resource Center (CRC) and to the Channel site. The external web site is accessible to anyone with a web browser and an Internet connection.

The URL for the StorageTek external web site is http://www.storagetek.com

Customer Resource Center

StorageTek's Customer Resource Center (CRC) is a web site that enables members to resolve technical issues by searching code fixes and technical documentation. (This site encompasses the former Electronic Documentation Center.) CRC membership entitles you to other proactive services, such as HIPER subscriptions, technical tips, answers to frequently asked questions, and online product support contact information. Customers who have a current warranty or a current maintenance service agreement may apply for membership by clicking on the Request Password button on the CRC home page. StorageTek employees may enter the CRC through PowerPort.

The URL for the CRC is http://www.support.storagetek.com.

e-Partners Site

StorageTek's e-Partners site is a Web site that provides information about products, services, customer support, upcoming events, training programs, and sales tools to support StorageTek's e-Partners. Access to this site, beyond the e-Partners Login page, is restricted. On the e-Partners Login page, StorageTek employees and current partners who do not have access can request a login ID and password and prospective partners can apply to become StorageTek resellers.

The URL for the e-Partners site is http://members.storagetek.com.

Global Services Support Tools

StorageTek's Global Services Support Tools site provides tools that aid in the sales and support of StorageTek's products and services. This is an internal Web site for StorageTek employees.

The URL for the Global Services Support Tools is http://wwssto.stortek.com

Documents on CD

Documents on CD (part number 3106600xx) is a compact disc that contains portable document format (PDF) files of StorageTek's tape, library, OPENstorage disk, and StorageNet publications. Contact your local Customer Services Logistics Depot to order this CD and to get onto the distribution list for this CD. The *Documents on CD* is only for StorageTek employees.

Hard-copy Publications

You may order hard copies of publications listed on the CRC or included on the *Documents on CD*.

Service publications have *numeric* part numbers. To order hard copies of service publications, contact your local Customer Services Logistics Depot.

Marketing publications have *alphanumeric* part numbers. To order hard copies of marketing publications, do one of the following:

- Visit the StorageTek's PowerPort and select alphabetical listings under "L" or select `Online Forms`. Then search for Literature Distribution. Follow the instructions on the Literature Distribution web page.

- Send an e-mail to Literature Distribution at DistrL@louisville.stortek.com.

■ Comments and Suggestions

A Reader's Comment Form at the back of this publication lets you communicate suggestions or requests for change. StorageTek encourages and appreciates reader feedback.

http://sts.stortek.com/sts/nid/nidrcf.htm

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General Information

1

This chapter describes the small computer system interface (SCSI) for the L20, L40 and L80 tape libraries. This manual does not describe the SCSI interface to the tape drives.

■ The 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, CD-ROMs, 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 only LUN 0. The library supports SCSI-3 commands. Thus the library will reject any selection with a LUN set to anything other than LUN 0.

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).

Figure 1-1. Example of a Library Configuration on the SCSI Bus (C24258)
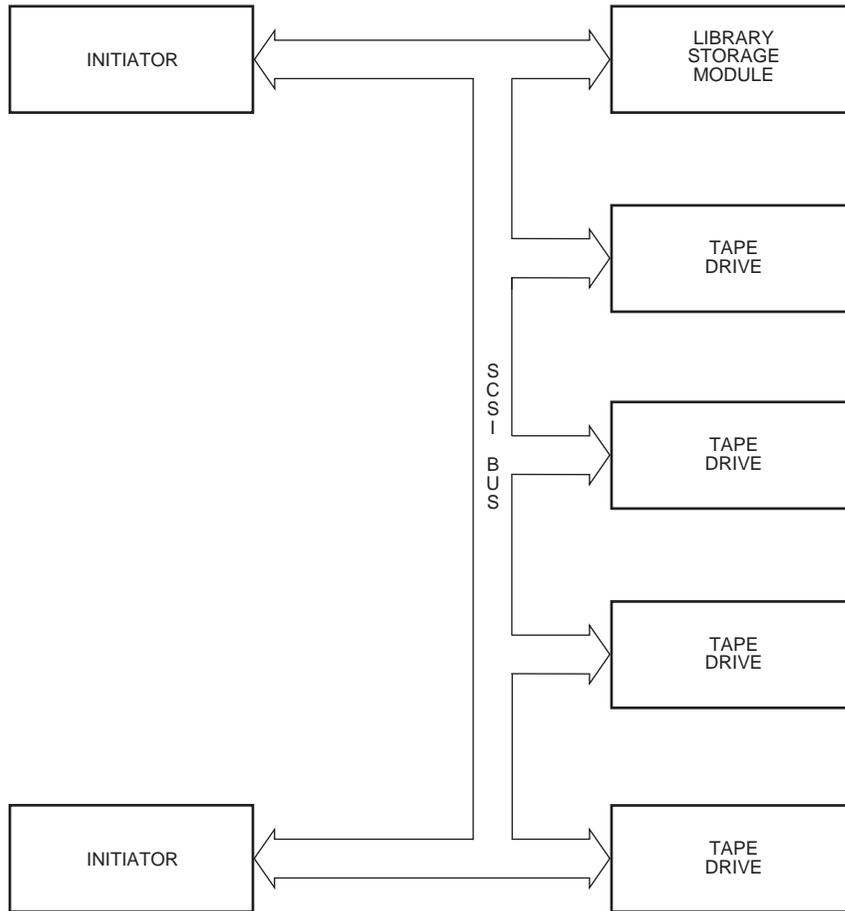
C24258

Benefits

Figure 1-1 is an example of a multi-initiator, multi-target configuration using a library and four tape drives.

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

The SCSI bus uses seven elements for interface control, data transfer, commands, and status. Chapter 3, "SCSI Bus Operations," explains each of these elements in more detail.

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, low-voltage differential (LVD), and high-voltage differential (HVD)
- 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
- Synchronous or wide transfers

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SCSI Bus Physical Description

2

This chapter contains the physical description for the small computer system interface (SCSI) bus for the L20,L40 and L80 tape libraries, including:

- Characteristics
- Interface cables
- Special signals
- P-cable to A-cable adapters

■ Characteristics

The library supports single-ended/LVD (low-voltage differential) and high-voltage differential (HVD) alternatives for the SCSI bus connection. The following paragraphs describe the characteristics for these alternatives.

The single-ended alternative has the following characteristics:

- Maximum cable length of 3 m (9.8 ft)
- Minimum cable length of 0.3 m (1 ft)
- Primarily for connections within a cabinet
- 0.1 m (4 in.) stubs (the distance from the on-board device to the bus)
- Twisted-pairs cables (sometimes)
- Less power than the differential alternative
- Low cost
- Lower performance data rates than LVD or HVD

The LVD alternative has the following characteristics:

- Maximum cable length of 12 m (39.4 ft)
- Minimum cable length of 0.36 m (14.2 in.)
- 0.1 m (4 in.) stubs (the distance from the on-board device to the bus)
- Less power than the HVD alternative
- Higher data transfer rate than the HVD alternative
- Usable for outside cabinet connections
- LVD- or Universal-rated cables
- Higher performance data rates than single-ended or HVD

The HVD alternative has the following characteristics:

- Maximum cable length of 25 m (82 ft)
- Minimum cable length of 0.3 m (1 ft)
- Usable for outside cabinet connections
- 0.2 m (7.8 in.) stubs (the distance from the on-board device to the bus)
- Twisted-pairs cables required

- Low and high frequency noise rejection
- Greater signal strength than the single-ended alternative
- Usable in less than ideal situations
- Intermediate performance data rates

■ SCSI Options

CAUTION:
***Potential equipment damage:* The single-ended, LVD, and HVD alternatives are not compatible and cannot be mixed on the same SCSI bus.**

Note: You can use the Configuration menu from the library operator panel to check the valid SCSI bus connections. The screen that displays the SCSI ID of the library should indicate either single-ended or differential. If the screen displays "Invalid Configuration," you have mixed single-ended devices with differential devices somewhere on the bus. Correct the bus connection; then use the feature to verify the bus connection.

The SCSI interface is built into the library's LLC card and can be configured for single-ended/LVD or HVD operation. The card supports 16-bit addressing and *eight*-bit transfers only. The card will not support synchronous or wide transfers.

Note: To connect a host to a SCSI bus for LVD devices, you must have a host-bus adapter (HBA) that is specifically for an LVD SCSI bus.

■ Interface Cables

The cable that attaches devices to the SCSI bus is very important. Marginal quality cables can cause intermittent parity errors and might corrupt data during transfer.

We recommend SCSI cables that have these general characteristics:

- Twisted pairs (two insulated wires twisted together) to help eliminate noise and crosstalk

- Discrete lines for the asserted and negated version of each signal

- Shielding that provides an impedance rating that matches the requirement for the SCSI alternative:

  - 122 Ω nominal for HVD
  - 84 Ω nominal for single-ended
  - 110 Ω to 135 Ω for LVD

CAUTION:
***Potential interference:* To minimize discontinuities and signal reflections, do not mix cables of different impedances on the same bus.**

Stringent LVD requirements: **Because of stringent requirements for LVD cable impedance-matching, you must use only LVD-specified cables or universal cables with LVD specifications for all LVD applications.**

- A 26 to 30 American Wire Gauge (AWG) conductor to minimize the effects of noise on the bus and to ensure proper distribution of terminator power (when terminator power is required).

  Note: The Terminator Power jumper on the LLC card in the library is selectable and is normally set to ON.

The style of the cable, flat or round, does not matter.

The library supports the following cable types and specifications:

P-cable	(The SCSI-3 P-cable consists of 68 conductors: 16 data lines 9 control lines 2 parity lines 7 ground, reserved, or special signal lines
A-cable	The SCSI-2 A-cable consists of 50 conductors: 8 data lines 9 control lines 1 parity lines 7 ground, reserved, or special signal lines

Note: If the SCSI bus uses an A-cable, you must use an adapter to terminate the eight additional data lines in the P-cable. You then must use the P-cable to connect the SCSI bus to the library and tape drives.

External

StorageTek supplies a variety of external SCSI bus cables to connect the library and tape drives to the SCSI bus. Types of cables include:

- 50-pin Centronics
- 68-pin Micro D-type
- 68-pin micro-centronix
- 68-pin AS/400 recessed hardware
- 68-pin RS6000 (2416 IOP)
- 68-pin 4-40 hardware

Contact a marketing representative or refer to the system assurance guide for your library for information about SCSI cables.

Daisy-Chain

The library and the tape drives may be daisy chained on the SCSI bus using short SCSI cables. The library and the tape drives each have two SCSI

connectors wired in parallel. To daisy chain these devices, connect a SCSI cable from the bus to one of the connectors; then connect a SCSI daisy-chain cable from the other connector to the next device. Daisy-chain cables are available from StorageTek.

Note: If a device is first or last on the SCSI bus, then it must be terminated. See "Terminator" for information and part numbers.

Connector

The SCSI connector for the library and the tape drives is a high-density (HD), shielded, 68-pin, D-type connector for P-cable attachments.

Terminator

You must terminate all SCSI signals at *each* end of the SCSI bus by connecting a terminator to one of the SCSI connectors on the device at each end of the SCSI bus. Table 2-1 lists the terminators for the single-ended, LVD, and HVD alternatives as well as the adapter:

Table 2-1. SCSI Terminators

Part Number	Description
10148002	68-pin, fast/narrow single-ended
10097653	68-pin LVD-SE multi-mode (actively switches between LVD and single-ended mode)
10148003	68-pin, fast/narrow HVD
10148010	50- to 68-pin, feed-through HVD

■ Special Signals

The library supports two special SCSI bus signals:

- Differential Sense (DIFFSENS)
- Terminator Power (TERMPWR)

Differential Sense

The differential sense (DIFFSENS) is a DC voltage level that distinguishes among the three SCSI alternatives: single-ended, LVD, and HVD:

Single-ended:	-0.35 V to +0.5 V
LVD:	+0.7 V to +1.9 V
HVD:	+2.4 V to +5.5 V

The DIFFSENS signal helps prevent damage to the SCSI bus and other equipment when the SCSI device is incompatible with the SCSI bus. Some potential for device damage still exists, however, depending on the type of incompatibility. The following table (Table 2-2) shows the effects of different types of incompatibility.

Table 2-2. SCSI Device Types into SCSI Bus Types

If you plug this device type into this SCSI bus type . . .	Single-Ended (SE) Bus	LVD Bus	HVD Bus
Single-ended (SE) device	No effect. This is a proper connection.	The entire bus will run in SE mode (with all SE restrictions).	The HVD bus will be disabled.
LVD device	The LVD device will run in SE mode.	No effect. This is a proper connection.	The LVD device will be disabled (potential damage to the device).
HVD device	The HVD device will be disabled.	The LVD bus and all LVD devices will be disabled (potential damage to LVD devices)	No effect. This is a proper connection.

Terminator Power

The library is capable of providing terminator power on the SCSI bus. All devices supporting the differential alternatives (LVD and HVD) must have the ability to provide terminator power (TERMPWR) with the following characteristics:

VTerm (HVD)	4.0 to +5.25 VDC
	1000 mA minimum source drive capability
	2.0 A current limiting
VTerm (LVD)	+3.0 to +5.25 VDC
	500 mA minimum source drive capability
	2.0 A current limiting

Note: Industry standards dictate that no more than three devices should provide terminator power on the bus. This ensures that voltage on the bus stays high (+5 VDC) without over-driving the signal or overloading the bus.

Jumpers on the library enable terminator power.

■ P-cable to A-cable Adapter

Problems can occur when you mix SCSI devices that use P-cables with devices that use A-cables:

- The terminator power (TERMPWR) requirements for devices using a P-cable have been increased to support a 16-bit data bus. Devices using an A-cable and supporting the SCSI-1 standard may not supply sufficient TERMPWR to operate on the SCSI bus.

  Two reserved lines on the A-cable (23 and 24) must provide TERMPWR to P-cable lines (33 and 34).

- When buses of different widths are connected on the same bus, data bus signals from wider cables are left open and must be terminated using an adapter.

When connecting a P-cable to an A-cable for eight-bit (narrow) data transfers, the following signals are left open. A special adapter must terminate these signals:

- +DB (15-8)
- +DB (P1)
- -DB (15-8)
- -DB (P1)

The adapter is part number 10148010.

See Figure 2-1 on page 2-7 for an example of this adapter and the terminated signals.

Figure 2-1. A-cable to P-cable Adapter (C24259)

P Cable

+DB(12)	1
-DB(12)	2
+DB(13)	3
-DB(13)	4
+DB(14)	5
-DB(14)	6
+DB(15)	7
-DB(15)	8
+DB(P1)	9
-DB(P1)	10
GROUND	11
GROUND	32
TERMPWR	33
TERMPWR	34
TERMPWR	35
TERMPWR	36
Reserved	37
Reserved	38
GROUND	60
+DB(8)	61
-DB(8)	62
+DB(9)	63
-DB(9)	64
+DB(10)	65
-DB(10)	66
+DB(11)	67
-DB(11)	68

Terminator

A Cable

1	GROUND
22	GROUND
23	Reserved
24	Reserved
25	TERMPWR
26	TERMPWR
27	Reserved
28	Reserved
50	GROUND

NOTE:
The numbers shown are cable conductor numbers, not connector contact numbers.

Terminator

C24259

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SCSI Bus Operations

<div style="text-align: right">3</div>

This chapter describes the seven elements that SCSI uses for controlling the interface, transferring data, issuing commands, and returning status for the L20, L40 and L80 library:

- Bus phases
- Bus signals
- Bus conditions
- Pointers
- Messages
- Commands
- Status byte

■ Bus Phases

The SCSI bus uses eight states, called bus phases, to establish and control connections between the initiator and the target:

- Bus Free
- Arbitration
- Selection
- Reselection

Information Transfer phases:

- Message (in or out)
- Command
- Data (in or out)
- Status

Each bus phase is governed by a predetermined set of rules established by SCSI.

Note: The SCSI bus can only be in *one* phase at a time.

The SCSI bus follows a specific sequence to go from one phase to another, shown in .

Figure 3-1. SCSI Bus Phases (C24260)
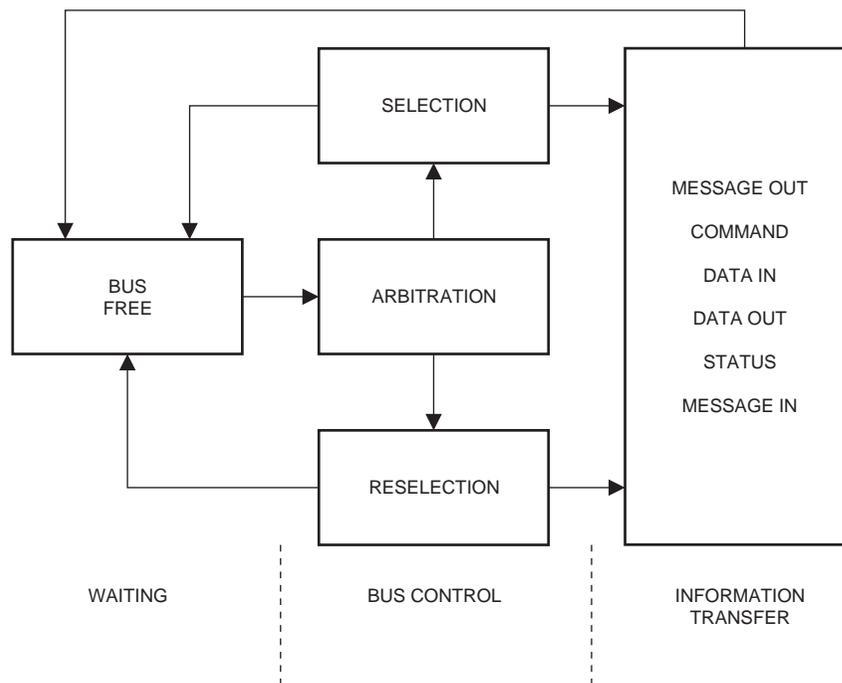
The normal progression of the SCSI bus is from:

1. Bus Free phase to the Arbitration phase

2. Arbitration phase to the Selection or Reselection phase

3. Selection or Reselection phase to one or more of the Information Transfer phases

4. Information Transfer phases to the Bus Free phase

Notes:

1. At any time, any phase can be followed by the Bus Free phase.

2. The data in or data out phase cannot have the command phase as the next phase in sequence. The status phase is followed by a Message In or Message Out phase. Otherwise, there are no restrictions on the sequences in the Information Transfer phase. Any Information Transfer phase can be followed by the same phase or any other Information Transfer phase.

3. A Reset condition can abort any phase and is always followed by the Bus Free phase.

Bus Free

During the Bus Free phase, the SCSI bus is available for use by any device (initiator or target) connected to it.

Arbitration

The Arbitration phase allows an initiator (or a target during reselection) to gain control of the SCSI bus. All devices requiring use of the bus assert their SCSI IDs to gain control.

If multiple devices attempt to gain control of the bus at the same time, the device with the highest-priority SCSI ID obtains control over the bus.

Selection

The Selection phase allows an initiator to select a target to perform some operation. In the Selection phase, the initiator asserts both its SCSI ID and the SCSI ID of the target being selected on the bus.

This selection process informs the device that it is being selected and identifies the initiator that is performing the selection.

Reselection

The Reselection phase allows a target to reconnect to an initiator after disconnecting.

Information Transfer

Four Information Transfer phases transfer data or provide status over the SCSI bus:

Command   The Command phase allows the device to request command information from the initiator.

Data   Two types of Data phases transfer data in asynchronous mode:

    Data In   The target sends data to the initiator.

    Data Out   The initiator sends data to the target.

Message   There are two types of Message phases:

    Message In   The target sends messages to the initiator.

Message Out   The target receives messages from the initiator. The target invokes this phase when the initiator asserts the attention (ATN) signal.

Status The Status phase allows the target to send status information to the initiator.

■ Bus Signals

Communication between two devices on the SCSI bus occurs any time after they establish connection using the bus phases. When two devices communicate, one device acts as an *initiator* and the other device acts as a *target*.

Figure 3-2 on page 3-5 shows the source and direction of the SCSI bus signals.

BSY   Busy is a control signal that indicates the SCSI bus is in use.

SEL   Select is a control signal that selects a target or initiator.

C/D   Control and Data signals are driven by the target to indicate whether control or data information is being transferred.

I/O   Input and Output are control signals driven by the target to control the direction data travels on the bus (with respect to the initiator).

MSG   Message is a control signal driven by the target.

REQ   Request is a control signal driven by the target to indicate a request for a REQ/ACK data transfer handshake.

ACK   Acknowledge is a control signal driven by an initiator to indicate an acknowledgment for a REQ/ACK data transfer handshake.

ATN   Attention is a control signal driven by an initiator to indicate an Attention condition.

RST   Reset is a control signal that generates a Reset condition when asserted.

DB (0-n)   Data bus signals (0-n) transfer data where n indicates the number of data bus signals.

DB (P,P1)   Data bus parity signals (P,P1) are undefined during the Arbitration phase and are defined as *odd* parity during data transfer.

Figure 3-2. Signal Source and Direction (C24261)
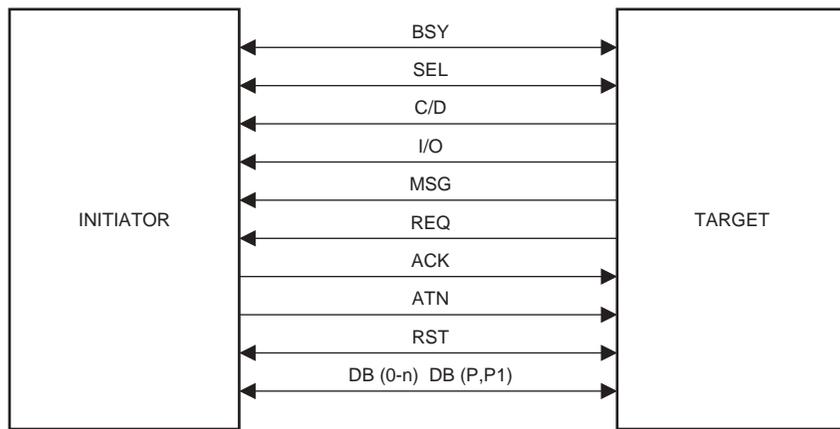
■ Signal Sources

Table 3-1 indicates the source and phase of the SCSI bus signals.

Table 3-1. Signal Source

Bus Phase	Bus Signals				
	BSY	**SEL**	**C/D** **I/O** **MSG** **REQ**	**ACK** **ATN**	**DB**
Bus Free	N	N	N	N	N
Arbitration	A	W	N	N	ID
Selection	I & T	I	N	I	I
Reselection	I & T	T	T	I	I
Command	T	N	T	I	I
Data In	T	N	T	I	T
Data Out	T	N	T	I	I
Status	T	N	T	I	T
Message In	T	N	T	I	T
Message Out	T	N	T	I	I

A   The signal is driven by all SCSI devices that are arbitrating.

I   If this signal is driven, it is driven only by the active initiator.

ID A unique data bit (the SCSI ID) is driven by each SCSI device that is arbitrating. The other 15 data bits are released (not driven) by this SCSI device. The parity bit DB(P,P1) may be driven or undriven to the asserted state but will never be driven to the negated state during this phase.

I&T The signal is driven by the initiator, target, or both, as specified in the Selection and Reselection phases.

N The signal is released—that is, not driven—by any SCSI device. The bias circuitry of the bus terminators pulls the signal to the negated state.

T If the signal is driven, it is driven only by the active target.

W The signal is driven by the device that *wins* during the arbitration phase

■ Bus Conditions

SCSI uses bus conditions to interrupt operations and to handle errors. These conditions cause a SCSI device to accomplish certain actions by altering the bus phase sequence.

The library supports five types of bus conditions:

- Attention
- Parity Errors
- Reset
- Contingent Allegiance
- Unit Attention

Example: A device has a problem executing a command or something happens to that device during an I/O operation, such as a device reset. In this case, a Contingent Allegiance condition is flagged to indicate to the initiator that a problem exists with the device.

Attention

The Attention condition allows an initiator to inform a device that a message is ready for transfer. The target obtains this message by going to the Message Out phase.

The initiator creates the Attention condition by asserting the ATN signal on the SCSI bus any time, except during the Arbitration or Bus Free phases.

Parity Errors

A Parity Error condition occurs if the target detects one or more parity errors in the message bytes received. The target retries the message by asserting the REQ signal after detecting the negated ATN signal and before changing to another bus phase. When the initiator detects this condition, it resends the message bytes in the same order as before.

If a parity error occurs during Command Out, Data Out, or Status In, the target sends a "Restore Pointers" message to the initiator and retries the command, data, or status phase.

Reset

The library recognizes three types of resets. It implements the SCSI hard reset alternative and the Bus Device Reset message. In addition, the library generates an implicit reset when the library is powered on.

When a reset condition is detected, the library performs these actions:

- Clears all I/O processes and discontinues any current command in progress.

- Clears logical unit and element reservations, except for persistent reservations, for all initiators.

- Sets the parameters for mode page 1Dh to the saved values (or to the default values if the saved values are in error).

Upon completion of a reset condition, the library generates a Unit Attention to all initiators to indicate that a reset occurred.

Contingent Allegiance

The target—the library or a drive—generates a Contingent Allegiance Condition for the initiator that caused the error after:

- The target returns a Check Condition status because it has detected an error, failure or other exception condition

- An unexpected, optional disconnect occurs between the target and the initiator. (In other words, the target unexpectedly returns to the Bus Free phase.)

When the target generates a Contingent Allegiance Condition, a series of activities occurs:

- The target preserves the sense data in case it is requested by the initiator.

- If the next command from the initiator to the target (following the Contingent Allegiance Condition) is Request Sense, the target returns the sense data. If the target receives any command other than Request Sense, the sense data is lost and the target processes the command.

Unit Attention

The Unit Attention Condition is a specific form of the Contingent Allegiance Condition. The target generates a Unit Attention condition for each initiator for:

- A hard reset condition
- A power-on reset
- A SCSI Bus Device Reset message

Example: A library is installed on the SCSI bus, but the library is powered off. When powering-on, the library generates a Unit Attention condition to all initiators attached to the SCSI bus. The initiator must clear the Unit Attention condition before communication with the library can occur.

