Quantum

SCSI Reference Guide

Scalar Intelligent Libraries

6-00423-16 Rev A

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SCSI Command Support

Device Model

Quantum intelligent libraries support both a media changer device (device type 08h) and, depending on the library model and configuration, a controller device (device type 0Ch). The controller device is used primarily to aid initialization and discovery for the servers in conjunction with the library's Logical Library model. Only the Scalar i2000/i6000 and Scalar i500 library models support DA blade configurations. Library models without DA blades configure tape drives to host the library control path to the logical library partition and hereby provide access to the media changer devices.


Note

"DA blade" is a generic term used in this manual to describe a Fibre Channel (FC)-to-FC I/O blade. The DA blade controller device is not a pure controller device, in that it does not support all the mandatory commands defined by SCC. This is an accepted industry practice established by vendors of bridges and routers.

This device model approach works by having the controller device or tape drive (typically at LUN 0) respond to commands directed at LUN 0, including the REPORT LUNS command, and the media changer device(s) (one media changer device per logical library partition) typically respond to commands on LUN1. This approach allows an initiator (host) to issue a REPORT LUNS command to the controller device to retrieve a listing of all available logical units, to determine the presence of connected Data Transfer Device(s) and media changer device(s).

DA Blade Controller Device Commands and Parameters

The following table lists the commands supported by the DA blade controller device.

Table 1 DA Blade Controller Device Supported Commands

Command	Code
INQUIRY	12h
MODE SELECT (6)	15h
MODE SELECT (10)	55h
MODE SENSE (6)	1Ah
MODE SENSE (10)	5Ah
READ BUFFER	3Ch
REPORT LUNS	A0h
REQUEST SENSE	03h
TEST UNIT READY	00h
WRITE BUFFER	3Bh

The following table lists the parameters supported by the DA blade controller device.

Table 2 DA Blade Controller Device Supported Parameters

Command	Page	Code
Inquiry	Supported VPD Pages	00h
Inquiry	Unit Serial Number Page	80h
Inquiry	Device Identification Page	83h
Mode Select/Sense	Disconnect Reconnect Page	02h
Mode Select/Sense	FC LU Control Page	18h
Mode Select/Sense	FC Port Control Page	19h
Mode Sense	Return all pages	3Fh

Media Changer Commands and Parameters

The following table lists the commands supported by the media changer device.

Table 3 Media Changer Supported Commands

Command	Code
Initialize Element Status - 07h	07h
Initialize Element Status With Range - E7h	E7h
Inquiry - 12h[1]	12h
Log Sense - 4Dh	4Dh
Mode Select (6) - 15h	15h
Mode Select (10) - 55h	55h
Mode Sense (6) - 1Ah	1Ah
Mode Sense (10) - 5Ah	5Ah
Move Medium – A5h	A5h
Persistent Reserve In – 5Eh[1]	5Eh
Persistent Reserve Out – 5Fh[1]	5Fh
Position to Element – 2Bh	2Bh
Prevent Allow Medium Removal – 1Eh	1Eh
Read Buffer – 3Ch[1]	3Ch
Read Element Status – B8h	B8h
Release Element (6) – 17h[1]	17h
Release Element (10) – 57h[1]	57h
Report LUNS – A0h[2]	A0h
Request Sense – 03h[1]	03h
Request Volume Element Address - B5h[3]	B5h
Reserve Element (6) - 16h[1]	16h
Reserve Element (10) - 56h[1]	56h
Send Diagnostic - 1Dh	1Dh
Send Volume Tag - B6h[3]	B6h
Test Unit Ready (00h)[1]	00h
Write Buffer (3Bh)[1]	3Bh

[1] If the library control path is configured via a tape drive, this command is processed by the tape drive on behalf of the media changer device.
[2] This command is supported by a media changer device if the media changer device is configured as LUN 0[for example: when control path failover (CPF) is enabled].
3 Supported only by Scalar i2000 and Scalar i6000.

The following table lists the parameters supported by the media changer device. The media changer device does not support any diagnostic parameters.

Table 4 Media Changer Supported Parameters

Command	Page	Code
Inquiry	Supported Vital Product Data Page (00h)	00h
Inquiry	Unit Serial Number Page (80h)	80h
Inquiry	Device Identification Page (83h)	83h
Inquiry	Management Network Addresses Page (85h)	85h
Inquiry	Management Network Addresses Page (85h)	C8h
Log Sense	Supported Log Page (00h)	00h
Log Sense	Tape Alert Log Page (2Eh)	2Eh
Mode Sense	Disconnect-Reconnect Page (02h)[1]	02h
Mode Sense	Fibre Channel Logical Unit Control Page (18h)[1]	18h
Mode Sense	Fibre Channel Port Control Page (19h)[1]	19h
Mode Sense	Informational Exceptions Control Page (1Ch)	1Ch
Mode Sense	Element Address Assignment Page (1Dh)	1Dh
Mode Sense	Transport Geometry Parameters Page (1Eh)	1Eh
Mode Sense	Device Capabilities Page (1Fh)	1Fh
Mode Sense	All Mode Pages (3Fh)	3Fh

[1] If the library control path is provided by a tape drive, this page is provided by the tape drive.

General Command Support Behavior

Multiple Initiator Support

Multiple initiators are not supported on the parallel SCSI or SAS interfaces. Information such as Unit Attentions and SCSI sense data will be held for only a single initiator. Multiple initiators are supported on the Fibre Channel interface. Unit attentions and SCSI sense data will be held for each initiator.

Element Addressing

The element-addressing model follows that of previous Quantum libraries. The starting addresses of the four element types are:

- 0001h: Medium Transport
- 0010h: Import/Export
- 0100h: Data Transfer
- 1000h: Storage

Command Status

Individual command status responses are not documented, as they all follow the same general format as described here. After processing any command, the library returns status from among the following:

Good - The library returns a Good status (00h) when it is able to process the command without errors.

Busy - The library returns Busy status (08h) when a motion command is still being processed, or the library is generally not able to process additional commands at that time.

Reservation Conflict - The library returns a Reservation Conflict (18h) whenever an initiator attempts to access a logical unit that has been reserved by another initiator, except for the following commands:

- INQUIRY
- LOG SENSE
- MODE SENSE (only if the library control path is configured through a tape drive)
- PREVENT/ALLOW MEDIUM REMOVAL
- READ ELEMENT STATUS (only when the Current Data [CurData] field is set to 1)
- REPORT LUNS
- REQUEST SENSE
- TEST UNIT READY

Check Condition - The library returns the Check Condition status (02h) when the following general situations occur (all generate sense data):

- The library is Not Ready (sense key 02h)
- The library has encountered a Hardware Error (sense key 04h)
- A parameter in the CDB is invalid or there is an invalid field in a parameter list, resulting in an Illegal Request (sense key 05h)
- A Unit Attention condition is pending (sense key 06h)
- A command has been aborted (sense key 0Bh)

For a complete list of all possible sense data and their causes, refer to Request Sense – 03h on page 81. This status information will not be separated by individual commands.

Status values of Condition Met, Intermediate Condition Met, and Queue Full are not currently used. The Initiator should issue a Request Sense command to determine the precise cause of the Check Condition status and clear it.

Response data, however, will be documented as applicable for each command, and included as part of the command section.

Unit Attentions

Unit Attentions will be queued by the library as necessary to report all events and conditions. They are presented in the order of their occurrence (first in, first out). Unit attentions are generated for the following conditions:

- A power on or a reset (external or internal) occurred
- A library door closed, or a transition from not ready to ready occurred
- A mailbox closed
- A firmware update completed
- A persistent reservation has been preempted or released, or a registration has been preempted
- Mode parameters have changed

Resets

Either a Power On Reset or a SCSI Reset resets the library. When reset, the library does the following:

- Returns to Bus Free
- Clears all non-persistent reservations
- Clears Prevent/Allow Medium Removal settings

Common CDB Fields

Each Command Descriptor Block contains a Logical Unit Number (LUN) field as well as a Control byte field. The LUN field is bits 5-7 of byte 1 and is there only for legacy compatibility. Logical Unit selection should be accomplished via the Identify message.

The Control byte is shown in the following table. It is always the last byte of a CDB, regardless of the size of the CDB.

Table 5 Control Byte

Byte \ **Bit**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
last	Vendor Specific		Reserved			NACA	Flag	Link

Vendor Specific – This field is used to provide additional data or control for a command. Specific uses (if any) are described within the applicable commands.

Normal Auto Contingent Allegiance (NACA) – If this field is set to 0, the initiator should issue a REQUEST SENSE command immediately following receipt of a Check Condition. If this field is set to 1, ACA support will be provided.

Flag – This field is not supported and must be set to 0.

Link – This field is not supported and must be set to 0.

Reserved Fields

Reserved fields are not checked, and no error will be sent if they contain non-zero values.

Vendor Specific Fields

Vendor Specific fields are not checked and no error will be sent if they contain non-zero values, unless specific uses are defined within a SCSI command and vendor specific settings are required.

Online/Offline Operation

Each media changer device can be placed in either an online or offline mode. The purpose of these modes is to configure whether the media changer device is being controlled by a SCSI initiator or by the local or remote user interface. When the media changer device is online, a SCSI initiator is controlling it and all SCSI commands are supported. When the media changer device is offline, the local or remote user interface is controlling it, and the only allowed SCSI commands are

- INQUIRY
- REPORT LUNS
- REQUEST SENSE
- TEST UNIT READYMODE SENSE (page 1Dh)

All other commands will respond with a check condition, along with an ASC/ASCQ of 04/8Dh (Logical unit offline) or 04/12h (Logical unit not ready, offline). The READ ELEMENT STATUS command is allowed with DVCID=1, VOLTAG=0 while the library is offline or the main door is open.

Note: If the SCSI media changer device is configured via a library control path-enabled tape drive, RESERVE and RELEASE commands are also accepted and handled when the library is reporting offline status.

The DA blade controller device SCSI command set is not affected by the online/offline mode of the media changer device.

Supported Interfaces

The library supports parallel SCSI, SAS and Fibre Channel interface types, supporting parallel SCSI and Fibre Channel interfaces as described below.

Parallel SCSI Interface Support

The library supports parity checking on the parallel SCSI interface. It will attempt to retry when parity errors are detected, but if unsuccessful will attempt to respond with a Check Condition indicating in which phase the parity error was detected.

If permitted by the initiator, the library will also support SCSI disconnect for commands that take a lengthy time to process, such as MOVE MEDIUM. Disconnect privilege is granted by the initiator via the Identify message.

Supported Messages

The SCSI message system (Message In/Message Out) allows communication between an initiator and a target for the purpose of physical path management. The supported messages are shown in the following table. The direction is relative to the initiator.

Table 6 Supported SCSI Messages

Message	Code	Direction	Description
COMMAND COMPLETE	00h	In	This message is sent from the target to an initiator to indicate that the execution of a command completed and valid status has been sent to the initiator.
EXTENDED MESSAGE	01h	Out	This message is sent from an initiator to the target to attempt to negotiate synchronous or wide data transfers. The library supports both.
SAVE DATA POINTERS	02h	In	This message is issued before every disconnect message following a Data In or Data Out phase. The message is not sent when disconnecting after a Command Descriptor Block (CDB) that did not transfer data.
RESTORE POINTERS	03h	In	This message is sent from the target to direct the initiator to continue sending data.
DISCONNECT	04h	In	This message is sent by the target to inform an initiator that the present data transfer will be suspended. The target will reselect the initiator at a later time to continue the current operation.
INITIATOR DETECTED ERROR	05h	Out	This message is sent from an initiator to inform the target that an error occurred. This allows the target to retry the operation.
ABORT	06h	Out	This message is sent from the initiator to the target to clear the current or pending operation. The target goes directly to the BUS FREE phase after successful receipt of this message.
MESSAGE REJECT	07h	Both	This message is sent from the initiator or target to indicate that the last message received was inappropriate or not implemented.
NO-OP	08h	Out	This message is sent from the initiator to inform the target that no message is valid in response to the target request for a message.
MESSAGE PARITY ERROR	09h	Out	This message is sent from the initiator to the target to indicate that one or more bytes in the last message received contained a parity error.
BUS DEVICE RESET	0Ch	Out	This message is sent from an initiator to clear all commands, data, and status at the target. When the target recognizes this message, it aborts the command currently being executed and proceeds to the BUS FREE state.