A target also generates a Unit Attention condition for:

- Changing the removable medium
- Changing the Mode Select parameters
- Preempting Persistent Reservations

The Unit Attention condition persists for each initiator until that initiator issues a command to the target or logical unit (other than Request Sense or Inquiry commands) for which the device returns a Check Condition status.

- If the next command from that initiator to the logical unit (following the Check Condition status) is Request Sense, the Unit Attention sense key is returned. If the target receives any command other than Request Sense, the Unit Attention condition is lost.

- If the target receives an Inquiry command from an initiator with a pending Unit Attention condition (before the device reports Check Condition status), the device completes an Inquiry command and does not clear the condition.

- If the target receives a Request Sense command from an initiator with a pending Unit Attention condition (before the device reports Check Condition status), the device reports any pending sense data and preserves the unit attention condition.

- If an initiator issues a command other than Inquiry or Request Sense while a Unit Attention condition exists for that initiator, the device returns Check condition status with the Unit Attention sense key and clears the Unit Attention condition.

■ Pointers

SCSI uses pointers to indicate the relative locations in memory of the initiator. The SCSI pointer architecture has two elements:

Current The current element points to the next byte of information to be transmitted. This set of pointers is shared by all devices.

Saved The saved element points to the beginning or initial I/O block being transmitted. There is one set of saved pointers for each *active* I/O process.

Each pointer element has three pointers for each I/O process:

Command The command pointer indicates the start of the command descriptor block.

Data The saved data pointer indicates the start of the data area. If the target issues a Save Pointer Message during that I/O process, the initiator updates and stores the new value in the saved data pointer.

Status The status pointer indicates the start of the status area.

The following explains how pointers are used during the I/O process:

Example: Because a device needs time to process commands or multiple data blocks, the target disconnects from the initiator to free the SCSI bus for other operations.

The target directs the initiator to save data pointers by sending a Save Data Pointer message before disconnection.

Note: Whenever the target detects an error or receives a message from the initiator indicating an error has occurred, the target requests that the initiator return to the location specified by the pointers to re-execute the operation. The target makes this request by sending a Restore Pointers message.

■ Message System

The message system allows SCSI devices to communicate for physical path management. There are two ways to transfer messages during the Information Transfer phase:

Message In Messages from the target to the initiator

Message Out Messages from the initiator to the target

The ATN signal prompts the target to start the Message Out phase. The Message Out phase is the next phase entered by the target; however, it can start at any time after detecting an Attention condition.

If the target receives any message other than Identify, Abort, or Bus Device Reset as the *first* message after selection, the target aborts the operation and enters the Bus Free phase. Table 3-2 on page 3-10 lists the valid messages for the library:

Table 3-2. Message Codes

Hex Code	Description	Direction
00	Command Complete	In
01	Extended	In/Out
02	Save Data Pointers	In
03	Restore Pointers	In
04	Disconnect	In
05	Initiator Detected Error	Out
06	Abort	Out
07	Message Reject	In/Out
08	No Operation	Out
09	Message Parity Error	Out
0C	Bus Device Reset	Out
80–FF	Identify	In/Out
Note:	In = Target to initiator, Out = Initiator to target	

Note: Table 3-2 lists only those messages supported by the library. The library does not support the use of linked or tagged commands.

In general, SCSI supports two types of messages:

• Messages containing a single byte
• Messages containing multiple bytes

The following sections describe the valid messages along with their hexadecimal code values.

Message Codes

The following paragraphs explain the messages.

Command Complete Message In

The library sends the Command Complete message (00) to the initiator to indicate that the execution of the command has completed and that valid status has been sent to the initiator.

Extended Message

The initiator might try to negotiate wide or synchronous transfers. The library accepts these negotiations but always negotiates to narrow and asynchronous transfers.

Save Data Pointers In

The library sends the Save Data Pointers message (02) to tell an initiator to save a copy of the active data pointer for the library. The library sends this message before sending the Disconnect message.

Restore Pointers Message In

The library sends the Restore Pointers message (03) to direct an initiator to restore the most recently saved command, data, and status pointers for the active I/O process. The message is sent after receiving an Initiator Detected Error message or Parity error during a transfer which can be retried. The transfer is then restarted.

Disconnect Message In

The library sends the Disconnect message (04) to inform an initiator that the present connection is going to be broken and that a later reconnect is required to complete the current command. After successfully sending this message, the library enters the Bus Free phase.

Initiator Detected Error Out

An initiator sends the Initiator Detected Error message (05) to inform the library that the initiator has detected an error. Depending on the active phase, the library aborts the current I/O, sends a Message Reject, or issues a Restore Pointers, and restarts the transfer.

Abort Out

An initiator sends the Abort message (06) to the library to halt a process. If an I_T_L nexus is established, any pending data and status is cleared and the process is aborted; otherwise, no action is taken.

Message Reject In/Out

Either an initiator or the library sends a Message Reject (07) to indicate the last message received was inappropriate or not supported.

No Operation Out

When a library receives a No Operation message (08), command processing continues without any action taken.

Message Parity Error Out

The library receives a Message Parity Error (09) when an initiator detects bad parity on a message byte. If the last phase was Message In, the library resends the message byte again.

Bus Device Reset Out

The Bus Device Reset message (0C) causes the library to immediately go to the Bus Free phase and resets the SCSI interface.

Identify Message In/Out

Either the initiator or the library sends the Identify message (80 to FF). The initiator sends this message to the library to enable the message system.

Identify messages are sent by either the initiator or the target to establish the physical path connection between an initiator and the target for a particular logical unit. The library sends this message to the initiator following the reselection sequence. The format of this message is

Table 3-3. Identify Message Format

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

Identify   This bit is set to 1 to distinguish the Identify message from all other messages.

DiscPriv   This bit (disconnect privilege) is used by the initiator to grant the library disconnect privileges:

0   Disconnect is not allowed

1   Disconnect is allowed

When the Identify message is sent by the library, the DiscPriv is set to 0.

LUNTAR   This bit must be set to 0 for the library

LUN   The only supported Logical Unit Number (LUN) for the library is 0.

Additional information regarding the messaging system (or messaging) can be found in the SCSI-3 standard.

Message Sequencing and Handling

During the selection phase, the Identify message must be the first message out from the initiator to the library. This message initiates the message system. The library must receive an Identify message during the selection phase to enable it to respond to the attention line during subsequent phases. When the message system has been initiated by the Identify message during the selection phase, the library accepts messages from the initiator when the attention line is active.

Synchronous Negotiations

The library will accept negotiations for synchronous communication but always will negotiate to asynchronous communication.

Wide Negotiations

The library will accept negotiations for wide transfers but always will negotiate to narrow, 8-bit transfers.

■ Status Byte

The target returns a status byte to the initiator at the completion of each command during the Status phase unless the command is cleared or interrupted by:

- An Abort message
- Device Reset message
- A "hard" reset condition
- An unexpected disconnect

Table 3-4 shows the structure of the status byte.

Table 3-4. Status Byte

Bytes	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
1	Reserved		Status Byte Code					Reserved

The library supports four status byte codes:

- Good
- Check Condition
- Busy
- Reservation Conflict

Good

Good status (00) indicates that the device successfully completed the command.

Check Condition

Check Condition status (02) occurs when any error, unit exception, or abnormal condition generates sense data. The initiator should issue a Request Sense command following a Check Condition status to determine the nature of the error.

Check Condition status occurs when one of the following conditions exist:

- Issuing an invalid command or parameter
- Issuing a command to a device that is not ready
- Detecting a hardware error
- Sensing an illegal request
- Detecting SCSI protocol errors

Busy

Busy status (08) occurs when the target is unable to accept a command from an otherwise acceptable initiator. The normal initiator recovery from a Busy status is to reissue the command.

Reservation Conflict

The library returns Reservation Conflict status (18) whenever a SCSI initiator attempts to access a logical unit or element that is reserved by another initiator.

■ Multiple Initiator Support

The library architecture supports multiple initiators with the following details:

- Up to 16 SCSI devices are supported. The library can be on a bus with a maximum of 15 initiators. In this configuration, the tape drive SCSI interfaces are required to be on a separate SCSI bus.

- Unit- and element-level Reserve and Release commands are supported. Persistent Reserve commands also are supported. An initiator may reserve elements that will then cause a reservation conflict if the reserved element is accessed by a different initiator. It is recommended that host software applications perform reservations whenever possible.

- If an initiator modifies a mode page, all other initiators will then receive a unit attention indicating the mode parameters have changed.

- The library maintains separate prevent/allow medium removal status for each initiator.

■ Host Time-Out Characteristics

Host time-out values for the SCSI bus may require adjustment based on the configuration of the library. The maximum time-out value is 10 minutes (for the maximum library configuration.)

■ Automated Cleaning

The library architecture provides for automated drive cleaning. The user enables automated cleaning through the operator panel and then adds a valid cleaning cartridge to the cleaning cartridge cell. (For the location of this cell, see Appendix A, "Element Mapping")

Notes: These notes apply to automated cleaning:

1. To be valid, a cleaning cartridge must have "CLN" somewhere on its VOLSER label.

2. The library configuration must support automated cleaning (see Appendix A, "Element Mapping" for more information).

With automated cleaning enabled, when a drive requires cleaning, the library interleaves the cleaning cartridge mount with normal host operations. The "Fast Load" option is always enabled for the cleaning cartridge, so the mount occurs within seconds. Typically, the cleaning mount occurs directly after a data cartridge dismount. Host applications see minimal processing interruptions (less than ten seconds) during the cleaning mount.

While the cleaning cartridge remains in the drive, the library processes host commands normally. If a host requests a data mount to the drive being cleaned, then the library rejects the command and sends the Not Ready sense key (02), with ASC 30 and ASCQ 03 (Cleaning Cartridge Installed).

The host receives the data mount error for the duration of the cleaning time. Cleaning times vary, depending on the type of drive, the cleaning cartridge, robotic times, and potential retry operations. The time required to clean a DLT drive varies with the number of times the cleaning tape is used. The tape is good for 20 uses. Each time you use it takes longer than the last time because the operation goes farther on the tape cartridge. The longest cycle, cleaning cycle (20), takes approximately 5 minutes and 15 seconds.

■ Fast Load

The library architecture provides for optional fast load operations. The following applies only if the fast load option is disabled. (If the fast load option is disabled, then the library's robot will mount a tape to a drive and wait at the drive location until the tape is fully loaded before beginning another task.)

If the fast load option is disabled, a SCSI move command may require additional time to complete. The library remains disconnected during this time. The host software must adjust SCSI time-out values to allow for the tape drive load time in addition to the robotics motion time.

■ Device Reservations

The library supports the Reserve/Release management method and also the Persistent Reservations management method. These methods are defined in the *ANSI SCSI-3 Primary Commands (SPC-2)* standard. For the reservation restrictions placed on commands for the Reserve/Release management method, see Table 3-5. For the reservation restrictions placed on the Persistent Reservations management method, see Table 3-6 on page 3-18.

Conflict   Command will not be performed and the library will terminate the command with Reservation Conflict status.

Allowed   Command will be allowed to execute to normal completion.

Table 3-5. Reserve/Release Management Method

Command	Action when Reserved by a different Initiator
Initialize Element (07h)	Conflict
Initialize Element with Range (E7h)	Conflict
Inquiry (12h)	Allowed
Log Sense (4Dh)	Allowed
Mode Select (15h/55h)	Conflict
Mode Sense (1Ah/5Ah)	Conflict
Move Medium (A5h)	Conflict
Persistent Reserve In (5Eh)	Conflict
Persistent Reserve Out (5Fh)	Conflict
Position to Element (2Bh)	Conflict
Prevent/Allow Removal (1Eh)	Prevent = 0, allowed
	Prevent = 1, conflict
Read Element Status (B8h)	Conflict, unless the CurData bit is 1 (see note)

Note: As of the publication date of this document, the CurData bit had not been fully implemented.

Table 3-5. Reserve/Release Management Method (Continued)

Command	Action when Reserved by a different Initiator
Release Unit (17h/57h)	Allowed, the reservation is not released.
Request Sense (03h)	Allowed
Request Volume Element Address (B5)	Conflict
Reserve Unit (16h/56h)	Conflict
Rezero Unit (01h)	Conflict
Send Diagnostic (1Dh)	Conflict
Send Volume Tag (B6h)	Conflict
Test Unit Ready (00h)	Conflict
Write Buffer (3Bh)	Conflict

Note: As of the publication date of this document, the CurData bit had not been fully implemented.

Table 3-6. Persistent Reservation Management Method

Command	From Non-registered Initiators	From Registered Initiators
Initialize Element (07h)	Conflict	Allowed
Initialize Element with Range (E7)	Conflict	Allowed
Inquiry (12h)	Allowed	Allowed
Log Sense (4Dh)	Allowed	Allowed
Mode Select (15h/55h)	Conflict	Allowed
Mode Sense (1Ah/5Ah)	Conflict	Allowed
Move Medium (A5h)	Conflict	Allowed
Persistent Reserve In (5Eh)	Allowed	Allowed

Table 3-6. Persistent Reservation Management Method (Continued)

Command	From Non-registered Initiators	From Registered Initiators
Persistent Reserve Out (5Fh)	Register, allowed	Register, allowed
	Reserve, conflict	Reserve, conflict
	Release, conflict	Release, allowed
	Clear, conflict	Clear, allowed
	Preempt, conflict	Preempt, allowed
	Pre/Abt, conflict	Pre/Abt, allowed
	Reg/Ign, allowed	Reg/Ign, allowed
Position to Element (2Bh)	Conflict	Allowed
Prevent/Allow Media Removal (1Eh)	Prevent = 0, allowed	Allowed
	Prevent = 1, conflict	
Read Element Status (B8h)	CurData = 0, conflict	Allowed
	CurData = 1, allowed	
Release Unit (17h/57h)	Conflict	Conflict
Request Sense (03h)	Allowed	Allowed
Request Volume Element Address (B5h)	Conflict	Allowed
Reserve Unit (16h/56h)	Conflict	Conflict
Rezero Unit (01h)	Conflict	Allowed
Send Diagnostic (1Dh)	Conflict	Allowed
Send Volume Tag (B6h)	Conflict	Allowed
Test Unit Ready (00h)	Conflict	Allowed
Write Buffer (3Bh)	Conflict	Allowed

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SCSI Commands

4

This chapter lists and describes SCSI command structures for the L20,L40 and L80 tape libraries. Table 4-1 contains a list of the commands, command codes, and page numbers that contain a description of the command.

Note: This manual does not describe the commands for the tape drives. Refer to the tape drive documentation for information about the SCSI commands for the tape drives.

■ Command List

Table 4-1. Supported Commands

Command	Hex Code	Page
Initialized Element Status	07	4-5
Initialized Element Status with Range	E7	4-5
Inquiry	12	4-7
Log Sense	4D	4-15
Mode Select	15	4-21
Mode Sense	1A	4-42
Move Medium	A5	4-67
Persistent Reserve In	5E	4-69
Persistent Reserve Out	5F	4-74
Position to Element	2B	4-78
Prevent/Allow Medium Removal	1E	4-79
Read Element Status	B8	4-80
Release	17	4-116
Request Sense	03	4-117
Request Volume Element Address	B5	4-129
Reserve	16	4-134
Rezero Unit	01	4-137
Send Diagnostic	1D	4-138

Table 4-1. Supported Commands (Continued)

Command	Hex Code	Page
Send Volume Tag	B6	4-141
Test Unit Ready	00	4-144
Write Buffer	3B	4-145

■ 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
- Logical unit number (LUN)
- 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 (Table 4-2 on page 4-3)
- 10-byte commands (Table 4-3 on page 4-3)
- 12-byte commands (Table 4-4 on page 4-3)

The first byte in the command descriptor block contains a group code and a command code.

The three-bit group code provides eight groups of commands.

The five-bit command code provides 32 command codes for each group.

Table 4-2. 6-Byte Command Command Descriptor Blocks

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

Table 4-3. 10-Byte Command Command Descriptor Blocks

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

Table 4-4. 12-Byte Command Command Descriptor Blocks

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

Control Byte

The control byte is the last byte of every command descriptor block (see Table 4-5).

Table 4-5. Control Byte

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
5 9 11	Vendor-specific		Reserved			NACA (0)	Flag (0)	Link (0)

- **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)
  Causes an interrupt in the initiator allowing a device to respond with intermediate status. This bit should be 0.

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

■ Operator Entries

The SCSI interface to the library requires that you set the following values:

- The library's SCSI ID
- Each drive's SCSI ID

You may set these values from the library's operator panel. See the library's operator's guide for instructions on setting these values.

▉ Initialize Element Status

The host uses the Initialize Element Status command (07) 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 library tabulates (or "performs an audit of") and maintains the inventory. It performs an audit after a user has opened and closed the front door.

The command descriptor block (see Table 4-6) is validated even though the command is not used. No checks are made of ignored fields.

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

Table 4-6. Initialize Element Status Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (07h)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (00h)							
3	Reserved (00h)							
4	Reserved (00h)							
5	NBL	Control Byte (00h)						

- **NBL**
  Ignore the No Bar Code Label (NBL) field.

▉ Initialize Element Status With Range

The Initialize Element Status With Range command (E7) 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 tabulates (or "performs an audit of") and maintains the inventory. It performs an audit after a user 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 (Table 4-7 on page 4-6).

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

Table 4-7. Initialize Element Status with Range Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (E7h)							
1	Logical Unit Number			Reserved (00h)				Range
2 to 3	(MSB) Element Address (LSB)							
4	Reserved (00h)							
5	Reserved (00h)							
6 to 7	(MSB) Number of Elements (LSB)							
8	Reserved (00h)							
9	NBL	Control Byte (00h)						

- **Range**
  Ignore this field.

- **Element Address**
  Ignore this field.

- **Number of Elements**
  Ignore this field.

- **NBL**
  Ignore the No Bar Code Label (NBL) field.

■ Inquiry

The Inquiry command (12) requests that the library send to the initiator information regarding the library's parameters (Table 4-8).

Table 4-8. Inquiry Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (12h)							
1	Logical Unit Number			Reserved (00h)			CmdDt (0)	EVPD
2	Page Code							
3	Reserved (00h)							
4	Allocation Length							
5	Control Byte (00h)							

- **CmdDT**
  The library does not support the optional Command Support Data, and the value of this field must be 0.

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

  0   A request for normal inquiry data

  1   A request for a vital supported 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 80h or 00h.

  00h   A request for normal inquiry data

  80h   Unit serial number page

- **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 38h (56d) bytes. The data length for page 0 is 06h (6d). The data length for the unit serial number page (80h) is 10h (16d) bytes.

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.

Normal Inquiry Data Definition

The library returns 38h (56d) bytes of normal inquiry data in the format shown in Table 4-9.

Table 4-9. Normal Inquiry Data

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB (1)	Device-Type Modifier (0)						
2	Obsolete (0h)					ANSI-Approved Version (3)		
3	AENC (0)	Obsolete (0)	NACA (0)	HiSup (0)	Response Data Format (2)			
4	Additional Length (n-4)							
5	Reserved (00h)							
6	BQue (0)	EncServ (0)	VS (0)	MultiP (0)	MChngr (0)	Reserved (00)		Addr16 (1)
7	RelAdr (0)	Obsolete (0)	WBus16 (0)	Sync (0)	Linked (0)	Reserved (0)	CmdQue (0)	SftRe (0)
8 to 15	(MSB) Vendor Identification (LSB)							
16 to 31	(MSB) Product Identification (LSB)							
32 to 35	(MSB) Product Revision Level (LSB)							
36 to 55	(MSB) Vendor Specific (LSB)							

- **Peripheral Qualifier**
  The library returns a value of 00h, which indicates that the library is a single logical unit. If a LUN other than 0 is sent, the value returned is 011b (b indicates binary notation).

- **Peripheral Device Type**
  The library returns a value of 8h, which indicates that the library is a medium changer device. If a LUN other than 0 is sent, the value returned is 1Fh.

- **RMB**
  The library returns a value of 1, which indicates that the medium is removable.

- **Device-Type Modifier**
  The library returns a value of 0, which indicates that there are no modifiers for the library.

- **ANSI-Approved Version**
  The library returns a value of 3, which indicates the library supports the current ANSI version of the SCSI-3 specification.

- **AENC**
  The library does not support the Asynchronous Event Notification Capability (AENC) function and returns a value of 0.

- **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.

- **HiSup**
  The library does not currently have hierarchical support, so the library returns a value of 0.

- **Response Data Format**
  The library returns a value of 2, which indicates that the data found is in accordance with the SCSI-2 specification.

- **Additional Length**
  The library returns a value of 33h, which indicates that there are 33h (51d) additional bytes of Inquiry data available to be returned to the initiator.

- **BQue**
  The library does not support tagged tasks (command queuing) and returns a value of 0 for the basic queuing bit as well as for the CmdQue bit.

- **EncServ**
  The library does not contain an embedded enclosures services component and thus returns a value of 0.

- **VS**
  The vendor specific bit is set to 0 to indicate that there is no vendor-specific information with this command.

- **MultiP**
  The library does not have multiple ports and returns a value of 0.

- **MChngr**

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

- **Addr16**

  The library supports 16 devices (addresses) on the SCSI bus and thus returns a value of 1.

- **RelAdr**

  The library does not support the Relative Address (RelAdr) function and returns a value of 0.

- **WBus 16**

  The library does not support 16-bit wide data bus transfers and returns a value of 0. (Thus the library supports only 8-bit wide data.)

- **Sync**

  The library does not support synchronous data transfer and returns a value of 0.

- **Linked**

  The library does not support linked commands and returns a value of 0.

- **CmdQue**

  The library does not support tag command queuing and returns a value of 0.

- **SftRe**

  The library does not support soft reset alternative in response to a reset condition and returns a value of 0.

- **Vendor Identification**

  This field contains the ASCII character sequence "STK" 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 of the device model followed by blanks. For an L20 library, it could contain the characters "L20." For an L40 library, it could contain the characters "L40."For an L80 library, it could contain the characters "L80." If the logical unit is not supported, this field contains blanks.

- **Product Revision Level**

  This field contains an ASCII character sequence that represents the product revision level.

- **Vendor Specific**

  This field contains vendor-specific data that should be ignored.

- **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.

If an Inquiry command is sent with a LUN other than 0, the value 7Fh is returned in the Peripheral Qualifier/Device Type byte. This is not an error.

The library returns 06h (6d) bytes of supported pages data in the format shown in Table 4-10 on page 4-13.

Supported Pages Definition

The supported pages definition (page 00h) has six bytes.

Table 4-10. Supported Pages Definition

Byte	Bit							
	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 (02h)							
4	Supported Page (00h)							
5	Supported Page (80h)							

- **Peripheral Qualifier**
  The library returns a value of 00h, which indicates that the library is a single logical unit. If a LUN other than 0 is sent, the value returned is 011b (b indicates binary notation).

- **Peripheral Device Type**
  The library returns a value of 8h, which indicates the library as a medium changer device. If a LUN other than 0 is sent, the value returned is 011b.

- **Page Code**
  This field is set to 00h, which identifies the page as the supported pages page.

- **Page Length**
  This field is set to 02h, which indicates that two vital pages are supported

- **Supported Page**
  The first supported page value is set to 00h, which indicates that the first vital page is page 0 (the current page). The second supported page value is set to 80h, which indicates that the second vital page is page 80 (unit serial number page).

Unit Serial Number Page Definition

The library returns Fh (15d) bytes of unit serial number page data in the format shown in Table 4-11.

Table 4-11. Unit Serial Number Page Data

Byte	Bit							
	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 (0Bh)							
4 to 14	(MSB) Product Serial Number (LSB)							

- **Peripheral Qualifier**
  The library returns a value of 000, which indicates that the library is a single logical unit. If a LUN other than 0 is sent, the value returned is 011b (b indicates binary notation).

- **Peripheral Device Type**
  The library returns a value of 8h, which indicates the library as a medium changer device. If a LUN other than 0 is sent, the value returned is 1Fh.

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

- **Page Length**
  This field is set to 0Bh, the number of bytes in the product serial number.

- **Product Serial Number**
  This field contains a unique 11-character ASCII identifier for the library.

  For example: LLC01001020

  Reading from left to right, the first three characters are the name, the next two characters are the site code, and the last six characters are the serial number. This product serial number is the LLC card FRU ID. If the card is replaced, the new LLC card FRU ID is returned.

■ Log Sense

The Log Sense command (4Dh) enables the library to report its error logs and statistics to the initiator (Table 4-12).

Table 4-12. Log Sense Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (4Dh)							
1	Logical Unit Number			Reserved (0)			PPC (0)	SP (0)
2	PC (1)		Page Code					
3	Reserved (00h)							
4	Reserved (00h)							
5 to 6	(MSB) Parameter Pointer (LSB)							
7 to 8	(MSB) Allocation Length (LSB)							
9	Control (00h)							

- **PPC**
  The library does not support parameter pointer control (PPC). The value must be 0.

- **SP**
  The library does not support the save parameters (SP) feature. The value must be 0.

- **PC**
  The library supports only cumulative values for page control (PC). The value must be 1.

  Note: The library will accept values of 0 or 1 in the PC field if the Page Code is 2Eh.

- **Page Code**
  The library supports:

  0h   A request for normal inquiry data

  7h   List n Errors Events Page

> **2Eh** TapeAlert Page (looks for 0 or 1 in PC field)

- **Parameter Pointer**
  The Parameter Pointer allows an initiator to request data starting at a specific parameter code. This value must be 00h for page code 0h.

- **Allocation Length**
  This field specifies the number of bytes the initiator has allocated for data returned from the Log Sense command. A value of 0 is not considered an error. The maximum data length for the log sense data that the library can return is 3C4h bytes. The length varies based on the Page Code selected:

> **0h** (List Supported Pages) the length is 7h.
>
> **7h** (Last n Errors Events Page) the length is 3C4h.
>
> **2Eh** (TapeAlert Page) the length is 144h.

Supported Pages Page Format

The Supported Pages Format page lists all the Log Sense page codes supported by the library (Table 4-13).

Table 4-13. Supported Pages Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Reserved (0)		Page Code (00h)					
1	Reserved (00h)							
2 to 3	(MSB) Page Length (n-3) (LSB)							
4	Supported Pages Page Code (00h)							
5	Last n Errors Events Page Code (07h)							
6	TapeAlert Page Code (2Eh)							

Last n Errors Events Page Format

The Last n Errors Events Page provides a list of the most recent errors events logged on the library. Each event is an ASCII string that includes a time stamp, a fault symptom code (FSC), an optional mechanism, and a count of how many times the error occurred (Table 4-14). Each error event is 48 bytes long, and the list can contain up to 20 events.