Table 6 Supported SCSI Messages (Continued)

Message	Code	Direction	Description
IDENTIFY	80h-FFh	Both	These messages are sent either by the initiator or by the target to establish (or re-establish) the logical connection path (nexus) between an initiator and target for a particular logical unit.

Fibre Channel Interface Support

Fibre Channel connections support configurations for Point-To-Point and Loop topologies. While tape drives support Point-To-Point (N), Loop (L) as well as preferred connections for Point-To-Point Preferred (NL) and Loop Preferred (LN), DA blade configurations support selections for Class 3 Loop-Preferred connections only. Private arbitrated loops are supported by DA blades if the library is not attached to a Fibre Channel fabric, and public arbitrated loops are supported if the library is attached to a Fibre Channel fabric.

Logical Libraries

The underlying physical library is not exposed externally to applications. Rather, logical representations of media changer devices are created, and these are presented instead. Through this method the physical library can be partitioned and concurrently shared in a heterogeneous environment. Storage and Data Transfer elements cannot be shared across logical libraries; they can only be assigned to one logical library at a time. The Medium Transport element (the robotic mechanism) is shared across all logical libraries, and as a result there may be some delays encountered as each logical library waits its turn for this shared resource.

Depending on library model, Import/Export elements can also be shared across logical libraries. This is further discussed in Mailbox Behavior. All other aspects of the logical media changer devices are identical to an independent physical media changer device.

Mailbox Behavior

The following characteristics affect Import/Export elements:

- The Import/Export elements are contained in removable magazines. When the magazines are removed, the elements are still counted in the number of Import/Export elements and will have element descriptors returned for them in response to a READ ELEMENT STATUS command. Their element status will indicate that they are not accessible, and will also report an exception with an ASC/ASCQ of 3B/12.
- Some libraries are configured with multiple physical mailboxes, each containing their own set of magazines. Whenever a mailbox is opened, the status for the elements it contains will indicate that they are not accessible until the mailbox is closed again.
- The mailbox magazine(s) can be assigned to and shared by different logical libraries. The Import/Export elements they contain are then used on a “first come, first served” basis. When shared Import/Export elements are in use by one logical library, element status for those elements will indicate that they are empty, but not accessible for all other logical libraries that share them. The presence of media and associated volume tag information will only be available to the logical library using the elements at that time. When media is removed from the shared elements, they become available for use by the next logical library requesting them, and their element status indicates that they are accessible.

These characteristics require applications to process the complete element status returned in the element descriptors (including accessibility and exception conditions) to achieve optimum usage of the Import/ Export elements. Reliance on only full or empty element status may result in failed operations (e.g., an Export). This might be due to not locating a usable Import/Export element when several may actually be available, if the search had only taken into account full status rather than accessibility.

Autocleaning

The library supports a user-configurable option to have the library automatically clean drives when requested by the drives (refer to the specific library documentation for details). This process involves the library loading a special cleaning cartridge into the requesting drive, allowing the drive to perform the cleaning operation, and then the library unloading the cartridge and returning it to storage.

If this option is enabled and configured, the library maintains a pool of storage slots that contain the cleaning cartridges. These slots and cartridges are not associated with or counted towards any logical library, and as such are not reported to any application.

The library typically checks for cleaning requests from drives after unloading data cartridges. If a cleaning request is found, the library will select a cleaning cartridge from the pool and perform the clean. While the cleaning operation is in progress, the logical library containing the drive being cleaned will continue to accept and perform SCSI commands. If a Move Medium command is received with the drive as a destination, and it is still being cleaned, the command will be queued until the cleaning operation completes. Cleaning operations vary by drive and conditions, but can take up to a few minutes to complete.

Element status for the Data Transfer element being cleaned will not reflect the presence of the cleaning cartridge. It will continue to report that it is empty and accessible.

Removed Drives

Depending on how the library is configured, occasionally Data Transfer elements will be reported where no drive is physically present at the time. This could be due to a drive that has been removed for service, or simply a placeholder for the addition of a future drive. These empty “drive bays” will be counted and reported via Mode Sense and Read Element Status commands. Status for such elements will indicate that they are not accessible, and will report an ASC/ASCQ of 83/04. These elements could appear in between Data Transfer elements that are present, creating “gaps” among the physical drives. This should not be considered an error. Thus, removed drives will be reported in READ ELEMENT STATUS data with an ACCESS bit set to zero and an EXCEPT bit set to one with a vendor specific ASC/ASCQ of 83/04h, DATA TRANSFER ELEMENT NOT INSTALLED, or ASC/ASCQ 3B/1Ah, DATA TRANSFER DEVICE REMOVED.

2

SCSI Commands

Initialize Element Status - 07h

What the Library Does With This Command

The library will determine status (full or empty) for all elements, as well as barcode label information (volume tags) for the media. Barcode labels will be scanned unless otherwise directed (and the library supports a non-barcode option). The library may not fully execute this command if the Automatic Inventory option is enabled, and element status is already known.

Results of the status initialization will be buffered by the library for retrieval via the READ ELEMENT STATUS command. Element status and barcode label information is retained by the library across power cycles.

Command Usage

This command can be used to gather status for all the elements, and should be issued whenever the library indicates that element status may have changed, such as after a power cycle or door opening and closing. It should then be followed by a READ ELEMENT STATUS command to retrieve the status.