Table 4-14. Last n Errors Events Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Reserved (0)		Page Code (07h)					
1	Reserved (00h)							
2 **to** **3**	(MSB) Page Length (n–3) (LSB)							
4–7 **8–23** **24–27** **28–31** **32–33** **34–35** **36–37** **38–39** **40–42** **43–51**	ASCII String for Event Specified by Parameter Pointer Fault symptom code Mechanism Count Year Month Date Hour Minute Second Pad (ASCII spaces)							
	Additional Events (48d bytes per event)							
n–47 **to** **n**	ASCII String for Last Available Event							

TapeAlert Page

Table 4-15 lists information about the TapeAlert page format. The "n" represents 64 one-byte alert flags.

Table 4-15. TapeAlert Parameter Format

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Page Code (2Eh)							
1	Reserved (0)							
2 to **3**	(MSB) Page Length (n-3) (LSB)							
. . .	TapeAlert Flags							
5n-1 to **5n**	Parameter Code (n)							
5n+1	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (0)	Reserved (0)		LP (0)
5n+2	Parameter Length							
5n+3	Value of Flag							Flag

Note: The entire TapeAlert page should be read to obtain all the information.

- **DU**
  The disable update (DU) is always 0, which indicates that the target updates the log parameter value instead of the initiator.

- **DS**
  The disable save (DS) is always 1, which indicates that saving the log is not supported.

- **TSD**
  The target save disable (TSD) value is always 0.

- **ETC**
  The enable threshold comparison (ETC) is always 0.

- **TMC**
  The threshold met criteria (TMC) is always 0.

- **LP**
  The list parameter (LP) bit is always 0, which indicates that the log parameter is a data counter.

TapeAlert Flags

Table 4-16 lists information about TapeAlert flags. *The flag names with asterisks (*) are currently supported.*

Table 4-16. TapeAlert Flags

Code	Flag Name	Description	Length (bytes)
0001h	Library Hardware A *	This flag is set when the library cannot communicate with a tape drive. This does *not* cause the library to stop operating.	1
0002h	Library Hardware B *	This flag is set when the servo control mechanism breaks lock. The various causes are when the hand positioning on the column fails or when the hand fails.	1
0003h	Library Hardware C	This flag is set when the library has a hardware fault.	1
0004h	Library Hardware D *	In the library, this flag is set when camera initialization, calibration, or mechanical initialization test fails.	1
0005h	Library Diagnostics Required	This flag is set when the library might have a hardware fault.	1
0006h	Library Interface *	This flag is set when a corrupted SCSI command is sent to the library from an initiator. Currently, this flag is set when a parity error is detected on the SCSI bus.	1
0007h	Predictive Failure	This flag is set when a library hardware failure is predicted.	1
0008h	Library Maintenance	This flag is set when preventive maintenance is required.	1
0009h	Library Humidity Limits	This flag is set when general conditions inside the library exceed the humidity specifications.	1
000Ah	Library Temperature Limits	This flag is set when general conditions inside the library exceed the temperature specifications.	1
000Bh	Library Voltage Limits	This flag is set when the voltage supply exceeds specifications.	1
000Ch	Library Stray Tape	This flag is set when a cartridge was left in a drive because of a previous hardware fault.	1
000Dh	Library Pick Retry *	This flag is set if the hand requires more than one try to pick a cartridge from a cell or drive.	1

Table 4-16. TapeAlert Flags (Continued)

Code	Flag Name	Description	Length (bytes)
000Eh	Library Place Retry *	This flag is set if the hand requires more than one try to place a cartridge into a cell.	1
000Fh	Library Load Retry *	This flag is set if the hand requires more than one try to place a cartridge into a drive.	1
0010h	Library Door *	This flag is set if the door has been opened, and no library motions are allowed. When the door is closed, the library will IPL.	1
0011h	Library Mail slot *	This flag is set when the mail slot (cartridge access port) switch has failed.	1
0012h	Library Magazine	This flag is set when the library needs the magazine.	1
0013h	Library Security	This flag is set when the security was compromised.	1
0014h	Library Security Mode	This flag is set when the security mode was changed.	1
0015h	Library Offline *	This flag is set when the library has been placed into maintenance mode from the operator panel or from a Web interface.	1
0016h	Library Drive Offline	This flag is set when a drive was taken offline.	1
0017h	Library Scan Retry *	This flag is set when more than one attempt is required to read a bar code. The problem is caused when only part of the bar code can be read. The library supports cartridges with no labels.	1
0018h	Library Inventory	This flag is set when the library detected an inconsistency in its inventory.	1
0019h	Library Illegal * Operation	This flag is set when an unsupported SCSI command is sent to the library. This is *not* a corrupted command detected for flag 6.	1

■ Mode Select

The Mode Select command (15) enables an initiator to specify certain operating parameters for the library (Table 4-17). The library uses the saved or default versions of these parameters to configure itself:

- During power-on
- Following a reset on the interface
- Upon receiving a Bus Device Reset message

The mode values sent to the library apply to all initiators. If an initiator issues a Mode Select command that changes any parameters, the library generates a Check Condition status to all other initiators with a sense key of Unit Attention and an Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) of Mode Parameters Changed.

When the library receives a Mode Select command, the library validates all parameters before it performs any changes. If a value is not valid, the library returns the appropriate error message and does not change the parameters.

Table 4-17. Mode Select Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (15h)							
1	Logical Unit Number			PF (1)	Reserved (0)			SP
2	Reserved (00h)							
3	Reserved (00h)							
4	Parameter List Length							
5	Control Byte (00h)							

- **PF**
  The library supports the SCSI-2 page format (PF) and requires a value of 1.

- **SP**
  The library supports the saved page (SP) function. The values are:

    0   Current mode values are changed to the values specified by this command. Saved values are not affected.

    1   Current mode values and saved mode values are changed to the values specified by this command.

- **Parameter List Length**
  This field indicates the length of the entire parameter list:

00h   No data is transferred.

8h   The Mode Select Parameter Header and the Drive Configuration Page (no drives) are transferred, in that order.

10h   The Mode Select Parameter Header and the Drive Configuration Page (one drive) are transferred, in that order.

10h   The Mode Select Parameter Header and the TapeAlert Mode Page are transferred, in that order.

18h   The Mode Select Parameter Header and the Element Address Assignment Page are transferred, in that order.

18h   The Mode Select Parameter Header and the Drive Configuration Page (two drives) are transferred, in that order.

20h   The Mode Select Parameter Header and the Drive Configuration Page (three drives) are transferred, in that order.

24h   The Mode Select Parameter Header and the Network Configuration Page are transferred, in that order.

28h   The Mode Select Parameter Header and the Miscellaneous Configuration Page are transferred, in that order.

28h   The Mode Select Parameter Header and the Drive Configuration Page (four drives) are transferred, in that order.

A value of 00h is not considered an error. Any other value is an error.

- **Mode Select Data**
  The initiator must provide mode parameter data in a parameter list that includes:

  - A 4-byte Mode Parameter Header and one of the following:
    - A 20-byte Element Address Assignment Page
    - A 12-byte TapeAlert Mode Select Page
    - A 4-byte, 12-byte, 20-byte, 28-byte, or 36-byte Drive Configuration page (vendor-specific), depending on the number of drives installed in the library
    - A 32-byte Network Configuration page (vendor-specific)
    - A 36-byte Miscellaneous Configuration page (vendor-specific)

  The mode pages supported by the library for a Mode Select command on a SCSI bus are the Element Address Assignment Page, the TapeAlert Mode Select Page, the Drive Configuration Page, the Network Configuration, and the Miscellaneous Configuration Page. If the parameter list length field in the command is 0, then no Mode Select data is required.

Note: Before issuing any Mode Select commands, an initiator should issue a Mode Sense command with the Page Control field set to 01h and the

Page Code field set to 3Fh to determine which pages are supported, which parameters within the pages are changeable, and the supported length of each page.

Mode Select Parameter Header

The four-byte Mode Select parameter header as follows:

Table 4-18. Mode Select Parameter Header

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

- **Mode Parameter Header Field Definitions**
  For the library, all fields must be 00h (Table 4-18).

Element Address Assignment Mode Page Definition

Table 4-19 defines the Element Address Assignment Mode page.

Table 4-19. Element Address Assignment Mode Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	PS (0)	Reserved (0)	Page Code (1Dh)					
1	Parameter Length (12h)							
2 to 3	(MSB) First Medium Transport Element Address (LSB)							
4 to 5	(MSB) Number of Medium Transport Elements (0001h) (LSB)							
6 to 7	(MSB) First Storage Element Address (LSB)							
8 to 9	(MSB) Number of Storage Elements (LSB)							
10 to 11	(MSB) First Import/Export Element Address (LSB)							
12 to 13	(MSB) Number of Import/Export Elements (LSB)							
14 to 15	(MSB) First Data Transfer Element Address (LSB)							

Table 4-19. Element Address Assignment Mode Page

Byte	Bit							
	7	6	5	4	3	2	1	0
16 to 17	(MSB) Number of Data Transfer Elements (LSB)							
18	Reserved (00h)							
19	Reserved (00h)							

- **PS** (Page Savable)
  This bit must be 0 for a Mode Select command.

- **Page Code**
  A 1Dh identifies the Element Address Assignment mode page.

- **Parameter Length**
  This field indicates the length of the element address assignment parameter list. This field must be 12h, which indicates that there are an additional 12h (18d) bytes of parameter data following this byte.

- **First Medium Transport Element Address**
  This field identifies the address of the hand in the library. The library has only one hand, so the default value is 0000h.

- **Number of Medium Transport Elements**
  This field identifies the number of hands in the library. The library has only one hand, so this field must be 0001h (1d).

- **First Storage Element Address**
  This field identifies the starting address of the cartridge tape storage cells in the library, and the default starting address is 03E8h (1000d).

- **Number of Storage Elements**
  This field identifies the number of cartridge tape storage cells in the library. This number is based on the configuration of the library and is obtained when the library performs a Mode Sense of mode page 1Dh. The number in the Mode Select command must be the same number returned by the Mode Sense command.

- **First Import/Export Element Address**
  This field identifies the address of the first CAP element; the default address is 000Ah (10d).

- **Number of Import/Export Elements**
  This field identifies the number of Import/Export storage locations. This value is obtained by when the library performs a Mode Sense of mode page

1Dh. The number in the Mode Select command must be the same number returned by the Mode Sense command.

- **First Data Transfer Element Address**
  This field identifies the address of the first tape drive; the default setting address is 1F4h (500d).

- **Number of Data Transfer Elements**
  This field identifies the total number of tape drives installed in the library. The number of Data Transfer Elements varies depending on configuration. Obtain this value by requesting a Mode Sense of mode page 1Dh. The number in the Mode Select command must be the same number returned by the Mode Sense command.

Element Address Assignments

An initiator can modify the element addresses in the library using a Mode Select command. The four element types are:

- Medium transport (the hand)
- Storage element (storage cells)
- Import/export (cartridge access port)
- Data transfer (tape drives)

Each element type is defined as a range of consecutive elements based on a starting element and a count. The ranges may be configured in any order, but one element type range may not overlap another element type range, and gaps between ranges are allowed.

The maximum allowable element number that can be configured using a Mode Select command is 251Bh (9499d). An attempt to configure an element number greater than this will result in the Mode Select command being rejected with a Check Condition status.

To change the element address assignments, an initiator should first perform a Mode Sense of mode page 1Dh (Element Address Assignment Page). This provides the count of each element type. The count of each element type cannot be changed and must be used as obtained from the Mode Sense. Only the starting element number can be modified. The initiator must calculate the starting addresses of each type to ensure no overlaps.

Because the library supports the saved page function, the element address assignments can be saved in non-volatile memory. These values are used to configure the library:

- During power-on
- Following a reset on the interface
- Upon receiving a Bus Device Reset message

TapeAlert Page

Table 4-20 defines the Mode Select TapeAlert page.

Table 4-20. Mode Select TapeAlert Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Page Code (1Ch)							
1	Page Length (0Ah)							
2	Perf (0)	Reserved (0)			DExcpt (1)	Test	Reserved (0)	LogErr (0)
3	Reserved (0h)				MRIE (3h)			
4 to 7	(MSB) Interval Timer (LSB)							
8 to 11	(MSB) Report Counter/Test Flag Number (LSB)							

- **Perf**
  The performance bit must be 0, which indicates acceptance of informational exception operations that cause delays.

- **DExcpt**
  The exception bit must be 1, which indicates the target disables all information exception operations and ignores the MRIE field.

  In this mode, the software must poll the TapeAlert Log page.

- **Test**

0	The target does not generate any false/test informational exception conditions.
1	The target generates false/test informational exception conditions.

- **LogErr**
  The log information exception conditions must be 0, which indicates that the logging of informational exception conditions is vendor-specific.

- **MRIE**
  This field indicates the method that the target uses to report informational

exception conditions. The value must be 3h, which indicates that the target reports any informational exception conditions by returning Check Condition status.

- **Interval Timer**
  Bytes 4 through 7 must be 00h. The target will only report informational exception condition one time.

- **Report Counter/Test Flag Number**
  This is a dual purpose field:

  - When the test Flag bit is 0, this field is the report counter, and Bytes 8 through 11 must be set to 00h. This indicates there is no limit to the number of times the target will report the informational exception condition. This value is returned with Mode Sense.

  - When the Flag bit is 1, this field is the test flag number.

  Two test mode options are supported in the current tape alert implementation. The modes are in the snapshot of all bits supported and the setting of the individual bits.

Test Mode for All Bits Supported

Using the mode select command to initiate this test will set all of the flags supported by the TapeAlert implementation in the TapeAlert log page. The TapeAlert log sense page then can be read to give the host a snapshot of the supported flags.

The flags will be cleared when the page is read. To do this, set the test mode flag in the TapeAlert mode select page. This indicates that the Report Count/ Test Flag Number field is in Test Flag Number mode. Next, set the test flag number to 0x7FFF and issue the Mode Select command. When the command is complete, the TapeAlert log sense page can be read.

Test Mode for Individual Bits

Another test mode allows individual bits to be turned on. This can be useful for the host to debug/test operator interfaces.

Any flag set must be a supported flag. If the flag is not supported, a check condition with an incorrect parameter code is returned. The TapeAlert log sense page then can be read to allow the host to get a log page with the flag of interest set. The flag will be cleared when the page is read.

To test a flag, set the Test Flag in the TapeAlert mode select page. This indicates the Report Count/Test Flag Number field is in Test Flag mode. Set the number of the flag to be tested. Issue the Mode Select command. When the command is complete, the TapeAlert log sense page can be read.

See "TapeAlert Flags" on page 4-19 for supported TapeAlert flags.

Drive Configuration Page

Table 4-21 defines the Drive Configuration page (2Dh), a vendor-specific page for the StorageTek L20, L40 and L80 libraries.

CAUTION:
Library reset required: **This Mode Select page is intended for use only during drive installation. You must reset (re-IPL) the library after you have used this Mode Select page to update the drive data.**

Table 4-21. Drive Configuration Page

Byte	Bit							
	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (2Dh)					
1	Parameter Length (2 + 8 * number of drives)							
2	Reserved (00h)							
3	Number of drives installed							
4 to 5	First Drive's Virtual Element Address							
6	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
7	Reserved (00h)							
8 to 11	(MSB) First Drive's Device ID (LSB)							
12 to 13	Second Drive's Virtual Element Address							
14	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
15	Reserved (00h)							
16 to 19	(MSB) Second Drive's Device ID (LSB)							

Table 4-21. Drive Configuration Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
20 to 21	Third Drive's Virtual Element Address (L40 or L80)							
22	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
23	Reserved (00h)							
24 to 27	(MSB) Third Drive's Device ID (LSB)							
28 to 29	Fourth Drive's Virtual Element Address (L40 or L80 only)							
30	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
31	Reserved (00h)							
32 to 35	(MSB) Fourth Drive's Device ID (LSB)							
36 to 37	Fifth Drive's Virtual Element Address (L80 only)							
38	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
39	Reserved (00h)							
40 to 43	(MSB) Fifth Drive's Device ID (LSB)							

Table 4-21. Drive Configuration Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
44 to 45	Sixth Drive's Virtual Element Address (L80 only)							
46	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
47	Reserved (00h)							
48 to 51	(MSB) Sixth Drive's Device ID (LSB)							
52 to 53	Seventh Drive's Virtual Element Address (L80 only)							
54	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
55	Reserved (00h)							
56 to 59	(MSB) Seventh Drive's Device ID (LSB)							
60 to 61	Eighth Drive's Virtual Element Address (L80 only)							
62	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
63	Reserved (00h)							
64 to 67	(MSB) Eighth Drive's Device ID (LSB)							

- **PS** (Page Savable) This bit must be 0 for the Mode Select command.

- **Page Code** A 2Dh indicates the Drive Configuration page.

- **Parameter Length**
  This field indicates the length of the Drive Configuration page (including drive information). The value in this field depends on the number of drives installed in the library and is calculated during the library's IPL.

2h	The library contains no drives.
Ah	The library contains one drive.
12h	The library contains two drives.
1Ah	The library contains three drives (L40 or L80).
22h	The library contains four drives (L40 or L80).
2Ah	The library contains five drives (L80).
32h	The library contains six drives (L80).
3Ah	The library contains seven drives (L80).
42h	The library contains eight drives (L80).

- **Number of Drives Installed**
  This field indicates how many drives are currently installed in the library:

00h	The library contains no drives.
01h	The library contains one drive.
02h	The library contains two drives.
03h	The library contains three drives (L40 or L80).
04h	The library contains four drives (L40 or L80).
05h	The library contains five drives (L80).
06h	The library contains six drives (L80).
07h	The library contains seven drives (L80).
08h	The library contains eight drives (L80).

- **Virtual Element Address** (per drive)
  This field indicates the virtual element address for a specific drive.

- **Set Drive Info** (per drive)
  This field indicates whether the drive information in the subsequent fields should be ignored:

0	Ignore the drive data for this drive.
1	Update the drive data for this drive with information in the following fields.

- **ID Valid** (per drive)
  This field is a Mode Sense field that indicates whether the ID of the drive is in the valid range. Since this field is not used in the Mode Select command, its value must be 0.

- **Interface** (per drive)
  This field identifies the type of interface for a specific drive. Since only SCSI drives are currently available for the library, the value must be 00.

- **Bus Status** (per drive)
  If the data path from the drive is SCSI, this field indicates to the library whether the drive is on the same SCSI bus as the library.

  0   Off bus

  1   On bus

- **Device ID** (per drive)
  This field sets the bus address of the drive. Valid SCSI addresses are 0 to 15h. The SCSI address appears in the least significant byte (LSB).

Network Configuration Page

The following table defines the Network Configuration Page (2Eh), a vendor-specific page for the StorageTek L20, L40 and L80 libraries.

CAUTION:
Library reset required: **This Mode Select page is intended for use only during library installation. You must reset (re-IPL) the library after you have used this Mode Select page to update the network data.**

Table 4-22. Network Configuration Page

Byte	Bit							
	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (2Eh)					
1	Parameter Length (1Eh)							
2	Reserved (0)	SNMP Supp (0)	HTTP Supp (1)	IP Info Valid	DHCP Info Valid	Conn Info Valid	Enet Info Valid (0)	Mac Info Valid
3 to 8	MAC Address (Ethernet)							
9	Connection Info				Ethernet Mode (0h)			
10	Reserved (0h)				DHCP Info (0h)			
11	Reserved (00h)							
12 to 15	(MSB) Internet Protocol (IP) Address (LSB)							
16 to 19	(MSB) IP Net Mask (LSB)							
20 to 23	(MSB) IP Gateway (LSB)							
24 to 31	(MSB) Reserved (00h) (LSB)							

- **PS** (Page Savable)
  This bit must be 0 for the Mode Select command.

- **Page Code**
  A 2Eh identifies the Network Configuration page.

- **Parameter Length**
  This field indicates the length (1Eh) of the Network Configuration page.

- **SNMP Support**
  This bit indicates whether the library supports the Simple Network Management Protocol (SNMP). This bit is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **HTTP Support**
  This bit indicates whether the library supports the HyperText Transfer Protocol. This bit is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **IP Information Valid**
  This bit indicates whether the Internet Protocol (IP) information is valid. This bit is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **DHCP Information Valid**
  This bit indicates whether the Dynamic Host Configuration Protocol (DHCP) information is valid. This bit is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **Connection Information Valid**
  This bit indicates whether the connection information is valid. This bit is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **Ethernet Information Valid**
  This bit indicates whether the Ethernet information is valid. This bit is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **MAC (Ethernet) Information Valid**
  This bit indicates whether the Media Access Control (Ethernet) address information is valid. This bit is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **MAC (Ethernet) Address**
  This field provides the library's unique Ethernet (Media Access Control) address. This field is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **Connection Information**
  This field provides information about the library's network connection. This

field is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **Ethernet Mode**
  The value in this field indicates the mode of the library's Ethernet connection. This field is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **DHCP Information**
  This field provides information about the library's Dynamic Host Configuration Protocol. This field is valid only for the Mode Sense command and is not checked in the Mode Select command.

- **IP Address**
  This field sets the library's IP address.

- **IP Net Mask**
  This field sets the library's network mask address.

- **IP Gateway**
  This field sets the library's network gateway address.

Miscellaneous Configuration Page

The following table shows the Miscellaneous Configuration Page (2Fh), a vendor-specific page for the StorageTek L20, L40 and L80 libraries.

CAUTION:
Library reset required: **This Mode Select page is intended for use only during library installation. You must reset (re-IPL) the library after you have used this Mode Select page to update the library data.**

Table 4-23. Miscellaneous Configuration Page

Byte	Bit							
	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (2Fh)					
1	Parameter Length (22h)							
2	Interface (00)		Reserved (00)		SCSI ID			
3	Reserved (000)							
4 to 7	Reserved (000)							
8	Clean	Fast Load	Set DNS Name	No CAP	Reduced Cells	Reserved (000)		
9	Reserved (000)							
10	Month							
11	Day							
12 to 13	Year							
14	Hour							
15	Minute							
16 to 35	DNS Name							

- **PS** (Page Savable)
  This bit must be 0 for the Mode Select command.

- **Page Code**
  A 2Fh identifies the Miscellaneous Configuration page.

- **Parameter Length**
  This field indicates the length (22h) of the Miscellaneous Configuration page.

- **Interface**
  This field indicates the type of interface for the library's control path. Since the only native interface available on the library is SCSI, the value in this field must be 00.

- **SCSI ID**
  This field sets a new SCSI address for the library.

  Note: The new SCSI address will be effective only after you reset the library.

- **Clean**
  This field enables or disables the Auto Clean function on the library:

  0   Auto Clean is *not* enabled

  1   Auto Clean is enabled

- **Fast Load**
  This field enables or disables the Fast Load function on the library:

  0   Fast Load is *not* enabled

  1   Fast Load is enabled

- **Set DNS Name**
  This field indicates that the library's domain name should be updated with the information in Bytes 16 through 35.

- **No CAP**
  The Library is not configured with a CAP. This applies to the L20 only.

- **Reduced Cells**
  When this bit is set the L20 is configured for 15, L40 is configured for 32 and the No CAP bit must be set to zero.

- **Month**
  This field sets the current month.

- **Day**
  This field sets the current day.

- **Year**
  This field sets the current year.

- **Hour**
  This field sets the current hour.

- **Minute**
  This field sets the current minute.

- **DNS Name**
  This field sets the library's domain name on the network.

■ Mode Sense

The Mode Sense command (1A) enables the library to report its operating mode parameters to the initiator (Table 4-24). The initiator can request one page or all pages of the mode parameters.

Note: The initiator can use the Mode Select command to change the values of certain mode parameters.

Table 4-24. Mode Sense Command

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

Note: Before issuing any Mode Select commands, an initiator should issue a Mode Sense command with the Page Control field set to 01h, and the Page Code field set to 3Fh to determine which pages are supported, which parameters within the pages are changeable, and what the supported length of each page is.

- **DBD** (Disable Block Descriptors)
  This bit should be set to 1 to indicate that the block descriptor should not be returned.

- **Page Control**
  These two bits define the type of parameters to be returned for the Mode Sense command, and includes values 0h (00b), 1h (01b), 2h (10b), or 3h (11b):

00   **Current Values:** The library returns the current parameter values, including:

- The parameters set in the last successful Mode Select command.

- The default values if saved values are unavailable or invalid.

- The saved values if a MODE command has not been executed since the last power-on, an interface reset condition, or Bus Device Reset message.

01   **Changeable Values**: The library returns the changeable parameter masks. The requested pages are returned, and indicate which parameters are changeable by the initiator. All bits of changeable parameters are set to 1. All bits of parameters that are not changeable by the initiator are set to 0.

10   **Default Values**: The library returns the default values. The requested pages are returned with each supported parameter set to its default value. Parameters not supported by the library are set to 0. The default values for the Element Address Assignment page are based on the configuration of the library.

11   **Saved Values**: The library returns the saved values. Requested pages are returned with each supported parameter set to its saved value. Parameters not supported by the library are set to 0. This option is valid only with mode pages that can be saved.

- **Page Code**
  This field specifies which pages the library returns, including:

  1Ch   TapeAlert page

  1Dh   Element Address Assignment page

  1Eh   Transport Geometry page

  1Fh   Device Capabilities page

  2Dh   Drive Configuration page (vendor-specific)

  2Eh   Network Configuration page (vendor-specific)

  2Fh   Miscellaneous Configuration page (vendor-specific)

  3Fh   All pages (in the above order)

- **Allocation Length**
  This field specifies the length of the parameter list the library returns. The maximum length is 164d (A4h) bytes. The length varies based on the Page Code selected:

- 4 bytes for the parameter list header (always present)

- 12 additional bytes for the TapeAlert page

- 20 additional bytes for the Element Address Assignment page

- 4 additional bytes for the Transport Geometry page

- 20 additional bytes for the Device Capabilities page

- A 4-byte, 12-byte, 20-byte, 28-byte, or 36-byte Drive Configuration page (vendor-specific), depending on the number of drives installed in the library

- 32 additional bytes for the Network Configuration page (vendor-specific)

- 36 additional bytes for the Miscellaneous Configuration page (vendor-specific)

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

Mode Sense Data

The library returns the following mode sense data:

- A four-byte Mode Parameter Header followed by

- One mode page or all mode pages in the order specified on page 4-43. The mode pages available are those defined for medium changers in the SCSI-3 standard, and include a Tape Alert page, an Element Address Assignment page, a Transport Geometry page, a Device Capabilities page, and a Setup and Configuration page.