Initialize Element Status CDB Format

The INITIALIZE ELEMENT STATUS CDB format is shown in the following table.

Table 7 INITIALIZE ELEMENT STATUS CDB format

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

No Barcode Labels (NBL) – A value of 0 indicates that the specified elements will be checked for all relevant status, including bar code labels. A value of 1 indicates that elements will be checked for media presence only (no bar code labels).

Note: Tape libraries that have barcode labels scanners/readers installed will always establish barcode label element status, regardless of the NBL bit setting.

Initialize Element Status With Range - E7h

What the Library Does With This Command

The library will examine the range of elements requested and determine their status relative to media presence (full or empty). Barcode labels will be scanned unless otherwise directed (and the library supports a non-barcode option). The library may not fully execute this command if the Automatic Inventory option is enabled, and element status is already known.

Results of the status initialization will be buffered by the library for retrieval via the READ ELEMENT STATUS command. Element status and barcode label information is retained by the library across power cycles.

Command Usage

This command can be issued to gather status for some or all of the elements, and can be used in conjunction with host application error handling if the normal element status maintained by the library returns an unexpected result. It should then be followed by a READ ELEMENT STATUS command to retrieve the status.

Initialize Element Status With Range CDB Format

The INITIALIZE ELEMENT STATUS WITH RANGE CDB format is shown in the following table.

Table 8 INITIALIZE ELEMENT STATUS WITH RANGE CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (E7h)							
1	Logical Unit Number			Reserved				Range
2	Starting Element Address							
3								
4	Reserved							
5	Reserved							
6	Number of Elements							
7								
8	Reserved							
9	NBL	Control						

Range – A value of 0 indicates that all element addresses will be checked and that the Starting Element Address and Number of Elements fields will be ignored. A value of 1 indicates that the series of elements beginning at the specified Starting Element Address for the specified Number of Elements will be checked.

Starting Element Address - The Starting Element Address specifies the beginning address of the range to check. It must be a valid address for an element that exists within the library; no adjustment will be made to convert to a next higher valid address. This field is ignored if the Range field is 0.

Number of Elements - This field specifies the number of elements to check. Gaps in element types and addresses are automatically handled until a quantity of physical elements equal to this number has been checked. If this field is 0, the range checked will start with the Starting Element Address and continue through all remaining elements. This field is ignored if the Range field is 0.

No Barcode Labels (NBL) – A value of 0 indicates that the specified elements will be checked for all relevant status, including bar code labels. A value of 1 indicates that elements will be checked for media presence only (no bar code labels).

Note: Tape libraries that have barcode labels scanners/readers installed will always establish barcode label element status, regardless of the NBL bit setting.

Inquiry - 12h

What the Library Does With This Command

In response to this command the library returns static data that describes various subsystem parameters. Each controller device and media changer device logical unit will return its own Inquiry data. If an INQUIRY command is received from an initiator with a pending unit attention condition, the library will perform the INQUIRY command and will not clear the unit attention condition. An INQUIRY command will respond with a Check Condition status only when it cannot return the requested Inquiry data.

Command Usage

This command would normally only be issued once for each logical unit as desired by the initiator to facilitate the initialization process.

Inquiry CDB Format

The INQUIRY CDB format is shown in the following table.

Table 9 INQUIRY CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (12h)							
1	Logical Unit Number			Reserved			CMDDT	EVPD
2	Page Code							
3	Reserved							
4	Allocation Length							
5	Control							

Command Support Data (CMDDT) – This field is not supported and must be set to 0.

Enable Vital Product Data (EVPD) – An EVPD value of 1 indicates that the vital product data specified by the Page Code should be returned. A value of 0 indicates that standard inquiry data should be returned.

Page Code - This field specifies which vital product data page to return if the EVPD bit is set to 1. If the EVPD bit is set to 0, the Page Code must be 00h. The library supports the following page codes:

- 00h - Supported Vital Product Data pages (this list)
- 80h - Unit Serial Number page
- 83h – Device Identification page
- 85h - Management Network Addresses page
- C8h - Vendor Specific Device Capabilities page

Allocation Length - The Allocation Length field specifies the maximum number of bytes that the initiator allocated for returned inquiry data. An Allocation Length of 0 indicates that no inquiry data is to be transferred (this condition is not considered an error).

The library terminates the data transfer when it has transferred the lesser of either the number of bytes specified by the Allocation Length field or all of the available inquiry data.

Standard Inquiry Response

Table 10 Standard Inquiry Response

Byte \ Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB	Reserved						
2	Version							
3	AERC	Obsolete	NormACA	HiSup	Response Data Format			
4	Additional Length							
5	SCCS	Rsvd	TPGS		3PC	Reserved		PROTECT
6	BQue	EncServ	BarC	MultiP	MChngr	Obsolete	Obsolete	Addr16
7	RelAdr	Obsolete	Wbus16	Sync	Linked	Obsolete	CmdQue	SftRe
8 : 15	Vendor Identification							
16 : 31	Product Identification							
32 : 35	Firmware Revision Level							
36 : 54	Full Firmware Revision Level							
55	Reserved							BarC
56*	Reserved				Clocking		QAS	IUS
57*	Reserved							
58*	Optional Version Descriptor 1							
59*								
:								
n-1*	Optional Version Descriptor n							
n*								

* When requesting a standard inquiry response from a media changer device logical unit hosted by a DA blade, only data for bytes 0 to 55 will be returned. Bytes 56 and all following bytes are not returned by media changer device logical units hosted by a DA blade.

Note: For Scalar i2000 and i6000 libraries - Once a library control firmware update gets scheduled, the library will not show the firmware revision of the installed library firmware bundle in the standard inquiry response if the library is operating in an emulation mode, but rather emulates a firmware version for the emulated device.

Peripheral Qualifier – A return value of 000b indicates that the library supports the peripheral device type at the specified LUN. A return value of 001b indicates that the library is capable of supporting the peripheral device type at the specified LUN, however the device is not currently connected to it. A return value of 011b indicates no peripheral device types are supported at that LUN.

Peripheral Device Type – For media changer device logical units, this field returns 01000b (08h) to indicate it is a media changer device. For the DA blade controller device logical unit, this field returns 01100b (0Ch) to indicate it is a controller device. If an unsupported LUN was specified, this field returns 11111b (1Fh), which indicates that the device type is unknown.

Removable Medium Bit (RMB) – For media changer device logical units, this field returns 1, indicating media is removable. For the DA blade controller device logical unit it returns 0.

Version – This field returns 03h, indicating compliance with the SCSI-3 standard. Note that this field will report SCSI-3 standard compliance despite support of various SMC-x defined command and response information for certain SCSI commands.

Asynchronous Event Reporting Capability (AERC) – Returned as 0, indicating AERC is not supported.

Normal ACA Supported (NormACA) – If the media changer device is configured through a control path drive, the NACA bit is not supported and this field returns 0.

Hierarchical Support (HiSup) – This field returns a 1, indicating that the hierarchical addressing model is used to assign LUNs, and that the REPORT LUNs command is supported.

Response Data Format – Returned as 0010b, indicating response data is in standard SCSI format.

Additional Length –

- When requesting a standard inquiry response from the DA blade controller device logical unit, this field is set to 1Fh, indicating 31 additional bytes of data following this field.
- When requesting a standard inquiry response from a media changer device logical unit hosted by a DA blade, this field returns 33h, indicating 51 additional bytes of data following this field.
- When requesting a standard inquiry response from a media changer device logical unit hosted by a tape drive, this field is set by the media changer device to 33h, indicating that 51 additional bytes of data will be following this field. However, the tape drive hosting the media changer device control path may modify data within the response and update the length value, depending on the tape drive interface type and supported version descriptors.

SCC Supported (SCCS) – For the media changer device logical units, this field returns a 0. For the DA blade controller device logical unit, this field returns a 1.

Target Port Groups Supported (TPGS) – If the media changer device control path is hosted by a DA blade, this field is set to 0. If the media changer device control path is hosted by a tape drive, this field is filled in by the tape drive hosting the interface and may be set to 1 if the REPORT TARGET PORT GROUPS command is supported.

Third Party Copy (3PC) – This field is set to 0 to indicate that third party copy is not supported.

PROTECT – This field is set to 0 to indicate that protection information is not supported.

Basic Queuing (BQue) – Returned as 0, indicating basic queuing is not supported.

Enclosure Services (EncServ) – Returned as 0, indicating an enclosure services component is not included.

Bar Code (BarC) – For media changer device logical units, this field returns a 1, indicating a bar code scanner or imaging device is installed (also returned in byte 55 below). For the controller device logical unit, this field returns a 0.

Multi Port (MultiP) – Returned as 0 if the device providing the medium changer interface supports a single port; returned as 1 if the device providing the medium changer interface supports 2 or more ports.

Media Changer (MChngr) – This field returns a 0, indicating it is not an attached media changer device.

Wide SCSI Address 16 (Addr16) – Returned as 1, indicating 16-bit wide SCSI addresses are supported (applies to parallel SCSI only).

Relative Address (RelAdr) – Returned as 0, indicating relative addressing is not supported.

Wide Bus 16 (Wbus16) – Returned as 1, indicating 16 bit transfers are supported (applies to parallel SCSI only).

Synchronous Transfer (Sync) – Returned as 1, indicating synchronous transfers are supported (applies to parallel SCSI only).

Linked Commands (Linked) – Returned as 0, indicating linked commands are not supported.

Command Queuing (CmdQue) – For Fibre Channel, this is returned as 1, indicating command queuing is supported. For SCSI and SAS, this is returned as 0, indicating no command queuing is supported.

Soft Reset (SftRe) – Returned as 0, indicating a soft reset is not supported.

Vendor Identification – Returned as one of the following (space filled to 8 bytes):

- `"QUANTUM "`
- `"ADIC "`

Product Identification – Depending upon the library type, returned as one of the following (space filled to 16 bytes):

- `"Scalar 24 "`
- `"Scalar 100 "`
- `"Scalar 1000 "`
- `"Scalar i2000 "`
- `"Scalar 10K "`
- `"Pathlight VX "`
- `"Scalar i500 "`
- `"Scalar i40-i80 "`
- `"Scalar i6000 "`
- `"Scalar i3-i6 "`

Firmware Revision Level – Returned as the ASCII representation of the revision level, such as “100A” or “203G”.

The remaining fields are only returned for media changer device logical units.

Full Firmware Revision Level – Same as the firmware revision level, but extended to include the build number (if available).

Bar Code (BarC) – Returned as 1, indicating a bar code scanner or imaging device is installed. Also returned in byte 6 above.

Clocking – This field is only returned for media changer device logical units controlled via parallel SCSI; otherwise, this field is reserved. This field does not apply to asynchronous transfers and is defined as:

- 00b – Indicates the target port supports only single transition (one transfer per clock cycle).

- 01b – Indicates the target port supports only double transition (two transfers per clock cycle; 16-bit only).
- 10b – Reserved.
- 11b – Indicates the target port supports single transition and double transition.

QAS – This field is only returned for media changer device logical units controlled via parallel SCSI; otherwise, this field is reserved. A quick arbitration and selection supported (QAS) bit of one indicates that the target port supports quick arbitration and selection. A value of zero indicates that the target port does not support quick arbitration and selection.

IUS – This field is only returned for media changer device logical units controlled via parallel SCSI; otherwise, this field is reserved. An information units supported (IUS) bit of one indicates that the SCSI target device supports information unit transfers. A value of zero indicates that the SCSI target device does not support information unit transfers.