The data can be truncated to the length specified in the allocation length field.

Mode Parameter Header Definition

Table 4-25 defines the Mode Parameter Header page.

Table 4-25. Mode Parameter Header

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

- **Mode Data Length**
  This field indicates the number of bytes of parameter information available to be transferred to the initiator, regardless of the allocation length. This field excludes the Mode Data Length byte but includes three additional Mode Parameter Header bytes and any mode pages that follow.

- **Block Descriptor Length**
  The library does not support block descriptors and returns a value of 00h.

TapeAlert Page

Table 4-26 defines the Mode Sense TapeAlert page.

Table 4-26. Mode Sense TapeAlert Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Page Code (1Ch)							
1	Page Length (0Ah)							
2	Perf (0)	Reserved (0)			DExcpt (1)	Test (0)	Reserved (0)	LogErr (0)
3	Reserved (0h)				MRIE (3h)			
4 to 7	(MSB) Interval Timer (LSB)							
8 to 11	(MSB) Report Counter/Test Flag Number (LSB)							

- **Perf** The performance bit is 0, which indicates acceptance of informational exception operations that cause delays.

- **DExcpt** The exception bit is 1, which indicates that the target disables all information exception operations ignoring the MRIE field. In this mode the software must poll the TapeAlert Log page.

- **Test** The test operations bit is 0, which requests that the target not generate any false/test informational exception conditions.

- **LogErr** The log information exception conditions bit is 0, which indicates that logging of informational exception conditions is vendor-specific.

- **MRIE** This field indicates the method the tape library uses to report informational exception conditions. The field is set to 3h but is ignored because the DExcpt bit is on.

- **Interval Timer** Bytes 4 through 7 are set to 00h, which indicates that the target will only report the informational exception condition one time.

- **Report Count** Bytes 8 through 11 are set to 00h, which indicates that there is no limit to the number of times the informational exception condition can be reported. For Mode Sense, the report counter is returned.

Element Address Assignment Page Definition

Table 4-27 defines the Element Address Assignment page of the Mode Sense command.

Table 4-27. Element Address Assignment Page

Byte	Bit							
	7	6	5	4	3	2	1	0
0	PS (1)	Reserved (0)	Page Code (1Dh)					
1	Parameter Length (12h)							
2 to 3	(MSB) First Medium Transport Element Address (LSB)							
4 to 5	(MSB) Number of Medium Transport Elements (0001h) (LSB)							
6 to 7	(MSB) First Storage Element Address (LSB)							
8 to 9	(MSB) Number of Storage Elements (LSB)							
10 to 11	(MSB) First Import/Export Element Address (LSB)							
12 to 13	(MSB) Number of Import/Export Elements (LSB)							
14 to 15	(MSB) First Data Transfer Element Address (LSB)							

Table 4-27. Element Address Assignment Page

Byte	Bit							
	7	6	5	4	3	2	1	0
16 to 17	(MSB) Number of Data Transfer Elements (LSB)							
18	Reserved (00h)							
19	Reserved (00h)							

- **PS (Page Savable)**
  This bit specifies that the library can save this page to non-volatile memory; the library returns a value of 1.

- **Page Code**
  This field identifies the Element Address Assignment mode page; the library returns a value of 1Dh.

- **Parameter Length**
  This field indicates the amount of element address data following this byte and returns a value of 12h (18d).

- **First Medium Transport Element Address**
  This field identifies the address of the hand in the library. The library has only one hand, so the default address is 0h (0d).

- **Number of Medium Transport Elements**
  This field identifies the number of hands within the library. The library has only one hand, so the value is 0001h (1d).

- **First Storage Element Address**
  This field identifies the starting address of the cartridge tape storage cells. The default starting address is 03E8h (1000d).

- **Number of Storage Elements**
  This field identifies the number of cartridge tape storage cells within the library. The total number of cartridge tape storage cells depends on how the library is equipped and configured.

- **First Import/Export Element Address**
  This field indicates the address of the first CAP cell. The default address is 000Ah (10d).

- **Number of Import/Export Elements**
  This field identifies the total number of CAP cells.

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

- **Number of Data Transfer Elements**
  This field identifies the number of tape drives in the library, and the library returns the configured count.

Transport Geometry Mode Page Definition

Table 4-28 gives the Mode Sense Transport Geometry Mode page definition.

Table 4-28. Transport Geometry Mode Page

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

- **PS**
  The value is 0, which indicates that the library cannot save this page to non-volatile memory.

- **Page Code**
  This field identifies the Transport Geometry mode page; the library returns a value of 1Eh.

- **Parameter Length**
  This field indicates the number of additional bytes of transport geometry descriptor data to follow the header. Each descriptor has two bytes of information. The library has one transport mechanism and returns a value of 02h.

- **Rotate**
  This field identifies the ability of the transport mechanism to handle two-sided media.

  Note: The library does not use multiple-sided media and returns a value of 0.

- **Member Number in Transport Element Set**
  This field identifies the specific transport element in the system to which this descriptor is applied. The library has one transport element and returns a value of 00h.

Device Capabilities Page Definition

Table 4-29 defines the Device Capabilities page of the Mode Sense command.

Table 4-29. Device Capabilities Page

Byte	Bit							
	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (1Fh)					
1	Parameter Length (12h)							
2	Reserved (0h)				StorDT[1] (1)	StorI/E[2] (1)	StorST[3] (1)	StorMT[4] (0)
3	Reserved (0h)							
4	Reserved (0h)				MT->DT (0)	MT->I/E (0)	MT->ST (0)	MT->MT (0)
5	Reserved (0h)				ST->DT (1)	ST->I/E (1)	ST->ST (1)	ST->MT (0)
6	Reserved (0h)				I/E->DT (1)	I/E->I/E (1)	I/E->ST (1)	I/E->MT (0)
7	Reserved (0h)				DT->DT (1)	DT->I/E (1)	DT->ST (1)	DT->MT (0)
8 to 11	Reserved (00h, 00h, 00h, 00h)							
12	Reserved (0h)				MT<>DT (0)	MT<>I/E (0)	MT<>ST (0)	MT<>MT (0)
13	Reserved (0h)				ST<>DT (0)	ST<>I/E (0)	ST<>ST (0)	ST<>MT (0)
14	Reserved (0h)				I/E<>DT (0)	I/E<>I/E (0)	I/E<>ST (0)	I/E<>MT (0)
15	Reserved (0h)				DT->DT (0)	DT<>I/E (0)	DT<>ST (0)	DT<>MT (0)
16 to 19	Reserved (00h, 00h, 00h, 00h)							

Table 4-29. Device Capabilities Page (Continued)

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Notes:								
1. DT - Data Transfer Element (tape drive)								
2. I/E = Import/Export Element (cartridge access port cell)								
3. ST = Storage Element (cartridge tape storage cell)								
4. MT= Medium Transport (hand)								

- **PS**
  This field indicates the library cannot save this page to non-volatile memory; the library returns a value of 0.

- **Page Code**
  This field identifies the Device Capabilities mode page and always contains a value of 1Fh.

- **Parameter Length**
  This field indicates the amount of device capabilities data following this byte; the library returns a value of 12h (18d).

- **StorDT**
  This field identifies the ability of a tape drive to perform the function of element storage; the library returns a value of 1.

- **StorI/E**
  This field identifies the ability of the CAP cell to perform the function of element storage; the library returns a value of 1.

- **StorST**
  This field identifies the ability of the cartridge tape storage cells to perform the function of element storage; the library returns a value of 1.

- **StorMT**
  This field identifies the ability of the hand to perform the function of element storage. The hand cannot be used as the source or destination of a move. The library returns a value of 0.

- **MT -> DT**
  This field identifies the support for the Move Medium command, where the source is the hand, and the destination is a tape drive. The library returns a value of 0.

- **MT -> I/E**
  This field identifies the support for the Move Medium command, where the source is the hand, and the destination is the CAP cell. The library returns a value of 0.

- **MT -> ST**
  This field identifies the support for the Move Medium command, where the source is the hand, and the destination is a cartridge tape storage cell. The library returns a value of 0.

- **MT -> MT**
  This field identifies the support for the Move Medium command, where both the source and the destination is the hand. The library returns a value of 0.

- **ST -> DT**
  This field identifies the support for the Move Medium command, where the source is a cartridge tape storage cell, and the destination is a tape drive. The library returns a value of 1.

- **ST -> I/E**
  This field identifies the support for the Move Medium command, where the source is a cartridge tape storage cell, and the destination is the CAP cell. The library returns a value of 1.

- **ST -> ST**
  This field identifies the support for the Move Medium command, where the source is a cartridge tape storage cell, and the destination is a cartridge tape storage cell. The library returns a value of 1.

- **ST -> MT**
  This field identifies the support for the Move Medium command, where the source is a cartridge tape storage cell, and the destination is the hand. The library returns a value of 0.

- **I/E -> DT**
  This field identifies the support for the Move Medium command, where the source is the CAP cell, and the destination is a tape drive. The library returns a value of 1.

- **I/E -> I/E**
  This field identifies the support for the Move Medium command, where both the source, and the destination is the CAP cell. The library returns a value of 1.

- **I/E -> ST**
  This field identifies the support for the Move Medium command, where the source is the CAP cell, and the destination is a cartridge tape storage cell. The library returns a value of 1.

- **I/E -> MT**
  This field identifies the support for the Move Medium command, where the source is the CAP cell, and the destination is the hand. The library returns a value of 0.

- **DT -> DT**
  This field identifies the support for the Move Medium command, where the source, and the destination is a tape drive. The library returns a value of 1.

- **DT -> I/E**
  This field identifies the support for the Move Medium command, where the source is a tape drive, and the destination is the CAP cell. The library returns a value of 1.

- **DT -> ST**
  This field identifies the support for the Move Medium command, where the source is a tape drive, and the destination is a cartridge tape storage cell. The library returns a value of 1.

- **DT -> MT**
  This field identifies the support for the Move Medium command, where the source is a tape drive, and the destination 1 element is the hand. The library returns a value of 0.

- **MT <> DT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the hand, and the destination 1 element is a tape drive. The library returns a value of 0.

- **MT <> I/E**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the hand, and the destination 1 element is the CAP cell. The library returns a value of 0.

- **MT <> ST**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the hand, and the destination 1 element is a cartridge tape storage cell. The library returns a value of 0.

- **MT <> MT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the hand, and the destination 1 element is the hand. The library returns a value of 0.

- **ST <> DT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are a cartridge tape storage cell, and the destination 1 element is a tape drive. The library returns a value of 0.

- **ST <> I/E**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are a cartridge tape storage cell, and the destination 1 element is the CAP cell. The library returns a value of 0.

- **ST <> ST**
  This field identifies support for the Exchange Medium command, where the source and destination 2 elements are a cartridge tape storage cell, and the

destination 1 element is a cartridge tape storage cell. The library returns a value of 0.

- **ST <> MT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are a cartridge tape storage cell, and the destination 1 element is the hand. The library returns a value of 0.

- **I/E <> DT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the CAP cell, and the destination 1 element is a tape drive. The library returns a value of 0.

- **I/E <> I/E**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the CAP cell, and the destination 1 element is the CAP cell. The library returns a value of 0.

- **I/E <> ST**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the CAP cell, and the destination 1 element is a cartridge tape storage cell. The library returns a value of 0.

- **I/E <> MT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are the CAP cell, and the destination 1 element is the hand. The library returns a value of 0.

- **DT <> DT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are a tape drive, and the destination 1 element is a tape drive. The library returns a value of 0.

- **DT <> I/E**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are a tape drive, and the destination 1 element is the CAP cell. The library returns a value of 0.

- **DT <> ST**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are a tape drive, and the destination 1 element is a cartridge tape storage cell. The library returns a value of 0.

- **DT <> MT**
  This field identifies the support for the Exchange Medium command, where the source and destination 2 elements are a tape drive, and the destination 1 element is the hand. The library returns a value of 0.

Drive Configuration Page

Table 4-30 defines the Drive Configuration page (2Dh), a vendor-specific page for the StorageTek L20, L40 and L80 libraries.

Table 4-30. Drive Configuration Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	PS (0)	Reserved (0)	Page Code (2Dh)					
1	Parameter Length (2 + 8 * number of drives)							
2	Reserved (00h)							
3	Number of drives installed							
4 to 5	First Drive's Virtual Element Address							
6	Set Drive Info (0)	ID Valid	Interface (00)		Bus Status	Reserved (000)		
7	Reserved (00h)							
8 to 11	(MSB) First Drive's Device ID (LSB)							
12 to 13	Second Drive's Virtual Element Address							
14	Set Drive Info (0)	ID Valid	Interface (00)		Bus Status	Reserved (000)		
15	Reserved (00h)							
16 to 19	(MSB) Second Drive's Device ID (LSB)							
20 to 21	Third Drive's Virtual Element Address (L40 or L80)							

Table 4-30. Drive Configuration Page

Byte	Bit							
	7	6	5	4	3	2	1	0
22	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
23	Reserved (00h)							
24 to 27	(MSB) Third Drive's Device ID (LSB)							
28 to 29	Fourth Drive's Virtual Element Address (L40 or L80)							
30	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
31	Reserved (00h)							
32 to 35	(MSB) Fourth Drive's Device ID (LSB)							
36 to 37	Fifth Drive's Virtual Element Address (L80 only)							
38	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
39	Reserved (00h)							
40 to 43	(MSB) Fifth Drive's Device ID (LSB)							
44 to 45	Sixth Drive's Virtual Element Address (L80 only)							
46	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		

Table 4-30. Drive Configuration Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
47	Reserved (00h)							
48 to 51	(MSB) Sixth Drive's Device ID (LSB)							
52 to 53	Seventh Drive's Virtual Element Address (L80 only)							
54	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
55	Reserved (00h)							
56 to 59	(MSB) Seventh Drive's Device ID (LSB)							
60 to 61	Eight Drive's Virtual Element Address (L80 only)							
62	Set Drive Info	ID Valid (0)	Interface (00)		Bus Status	Reserved (000)		
63	Reserved (00h)							
64 to 67	(MSB) Eight Drive's Device ID (LSB)							

- **PS** (Page Savable)
  This field indicates the library cannot save this page to non-volatile memory; the library returns a value of 0.

- **Page Code**
  A 2Dh identifies the Drive Configuration page.

- **Parameter Length**
  This field indicates the length of the Drive Configuration page (including drive information). The value in this field depends on the number of drives

installed in the library and is calculated during the library's IPL. The lengths are:

2h	The library contains no drives.
Ah	The library contains one drive.
12h	The library contains two drives.
1Ah	The library contains three drives (L40 or L80).
22h	The library contains four drives (L40 or L80).
2Ah	The library contains five drives (L80).
32h	The library contains six drives (L80).
3Ah	The library contains seven drives (L80).
42h	The library contains eight drives (L80).

- **Number of Drives Installed**
  This field indicates how many drives are currently installed in the library:

00h	The library contains no drives.
01h	The library contains one drive.
02h	The library contains two drives.
03h	The library contains three drives (L40 or L80).
04h	The library contains four drives (L40 or L80).
05h	The library contains five drives (L80).
06h	The library contains six drives (L80).
07h	The library contains seven drives (L80).
08h	The library contains eight drives (L80).

- **Virtual Element Address** (per drive)
  This field identifies the virtual element address for a specific drive.

- **Set Drive Info** (per drive)
  This field in the Mode Select command indicates whether the drive information in the subsequent fields should be ignored. For the Mode Sense command, the library returns a value of 0.

- **ID Valid** (per drive)
  This field indicates whether the ID of the drive is in the valid range.

0	Invalid
1	Valid

- **Interface** (per drive)
  This field identifies the type of interface for a specific drive. Since only SCSI drives are currently available for the library, the library returns a value of 00.

- **Bus Status** (per drive)
  If the data path from the drive is SCSI, this field indicates whether the drive is on the same SCSI bus as the library.

  0   Off bus

  1   On bus

- **Device ID** (per drive)
  This field indicates the bus address of the drive. Valid SCSI addresses are 0 to 15h. The SCSI address appears in the least significant byte (LSB).

Network Configuration Page

The following table defines the Network Configuration Page (2Eh), a vendor-specific page for the StorageTek L20,L40 and L80 libraries.

Table 4-31. Network Configuration Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	PS (0)	Reserved (0)	Page Code (2Eh)					
1	Parameter Length (1Eh)							
2	Reserved (0)	SNMP Supp (0)	HTTP Supp (1)	IP Info Valid	DHCP Info Valid (1)	Conn Info Valid	Enet Info Valid (0)	Mac Info Valid (1)
3 to 8	MAC Address (Ethernet)							
9	Connection Info (2h)				Ethernet Mode (0h)			
10	Reserved (0h)				DHCP Info (0h)			
11	Reserved (00h)							
12 to 15	(MSB) Internet Protocol (IP) Address (LSB)							
16 to 19	(MSB) IP Net Mask (LSB)							
20 to 23	(MSB) IP Gateway (LSB)							
24 to 31	(MSB) Reserved (00h) (LSB)							

- **PS** (Page Savable)
  This field indicates the library cannot save this page to non-volatile memory; the library returns a value of 0.

- **Page Code**
  A 2Eh identifies the Network Configuration page.

- **Parameter Length**
  This field indicates the length (1Eh) of the Network Configuration page.

- **SNMP Support**
  This bit indicates whether the library supports the Simple Network Management Protocol (SNMP). Currently, the library does not support SNMP, so the library returns a value of 0.

- **HTTP Support**
  This bit indicates whether the library supports the HyperText Transfer Protocol. The library returns a value of 1 to indicate that the library supports HTTP.

- **IP Information Valid**
  This bit indicates whether the Internet Protocol (IP) information is valid.

  0   The information is *not* valid.

  1   The information is valid

- **DHCP Information Valid**
  This bit indicates whether the Dynamic Host Configuration Protocol (DHCP) information is valid. Currently, the library does not support DHCP, so the library returns a value of 0.

- **Connection Information Valid**
  This bit indicates whether the connection information is valid.

  0   The information is *not* valid.

  1   The information is valid.

- **Ethernet Information Valid**
  This bit indicates whether the Ethernet information is valid. Because the library currently does not detect a connection to an Ethernet network, the library returns a value of 0.

- **MAC (Ethernet) Information Valid**
  This bit indicates whether the Media Access Control (Ethernet) address information is valid. Because the library's Ethernet address is unique, the library returns a value of 1 to indicate that the information is valid.

- **MAC (Ethernet) Address**
  This field provides the library's unique Ethernet (Media Access Control) address.

- **Connection Information**
  This field provides information about the library's network connection. The library returns a value of 2h to indicate that the library is connected to a 10Base-T network.

- **Ethernet Mode**
  The value in this field indicates the mode of the library's Ethernet connection. Because the library currently does not detect a connection to an Ethernet network, the library returns a value of 0.

- **DHCP Information**
  This field provides information about the library's Dynamic Host Configuration Protocol. Because the library does not currently support DHCP, the library returns a value of 0h.

- **IP Address**
  This field identifies the library's IP address.

- **IP Net Mask**
  This field identifies the library's network mask address.

- **IP Gateway**
  This field identifies the library's network gateway address.

Miscellaneous Configuration Page

The following table shows the Miscellaneous Configuration Page (2Fh), a vendor-specific page for the StorageTek L20, L40 and L80 libraries.

Table 4-32. Miscellaneous Configuration Page

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	PS (0)	Reserved (0)	Page Code (2Fh)					
1	Parameter Length (22h)							
2	Interface (00)		SCSI Type		SCSI ID			
3	Reserved (000)							
4 to 7	Reserved (000)							
8	Clean	Fast Load	Set DNS Name	No CAP	Reduced Cells	Reserved (000)		
9	Reserved (000)							
10	Month							
11	Day							
12 to 13	Year							
14	Hour							
15	Minute							
16 to 35	DNS Name							

- **PS** (Page Savable)
  This field indicates the library cannot save this page to non-volatile memory; the library returns a value of 0.

- **Page Code** A 2Fh identifies the Miscellaneous Configuration page.

- **Parameter Length** This field indicates the length (22h) of the Miscellaneous Configuration page.

- **Interface**
  This field indicates the type of interface for the library's control path. Since the only native interface available on the library is SCSI, the library returns a value of 00.

- **SCSI Type**
  This is a Read Only field that indicates the SCSI interface type:

00b	Unknown
01b	Low Voltage Differential (LVD)
10b	High Voltage Differential (HVD)

- **SCSI ID** This field indicates the SCSI address of the library.

- **Clean**
  This field indicates whether the Auto Clean function is enabled on the library:

0	Auto Clean is *not* enabled
1	Auto Clean is enabled

- **Fast Load**
  This field indicates whether the Fast Load function is enabled on the library:

0	Fast Load is *not* enabled
1	Fast Load is enabled

- **Set DNS Name**
  This field is used only in the Mode Select command when you are setting the library's domain name. It has no meaning in the Mode Sense command.

- **No CAP**
  The Library is not configured with a CAP. This applies to the L20 only.

- **Reduced Cells**
  When this bit is set the L20 is configured for 15, or the L40 is configured for 32, or the L80 is configured for 64. The No CAP bit must be set to zero when this bit is set.

- **Month**
  This field identifies the current month.

- **Day**
  This field identifies the current day.

- **Year**
  This field identifies the current year.

- **Hour**
  This field identifies the current hour.

- **Minute**
  This field identifies the current minute.

- **DNS Name**
  This field identifies the library's domain name on the network.

■ Move Medium

The Move Medium command (A5) moves a cartridge tape from one specific element location to another specific element location (Table 4-33).

The Mode Sense command provides a matrix with the valid source and destination element combinations for the Move Medium command.

The Fast Load option on the library controls the completion of the move command when the destination element is a tape drive. If the fast load option is disabled, the library performs the move motion, and waits until the tape drive load operation completes before returning status for the move command. When the fast load option is enabled, the library performs the move motion, and verifies the tape drive load starts before returning status for the move command.

Table 4-33. Mode Move Medium Command

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

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

- **Source Element Address**
  This field is the element address from which the cartridge tape is to be removed. This may be a storage cell, the CAP 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, the 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.

  > **Note:** 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.

  > **Note:** 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

The Persistent Reserve In (5E) and Persistent Reserve Out (5F) commands resolve contention among multiple initiators and multiple-port targets within the system.

Note: Do not use these commands with either the Reserve command or the Release command.

The library uses the Persistent Reserve In command to identify which initiators are holding conflicting or invalid persistent reservations. The command's format appears in Table 4-34.

Table 4-34. Persistent Reserve In Command

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Operation Code (5Eh)							
1	Reserved			Service Action				
2	Reserved (00h)							
3	Reserved (00h)							
4	Reserved (00h)							
5	Reserved (00h)							
6	Reserved (00h)							
7 to 8	(MSB) Allocation Length (LSB)							
9	Control (00h)							

- **Service Action**
  This field defines the type of request that is being made to the initiator. Valid values are 00h and 01h. Values 02h through 1Fh are reserved.

  00h The initiator reads all registered reservation keys

  01h The initiator reads all current persistent reservations

- **Allocation Length**
  This field indicates how much space has been reserved for the returned parameter list. If the length is not sufficient to contain the entire parameter list, the parameter list will be incomplete. However, a partial list is not an error.

Read Keys Data

The Read Keys service action requests that the initiator return a list of all the current Reservation keys it has registered. Refer to Table 4-35 for the format of the parameter data returned in response to a Persistent Reserve In command with the Read Keys service action.

Table 4-35. Read Keys Parameter Data

Byte	Bit							
	7	6	5	4	3	2	1	0
0 to 3	(MSB) Generation (LSB)							
4 to 7	(MSB) Additional Length (n-7) (LSB)							
	Reservation Key List							
8 to 15	(MSB) First Reservation Key (LSB)							
More	Additional Reservation Keys							
n-7 to n	(MSB) Last Reservation Key (LSB)							

- **Generation**
  This value is a 32-bit counter that is incremented every time a Persistent Reserve Out command requests a Register, a Clear, a Preempt, or a Preempt and Abort operation. It allows the library to verify that its configuration of initiators has not been illegally modified.

- **Additional Length**
  This field indicates the number of bytes in the reservation key list.

- **Reservation Key List**
  These fields contain all the eight-byte reservation keys that have been registered with the library through a Persistent Reserve Out command.

Read Reservations Data

The Read Reservations service action requests that the initiator return a description of all current Reservation keys it has registered. Refer to Table 4-36 for the format of the parameter data returned in response to a Persistent Reserve In command with the Read Reservations service action.

Table 4-36. Read Reservations Parameter Data

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

- **Generation**
  This value is a 32-bit counter that is incremented every time a Persistent Reserve Out command requests a Register, a Clear, a Preempt, or a Preempt and Abort operation. It allows the library to verify that its configuration of initiators has not been illegally modified.

- **Additional Length**
  This field indicates the number of bytes in the list of reservation descriptors.

- **Reservation Descriptors**
  Each persistent reservation for a logical unit has one reservation descriptor that has the format shown in Table 4-37 on page 4-72.

Table 4-37. Reservation Descriptors Format

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0 to 7	(MSB) Reservation Key (LSB)							
8 to 11	(MSB) Scope-specific Address (LSB)							
12	Reserved (00h)							
13	Scope				Type			
14 to 15	Obsolete (00h)							

- **Reservation Key**
  This value indicates the reservation key for the descriptor data that follows.

- **Scope-specific Address**
  If the scope is an Element Reservation, the Scope-specific Address field will contain the element address. The address will be zero-filled in the most significant bytes to fit the field.

- **Scope**
  The value in the Scope field indicates whether a persistent reservation applies to an entire logical unit or to an element. Valid values are 0h and 2h.

  0h   The persistent reservation applies to the logical unit

  2h   The persistent reservation applies to the element

- **Type**
  This value specifies the characteristics of the persistent reservation. Valid values are 3h and 6h.

3h   **Exclusive Access:** This value indicates that the initiator holding the persistent reservation has exclusive read and write access. If any other initiator requests a data transfer to or from the target, the result will be a reservation conflict.