Version Descriptors – Indicate SCSI command compliance with certain standards. The data transfer element hosting the interface will add/insert version descriptors reporting which physical layer and transport layer revisions are claimed. One or more of the following version descriptors may be reported:

- **005Ch** – 2 ANSI INCITS 366-2003.
- **008Dh** – SAM-4.
- **0120h** – SPC compliance.
- **02FEh** – SMC-2 ANSI INCITS 382-2004 compliance.
- **0917h** – FCP-2 ANSI INCITS 350-2003 or FCP-3.
- **0A11h** – FCP-3 ANSI INCITS 416-2006.
- **0D7Dh** – FC-AL-2 ANSI INCITS 332-1999 with Amnd 1 AM1-2003.
- **0DBCh** – FC-FS ANSI INCITS 373-2003.
- **131Ch** – FC-Tape ANSI INCITS TR-24 1999.
- **133Ch** – FC-FLA ANSI INCITS TR-20 1998.

Vital Product Data Pages

The collection of Vital Product Data pages is as follows:

Supported Vital Product Data Page (00h)

Table 11 Supported Vital Product Data Page (00h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (00h)							
2	Reserved							
3	Page Length							
4	First Page Code Supported							
5	Second Page Code Supported							

Table 11 Supported Vital Product Data Page (00h)

Byte \ Bit	7	6	5	4	3	2	1	0
6	Third Page Code Supported							
7	Fourth Page Code Supported							
8	Fifth Page Code Supported							

Peripheral Qualifier - The return value 000b indicates that the library supports the peripheral device type at the specified LUN. This field returns 011b if no peripheral device types are supported at that LUN.

Peripheral Device Type – For media changer device logical units, this field returns 01000b (08h) to indicate it is a media changer device. For the controller device logical unit, this field returns 01100b (0Ch) to indicate it is a controller device. If an unsupported LUN was specified, this field returns 11111b (1Fh), which indicates that the device type is unknown.

Page Code - Returned as 00h, indicating this page.

Page Length - Returns the number of bytes following this field.

First Page Code Supported - Returned as 00h, indicating support for the Supported Vital Product Data Page.

Second Page Code Supported - Returned as 80h, indicating support for the Unit Serial Number Page.

Third Page Code Supported - Returned as 83h, indicating support for the Device Identification Page.

Forth Page Code Supported - Returned as 85h, indicating support for the Management Network Addresses Page.

Fifth Page Code Supported - Returned as C8h, indicating support for Vendor Specific Device Capabilities Page.

Unit Serial Number Page (80h)

Table 12 Unit Serial Number Page (80h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (80h)							
2	Reserved							
3	Page Length							
4 : 27	Serial Number							

Peripheral Qualifier – The return value 000b indicates that the library supports the peripheral device type at the specified LUN. This field returns 011b if no peripheral device types are supported at that LUN.

Peripheral Device Type – For media changer logical units, this field returns 01000b (08h) to indicate it is a media changer device. For the controller device logical unit, this field returns 01100b (0Ch) to indicate it is a controller device. If an unsupported LUN was specified, this field returns 11111b (1Fh), which indicates that the device type is unknown.

Page Code – Returned as 80h, indicating this page.

Page Length – Returned as 18h, indicating the remaining number of bytes following this field.

Serial Number – The value returned for this field is the serial number for the system, prefixed with the vendor identification. The serial number is padded with trailing spaces as needed to complete the 24 bytes.

For example:

```
QUANTUM123456789 or QUANTUM123456789_LL1
```

If the serial number cannot be obtained, the serial number portion is replaced with zeros followed by trailing spaces. For example:

```
QUANTUM000000000
```

Device Identification Page (83h)

Table 13 Device Identification Page (83h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (83h)							
2	Reserved							
3	Page Length (n-3)							
Identification Descriptors (see Table 14)								
4 :	First Identification Descriptor							
:								
: n	Last Identification Descriptor							

Peripheral Qualifier – The return value 000b indicates that the library supports the peripheral device type at the specified LUN. This field returns 011b if no peripheral device types are supported at that LUN.

Peripheral Device Type – For media changer device logical units, this field returns 01000b (08h) to indicate it is a media changer device. For the controller device logical unit, this field returns 01100b (0Ch) to indicate it is a controller device. If an unsupported LUN was specified, this field returns 11111b (1Fh), which indicates that the device type is unknown.

Page Code – Returned as 83h, indicating this page.

Page Length – Returns the remaining number of bytes following this field.

Identification Descriptors

The general format of identification descriptors are as follows:

Table 14 Identification Descriptors

Byte \ Bit	7	6	5	4	3	2	1	0
0	Protocol Identifier				Code Set			
1	PIV	Rsvd	Association		Identifier Type			

Table 14 Identification Descriptors

Byte \ Bit	7	6	5	4	3	2	1	0
2	Reserved							
3	Identifier Length (n-3)							
4 : n	Identifier							

Protocol Identifier – The PROTOCOL IDENTIFIER field may indicate the SCSI transport protocol to which the identifier type applies. If the ASSOCIATION field contains a value other than 01b (i.e., target port) or 10b (i.e., SCSI target device) or the PIV bit is set to zero, then the PROTOCOL IDENTIFIER field contents are reserved. If the ASSOCIATION field contains a value of 01b or 10b and the PIV bit is set to one, then the PROTOCOL IDENTIFIER field shall contain one of the values shown below to indicate the SCSI transport protocol to which the identifier type applies.

- 0h – Fibre Channel
- 1h – Parallel SCSI
- 2h – SSA
- 3h – IEEE 1394
- 4h – SCSI Remote Direct Memory Access Protocol
- 5h – Internet SCSI (iSCSI)
- 6h – SAS Protocol Layer
- 7h – Automation/Drive Interface Transport Protocol
- 8h – AT Attachment Interface (ATA/ATAPI)
- 9h to Eh – Reserved
- Fh – No specific protocol

Code Set – This field returns the following values:

- 1h – the Identifier field contains binary values
- 2h – the Identifier field contains ASCII characters

PIV – A protocol identifier valid (PIV) bit set to zero indicates the PROTOCOL IDENTIFIER field contents are reserved. If the ASSOCIATION field contains a value of 01b or 10b then a PIV bit set to one indicates the PROTOCOL IDENTIFIER field contains a valid protocol identifier. If the ASSOCIATION field contains a value other than 01b or 10b, then the PIV bit contents are reserved.