6h   **Exclusive Access, Registrants Only:** This value indicates that any currently registered initiator has exclusive read and write access. If any non-registered initiator requests a data transfer to or from the target, the result will be a reservation conflict.

■ Persistent Reserve Out

The Persistent Reserve Out (5F) command reserves a target for the exclusive or shared use of an initiator. The command's format appears in Table 4-38.

Table 4-38. Persistent Reserve Out Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (5Fh)							
1	Reserved (000)			Service Action				
2	Scope				Type			
3	Reserved (00h)							
4	Reserved (00h)							
5	Reserved (00h)							
6	Reserved (00h)							
7 to 8	(MSB) Parameter List Length (18h) (LSB)							
9	Control (00h)							

- **Service Action**
  This value indicates the action that will result from the Persistent Reservation Command:

  00h **Register**: Register a reservation key with the device server without generating a reservation.

  01h **Reserve**: Create a persistent reservation of the scope and type specified in Byte 2.

  02h **Release**: Remove an active persistent reservation.

  03h **Clear**: Clear all persistent reservations for all initiators and reset all reservation keys to 0.

  04h **Preempt**: Remove all reservations and registrations for the initiators associated with the service action reservation key in the parameter list.

05h **Preempt and Abort**: Perform a Preempt action and, additionally, clear the task set for all initiators associated with the service action reservation key. Also, clear any CAP locks and contingent allegiance in effect for these initiators.

- **Scope**
  The value in the Scope field indicates whether a persistent reservation applies to an entire logical unit or to an element. Valid values are 0h and 2h.

  0h The persistent reservation applies to the logical unit

  2h The persistent reservation applies to the element

- **Type**
  This value specifies the characteristics of the persistent reservation. Valid values are 3h and 6h.

  3h **Exclusive Access:** This value indicates that the initiator holding the persistent reservation has exclusive read and write access. If any other initiator requests a data transfer to or from the target, the result will be a reservation conflict

  6h **Exclusive Access, Registrants Only:** This value indicates that any registered initiator has read and write access. If any non-registered initiator requests a data transfer to or from the target, the result will be a reservation conflict.

- **Parameter List Length**
  This value should always specify a field length of 18h (24d) bytes. The parameter data for the Persistent Reserve Out command includes all fields, even when a field is not required for the specified service action.

- **Parameter List**
  The parameter list for the Persistent Reserve Out command has the format shown in .

Table 4-39. Persistent Reserve Out Parameter List

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0 **to** **7**	(MSB) Reservation Key (LSB)							
8 **to** **15**	(MSB) Service Action Reservation Key (LSB)							
16 **to** **19**	(MSB) Scope-specific Address (LSB)							
20	Reserved (00h)							APTPL
21	Reserved (00h)							
22 **to** **23**	Obsolete (00h)							

- **Reservation Key**
  This field contains an eight-bit value that identifies the initiator.

- **Service Action Reservation Key**
  This field contains information needed for three service actions: Register, Preempt, and Preempt and Abort. Refer to Table 4-40 for definitions of these actions.

Table 4-40. Service Action Reservation Key Information

If the service action[1] is	Then the information in this field is
Register	the new reservation key to be registered
Preempt	the reservation key of the persistent reservation being preempted
Preempt and Abort	the reservation key of the persistent reservation being preempted
1. See list of service action values on page 4-74.	

- **Scope-specific Address**
  If the scope is an Element Reservation, the Scope-specific Address field will contain the element address. The address will be zero-filled in the most significant bytes to fit the field.

  If the service action is Register or Clear or if the scope is a Logical Unit reservation, the Scope-specific Address field will be set to 0.

- **APTPL (Activate Persist Through Power Loss)**
  This bit is valid only for the Register service action:

  0   The loss of power in the target releases all persistent reservations and sets all reservation keys to their default value of 0.

  1   The loss of power in the target causes the target to store all persistent reservations and all reservation keys for all initiators.

■ Position to Element

The Position to Element command (2B) moves the hand to the specified element (Table 4-41).

Table 4-41. Position to Element Command

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Logical Unit Number			Reserved (00h)				
2 to 3	(MSB) Transport Element Address (LSB)							
4 to 5	(MSB) Destination Element Address (LSB)							
6	Reserved (00h)							
7	Reserved (00h)							
8	Reserved (00h)							Invert (0)
9	Count Byte (00h)							

- **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

The Prevent/Allow Medium Removal command (1E) requests that the library enable or disable operator panel access to the cartridge access port (CAP). Refer to Table 4-42 for the command's format.

Note: The Prevent/Allow command is accepted by the L20 library and returned successfully. However, the library takes no action. The CAP on the L20 library cannot be locked or unlocked by the library, even if the CAP is being used as a data storage cell. If the CAP is being used as a data storage cell, the CAP must be locked using the manual lock so that the CAP cannot be opened.

Table 4-42. Prevent/Allow Medium Removal Command

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

- **Prevent Bit**
  The prevent values are:

  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

The Read Element Status command (B8) requests that the library return the status of the elements in the library (Table 4-43).

Table 4-43. Read Element Status Command

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

- **VolTag**
  This bit indicates whether volume tag (VolTag) information is to be reported in response to this command:

0	Volume Tag information is not reported.
1	Volume Tag information is reported.

- **Element Type Code**
  This field specifies the particular element types selected for reporting:

0h	All Element Types reported
1h	Medium Transport Element (hand)
2h	Storage Element (cartridge tape storage cells)
3h	Import/Export Element (the CAP cell)

4h   Data Transfer Element (tape drive)

For an Element Type Code of 0h, the element types are reported in ascending element address order, beginning with the first element greater than or equal to the Starting Element Address.

- **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.

- **CurData**
  The current data bit specifies whether library mechanics are active or static.

  0   Library operations are normal, and library mechanics are active.

  1   The library is responding with data only; no mechanical operations are active.

  Note: As of the publication date of this document, the CurData bit had not been fully implemented.

- **DvcID**
  The device identification bit indicates whether the return data will contain device identification information.

  0   The target will not return device identification information.

  1   The target 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, or

- The number of element descriptors specified in the Number of Elements field have been transferred, or

- There is less allocation length space available than required for the next complete element descriptor or header to be transferred.

- **PlyGrnd**
  This bit indicates whether to report the playground cells. In order to have the playground reported you must set this bit and in addition you must set the Element Type Code to 0 (all element types). If the Element Type Code is not 0 and this bit is set a Check Condition will be returned. Also since this is a vendor unique extension it operates a little different than the normal Read Element Status command. If the user wants the playground reported the Allocation length must be large enough to fit all the data. Thus, if you request the playground you get all the cells reported or none.

- **Read Element Status Data**
  The library returns data for a Read Element Status command with this structure:

  - 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 (Table 4-44).

Table 4-44. Element Status Data Header

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

- **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 Definition

The library sends this header once for each type of element descriptors (Table 4-45).

Table 4-45. Element Status Page Header

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

- **Element Type Code**
  This field indicates the specific element type being reported by this element descriptor page. The types are:

01h	Medium Transport Element (hand)
02h	Storage Element (cartridge tape storage cells)
03h	Import/Export Element (the CAP cell)
04h	Data Transfer Element (tape drive)
FFh	Playground Elements (cleaning and diagnostic storage cells)

- **PVolTag**
  This bit indicates if primary volume tag (PVolTag) information has been requested and is present. The possible values indicate:

> **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**
  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 (the CAP cell)
  - 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 Definition

The medium transport element is the hand. The library contains one hand. The Medium Transport Element Descriptor defines the hand's characteristics (Table 4-46).

Table 4-46. Medium Transport Element Descriptor

Byte	Bit							
	7	6	5	4	3	2	1	0
0 to 1	(MSB) Element Address (LSB)							
2	Reserved (00h)					Except	Reserved (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (00h)							
7	Reserved (00h)							
8	Reserved (00h)							
9	SValid	Invert (0)	Reserved (00h)					
10 to 11	(MSB) Source Storage Element Address (LSB)							
12 to 47	Primary Volume Tag Information (Field omitted if PVolTag=0)							
48 to 51	Reserved (00h, 00h, 00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							
52	Media Domain (Field moved up if Primary Volume Tag Information omitted.)							
53	Media Type (Field moved up if Primary Volume Tag Information omitted.)							

Table 4-46. Medium Transport Element Descriptor

Byte	Bit							
	7	6	5	4	3	2	1	0
54 to 55	Reserved (00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							

- **Element Address**
  This field contains the element address of the hand.

- **Except**
  This bit indicates the current operational state of the hand:

  0   The hand is operational.

  1   The hand 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.

- **Full**
  This bit indicates if the hand contains a cartridge tape:

  0   The hand does not contain a cartridge tape.

  1   The hand contains a cartridge tape.

  An initiator would see a cartridge in the hand during a Read Element Status only in the case of an anomaly.

- **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.

- **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.

- **SValid**
  This bit indicates if the Source Element Address and Invert fields are valid:

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

  1   The Source Element Address and Invert fields are valid.

- **Invert**
  The library does not support multi-sided media and returns a value of 0.

- **Source Storage Element Address**
  This field is valid only if the SValid field is 1. This field contains the address of the last element from which the data cartridge was moved.

- **Primary Volume Tag Information**
  When the PVolTag bit is set to 1, the library returns volume tag information. When PVolTag is set to 0, this field is omitted, and the reserved fields below it are moved up.

  The library volume tag information includes six bytes of left-justified ASCII data that represents volume/serial number data from the cartridge tape. The field is padded to 32 bytes with 26 ASCII spaces. If the label on the cartridge tape is not readable, these 32 bytes will be set to 0.

  The last four bytes of the Volume Tag Information typically consist of two reserved bytes and two volume sequence bytes. The library does not support sequence numbers. These four bytes are set to 0.

- **Media Domain**
  The Media Domain field along with the Media Type field provides a hierarchy of information that indicates the type of media in the element:

01h	The element contains a DLT form factor cartridge.
43h	The element contains a LTO cleaning form factor cartridge (43h is 'C').
4Ch	The element contains an LTO form factor cartridge (4Ch is 'L').
FFh	The media domain cannot be determined.

  Note: This field is not valid if the Full bit is not set.

- **Media Type**
  The Media Type field along with the Media Domain field provides a hierarchy of information that indicates the type of media in the element.

  If the Media Domain field is 01h, the value reported for the Media Type field identifies in ASCII the type of DLT cartridge:

B	The element contains a Benchmark DLT1 cleaning cartridge.
C	The element contains a DLT CompacTape III cartridge or a DLT cleaning cartridge.
D	The element contains a DLT CompacTape IV cartridge.
E	The element contains a DLT CompacTape III XT cartridge.
S	The element contains an SDLT cartridge.
FFh	The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 43h (43h is 'C'), the value reported for the Media Type field identifies in ASCII the type of LTO cleaning cartridge:

1   The element contains an HP Ultrium 1 LTO cleaning cartridge.

2   The element contains an IBM Ultrium 1 LTO cleaning cartridge.

3   The element contains a Seagate Ultrium 1 LTO cleaning cartridge.

U   The element contains a Universal LTO cleaning cartridge, a valid cleaning cartridge for all LTO drives.

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 4Ch (4Ch is 'L'), the value reported for the Media Type field identifies in ASCII the type of LTO cartridge:

1   The element contains a 100 GB Ultrium 1 LTO cartridge.

2   The element contains a 200 GB Ultrium 2 LTO cartridge.

A   The element contains a 50 GB Ultrium 1 LTO cartridge.

B   The element contains a 35 GB Ultrium 1 LTO cartridge.

C   The element contains a 10 GB Ultrium 1 LTO cartridge.

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

Storage Element Descriptor Definition

Storage elements are the main cartridge tape storage cells of the library. The Storage Element Descriptor describes a storage cell (Table 4-47).

Table 4-47. Storage Element Descriptor

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0 to 1	(MSB) Element Address (LSB)							
2	Reserved (00h)				Access (1)	Except (0)	Reserved (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (00h)							
7	Reserved (00h)							
8	Reserved (00h)							
9	SValid	Invert (0)	Reserved (00h)					
10 to 11	(MSB) Source Storage Element Address (LSB)							
12 to 47	Primary Volume Tag Information (Field omitted if PVolTag=0)							
48 to 51	Reserved (00h, 00h, 00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							
52	Media Domain (Field moved up if Primary Volume Tag Information omitted.)							
53	Media Type (Field moved up if Primary Volume Tag Information omitted.)							

Table 4-47. Storage Element Descriptor

Byte	Bit							
	7	6	5	4	3	2	1	0
54 to 55	Reserved (00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							

- **Element Address**
  This field contains the element address of the storage element reported.

- **Access**
  This bit indicates access is allowed to the storage element by the hand. The library returns a value of 1.

- **Except**
  This bit indicates the operational state of the storage element:

  0   The storage element is in a normal state.

  1   The storage element is in an abnormal state, and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state. Other fields in the descriptor might be invalid, and should be ignored.

- **Full**
  This field indicates if the storage element contains a cartridge tape:

  0   The storage element does not contain a cartridge tape.

  1   The storage element does contain a cartridge tape.

- **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.

- **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.

- **SValid**
  This bit indicates if the Source Element Address and Invert fields are valid:

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

  1   The Source Element Address and Invert fields are valid.

- **Invert**
  The library does not support multi-sided media and returns a value of 0.

- **Source Storage Element Address**
  This field is valid only if the SValid bit is 1. It contains the address of the last element from which the data cartridge was moved.

- **Primary Volume Tag Information**
  When the PVolTag bit is set to 1, the library returns Volume Tag Information. When PVolTag is set to 0, this field is omitted, and the reserved fields below it are moved up.

  The library Volume Tag Information includes six bytes of left-justified ASCII data, which represents volume/serial number data from the cartridge tape. The field is padded to 32 bytes with 26 ASCII spaces. If the label on the cartridge tape is not readable, these 32 bytes are set to 0.

  The last four bytes of the Volume Tag Information typically consist of two reserved bytes and 2 volume sequence bytes. The library does not support sequence numbers. These four bytes are set to 0.

- **Media Domain**
  The Media Domain field along with the Media Type field provides a hierarchy of information that indicates the type of media in the element:

01h	The element contains a DLT form factor cartridge.
43h	The element contains a LTO cleaning form factor cartridge (43h is 'C').
4Ch	The element contains an LTO form factor cartridge (4Ch is 'L').
FFh	The media domain cannot be determined.

  Note: This field is not valid if the Full bit is not set.

- **Media Type**
  The Media Type field along with the Media Domain field provides a hierarchy of information that indicates the type of media in the element.

  If the Media Domain field is 01h, the value reported for the Media Type field identifies in ASCII the type of DLT cartridge:

B	The element contains a Benchmark DLT1 cleaning cartridge.
C	The element contains a DLT CompacTape III cartridge or a DLT cleaning cartridge.
D	The element contains a DLT CompacTape IV cartridge.
E	The element contains a DLT CompacTape III XT cartridge.
S	The element contains an SDLT cartridge.
FFh	The media type cannot be determined.

  Note: This field is not valid if the Full bit is not set

If the Media Domain field is 43h (43h is 'C'), the value reported for the Media Type field identifies in ASCII the type of LTO cleaning cartridge:

1   The element contains an Generation 1 LTO cleaning cartridge.

2   The element contains an IBM Generation 1 LTO cleaning cartridge.

3   The element contains a Seagate Generation 1 LTO cleaning cartridge.

U   The element contains a Universal LTO cleaning cartridge, a valid cleaning cartridge for all LTO drives."

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 4Ch (4Ch is 'L'), the value reported for the Media Type field identifies in ASCII the type of LTO cartridge:

1   The element contains a 100 GB Ultrium 1 LTO cartridge.

2   The element contains a 200 GB Ultrium 2 LTO cartridge.

A   The element contains a 50 GB Ultrium 1 LTO cartridge.

B   The element contains a 35 GB Ultrium 1 LTO cartridge.

C   The element contains a 10 GB Ultrium 1 LTO cartridge.

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

Import/Export Element Descriptor Definitions

Import/Export elements are the CAP cells of the library. The Import/Export Element Descriptor describes the CAP cell (Table 4-48).

Table 4-48. Import/Export Element Descriptor

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0 **to** **1**	(MSB) Element Address (LSB)							
2	Reserved (00h)		InEnab (1)	ExEnab (1)	Access	Except	ImpExp	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (00h)							
7	Reserved (00h)							
8	Reserved (00h)							
9	SValid	Invert (0)	Reserved (00h)					
10 **to** **11**	(MSB) Source Storage Element Address (LSB)							
12 **to** **47**	Primary Volume Tag Information (Field omitted if PVolTag=0)							
48 **to** **51**	Reserved (00h, 00h, 00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							
52	Media Domain (Field moved up if Primary Volume Tag Information omitted.)							
53	Media Type (Field moved up if Primary Volume Tag Information omitted.)							

Table 4-48. Import/Export Element Descriptor

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
54 to 55	Reserved (00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							

- **Element Address**
  This field contains the element address of the import/export element reported.

- **InEnab**
  This bit indicates the import/export element supports the movement of cartridge tapes into the library. The library returns a value of 1.

- **ExEnab**
  This bit indicates that the import/export element supports the movement of cartridge tapes out of the library. The library returns a value of 1.

- **Access**
  This bit indicates access is allowed to the import/export element by the hand:

  0 The CAP is open and cannot be accessed by the hand. Thus the Full and Primary Volume Tag information cannot be determined and should be ignored.

  Note: More information about this condition is available through the Additional Sense Code and Additional Sense Code Qualifier fields.

  1 The CAP is closed and accessible.

- **Except**
  This bit indicates the operational state of the import/export element:

  0 The import/export element is in the 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. Other fields in this descriptor might be invalid, and should be ignored.

- **ImpExp**
  This bit indicates how the cartridge tape was placed in the element:

0   The cartridge tape in the import/export element was placed there by the library hand as part of an export operation.

1   The cartridge tape in the import/export element was placed there by an operator as part of an import operation.

- **Full**
  This bit indicates if the import/export element contains a cartridge tape:

  0   The import/export element does not contain a cartridge tape.

  1   The import/export element does contain a cartridge tape.

- **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.

- **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.

- **SValid**
  This bit indicates if the Source Element Address and Invert fields are valid:

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

  1   The Source Element Address and Invert fields are valid.

- **Invert**
  The library does not support multi-sided media. The information reported is 0.

- **Source Storage Element Address**
  This field is valid only if the SValid bit is 1. It contains the address of the last element from which the data cartridge was moved.

- **Primary Volume Tag Information**
  When the PVolTag bit is set to 1, the library returns Volume Tag Information. When PVolTag is set to 0, this field is omitted, and the reserved fields below it are moved up.

  The library Volume Tag Information includes 6 bytes of left-justified ASCII data which represents volume/serial number data read from the cartridge tape. The field is padded to 32 bytes with 26 ASCII spaces. If the label on the cartridge tape is not readable, these 32 bytes will be set to 0.

  The last four bytes of the Volume Tag Information consist of two reserved bytes and two-volume sequence bytes. The library does not support sequence numbers. These four bytes are set to 0.

- **Media Domain**
  The Media Domain field along with the Media Type field provides a hierarchy of information that indicates the type of media in the element:

  01h The element contains a DLT form factor cartridge.

  43h The element contains a LTO cleaning form factor cartridge (43h is 'C').

  4Ch The element contains an LTO form factor cartridge (4Ch is 'L').

  FFh The media domain cannot be determined.

  Note: This field is not valid if the Full bit is not set.

- **Media Type**
  The Media Type field along with the Media Domain field provides a hierarchy of information that indicates the type of media in the element.

  If the Media Domain field is 01h, the value reported for the Media Type field identifies in ASCII the type of DLT cartridge:

  B The element contains a DLT form factor cartridge.

  C The element contains a DLT CompacTape III cartridge or a DLT cleaning cartridge.

  D The element contains a DLT CompacTape IV cartridge.

  E The element contains a DLT CompacTape III XT cartridge.

  S The element contains an SDLT cartridge.

  FFh The media type cannot be determined.

  Note: This field is not valid if the Full bit is not set.

  If the Media Domain field is 43h (43h is 'C'), the value reported for the Media Type field identifies in ASCII the type of LTO cleaning cartridge:

  1 The element contains an HP Ultrium 1 LTO cleaning cartridge.

  2 The element contains an IBM Ultrium 1 LTO cleaning cartridge.

  3 The element contains a Seagate Ultrium 1 LTO cleaning cartridge.

  U The element contains a Universal LTO cleaning cartridge, a valid cleaning cartridge for all LTO drives.

  FFh The media type cannot be determined.

  Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 4Ch (4Ch is 'L'), the value reported for the Media Type field identifies in ASCII the type of LTO cartridge:

1 The element contains a 100 GB Ultrium 1 LTO cartridge.

2 The element contains a 200 GB Ultrium 2 LTO cartridge.

A The element contains a 50 GB Ultrium 1 LTO cartridge.

B The element contains a 35 GB Ultrium 1 LTO cartridge.

C The element contains a 10 GB Ultrium 1 LTO cartridge.

FFh The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

Data Transfer Element Descriptor Definitions (DvcID = 0)

Data transfer elements are the tape drives in the library. The Data Transfer Element Descriptor Definitions page describes a tape drive. The following table (Table 4-49) shows the data returned when the DvcID bit in the command is set to 0.

Table 4-49. Data Transfer Element Descriptor (DvcID = 0)

Byte	Bit							
	7	6	5	4	3	2	1	0
0 to 1	(MSB) Element Address (LSB)							
2	Reserved (0)				Access	Except	Reserved (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	NotBus	Reserved (0)	ID Vld	LU Vld (0)	Reserved 0)	LUN (0)		
7	SCSI Bus Address							
8	Reserved (00h)							
9	SValid	Invert (0)	Reserved (00h)					
10 to 11	(MSB) Source Storage Element Address (LSB)							
12 to 47	Primary Volume Tag Information (Field omitted if PVolTag = 0)							
48 to 51	Reserved (00h, 00h, 00h, 00h) (Field moved up if Primary Volume Tag information omitted.)							
52	Media Domain (Field moved up if Primary Volume Tag information omitted.)							

Table 4-49. Data Transfer Element Descriptor (DvcID = 0) (Continued)

Byte	Bit							
	7	6	5	4	3	2	1	0
53	Media Type (Field moved up if Primary Volume Tag information omitted.)							
54	Transport Domain (Field moved up if Primary Volume Tag information omitted.)							
55	Transport Type (Field moved up if Primary Volume Tag information omitted.)							
56 to 87	(MSB) Transport Serial Number (LSB)							

- **Element Address**
  This bit contains the element address of the data transfer element reported.

- **Access**
  This bit indicates access is allowed to the data transfer element by the hand:

  0   Access is not allowed to the tape drive element by the hand. This will be the case when a cartridge tape is loaded and in use by the tape drive. The tape must be ejected before it becomes accessible.

  1   The tape drive is accessible.

- **Except**
  This bit indicates the operational state of the data transfer element:

  0   The data transfer element is in the normal state.

  1   The data transfer element is in an abnormal state, and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state. Other fields in this descriptor might be invalid, and should be ignored.

- **Full**
  This bit indicates if the data transfer element contains a cartridge tape:

  0   The data transfer element does not contain a cartridge tape.

  1   The data transfer element does contain a cartridge tape.

- **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.

- **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.

- **Not Bus**

  This bit will only be valid if the ID is valid. A value of 1 indicates that the SCSI bus address and LUN reported for this tape drive are not on the same SCSI bus as the medium changer device. This value is set when the drive information is set during configuration.

- **ID Valid**

  If this bit is 1h, the SCSI Bus Address field is valid.

- **LU Valid**

  The library does not support this bit and returns a value of 0.

- **Logical Unit Number**

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

- **SCSI Bus Address**

  The user configures the SCSI Bus Address field. The library returns the SCSI bus address of the data transfer element.

- **SValid**

  This bit indicates if the Source Element Address and Invert fields are valid:

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

- **Invert**

  The library does not support multi-sided media and returns a value of 0.

- **Source Storage Element Address**

  This field is valid only if the SValid bit is 1. It contains the address of the last element from which the data cartridge was moved.

- **Primary Volume Tag Information**

  When the PVolTag bit is set to 1, the library returns Volume Tag Information. When PVolTag is set to 0, this field is omitted, and the reserved fields below it are moved up.

  The library Volume Tag Information includes 6 bytes of left-justified ASCII data which represents volume/serial number data read from the cartridge tape. The field is padded to 32 bytes with 26 ASCII spaces. If the label on the cartridge tape is not readable, these 32 bytes will be set to 0.

The last four bytes of the Volume Tag Information have two reserved bytes and two volume sequence bytes. The library does not support sequence numbers. These four bytes are set to 0.

- **Media Domain**
  The Media Domain field along with the Media Type field provides a hierarchy of information that indicates the type of media in the element:

  01h   The element contains a DLT form factor cartridge.

  43h   The element contains a LTO cleaning form factor cartridge (43h is 'C').

  4Ch   The element contains an LTO form factor cartridge (4Ch is 'L').

  FFh   The media domain cannot be determined.

  Note: This field is not valid if the Full bit is not set.

- **Media Type**
  The Media Type field along with the Media Domain field provides a hierarchy of information that indicates the type of media in the element.

  If the Media Domain field is 01h, the value reported for the Media Type field identifies in ASCII the type of DLT cartridge:

  B   The element contains a Benchmark DLT1 cleaning cartridge.

  C   The element contains a DLT CompacTape III cartridge or a DLT cleaning cartridge.

  D   The element contains a DLT CompacTape IV cartridge.

  E   The element contains a DLT CompacTape III XT cartridge.

  S   The element contains an SDLT cartridge.

  FFh   The media type cannot be determined.

  Note: This field is not valid if the Full bit is not set.

  If the Media Domain field is 43h (43h is 'C'), the value reported for the Media Type field identifies in ASCII the type of LTO cleaning cartridge:

  1   The element contains an HP Ultrium 1 LTO cleaning cartridge.

  2   The element contains an IBM Ultrium 1 LTO cleaning cartridge.

  3   The element contains a Seagate Ultrium 1 LTO cleaning cartridge.

  U   The element contains a Universal LTO cleaning cartridge, a valid cleaning cartridge for all LTO drives.

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 4Ch (4Ch is 'L'), the value reported for the Media Type field identifies in ASCII the type of LTO cartridge:

1   The element contains a 100 GB Ultrium 1 LTO cartridge.

2   The element contains a 200 GB Ultrium 2 LTO cartridge.

A   The element contains a 50 GB Ultrium 1 LTO cartridge

B   The element contains a 35 GB Ultrium 1 LTO cartridge.

C   The element contains a 10 GB Ultrium 1 LTO cartridge.

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

- **Transport Domain**
  The Transport Domain field with the Transport Type field provide a hierarchy of information that indicates the type of data transfer element installed:

  01h   The transport supports DLT form factor cartridges.

  4Ch   The transport supports LTO form factor cartridges (4Ch is 'L').

  FFh   The transport domain cannot be determined.

- **Transport Type**
  The Transport Type field with the Transport Domain field provide a hierarchy of information that indicates the type of data transfer element installed.

  If the Transport Domain field is 01h, the value reported for the Transport Type field identifies the type of DLT drive installed:

  04h   A Quantum DLT7000 drive

  07h   A Quantum DLT8000 drive

  12h   A Benchmark DLT1 drive

  14h   A Quantum SDLT drive

  FFh   The type cannot be determined.

  If the Transport Domain field is 4Ch (4Ch is 'L'), the value reported for the Transport Type field identifies the type of LTO drive installed:

30h An HP Ultrium 1 LTO drive

31h An IBM Ultrium 1 LTO drive

32h A Seagate Ultrium 1 LTO drive

33h An HP Ultrium 2 LTO drive

34h An IBM Ultrium 2 LTO drive

35h A Seagate Ultrium 2 LTO drive

FFh The type cannot be determined.

- **Transport Serial Number**
  Thirty-two ASCII characters represent the unique transport serial number. For tape drives with less than 32 bytes of ASCII serial number data, the value is left-justified and the unused LSB bytes contain ASCII blanks. If the serial number is not available from a tape drive that should support an ASCII serial number, ASCII blanks are returned.

  Note: Left justification in this 32-byte field provides space for serial numbers of varying lengths.

Data Transfer Element Descriptor Definitions (DvcID = 1)

Data transfer elements are the tape drives in the library. The Data Transfer Element Descriptor Definitions page describes a tape drive. The following table (Table 4-50) shows the data returned when the DvcID bit in the command is set to 1.

Table 4-50. Data Transfer Element Descriptor (DvcID = 1)

Byte	Bit							
	7	6	5	4	3	2	1	0
0 to 1	(MSB) Element Address (LSB)							
2	Reserved (0)				Access	Except	Reserved (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	NotBus	Reserved (0)	ID Vld	LU Vld (0)	Reserved 0)	LUN (0)		
7	SCSI Bus Address							
8	Reserved (00h)							
9	SValid	Invert (0)	Reserved (00h)					
10 to 11	(MSB) Source Storage Element Address (LSB)							
12 to 47	Primary Volume Tag Information (Field omitted if PVolTag = 0)							
48	Reserved (0h)				Code Set			
49	Reserved (0h)				Identifier Type			
50	Reserved (00h)							
51	Identifier Length (x)							

Table 4-50. Data Transfer Element Descriptor (DvcID = 1) (Continued)

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
52 to 52+x-1 (x bytes)	Identifier							
32-x bytes	Identifier Pad							
84	Media Domain							
85	Media Type							
86	Transport Domain							
87	Transport Type							

- **Element Address**
  This bit contains the element address of the data transfer element reported.

- **Access**
  This bit indicates access is allowed to the data transfer element by the hand:

  0   Access is not allowed to the tape drive element by the hand. This will be the case when a cartridge tape is loaded and in use by the tape drive. The tape must be ejected before it becomes accessible.

  1   The tape drive is accessible.

- **Except**
  This bit indicates the operational state of the data transfer element:

  0   The data transfer element is in the normal state.

  1   The data transfer element is in an abnormal state, and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state. Other fields in this descriptor might be invalid, and should be ignored.

- **Full**
  This bit indicates if the data transfer element contains a cartridge tape:

  0   The data transfer element does not contain a cartridge tape.

  1   The data transfer element does contain a cartridge tape.

- **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.

- **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.

- **Not Bus**

  This bit will only be valid if the ID is valid. A value of 1 indicates that the SCSI bus address and LUN reported for this tape drive are not on the same SCSI bus as the medium changer device. This value is set when the drive information is set during configuration.

- **ID Valid**

  If this bit is 1h, the SCSI Bus Address field is valid.

- **LU Valid**

  The library does not support this bit and returns a value of 0.

- **Logical Unit Number**

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

- **SCSI Bus Address**

  The user configures the SCSI Bus Address field. The library returns the SCSI bus address of the data transfer element.

- **SValid**

  This bit indicates if the Source Element Address and Invert fields are valid:

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

  1   The Source Element Address and Invert fields are valid.

- **Invert**

  The library does not support multi-sided media and returns a value of 0.

- **Source Storage Element Address**

  This field is valid only if the SValid bit is 1. It contains the address of the last element from which the data cartridge was moved.

- **Primary Volume Tag Information**

  When the PVolTag bit is set to 1, the library returns Volume Tag Information. When PVolTag is set to 0, this field is omitted, and the reserved fields below it are moved up.

  The library Volume Tag Information includes 6 bytes of left-justified ASCII data which represents volume/serial number data read from the cartridge tape. The field is padded to 32 bytes with 26 ASCII spaces. If the label on the cartridge tape is not readable, these 32 bytes will be set to 0.

The last four bytes of the Volume Tag Information have two reserved bytes and two volume sequence bytes. The library does not support sequence numbers. These four bytes are set to 0.

- **Code Set**
  This field specifies the code set used for the identifier field:

  0h   Reserved.

  1h   The identifier contains binary values.

  2h   The identifier field contains ASCII graphic codes (that is, code values 20h through 7Eh).

- **Identifier Type**
  The Identifier Type field indicates the format and assignment authority for the identifier:

  0h   No assignment authority was used, and consequently there is no guarantee that the identifier is globally unique In other words, the identifier is vendor-specific.

  2h   The identifier field contains a Canonical form IEEE Extended Unique identifier, 64-bit (EUI-64). In this case, the identifier length field is set to 8. Note that the IEEE guidelines for EUI-64 specify a method for unambiguously encapsulating an IEEE 48-bit identifier within an EUI-64.

- **Identifier Length**
  This field indicates the length of the Identifier field. Note that the combined length of the Identifier field and the Identifier Pad is 32 bytes**.**

- **Identifier**
  This field contains the device identification of the type indicated in the Identifier Type field and in the format specified in the Code Set field.

- **Identifier Pad**
  This field contains binary zeros if the identifier is binary. This field contains ASCII blanks if the identifier is ASCII. The number of zeros or blanks depends on the length of the Identifier field. Note that the combined length of the Identifier field and the Identifier Pad is 32 bytes**.**

- **Media Domain**
  The Media Domain field along with the Media Type field provides a hierarchy of information that indicates the type of media in the element:

01h   The element contains a DLT form factor cartridge.

43h   The element contains a LTO cleaning form factor cartridge (43h is 'C').

4Ch   The element contains an LTO form factor cartridge (4Ch is 'L').

FFh   The media domain cannot be determined.

Note: This field is not valid if the Full bit is not set.

- **Media Type**
  The Media Type field along with the Media Domain field provides a hierarchy of information that indicates the type of media in the element.

  If the Media Domain field is 01h, the value reported for the Media Type field identifies in ASCII the type of DLT cartridge:

  B   The element contains a Benchmark DLT1 cleaning cartridge.

  C   The element contains a DLT CompacTape III cartridge or a DLT cleaning cartridge.

  D   The element contains a DLT CompacTape IV cartridge

  E   The element contains a DLT CompacTape III XT cartridge.

  S   The element contains an SDLT cartridge.

  FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 43h (43h is 'C'), the value reported for the Media Type field identifies in ASCII the type of LTO cleaning cartridge:

  1   The element contains an HP Ultrium 1 LTO cleaning cartridge.

  2   The element contains an IBM Ultrium 1 LTO cleaning cartridge.

  3   The element contains a Seagate Ultrium 1 LTO cleaning cartridge.

  U   The element contains a Universal LTO cleaning cartridge, a valid cleaning cartridge for all LTO drives.

  FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 4Ch (4Ch is 'L'), the value reported for the Media Type field identifies in ASCII the type of LTO cartridge:

1	The element contains a 100 GB Ultrium 1 LTO cartridge.
2	The element contains a 200 GB Ultrium 2 LTO cartridge.
A	The element contains a 50 GB Ultrium 1 LTO cartridge.
B	The element contains a 35 GB Ultrium 1 LTO cartridge.
C	The element contains a 10 GB LTO cartridge.
FFh	The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

- **Transport Domain**
  The Transport Domain field with the Transport Type field provide a hierarchy of information that indicates the type of data transfer element installed:

01h	The transport supports DLT form factor cartridges.
4Ch	The transport supports LTO form factor cartridges (4Ch is 'L').
FFh	The transport domain cannot be determined.

- **Transport Type**
  The Transport Type field with the Transport Domain field provide a hierarchy of information that indicates the type of data transfer element installed.

  If the Transport Domain field is 01h, the value reported for the Transport Type field identifies the type of DLT drive installed:

04h	A Quantum DLT7000 drive
07h	A Quantum DLT8000 drive
12h	A Benchmark DLT1 drive
14h	A Quantum SDLT drive
FFh	The type cannot be determined.

If the Transport Domain field is 4Ch (4Ch is 'L'), the value reported for the Transport Type field identifies the type of LTO drive installed:

30h	An HP Ultrium 1 LTO drive
31h	An IBM Ultrium 1 LTO drive
32h	A Seagate Ultrium 1 LTO drive
33h	An HP Ultrium 2 LTO drive

34h   An IBM Ultrium 2 LTO drive

35h   A Seagate Ultrium 2 LTO drive

FFh   The type cannot be determined.

Playground Element Descriptor Definition

The Playground Element Descriptor describes a playground cell (Table 4-51).

Table 4-51. Playground Element Descriptor

Byte	Bit							
	7	6	5	4	3	2	1	0
0 to 1	(MSB) Element Address (LSB)							
2	Reserved (00h)				Access (0)	Except (0)	Reserved (0)	Full
3	Reserved (00h)							
4	Additional Sense Code (0)							
5	Additional Sense Code Qualifier (0)							
6	Reserved (00h)							
7	Reserved (00h)							
8	Reserved (00h)							
9	SValid (0)	Invert (0)	Reserved (00h)					
10 to 11	(MSB) Source Storage Element Address (0) (LSB)							
12 to 47	Primary Volume Tag Information (Field omitted if PVolTag=0)							
48 to 51	Reserved (00h, 00h, 00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							

Table 4-51. Playground Element Descriptor

Byte	Bit							
	7	6	5	4	3	2	1	0
52	Media Domain (Field moved up if Primary Volume Tag Information omitted.)							
53	Media Type (Field moved up if Primary Volume Tag Information omitted.)							
54 to 55	Reserved (00h, 00h) (Field moved up if Primary Volume Tag Information omitted.)							

- **Element Address**
  This field contains the element address of the storage element reported.

- **Access**
  This bit indicates access is allowed to the storage element by the hand. The library returns a value of 0.

- **Except**
  This bit indicates the operational state of the storage element:

  0   The storage element is in a normal state.

  1   The storage element is in an abnormal state, and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state. Other fields in the descriptor might be invalid, and should be ignored.

- **Full**
  This field indicates if the storage element contains a cartridge tape:

  0   The storage element does not contain a cartridge tape.

  1   The storage element does contain a cartridge tape.

- **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.

- **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.

- **SValid**
  This bit indicates if the Source Element Address and Invert fields are valid:

> **0** The Source Element Address and Invert fields are not valid.
>
> **1** The Source Element Address and Invert fields are valid.

- **Invert**
  The library does not support multi-sided media and returns a value of 0.

- **Source Storage Element Address**
  This field is valid only if the SValid bit is 1. It contains the address of the last element from which the data cartridge was moved.

- **Primary Volume Tag Information**
  When the PVolTag bit is set to 1, the library returns Volume Tag Information. When PVolTag is set to 0, this field is omitted, and the reserved fields below it are moved up.

  The library Volume Tag Information includes six bytes of left-justified ASCII data, which represents volume/serial number data from the cartridge tape. The field is padded to 32 bytes with 26 ASCII spaces. If the label on the cartridge tape is not readable, these 32 bytes are set to 0.

  The last four bytes of the Volume Tag Information typically consist of two reserved bytes and 2 volume sequence bytes. The library does not support sequence numbers. These four bytes are set to 0.

- **Media Domain**
  The Media Domain field along with the Media Type field provides a hierarchy of information that indicates the type of media in the element:

  > **01h** The element contains a DLT form factor cartridge.
  >
  > **43h** The element contains a LTO cleaning form factor cartridge (43h is 'C').
  >
  > **4Ch** The element contains an LTO form factor cartridge (4Ch is 'L').
  >
  > **FFh** The media domain cannot be determined.

  Note: This field is not valid if the Full bit is not set.

- **Media Type**
  The Media Type field along with the Media Domain field provides a hierarchy of information that indicates the type of media in the element.

  If the Media Domain field is 01h, the value reported for the Media Type field identifies in ASCII the type of DLT cartridge:

  > **B** The element contains a Benchmark DLT1 cleaning cartridge.
  >
  > **C** The element contains a DLT CompacTape III cartridge or a DLT cleaning cartridge.

D   The element contains a DLT CompacTape IV cartridge.

E   The element contains a DLT CompacTape III XT cartridge.

S   The element contains an SDLT cartridge.

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set

If the Media Domain field is 43h (43h is 'C'), the value reported for the Media Type field identifies in ASCII the type of LTO cleaning cartridge:

1   The element contains an HP Ultrium 1 LTO cleaning cartridge.

2   The element contains an IBM Ultrium 1 LTO cleaning cartridge.

3   The element contains a Seagate Ultrium 1 LTO cleaning cartridge.

U   The element contains a Universal LTO cleaning cartridge, a valid cleaning cartridge for all LTO drives

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

If the Media Domain field is 4Ch (4Ch is 'L'), the value reported for the Media Type field identifies in ASCII the type of LTO cartridge:

1   The element contains a 100 GB Ultrium 1 LTO cartridge.

2   The element contains a 200 GB Ultrium 2 LTO cartridge.

A   The element contains a 50 GB Ultrium 1 LTO cartridge.

B   The element contains a 35 GB Ultrium 1 LTO cartridge.

C   The element contains a 10 GB Ultrium 1 LTO cartridge.

FFh   The media type cannot be determined.

Note: This field is not valid if the Full bit is not set.

■ Release

The Release command (17) enables the initiator to release unit or element reservations of the library (see Table 4-52) as set using a previous Reserve command.

Performing a unit release of a library that has no active reservations is not considered an error. Only the initiator that performed the reservation can release the reservation. If another initiator attempts to release a unit reservation, the library returns good status, but does not release the reservation.

Table 4-52. Release Command

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	Logical Unit Number			Obsolete (0h)				Element
2	Reservation Identification							
3	Reserved (00h)							
4	Reserved (00h)							
5	Control Byte (00h)							

- **Element**
  This bit indicates if the release is an element release:

1	The reserved elements associated with the Reservation Identification field from this initiator are to be released from reserved status.
0	The library or any elements reserved by the initiator are to be released from reserved status.

- **Reservation Identification**
  This field is a value established by the initiator in a previous Reserve command. The field identifies the specific element reservation to be released. If an invalid Reservation Identification is specified, the library returns a Check Condition status. If the Element bit is 0, ignore this field.

■ Request Sense

The Request Sense command (03) requests the library transfer sense data to the initiator (Table 4-53).

Note: A reset or an abort message clears the contingent allegiance.

Table 4-53. Request Sense Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (03h)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (00h)							
3	Reserved (00h)							
4	Allocation Length							
5	Control Byte (00h)							

- **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**
  The library returns sense data in response to a Request Sense command.

Sense Data

Sense data is available when:

- The previous command to the specified I_T_L nexus terminated with Check Condition status. Multiple errors might occur during the processing of a single SCSI command. The sense key reflects the first error that occurred.

- The previous command to the specified I_T_L nexus terminated with an unexpected bus free error. (Sense data might be available in this case, but not always.)

- The Request Sense command was issued to an unsupported LUN. In this case, the library does not return a check condition and returns sense data:

  - Sense Key set to Illegal Request (05h)
  - ASC set to Logical Unit Not Supported (25h)
  - ASCQ set to 00h

  If no sense data is available for the specified I_T_L nexus, the library returns sense data:

  - Sense Key set to No Sense (0h)
  - ASC set to No Additional Sense Information (00h)
  - ASCQ set to 00h

- The library returns Check Condition status for a Request Sense command only to report errors specific to the command itself.

  For example:

  - A non-zero reserved bit is detected in the CDB.
  - An unrecoverable parity error is detected on the data bus.

  If a recovered error occurs during the execution of a Request Sense command, the library returns the sense data with Good status. If the library returns a Check Condition status for a Request Sense command, the sense data might be invalid.

Request Sense Data Definitions

Table 4-54 shows the Request Sense Data Definitions.

Table 4-54. Request Sense Data

Byte	Bit							
	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	(MSB) Information (00h, 00h, 00h, 00h) (LSB)							
7	Additional Sense Length (n-7)							
8 to 11	(MSB) Command Specific Information (00h, 00h, 00h, 00h) (LSB)							
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	(MSB) Field Pointer (LSB)							
18	CAP Condition							
19	Reserved (00h)							

- **Valid**
  This bit indicates if the Information field contains valid data. The library does not return data in the Information field. The value is 0.

- **Error Code**
  This bit indicates if the error is current or deferred. The library returns only current errors. The value is 70h.

- **Segment Number**
  The library does not support segment numbers and returns a value of 00h.

- **Sense Key**
  The Sense Key (SK) field, with the Additional Sense Code and Additional Sense Code Qualifier fields, describes the error.

- **Information**
  The library does not support this field and returns a value of 00h.

- **Additional Sense Length**
  This field indicates the Additional Sense Length provided by the library excluding this byte. The typical value is 0Ch (12d).

- **Command Specific Information**
  The library does not support this field and returns a value of 00h.

- **Additional Sense Code**
  The Additional Sense Code (ASC) field, with the Sense Key and Additional Sense Code Qualifier fields, describes the error.

- **Additional Sense Code Qualifier**
  The Additional Sense Code Qualifier (ASCQ) field, with the Sense Key and Additional Sense Code fields, describes the error.

- **Field Replaceable Unit Code**
  The library does not support this field and returns a value of 00h.

- **SKSV (Sense Key Specific Valid)**
  When the Sense Key Specific Valid bit is set to 1, the fields C/D and Field pointer are valid. Otherwise, ignore these fields.

- **C/D (Command/Data)**
  Command/Data indicates whether the Check Condition status resulted from an illegal parameter in either the command descriptor block (Command) or the parameter list (Data):

  0 The reserved elements associated with the Reservation Identification field from this initiator are to be released from reserved status.

  1 Illegal parameter in the command descriptor block.

- **BPV (Bit Pointer Valid)**
  The library does not support the Bit Pointer Valid (BPV) field and returns a value of 0.

- **Bit Pointer**
  The library does not support this field and returns a value of 0h.

- **Field Pointer**
  This field contains the number of the byte where 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, which 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 02.

- **CAP Condition**
  This field indicates the condition of the CAP relative to the most recent audit. The field set to a value other than 00h only when the Unit Attention 6h, ASC 28h, ASCQ 01h (CAP Element Accessed) has occurred. Under those circumstances one of these values appears:

  40h   The CAP was closed

Sense Key

The Sense Key field provides basic information about an error. Table 4-55 lists the Sense Keys with an explanation for each code. The Sense Key field, with the Additional Sense Code and Additional Sense Code Qualifier fields, provides a description about the error.

See "Additional Sense Codes and Qualifiers" for more information.

Table 4-55. Sense Key Code Descriptions

Code	Error	Description
0	No Sense	Indicates there is no specific sense key information to be reported. A sense key of 0 indicates a successful command.
2	Not Ready	Indicates the addressed logical unit is not ready for library motion commands (library is not initialized, device is not ready).
4	Hardware Error	Indicates the device detected an unrecoverable hardware failure while performing the command or during a self-test.
5	Illegal Request	Indicates an illegal parameter in the command descriptor block or in the parameter list data.
6	Unit Attention	Indicates a power-on or reset has occurred to the device, or a not ready-to-ready transition has occurred, or an I/O element has been accessed. Also, this may indicate mode parameters have changed, or the microcode has been changed.
B	Aborted Command	Indicates the device aborted the command. The initiator might be able to recover by trying the command again.

Additional Sense Codes and Qualifiers

Bytes 12 and 13 of the sense data contain the Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) fields. These codes provide additional device-specific information about the error or exception.

Each code contains a unique combination of the sense key, additional sense code, and additional sense code qualifier. The following pages describe the error codes for the library grouped by type of sense key.

No Sense Key

The library returns a No Sense Key (00h) when sense is requested, but no error has occurred. The ASC and ASCQ values are zero.

Not Ready Sense Key Codes

The following table lists the full code for each Not Ready sense key (2h).

Table 4-56. Not Ready Sense Keys

Description	Sense Key	ASC	ASCQ
Not Ready, Cause Not Reportable	2h	04h	00h
Not Ready, In Process of Becoming Ready	2h	04h	01h
Not Ready, Manual Intervention Required	2h	04h	03h
Not Ready, Maintenance Mode	2h	04h	81h
Not Ready, Cartridge Access Port Open	2h	3Ah	02h
Not Ready, Cleaning Cartridge Installed	2h	30h	03h

If a command is sent when the library is not ready, it generates a Not Ready error code (see Table 4-56). The following codes describe the conditions of the library that can generate Not Ready codes.

Not Ready, Cause Not Reportable

The library detected a not ready state after execution of the command was started.

Not Ready, In Process of Becoming Ready

The library is initializing and performing an audit. Initialization occurs in a number of situations, including power-on, after the door has been opened then closed, as part of the Send Diagnostic command, when requested from the operator panel, and as part of a recovery during certain failures.

Not Ready, Manual Intervention Required

Manual intervention errors include: the front door is open, the CAP is open, the library is in maintenance mode, or the library is in an inoperable state.

- If the library front door is open, closing the door causes the library to reinitialize and go into a ready state.

- If the library is in an inoperable state, reinitialize the library using the operator panel.

- If the library is in maintenance mode, take the library out of this mode using the operator panel or CSE port.

Not Ready, Maintenance Mode

The library was placed in maintenance mode from the operator panel or CSE port.

Not Ready, Cartridge Access Port Open

The library detected that the CAP is open and a SCSI command was issued to access the CAP.

Not Ready, Cleaning Cartridge Installed

The library is performing an Auto Clean function on the data transfer element (tape drive) requested.

Hardware Error Sense Key

The following table lists the full code for each Hardware Error sense key (4h).

Table 4-57. Hardware Error Sense Keys

Description	Sense Key	ASC	ASCQ
Hardware Error, General	4h	40h	01h
Hardware Error, Tape Drive	4h	40h	02h
Hardware Error, Cartridge Access Port	4h	40h	03h
Hardware Error, Imbedded Software	4h	44h	00h

The library generates a Hardware Error sense key (see Table 4-57) if a hardware or firmware error is detected during command execution. The following pages describe the conditions that generate hardware errors.

Hardware Error, General

The library generates a general hardware error when it detects an internal electronics error during a command. This includes the electronics, vision system, and robotics of the library.

Hardware Error, Tape Drive

The library generates a tape-drive error when an operation to the drive fails. The problem could be the tape drive or the interface between the library and tape drive.

Hardware Error, CAP

The library generates a hardware error when the CAP fails.

Hardware Error, Embedded Software

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

Illegal Request Sense Key

The following table lists the full code for each the Illegal Request sense key (5h).

Table 4-58. Illegal Request Sense Keys

Description	Sense Key	ASC	ASCQ	SKSV
Parameter Length Error	5h	1Ah	00h	Yes
Invalid Command	5h	20h	00h	Yes
Invalid Element	5h	21h	01h	No
Invalid Field in CDB	5h	24h	00h	Yes
Logical Unit Not Supported	5h	25h	00h	No
Invalid Field in Parameters	5h	26h	00h	Check SKSV
Invalid Release of Persistent Reservation	5h	26h	04h	No
Incompatible Medium	5h	30h	00h	No
Saving Parameters Not Supported	5h	39h	00h	Yes
Medium Not Present, Drive Not Unloaded	5h	3Ah	00h	No

Table 4-58. Illegal Request Sense Keys

Description	Sense Key	ASC	ASCQ	SKSV
Medium Magazine Removed (Not for L20, L40 or L80)	5h	3Bh	12h	No
Destination Element Full	5h	3Bh	0Dh	No
Source Element Empty	5h	3Bh	0Eh	No
Insufficient Reservation Resources	5h	55h	02h	No

Any illegal parameters in a command descriptor block (CDB) or parameter list for a particular command generate an Illegal Request sense key (see Table 4-58).

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, which is in error.

If available, the SKSV bit in the sense data is set to 1. See "Request Sense" on page 4-117 for more information.

Unit Attention Sense Key

The following table lists the full code for each Unit Attention sense key (6h).

Table 4-59. Unit Attention Sense Keys

Description	Sense Key	ASC	ASCQ
Power-On Occurred	6h	29h	01h
Not Ready-to-Ready Transition	6h	28h	00h
CAP Element Accessed	6h	28h	01h
Mode Parameters Changed	6h	2Ah	01h
Reservations Preempted	6h	2Ah	03h
Reservations Released	6h	2Ah	04h
Registrations Preempted	6h	2Ah	05h
Microcode Has Been Changed	6h	3Fh	01h
SCSI Bus Reset	6h	29h	02h
Bus Device Reset Message Occurred	6h	29h	03h

The library generates a Unit Attention sense key (see Table 4-59) for *all* initiators if the library needs to inform the host of an asynchronous event. The following pages describe library conditions that generate Unit Attention errors.

Power On

The library generates this type of Unit Attention when the library is powered-on, IPLed from the operator panel, or reset over the interface. A Unit Attention is generated for all initiators.

Not Ready to Ready Transition

The library generates this type of Unit Attention when the library transitions to a ready state from a not ready state. This transition can occur following any conditions that cause a not ready state. A Unit Attention is generated for all initiators.

CAP Element Accessed

The library generates this type of Unit Attention when the operator opens and closes the CAP. Issue a Read Element Status command to obtain an updated inventory. A Unit Attention is generated for all initiators.