Association – This field returns the following values:

- 0h – the Identifier field is associated with the address physical or logical device
- 1h – the Identifier field is associated with the port that received the request

Identifier Type – This field returns the following values:

- 1h – The identifier is a concatenation of the Vendor Identification field from the Standard Inquiry response and the Serial Number field (without the Vendor Identification prefix) from the Unit Serial Number page.
- 3h – The identifier is an IEEE Registered format Name_Identifier (Worldwide Name).

- 4h – The identifier is a port number. In this case, the Code Set and Association fields will both be set to 1.

Identifier Length – This is the length of the Identifier field, and will vary by identifier type.

Identifier – This is the identifier as described by the Code Set, Association, and Identifier Type fields.

Identification Descriptors

The media changer device logical unit returns the T10 Device Identification Descriptor (type 1h) as well as the NAA Device Identification Descriptor (type 3h). The data transfer element hosting the interface will add a NAA Port Identification Descriptor (type 3h), and a Relative Target Port Identifier (type 4h) and may modify which descriptor is reported depending on the medium changer reporting as its own device at LUN 0, or just a LUN behind the data transfer element device.

Media Changer Identification Descriptor

Media changer logical units report only a single identifier. They will report the same identifier on either SCSI or Fibre Channel.

Table 15 Media Changer Identification Descriptor

Byte / Bit	7	6	5	4	3	2	1	0
0	Protocol Identifier				Code Set = 2h			
1	PIV	Rsvd	Association = 0h		Identifier Type= 1h			
2	Reserved							
3	Identifier Length = 20h (32)							
4 11	Vendor Identification (as reported in the Standard Inquiry response)							
12 35	Serial Number (as reported in the Unit Serial Number page without Vendor Identification prefix)							

Controller Device Identification Descriptors

On the parallel SCSI and SAS interface, the controller device logical unit will return the same identification descriptor as the media changer devices, as shown in Table 15.

On the Fibre Channel interface, the controller device logical unit will return *three* different identification descriptors as shown in Table 16, Table 17, and Table 19.

The first *two* descriptors describe the World Wide Node Name and World Wide Port Name.

Table 16 Controller Device Node Identification Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Protocol Identifier				Code Set = 1h			
1	PIV	Rsvd	Association = 0h		Identifier Type= 3h			
2	Reserved							
3	Identifier Length = 08h							
4 : 11	World Wide Node Name (WWNN)							

Table 17 Controller Device Port Identification Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Protocol Identifier				Code Set = 1h			
1	PIV	Rsvd	Association = 1h		Identifier Type= 3h			
2	Reserved							
3	Identifier Length = 08h							
4 : 11	World Wide Port Name (WWPN)							

The eight-byte Node and Port Worldwide Names have the following format:

Table 18 Node and Port Worldwide Names

MSB		**LSB**
4-bit NAA ID	24-bit Company ID	36-bit Vendor Specified Identifier
5h	00 30 8C	Assigned per library

The *third* descriptor (see table below) describes the relative target port.

Table 19 Relative Target Port Identification Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Protocol Identifier				Code Set = 1h			
1	PIV	Rsvd	Association = 1h		Identifier Type= 4h			
2	Reserved							

Table 19 Relative Target Port Identification Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
3	Identifier Length = 04h							
4 : 7	Port Number (Starting with 1)							

Management Network Addresses Page (85h)

Table 20 Network Address Page

Byte \ Bit	7	6	5	4	3	2	1	0
0	Peripheral Qualifier					Peripheral Device Type		
1	Page Code (85h)							
2	(MSB)							
3	Page Length (n-3)							(LSB)
4	(MSB)	Network services descriptor (first)						(LSB)
n	(MSB)	Network services descriptor (last)						(LSB)

Each network service descriptor contains information about one management service.

Table 21 Network Services Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Rsvd	Association		Service Type				
1	Reserved							
2	(MSB)							
3	Network Address Length (n-3)							(LSB)
4 . . N	Network Address							

Association - The association shall always be set to 00h "The Identifier field is associated with the addressed logical unit."

Service Type - The service type defines the library access and protocol methodologies. Scalar libraries only support service type 03h to indicate remote UI, CLI, or Web Services support.

Table 22 Service Types

Service Type	Service Type Name	Description	Protocol	Scheme
00h	Reserved			
01h	Reserved			
02h	Diagnostics	Service Web Interface	HTTP	service
02h	Diagnostics	Secure Service Web Interface	HTTPS	service
03h	Management/Status[1]	Library Web Interface	HTTP	http
03h	Management/Status	Secure Library Web Interface	HTTPS	https
03h	Status	Vendor Command Line Interface	Telnet	telnet
03h	Status	Secure Vendor Command Line Interface	SSH	ssh
04h	Reserved			
05h	Code Download[2]	Library Firmware Download	FTP	ftp
05h	Code Download	Library Firmware Download	TFTP	tftp
05h	Code Download	Library Firmware Download	SFTP	sftp
05h	Code Download	Drive Firmware Download	FTP	dftp
05h	Code Download	Drive Firmware Download	TFTP	dtftp
05h	Code Download	Drive Firmware Download	FTP	dsftp

1. The library web interface service is required if this page is supported.
2. The default behavior for "Code Download" network services shall be to apply the new firmware and perform any necessary reconfiguration to apply that firmware. The device may support applying the firmware at the next power cycle and may designate such "postponed" download by reporting another network service and pre-pending a "p" to the scheme (for example: pftp).

Network Address Length - The network address length field contains the length in bytes of the network address field. This length reported in this field is a multiple of 4 bytes.

Network Address - The network address is a null-terminated, null-padded URL. The table above lists the defined network addresses which may be returned. Other vendor unique network addresses may also be returned, although only service type 03h is supported at this time.