Note: After running Send Diagnostic page code 80 or 81, this Unit Attention sense key will be returned at completion, which indicates that the inventory has changed.

Mode Parameters Changed

The library generates this type of Unit Attention when a different initiator performs a Mode Select operation. Issuing a Mode Sense command can retrieve the current parameters. This Unit Attention is issued for all initiators except the one that performed the Mode Select.

Persistent Reservations/Registrations Preempted or Released

The library generates these types of Unit Attention sense keys when one initiator has its persistent reservations or registrations cleared by another initiator.

Microcode Has Been Changed

The library issues this Unit Attention sense key after executing a Write Buffer command to update the functional microcode for the library.

SCSI Bus Reset

The library generates this type of Unit Attention to all initiators after the SCSI bus is clear of all I/O processes following a hard reset.

Bus Device Reset Message Occurred

The library generates this message to all initiators after the library is clear of all I/O processes following a hard reset.

Aborted Command Sense Key

The can generate the following Aborted Command sense key codes:

Table 4-60. Aborted Command Sense Keys

Description	Sense Key	ASC	ASCQ
SCSI Parity Error	0Bh	47h	00h
Initiator Detected Error	0Bh	48h	00h
Command Overlap	0Bh	4Eh	00h

The library generates an Aborted Command error code (see Table 4-60) when a SCSI command is aborted because of a SCSI protocol error. The initiator might not register a Check Condition status related to these errors because of the nature of the aborted commands, but the sense data is available. The following pages describe the conditions of the library that generates Aborted Commands.

SCSI Parity Error

The library detected a parity error during a data transfer operation, or the host rejected a Restore Pointers message.

Initiator Detected Error

The library receives an Initiator Detected Error message from the initiator, and the operation could not be completed.

Command Overlap

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

■ Request Volume Element Address

The Request Volume Element Address command (B5) requests that the library return the results of a previous Send Volume Tag command. See Table 4-61 for the format of the Request Volume Element Address command.

Table 4-61. Request Volume Element Address Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (B5h)							
1	Logical Unit Number			VolTag		Element type code		
2 to 3	(MSB) Starting Element Address (LSB)							
4 to 5	(MSB) Number of Elements (LSB)							
6	Reserved (00h)							
7 to 9	(MSB) Allocation Length (LSB)							
10	Reserved (00h)							
11	Control Byte (00h)							

- **VolTag** (Volume Tag)
  This bit indicates whether volume tag (VolTag) information is to be reported in response to this command:

  0   Volume Tag information is not reported.

  1   Volume Tag information is reported.

- **Element Type Code**
  This field specifies the element types selected for reporting by this command:

  0h   All Element Types reported

  1h   Medium Transport Element (hand)

2h   Storage Element (cartridge tape storage cells)

3h   Import/Export Element (the CAP cell)

4h   Data Transfer Element (tape drive)

For an Element Type Code of 0h, the element types are reported in ascending element address order, beginning with the first element greater than or equal to the Starting Element Address.

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

  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.

- **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 has been transferred.

  - There is less allocation length space available than required for the next complete element descriptor or header to be transferred.

- **Request Volume Element Address Data**
  The library returns data for a Request Volume Element Address command in:

  - An eight-byte Volume Element Address 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. There is a separate Element Descriptor format for each element type.

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

Volume Element Address Header Definition

The Volume Element Address Header is sent once for each command. See Table 4-62 for the header's format.

Table 4-62. Volume Element Address Header

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

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

- **Send Action Code** This field contains the value of the send action code field from the previous Send Volume Tag command. The value is 5h.

- **Byte Count of Report Available** This field indicates the number of bytes of element status data available for all elements that meet the requirements of the Request Volume Element Address 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 Pages** The element pages returned by a Request Volume Element Address command are the same format as returned by the Read

Element Status command. See "Read Element Status" on page 4-80 for more information.

■ Reserve

The Reserve command (16) allows the initiator to perform unit reservations or element reservations. Unit reservations are reservations of the library as a whole. Element reservations are reservations of specific elements of the library. See Table 4-63 for the command's format.

Table 4-63. Reserve Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (16h)							
1	Logical Unit Number			Obsolete (0h)				Element
2	Reservation Identification							
3 **to** **4**	(MSB)　　　　　　　　　　　Element List Length　　　　　　　　　　　(LSB)							
5	Control Byte (00h)							

- **Element**
  This bit indicates if the reserve is an element reserve. The library supports reservation at the element level:

  0　　The entire library unit is reserved.

  1　　A series of elements, identified by the Reservation Identification field and specified by the Element List Descriptor, is reserved.

- **Reservation Identification**
  This field is a value established by an initiator to identify a specific element reservation request. The library supports a maximum of 64 element reservations.

  Note: Ignore this field if the Element bit is not set.

- **Element List Length**
  This field indicates the length in bytes of the Element List that follows the command. The list may include a maximum of 16 Element List Descriptors, each of which is 6 bytes long. Valid values are 0, 6, and increments of 6 up to the maximum of 60h (96d).

  If the value is 0 and the Element bit is set, no elements are reserved.

  Note: Ignore this field if the Element bit is not set.

Element List Descriptor Definitions

An Element List is required if the Element bit is set. The list consists of 0 to 16 instances of the Element List Descriptor; see Table 4-64 for the descriptor's format.

Table 4-64. Element List Descriptor

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0 to 1	Reserved (00h, 00h)							
2 to 3	(MSB) Number of Element (LSB)							
4 to 5	(MSB) Element Address (LSB)							

- **Number of Elements**
  This field indicates the number of elements of a specific type (cartridge tape storage cells, the CAP cell, or tape drives) to be reserved. If the value of this field is 0, all elements starting at the Element Address through the last element address for that library are reserved.

- **Element Address**
  This field indicates the address of the element or the starting address of a series of elements to be reserved.

Other Commands and Reservations

Unit and element reservations are released or canceled by:

- A Release command from the same initiator
- Receipt of a Bus Device Reset message
- An interface reset
- A power-on reset of the library

If the library is reserved as a unit, the library processes only the following commands from another initiator:

- Prevent/Allow Medium Removal with Prevent bits set to 0
- Inquiry
- Release

- Request Sense
- Log Sense
- Read Element Status with the CurData bit set to 1

All other commands result in a Reservation Conflict status (18h).

An element reservation may be used to modify or supersede a previous element reservation by the same initiator. If the superseding reservation does not result in any reservation conflicts or error conditions, the previous reservation is released, and the new reservations are completed. A unit reservation of the library supersedes any previous element reservations by the same initiator.

■ Rezero Unit

The Rezero Unit command (01h) performs no actions. The library accepts this command only for compatibility with existing host applications. Table 4-65 shows the command's format.

The command descriptor block will be validated even though the command is not used.

Table 4-65. Rezero Unit Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (01h)							
1	Logical Unit Number			Reserved (0h)				
2	Reserved (00h)							
3	Reserved (00h)							
4	Reserved (00h)							
5	Control Byte (00h)							

■ Send Diagnostic

The Send Diagnostic command (1Dh) requests the library to perform a self-diagnostic test. The library supports the self-test option of this command and several extended tests. Table 4-66 shows the format of this command.

The self-test includes initialization diagnostics and calibration of the library. The extended diagnostics provide random cartridge motions and additional calibration features.

The library disconnects while a diagnostic test is being performed, then reconnects when the diagnostic test completes. This disconnected time can be several minutes, and time-outs should be adjusted accordingly.

The library returns status based on the diagnostic test result. The Receive Diagnostic command is not used.

Table 4-66. Send Diagnostic Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (1Dh)							
1	Logical Unit Number			PF	Reserved (0)	SelfTest	DevOfl (0)	UnitOfl (0)
2	Reserved (00h)							
3 to 4	(MSB) Parameter List Length (LSB)							
5	Control Byte (00h)							

- **PF**
  The library supports the page format (PF) specified by SCSI-2. The value of PF should be 1. However, the library accepts a 0 for self test.

- **SelfTest**
  This bit indicates whether the self-test function is requested.

  0   The self-test function is not requested.

  1   The self-test function is requested. The Parameter List Length also must be 0

- **DevOfl**
  This feature is not supported by the library; the value must be 0.

- **UnitOfl**
  This feature is not supported by the library; the value must be 0.

- **Parameter List Length**
  For the self-test option, a value of 0h is required.

  For extended diagnostics, a value of 8h is required.

Send Diagnostic Data

For extended diagnostics, the initiator must provide Send Diagnostic parameter data in a parameter list that includes

- A page code
- Diagnostic parameters

Table 4-67 shows the parameter's format.

Table 4-67. Send Diagnostic Page Format

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Page Code							
1	Reserved (00h)							
2 to 3	(MSB) Page Length (0004h) (LSB)							
4 to 7	(MSB) Diagnostic Parameters (LSB)							

CAUTION:
Additional host commands might be required:

- **The Random Move Diagnostic Page Code 80h (cells only) randomly moves tapes around the library, and does not restore the tapes to their original cells. The host program must issue an inventory request to the library to determine the locations of the tapes.**

- The Random Move Diagnostic Page Code 81h (cells and drives) randomly moves tapes around the library, and mounts and dismounts tapes to drives. Drives will remain loaded upon completion of this test. The drive will have to be unloaded manually or by the host program.

- **Page Code**
  This field specifies which extended diagnostic test is to be executed:

  80h Random moves, cells only

  81h Random moves, cells and drives

  82h Random moves, non-destructive, cells only

  83h Random moves, non-destructive, cells and drives

  90h Uncalibrate

  92h IPLs the library

- **Page Length**
  This field specifies the number of bytes in the parameter list, which follows. The value is always 0004h.

- **Diagnostic Parameters**
  This field specifies additional parameters for the diagnostic self-test. Valid values depend on the value of the page code. For the tests that perform random moves (page codes 80h and 81h), this field indicates the length of time, in seconds, to perform tests. For page code 92h, the diagnostic parameters should be 'R''S''T'0h, indicating a reset. For all other values of page code, this field is reserved and must be 0h.

Note: For Random Move Diagnostic Page Code 80h (cells only) to run successfully, at least two tapes must be in the library (not counting the tapes in the CAP). For Random Move Diagnostic Page Code 81h (cells and drives) to run successfully, at least two more tapes than the number of drives must be in the library.

Diagnostic Operations

Because the Receive Diagnostic command is not supported, check the error log (also referred to as the events log) following a diagnostic failure. This provides specific details of the error. The error log is available via a log sense command or from the operator panel.

Execution of the random move diagnostics will change the library inventory. Following execution of a random move diagnostic, the library will issue a unit attention to indicate that the inventory has changed.

The uncalibrate diagnostic (page code 90h) uncalibrates all target data. This forces the library to recalibrate during subsequent operations.

The IPL diagnostic (92h) causes the library to load its operational software into its working memory and set auto-configuration values.

Note: The library generates a Not Ready to Ready Unit Attention Sense Key for all other initiators after diagnostic operations have completed.

■ Send Volume Tag

The Send Volume Tag command (B6) is a request for the library to transfer a volume tag template. The template corresponds to a VOLSER label template and is used by the library to search for desired elements. A subsequent Request Volume Element Address command is used to transfer the results of this search. Table 4-68 shows the format of the Send Volume Tag Command.

Table 4-68. Send Volume Tag Command

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Operation Code (B6h)							
1	Logical Unit Number			Reserved (0)	Element Type Code			
2 to 3	(MSB) Starting Element Address (LSB)							
4	Reserved (00h)							
5	Reserved (0)			Send Action Code (5h)				
6	Reserved (00h)							
7	Reserved (00h)							
8 to 9	(MSB) Parameter List Length (LSB)							
10	Reserved (00h)							
11	Control Byte (00h)							

- **Element Type Code**
  This field specifies the element types selected for reporting by this command:

0h	All Element Types reported
1h	Medium Transport Element (hand)
2h	Storage Element (cartridge tape storage cells)
3h	Import/Export Element (CAP cell)
4h	Data Transfer Element (tape drive)

For an Element Type Code of 0h, the element types are reported in ascending element address order, beginning with the first element greater than or equal to Starting Element Address.

- **Starting Element Address**
  This field specifies the element address at which to start the search. Only elements with an element address greater than or equal to the Starting Element Address are reported.

  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.

- **Send Action Code**
  This field specifies the function to be performed. The library only supports the translate and search primary volume tag function. The value is 5h.

- **Parameter List Length**
  This field indicates the length in bytes of the Parameter List that follows the command:

  00h   No data is transferred

  28h   A Volume Identification Template is transferred

  Note: A value of 0 is not considered an error.

Send Volume Tag Parameter List

The Send Volume Tag command requires a parameter list that defines the volume template to search for. Table 4-69 shows the command's format.

Table 4-69. Send Volume Tag Parameter List

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0 to 31	(MSB) Volume Identification Template (LSB)							
32	Reserved (00h)							
33	Reserved (00h)							
34 to 35	(MSB) Minimum Volume Sequence Number (LSB)							
36	Reserved (00h)							
37	Reserved (00h)							
38 to 39	(MSB) Maximum Volume Sequence Number (LSB)							

- **Volume Identification Template**
  This field specifies a volume identification search template. A maximum of 6 characters may be used. The first 0 terminates the volume identification search template. The remaining characters must be 0.

  Characters allowed are the same as those used on the cartridge VOLSER labels and include characters A through Z, digits 0 through 9, and special characters that include the dollar sign ($), the pound character (#), and the ASCII space character.

  The wild-card characters "*" and "?" (2Ah and 3Fh) also may be used.

- **Minimum Volume Sequence Number**
  Sequence numbers are not supported on the library; ignore this field.

- **Maximum Volume Sequence Number**
  Sequence numbers are not supported on the library; ignore this field.

■ Test Unit Ready

The Test Unit Ready command (00) 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. Table 4-70 shows the command's format.

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.

Table 4-70. Test Unit Ready Command

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code (00h)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (00h)							
3	Reserved (00h)							
4	Reserved (00h)							
5	Control Byte (00h)							

■ Write Buffer

The Write Buffer command (3Bh) updates the functional microcode for the library. A sequence of one or more Write Buffer commands that updates the microcode is called a download. A change in the initiator from one Write Buffer command to another in a multiple-transfer download is considered a new download process request, and terminates the active process. This allows another initiator to download microcode if the first initiator goes down before completing its download request. Table 4-71 shows the command's format.

CAUTION:
Potential IPL problem: **Make sure that the download of the microcode has completed successfully before you attempt to IPL the library. The IPL will fail if the download has been unsuccessful. For more information about downloading microcode, refer to the** *L20 Tape Library User's Guide,* **the** *L40 Tape LIbrary User's Guide or the L80 Tape Library User's Guide.*

A successful download writes new microcode to the flash memory and IPLs the library after the final Write Buffer command completes. The library performs block verification on the first 32 bytes of data and a CRC over the entire image after the last command. A unit attention is set for all initiators other than the initiator that requested the download with the additional sense code set to Microcode Has Been Changed.

Table 4-71. Write Buffer Command

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Operation Code (3Bh)							
1	Reserved (0h)					Mode		
2	Buffer ID (00h)							
3 to 5	(MSB) Buffer Offset (LSB)							
6 to 8	(MSB) Parameter List Length (LSB)							
9	Control (00h)							

- **Mode**
  This field indicates the type of download to be performed. The library supports four modes:

- **Download Microcode (100b)**
  This mode downloads code in a single transfer or multiple transfers. The library keeps track of the placement of data for multiple transfers. The data must be sent in sequential order. The library also detects when the download is complete. A change to this mode from any other mode is considered a new download request, and terminates any active download.

- **Download Microcode and Save (101b)**
  This mode downloads code in a single transfer only. Two consecutive Write Buffer commands with this mode are considered to be two complete and separate requests.

- **Download Microcode with Offsets (110b)**
  This mode is used for multiple transfer downloads. The first Write Buffer command must contain data for the start of the image. The remaining commands can send data in any order using the Buffer Offset field. The library does not check for data overlap. It is up to the initiator to keep track of the amount of microcode transferred and the microcode placement.

  This mode cannot be used exclusively to download microcode. It is used for all Write Buffer commands in a download except for the last one. The last Write Buffer command uses the Download Microcode with Offsets and Save (111b) mode. This tells the library that the download is finished. A change to this mode from any other mode is considered a new download request, and terminates any active download.

- **Download Microcode with Offsets and Save (111b)**
  This mode is used only once per download. It is used in conjunction with the Download Microcode with Offsets (110b) mode to indicate the last Write Buffer command of a download. A parameter list length of 0 is allowed for this mode. A change to this mode from any mode other than 110b is considered a new download request, and terminates any active download.

- **Buffer ID**
  This field defines the region of memory to be modified. Currently only a value of 00h is supported. A non-zero value returns a Check Condition status with an Illegal Request sense key. The additional sense code is set to Invalid Field in CDB that identifies Byte 2.

- **Buffer Offset**
  This field identifies the offset from the start address of the load area into which the data is placed. For modes 100b and 101b, this field must be set to 0. A non-zero results in a Check Condition status with an Illegal Request Sense Key. The additional sense code set to Invalid Field in CDB that identifies Byte 3 (the parameter list length). For modes 110b and 111b, this field is ignored.

- **Parameter List Length**
  This field indicates the number of bytes being sent to the library. A length of 0 is allowed for mode 111b only. The first command must contain a minimum of 32 bytes. The length value must be an even number; an odd number results in a Check Condition with an Illegal Request sense key. The ASC will be set the Invalid Field in CDB identifying Byte 6. Any other error also results in a Check Condition status with an Illegal Request sense key. The ASC will be set to Invalid Field in CDB identifying Byte 6.

- **Write Buffer Command Data**
  The initiator must provide microcode only. This command is used only to download microcode.

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Element Mapping

A

This appendix details how element numbers will be mapped into physical library locations using panel-row-column notation. These element numbers are returned to a SCSI host through the Mode Sense command.

■ Data Transfer (Drive) Element Mapping

The data transfer elements are the tape drives installed in the library. The following sections explain how each library maps these elements.

L20 Data Transfer Elements

Element mapping of drives in the L20 library begins with element 500d (1F4h). If the library contains two drives, the element addresses will be 500d and 501d (1F5h), respectively.

Note: Autoconfiguration moves from left to right (orientation is from the front of the library). The first drive that the robot senses will be assigned element address 500d.

L40 Data Transfer Elements

Element mapping of drives in the L40 library begins with element 500d (1F4h). If the library contains four drives, the element addresses will be 500d, 501d (1F5h), 502d (1F6), and 503d (1F7h), respectively.

Note: Autoconfiguration moves from the top to the bottom of the library. The first drive that the robot senses will be assigned element address 500d.

L80 Data Transfer Elements

Element mapping of drives in the L80 library begins with element 500d (1F4h). If the library contains eight drives, the element addresses will be 500d, 501d (1F5h), 502d (1F6), 503d (1F7h), 504d (1F8h), 505d (1F9h), 506d (1FAh) and 507d (1FBh) respectively.

Note: Autoconfiguration moves from the top to the bottom of the library. The first drive that the robot senses will be assigned element address 500d.

■ Import/Export (CAP) Element Mapping

The import/export element in the library is the Cartridge Access Port (CAP). The following sections explain how each library maps this element.

The L20 CAP Element

The following rules apply to CAP element mapping on the L20 library:

- If the CAP is permanently locked, the library considers the CAP cell an additional storage element and maps it accordingly. The actual address of the CAP cell will depend on the configuration of the library, but the address will always be the last in the sequence of storage element addresses.
- If the CAP is not locked, the element address of the CAP cell is 10d (Ah).

L40 CAP Elements

The element addresses of the two CAP cells in the L40 library are 10d (Ah) and 11d (Bh).

L80 CAP Elements

The element addresses of the five CAP cells in the L80 library starts at 10d (Ah).

■ Default Element Mapping

The following rules apply to the default element mapping values in each library:

- The medium transport element (robot) is element 0d (0h).
- The first import/export element (CAP) is element 10d (Ah).
- The first data transfer element (drive) is element 500d (1F4h).
- The first storage element (cell) is element 1000d (3E8h).

The following tables show these defaults and depict how last element addresses are affected by variables in a library's configuration.

Table A-1. L20 First and Last Element Addresses

Type of Element	First Element Address	Variables Affecting Last Element Address	Last Element Address
Robot	0d (0h)	None	0d (0h)
CAP cell	10d (Ah)	The CAP is not permanently locked.	10d (Ah)
	1018d (3FAh)	The CAP is permanently locked, and Auto Clean is enabled. **Note:** The CAP is cell element 1018d in this configuration.	1018d (3FAh)
	1019d (3FBh)	The CAP is permanently locked, and Auto Clean is disabled. **Note:** The CAP is cell element 1019d in this configuration.	1019d (3FBh)
Drives	500d (1F4h)	Only one drive is installed.	500d (1F4h)
		Two drives are installed.	501d (1F5h)

Table A-1. L20 First and Last Element Addresses (Continued)

Type of Element	First Element Address	Variables Affecting Last Element Address	Last Element Address
Storage Cells	1000d (3E8h)	The 10-cartridge configuration is in effect; the CAP is not permanently locked, and Auto Clean is enabled.	1008d (3F0h)
	1000d (3E8h)	The 10-cartridge configuration is in effect; the CAP is not permanently locked, and Auto Clean is disabled.	1009d (3F1h)
	1000d (3E8h)	The 15-cartridge configuration is in effect; the CAP is not permanently locked, and Auto Clean is enabled.	1013d (3F5h)
	1000d (3E8h)	The 15-cartridge configuration is in effect; the CAP is not permanently locked, and Auto Clean is disabled.	1014d (3F6h)
	1000d (3E8h)	The full configuration is in effect; the CAP is not permanently locked, and Auto Clean is enabled.	1017d (3F9h)
	1000d (3E8h)	The full configuration is in effect; the CAP is not permanently locked, and Auto Clean is disabled.	1018d (3FAh)
	1000d (3E8h)	The full configuration is in effect; the CAP is permanently locked, and Auto Clean is enabled. **Note:** The CAP is cell element 1018d in this configuration.	1018d (3FAh)
	1000d (3E8h)	The full configuration is in effect; the CAP is permanently locked, and Auto Clean is disabled. **Note:** The CAP is cell element 1019d in this configuration.	1019d (3FBh)

Table A-2. L40 First and Last Element Addresses

Type of Element	First Element Address	Variables Affecting Last Element Address	Last Element Address
Robot	0d (0h)	None	0d (0h)
CAP cells (2)	10d (Ah)	None	11d (Bh)
Drives	500d (1F4h)	Only one drive is installed.	500d (1F4h)
		Two drives are installed.	501d (1F5h)
		Three drives are installed.	502d (1F6h)
		Four drives are installed.	503d (1F7h)
Storage Cells	1000d (3E8h)	The 20-cartridge configuration is in effect.	1019d (3FBh)
	1000d (3E8h)	The 32-cartridge configuration is in effect.	1031d (407h)
	1000d (3E8h)	The 40-cartridge configuration is in effect, and Auto Clean is enabled.	1039d (40Fh)
	1000d (3E8h)	The 41-cartridge configuration is in effect.and Auto Clean is disabled.	1040d (410h)

Table A-3. L80 First and Last Element Addresses

Type of Element	First Element Address	Variables Affecting Last Element Address	Last Element Address
Robot	0d (0h)	None	0d (0h)
CAP cells (5)	10d (Ah)	None	14d (Eh)
Drives	500d (1F4h)	Only one drive is installed.	500d (1F4h)
		Two drives are installed.	501d (1F5h)
		Three drives are installed.	502d (1F6h)
		Eight drives are installed.	503d (1F7h)
Storage Cells	1000d (3E8h)	The 20-cartridge configuration is in effect.	1019d (3FBh)
	1000d (3E8h)	The 32-cartridge configuration is in effect, and Auto Clean is enabled.	1031d (307h)
	1000d (3E8h)	The 40-cartridge configuration is in effect, and Auto Clean is enabled.	1039d (40Fh)
	1000d (3E8h)	The 60-cartridge configuration is in effect, and Auto Clean is enabled.	1059d (423h)
	1000d (3E8h)	The 64-cartridge configuration is in effect, and Auto Clean is enabled.	1063d (427h)
	1000d (3E8h)	The 80-cartridge configuration is in effect, and Auto Clean is enabled.	1079d (437h)
	1000d (3E8h)	The 81-cartridge configuration is in effect, and Auto Clean is disabled.	1080d (438h)

■ Reserved Cell

To facilitate the automatic cleaning (Auto Clean) of drives, the library can have a cell that is reserved only for a cleaning cartridge.

L20 Reserved Cell

If the operator has enabled the Auto Clean function on the L20 library, then the first storage cell in the library is reserved for the cleaning cartridge.

L40 Reserved Cell

If the operator has enabled the Auto Clean function on the L40 library, then the cell above the CAP is reserved for the cleaning cartridge.

L80 Reserved Cell

If the operator has enabled the Auto Clean function on the L80 library, then the two cells above the CAP is reserved for the cleaning cartridge.

■ L20 Storage Elements

The following diagrams show the addresses of the storage elements within the L20 library as they are affected by the status of the Auto Clean function.

Figure A-1. L20 Storage Cell Addresses when Auto Clean is Disabled (L201_019)

L201_019
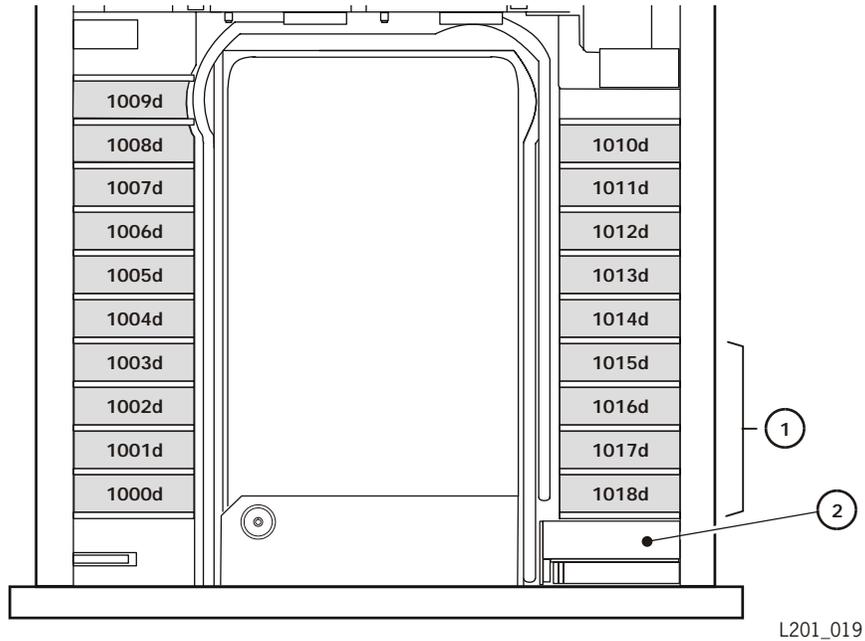
L20 Wall Element Map/Auto Clean Disabled

1. Storage cells that are excluded in the 15-cartridge configuration
2. CAP cell

Figure A-2. L20 Storage Cell Addresses when Auto Clean is Enabled (L201_020)

L201_020
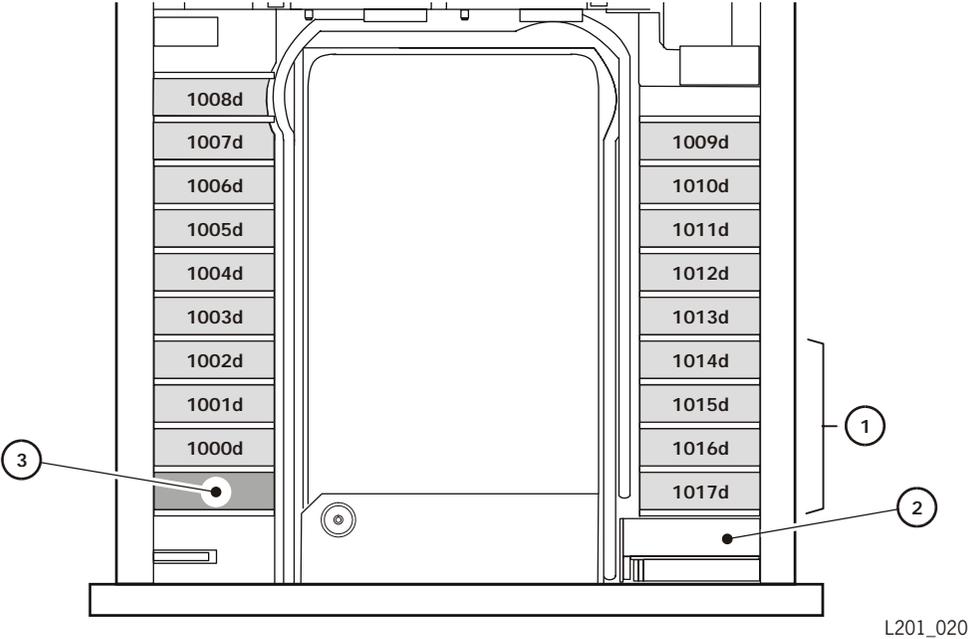
L20 Wall Element Map/Auto Clean Enabled

1. Storage cells that are excluded in the 15-cartridge configuration
2. CAP cell
3. Cell reserved for cleaning cartridge

L40 Storage Elements

The following diagram shows the addresses of storage elements within the L40 library for both the minimum (20-cartridge) configuration and the maximum (40- or 41-cartridge) configuration. The difference between a 40-cartridge and a 41-cartridge configuration occurs in the status of the Auto Clean function.

Note: The CAP contains 2 cells.

Figure A-3. L40 Storage Cell Addresses (L201_030)
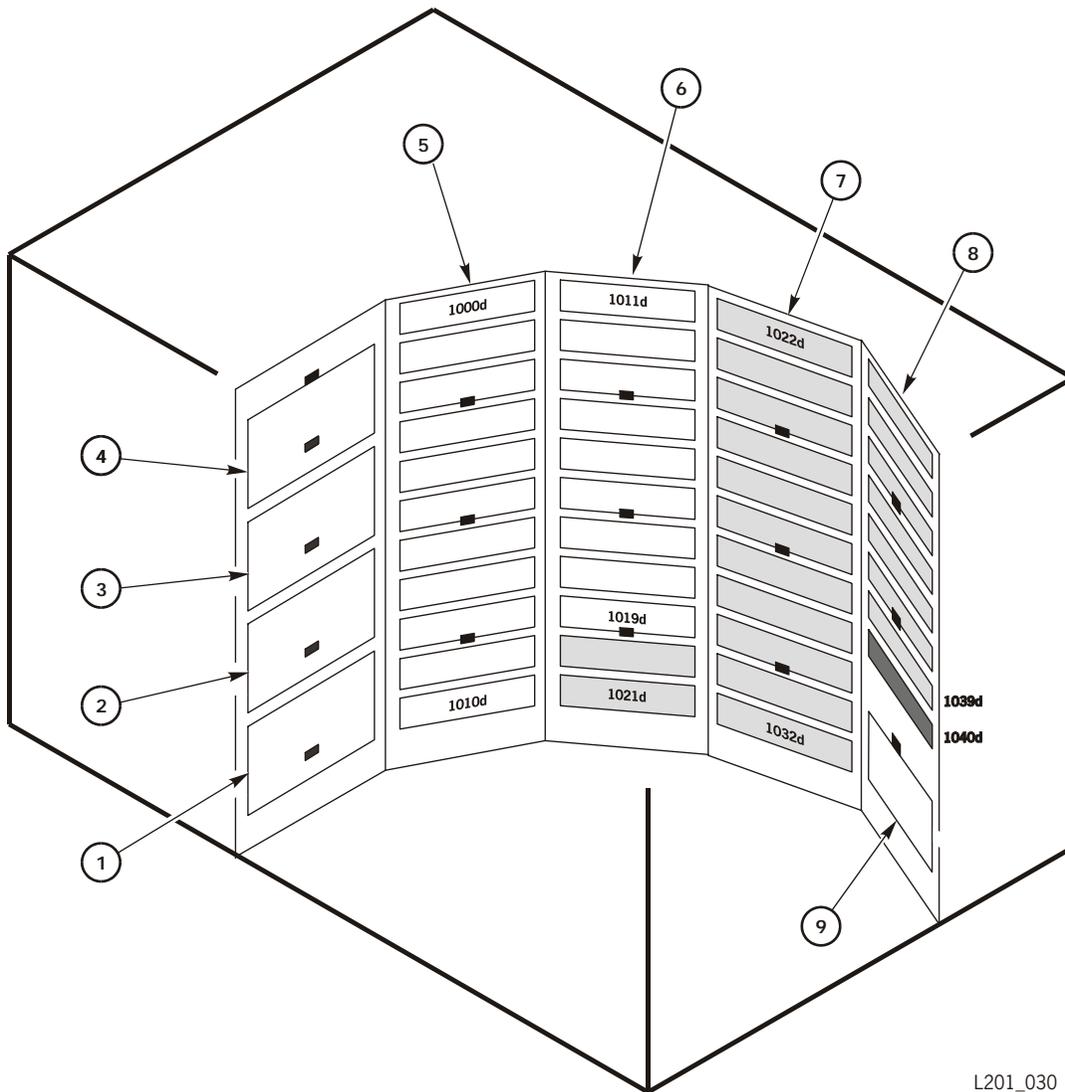
L201_030

1. Drive Slot 3

Figure A-3. L40 Storage Cell Addresses (Continued) (L201_030)

2. Drive Slot 2
3. Drive Slot 1
4. Drive Slot 0
5. Column 0
6. Column 1
7. Column 2
8. Column 3
9. CAP (two cells)

Note:

1. The reserved cell becomes 1040d in the maximum configuration when auto clean is off.
2. In a 40 cell capacity library, if Auto Clean or CAP is not enabled, the cleaning cartridge cell can be used for a data cartridge, totalling 41 cells.

Legend:

- Column 0 and 1 white cells used for minimum configuration.
- Column 2 and 3 gray cells used for maximum configuration.
- Black cell above the CAP is used for cleaning cartridge if Auto Clean is enabled.
- Small black rectangles are targets.

■ L80 Storage Elements

The following diagram shows the addresses of storage elements within the L80 library.

Note: The CAP contains five cells.

Figure A-4. L80 Storage Cell Addresses (L201_150)
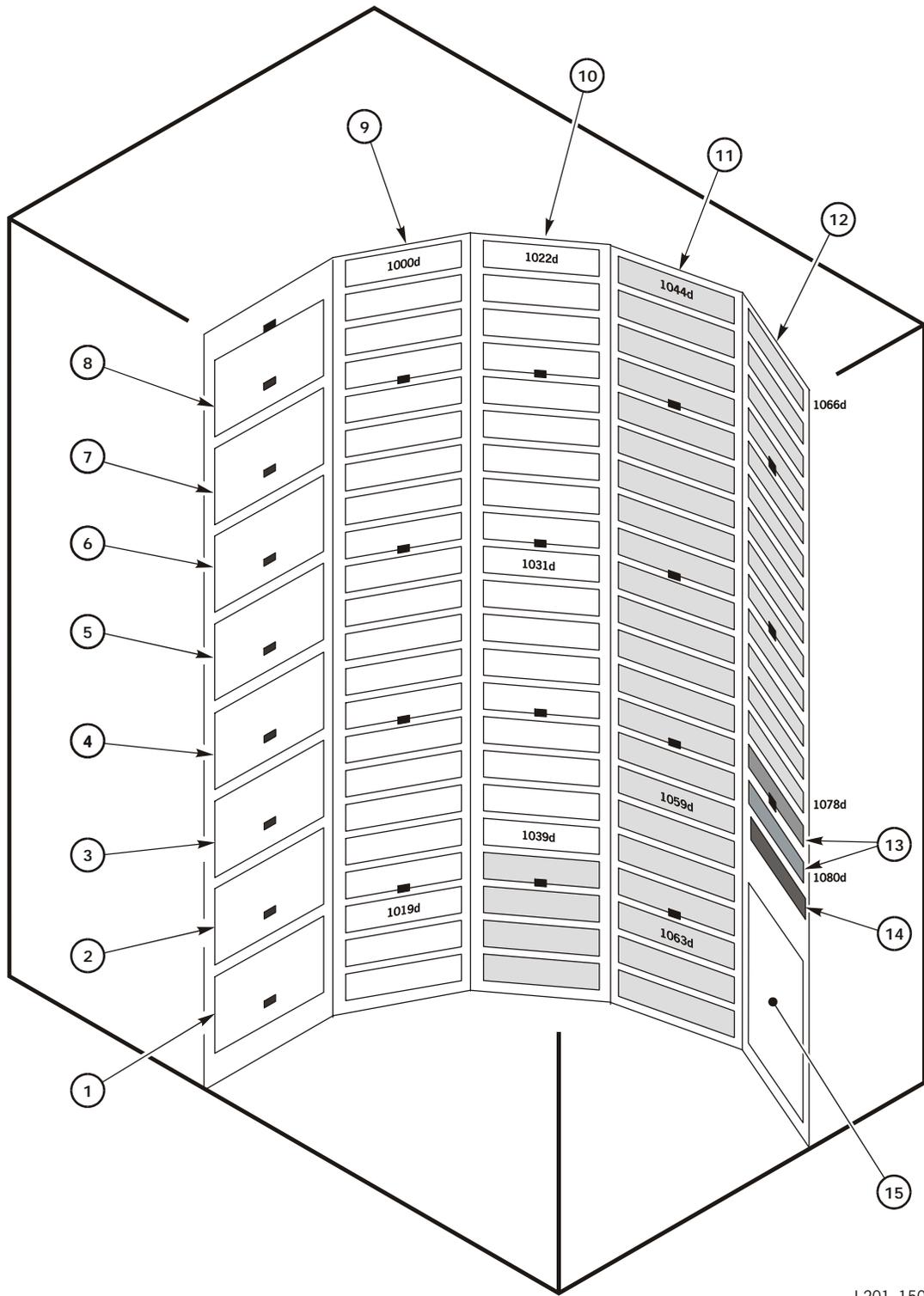
1. Drive Slot 7

Figure A-4. L80 Storage Cell Addresses (Continued) (L201_150)

2. Drive Slot 6

3. Drive Slot 5

4. Drive Slot 4

5. Drive Slot 3

6. Drive Slot 2

7. Drive Slot 1

8. Drive Slot 0

9. Column 0

10. Column 1

11. Column 2

12. Column 3

13. Cleaning cartridge cells (2) when Auto Clean is enabled

14. Library calibration label

15. CAP (five cells)

Notes: In an 80-cell capacity library, if Auto Clean is not enabled, the operator can place data cartridges into the cleaning cartridge cells, making the total capacity 81. If Auto Clean is enabled, the total capacity is 79.

Legend:

- Use Columns 0 an 1 white cells for the 40-cell configuration.
- Use Columns 0 and 1 white cells and Columns 1,2 and 3 light gray cells for the 80-cell configuration.
- Use two dark gray cells above the CAP for cleaning cartridges if Auto Clean is enabled.
- Small black rectangles are targets.

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Glossary

This glossary defines abbreviations and new or special terms in this publication.

A

abort To end a process.

ACA Auto Contingent Alliance.

ACK Acknowledgement. A message sent by the receiver of a communication, acknowledging its receipt.

AENC Asynchronous event notification capable.

algorithm An ordered set of well-defined rules that govern an operation, such as data compression.

allowed A function in Fibre Channel that allows a feature or parameter to be used between an initiator and a target.

American National Standard Code for Information Interchange (ASCII) The standard code that uses a coded character set consisting of 7-bit coded characters (8 bits including parity check) for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of control characters and graphic characters. (A)

American National Standards Institute (ANSI) See National Committee for Information Technology Standards.

ANSI *See* American National Standards Institute.

ASCII See American National Standard Code for Information Interchange.

ASC See automated cartridge system.

ASCQ Additional Sense Code Qualifier. A bit set in the Request Sense data format.

asynchronous A mode of data transfer that pertains to two or more processes that do not depend on specific events such as timing signals.

asynchronous event notification A form of communication used between processes to notify a process of an asynchronous action, such as an input/output activity or message transmission.

ATN Attention. A signal driven by the initiator that indicates an attention condition.

automated cartridge system (ACS) A system that consists of five components: host software, a library management unit, a library control unit, library storage modules, and cartridge subsystems. These components provide automatic mounting and dismounting of cartridge tapes into a transport, cartridge access port, or pass-thru port.

AVolTag Alternate VOLume TAG.

AWG American Wire Gauge.

B

b (1) A symbol that designates binary notation using bits 1 and 0; for example, 101b. (2) See bit.

B See byte.

bit (1) A unit of information equal to a 1 or a 0. (2) Either of the digits 0 or 1 when used in the binary numeration system.(T)

BPV Bit pointer valid.

BSY See busy.

bus A facility that transfers data between several devices located between two end points, with only one device capable of transmitting at a given moment. (T).

busy (BSY) An OR-tied signal that indicates the SCSI bus is in use.

byte (1) A string that consists of a number of bits, treated as a unit, and representing a character. (T) (2) A number of bits, treated as a unit, and representing a character.

C

CAP See cartridge access port.

cartridge access port (CAP) In a StorageTek library, a mail slot through which an operator feeds tape cartridges into and retrieves tape cartridges from a library.

C/D See control and data signals.

CDB See command descriptor block.

cell (1) A slot in the library in which a cartridge is stored. (2) A place in which a cartridge is stored in a library.

channel An optical or electrical path that connects the host and main storage with input/output devices.

CLS See close.

CmdQue Command Queuing.

Command Descriptor Block The structure block that transfers commands from the initiator to a target on a SCSI bus.

control and data signals (C/D) These signals are driven by the target to indicate the type of information on the SCSI bus.

CSE Customer service engineer. See solutions delivery engineer.

D

d Decimal number notation; for example, 9499d is equal to 251Bh (hexadecimal notation).

DB See data bus.

data bus (DB) A SCSI bus signal.

DBD Disable Block Descriptors.

device (DEV) (1) An individual storage element within the subsystem, that consists of the access arms and heads, disk surfaces, and the supporting electronics required to locate, write, and read data. (2) A host adapter or control unit attached to the SCSI bus.

DevOfl Device Offline.

DHCP See Dynamic Host Configuration Protocol.

differential (diff) A SCSI bus alternative that provides better signal quality with less crosstalk and noise but requires more power to drive the signal. The maximum cable length is 25 m (82 ft.).

differential sense (DIFFSENS) A SCSI bus signal.

DIFFSENS See differential sense.

Digital Linear Tape (DLT) A trademarked name for Quantum cartridge tapes and tape drives.

disabled (1) Inactive. (2) Off.

DLT See Digital Linear Tape.

DNS Domain Name Service (or System)

DS Disable save.

DT Data transfer element (the tape drive).

Dynamic Device Reconfiguration (DDR) The facility provided by MVS to allow a volume to be moved from one drive (or cartridge tape unit) to another while the volume is being used.

Dynamic Host Configuration Protocol (DHCP) Server software that automatically sets the library IP address, subnet mask, and name.

E

ECMA European Computer and Manufacturers Association.

enabled (1) Active. (2) On.

encoding The process that changes the original form in which information is available into another form. An example of this is changing handwritten text into computer bytes.

EVPD Enable Vital Product Data.

ExEnab An export element that supports movement of cartridge tapes.

F

Fault Symptom Code (FSC) A four-character hexadecimal code generated in response to a subsystem error to help isolate failures within the device.

FCC See Federal Communications Commission.

Federal Communications Commission (FCC) A board of commissioners appointed by the President under the Communications Act of 1934 with the power to regulate all interstate and foreign communications by wire and radio originating in the United States. (IBM)

field A group of one or more contiguous bits.

field replaceable unit (FRU) An assembly that is replaced in its entirety when any one of its components fails. (IBM)

FRU See field Replaceable Unit.

FSC See Fault Symptom Code.

full duplex A communication protocol that allows signals to be transmitted and received simultaneously. See also half duplex.

H

h A symbol that designates hexadecimal notation (base 16 numbering system); for example, 10h is equal to 16d (decimal).

half duplex A communications protocol that permits a port to transmit or receive frames at any point in time, but not simultaneously, as in full duplex. The one exception to this is with link control frames, which are always allowed in full duplex. See also full duplex.

host (1) The primary computer on a network, with which other computers interact. (2) A processor, usually composed of a central processing unit and memory, that typically communicates with peripheral devices over channels or networks, to perform input/output operations such as network control. It also provides end users with computation services and database access.

host adapter A device connecting between a host system and SCSI bus. The device usually performs the lower level layers of SCSI bus protocol operating as an initiator.

HTTP HyperText Transfer Protocol.

HVD High Voltage Differential. A more established SCSI bus alternative. This alternative requires 5 VDC. *See* LVD.

I

ID (1) Identification. (2) Identifier

I/E Import/export element (the cartridge access port).

IEC International Electrotechnical Commission.

IEEE Institute of Electrical and Electronics Engineers.

ImpExp An indication of how the cartridge tape was placed and in which element.

in. *See* inch

InEnab An import element that supports movement of cartridge tapes.

initial program load (IPL) A process that activates a machine reset and loads system programs to prepare a computer system for operation. Processors having diagnostic programs activate these programs at initial program load execution. Devices running firmware usually reload the functional firmware from a diskette or disk drive at initial program load execution**.**

initiator A SCSI device that requests an input/output process be performed by another SCSI device called a target.

input/output (I/O) Pertaining to a device, process, or channel involved in data input, data output, or both. (IBM)

I/O *See* input/output.

IPL *See* initial program load.

ISO *See* International Standards Organization.

International Standards Organization (ISO) An organization of national standards bodies from various countries that promotes development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity. (IBM)

L

library (1) A library is composed of one or more automated cartridge systems (ACSs), attached transports (such as cartridge drives or controller transport units), volumes placed into the ACSs, host software that controls and manages the ACSs and associated volumes, and the library control data sets that describe the state of the ACSs. (2) A robotic system that stores, moves, mounts, and dismounts cartridges that are used in data read or write operations. (3) A hardware component in an automated tape cartridge system.

Logical Unit Number (LUN) A SCSI bus term that indicates one or more physical or virtual peripheral devices addressable through the target or control unit.

LP List parameter.

LSB (1) Least significant bit. (2) Least significant byte.

LTO Linear Tape Open, an open specification for tape storage devices.

LUN *See* Logical Unit Number.

LVD Low Voltage Differential. A SCSI bus alternative which will be formalized in the SCSI-3 specifications. This alternative requires 3.3 VDC. *See* HVD. *See also* SCSI-3.

M

m *See* meter.

mm *See* millimeter.

mA Milliampere or one-thousandth (10-3) of an ampere.

MAC Media Access Control.

meter (m) A metric measurement of length equal to 1.0936 yards, 3.2808 feet, or 39.3696 inches. (IBM)

megabytes per second (MB/s or MB/sec) A measurement that usually describes the speed of data transfer.

message (MSG) A signal driven by the target during the message phase of the SCSI bus.

Mb/s Megabits per second.

MB/s *See* megabytes per second.

Mode Select Command The command used in Fibre Channel that specifies operational parameters and options for a logical unit. The Mode Select command shows the fields to be changed and the default values for these fields.

MSB (1) Most significant bit. (2) Most significant byte.

MSG *See* message.

MT Medium transport (the hand).

N

nanometer (hm) One-billionth of a meter.

National Committee for Information Technology Standards (NCTIS) The standards organization that was formerly known as the American National Standards Institute (ANSI). It is not associated with the United States government but that develops standards that are used voluntarily by product vendors in the United States.

NCITS *See* National Committee for Information Technology Standards.

network An arrangement of nodes and branches that connect processing devices to one another via software and hardware links to facilitate information interchange.

nm Abbreviation for nanometers.

No Operation (NOP) command A command used in Basic Link Services. It is prohibited when originated by the initiator and prohibited when originated by a drive.

NOP *See* No Operation command.

NotBus "Not this bus" indication.

ns Nanoseconds, one billionth of a second.

O

Operation Code Structure A component of the command descriptor blocks that compose Byte 0 of both the 6-byte and 10-byte command descriptor.

OPN Open.

OR-tied (1) A condition that indicates that the operation is complete when any one of the conditions are met. (2) A SCSI bus condition that describes the logic of a signal.

P

P (1) See parity. (2) Plug, such as P138.

PC Page code or page control.

PF Page format.

parity (P or par) A data transmission attribute used to ensure error-free transmission.

pointers A SCSI element that points to relative locations in memory.

PPC Parameter pointer control.

PS (1) Page Savable. (2) Power supply

PVolTag Primary volume tag.

R

Read Link Error Status Block (RLS) command A command used in Extended Link Services. It is invokable when originated by the initiator, allowable when originated by a drive, and prohibited when originated by a drive.

RelAdr Relative address.

Remove Connection (RMC) command A command used in Basic Link Services. It is prohibited when originated by the initiator and is prohibited when originated by a drive.

REQ See Request.

Request (REQ) A SCSI signal driven by the target that indicates a data transfer request handshake.

RESET button   Pressing this button starts an initial program load (IPL) of the library.

reset switch   The switch on the library management unit or library storage module that permits bypassing of certain non-fatal errors occurring during initial program load. After the functional code is active, it forces a manual dump.

reset the library   To cause the library to reload its operating software (firmware) into working memory and reset some configuration values. The operator must press the RESET button.

RLS command *See* Read Link Error Status Block.

RMB   Removable Medium Bit.

RMC command   *See* Remove Connection command.

RST   *See* reset.

Rsvd   Reserved.

S

SCSI   *See* Small Computer System Interface.

SCSI device   A host adapter or control unit attached to the SCSI bus. Synonymous with target.

SCSI-3   The set of SCSI commands used specifically for Fibre Channel. SCSI-3 comes in a Generic Packetized Protocol (SCSI-3 GPP) and Fibre Channel Protocol (SCSI-3 FCP), chosen by SCSI as its primary implementation of SCSI on Fibre Channel. SCSI-3 FCP allows queuing of commands from the initiator at the target, retains the half-duplex nature of the parallel SCSI-2, and permits a single operation, such as a READ command, to operator over a single port pair between an initiator and a target.

SEL   *See* select.

select (SEL)   (1) A signal that the initiator

uses to select a target. (2) An indication that the controller transport unit is selected and in use by an operating system. (3) An extended format data record after compression and compaction.

SelfTestl   *See* Self test.

SelfTest   A test that runs automatically after a device turns on.

Sense Key (SK)   A field in the Request Sense data format, it provides a basic description about an error. It is used with the additional sense code and additional sense code qualifier in SCSI sense data.

SftRe   Soft reset.

single-ended   A SCSI bus alternative, it is an inexpensive bus requiring less power than the differential alternative. The maximum cable length is 6 m (20 ft.).

SK   See Sense Key.

SKSV   Sense key specific valid.

small computer systems interface (SCSI) A local interface operating over a wide range of transfer rates using a common command set for all devices attached to the interface. It connects host computer systems to a variety of peripheral devices.   See also SCSI-2, SCSI-3.

SNMP   Simple Network Management Protocol.

solutions delivery engineer (SDE) The StorageTek field representative who installs StorageTek products and maintains product performance in a customer's account.

SP   (1) Save pages. (2) Save parameters. (3) Servo processor.

ST   Storage element.

STK   StorageTek. Storage Technology Corporation.

StorDT Store data transfer element (the tape drive).

StorI/E Store element (the cartridge access port).

StorST Store storage cell location.

StorMT Store medium element (the hand).

SVaild Source elements are valid.

synchronous (SYNC) (1) Pertaining to two or more processes that depend upon the occurrences of specific events, such as common timing signals. (T) (2) A SCSI bus signal for device termination networks.

T

TapeAlert A specification for tape and library diagnostics based on performance and interpretation of information.

target (1) A SCSI device that performs an input/output operation requested by the initiator. (2) A marker on components in the library storage module used by the robot for calibration during audits.

terminator power (TERMPWR) A SCSI bus signal for device termination networks.

TERMPWR See terminator power.

TrmIOP Terminate input/output process.

TSD Target save disable.

U

UnitOfl Unit offline.

V

VDE Verband Deutscher Elektrotechniker.

vendor specific Something (a bit, field, code value) not defined by a specification and unique to the manufacturer for reporting purposes.

VolTag Volume tag.

X

XFER Transfer.

Z

zero A false or negative signal.

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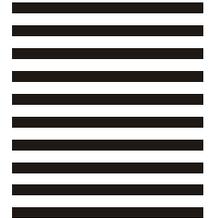
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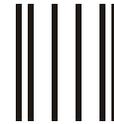
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