The network address conforms to RFC 2396 and is of the form "scheme://host:port/path". The host field contains the numeric IP address of the referenced host. The service type and scheme identifies the unique service that the library may report. For HTTP communication this path may be a redirect but for all others it is a direct path. The port may be vendor specific unless otherwise designated in the specification for that service.

Vendor Specific Device Capabilities Page (C8h)

Note This page may not be supported by all library models.

Table 23 Vendor Specific Device Capabilities Page

Byte \ Bit	7	6	5	4	3	2	1	0
0	Protocol Identifier			Peripheral Device Type				
1	Page Code (C8h)							
2	MSB	Page Length (4)						
3								LSB
4	Reserved					ADVFO	BASIC FO	RSVD
5	Reserved						Reserved	
6	Reserved				Reserved			
7	Reserved							

Peripheral Qualifier – The return value of 000b indicates that the library is a single LUN device. If a LUN other than 00000b was specified, this field returns 011b which indicates that only LUN 0 is supported.

Peripheral Device Type – For media changer device logical units, this field returns 01000b (08h) to indicate it is a media changer device. Any LUN other than 0 returns 11111b which indicates that the device is unknown.

Page Code – Returned as C8h, indicating this page.

Page Length – Returns 4, indicating the remaining number of bytes following this field.

ADVFO – An advanced failover (ADVFO) bit set to one indicates the device server supports advanced path failover. An advanced failover (ADVFO) bit set to zero indicates the device server does not support advanced path failover.

BASICFO – A basic failover (BASICFO) bit set to one indicates the device server supports basic path failover. A BASICFO bit set to zero indicates support for basic path failover is not supported.

Log Sense - 4Dh

What the Library Does with This Command

The library returns information for the requested log page. The only supported log page is the Tape Alert page, with a limited set of flags. The library will return the current values of the flags on request, and then clear them.

Command Usage

This command can be used to monitor conditions of the library.

Log Sense CDB Format

The LOG SENSE CDB format is shown in the following table.

Table 24 LOG SENSE CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (4Dh)							
1	Logical Unit Number			Reserved			PPC	SP
2	PC		Page Code					
3	Reserved							
4	Reserved							
5	Parameter Pointer							
6								
7	Allocation Length							
8								
9	Control							

Parameter Pointer Control (PPC) – Must be set to 0. The library will return log parameters starting with the parameter code specified in the Parameter Pointer field, and return up to the number of bytes specified in the Allocation Length field. Log parameters are returned in ascending order according to their parameter code. A PPC bit of 0 and a Parameter Pointer field of 0 will cause all available log parameters for the requested page code to be returned, subject to the Allocation Length.

Save Parameters (SP) – Must be set to 0. The library does not support the saving of log parameters.

Page Control (PC) – Must be set to 01b. The library only returns cumulative values for any log parameter rather than threshold or default values.

Page Code – The Page Code field identifies which log page is being requested by the initiator.

Table 25 Page Code field

Page Code	Page Name	Page Description
00h	Supported Log Pages	Returns list of supported log pages
2Eh	Tape Alert Log	Returns the 64 tape alert flags

Parameter Pointer - This field specifies which log parameter to begin with for the requested log page. A PPC bit of 0 and a Parameter Pointer field of 0 will cause all available log parameters for the requested page code to be returned, subject to the Allocation Length. More detailed definition of this field is contained within the specific log page descriptions.

Allocation Length - The Allocation Length field is used to determine the maximum amount of data to return. The transfer completes after either all the data has been transferred or an amount equal to the Allocation Length has been sent. Specify FFFFh to include all available data.

Log Sense Response

The response to a LOG SENSE command returns the log page specified in the Page Code field of the CDB. The log page format is described in “Log Page Format.” The valid Page Code fields are listed in Table 25 on page 29. The various log parameters are described within their respective pages, along with their Parameter Codes. The Log Parameter format is described in “Log Parameter Format.”

Log Page Format

The following table shows the Log Page format. The first four bytes are the Parameter List Header, followed by the list of log parameters.

Table 26 Log Page format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserved							
2	Page Length (n-3)							
3								
4 : x+3	Log Parameter (First) (Length x)							
:								
n-y+1 : n	Log Parameter (Last) (Length y)							

Page Code – This field identifies which log page is being transferred.

Page Length - This field indicates the total number of bytes available to return for this page, beginning with the first log parameter. The value set for this field depends on the value specified for the Page Code.

Log Parameters – These are dependent upon the log page. The various parameters as well as their format for the supported pages are listed below.

Table 27 Log Parameter Format

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

Parameter Code – This field identifies which log parameter was transferred. The valid values for this field depend on the log page.

Disable Update (DU) – Will be set to 0. The library will always update values reflected by the log parameters.

Disable Save (DS) – Will be set to 1. The library does not support saving of log parameters.

Target Save Disable (TSD) – Will be set to 0. The library provides a self-defined method for saving log parameters.

Enable Threshold Comparison (ETC) – Will be set to 0. No comparison to threshold values is made.

Threshold Met Criteria (TMC) – Will be set to 0. Comparison to threshold values is not supported.

List Parameter Binary (LBIN) – This field is only valid if LP is set to 1. When LBIN is set to 0, the list parameter is ASCII. When LBIN is set to 1, the list parameter is a binary value.

List Parameter (LP) – This field will be set to 0 for data counters and set to 1 for list parameters.

Parameter Length – This field indicates the number of bytes that follow this field, which is the size of the parameter value.

Parameter Value – This field contains the actual parameter data, which can be either a data counter or a list parameter (ASCII string or binary value).

Supported Log Page (00h)

This page returns a list of all log pages supported by the library.

Table 28 Supported Log Page (00h)

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (000000b)					
1	Reserved							
2	Page Length (0002h)							
3								
4	Supported Log Page (00h)							
5	Tape Alert Log Page (2Eh)							

Page Code – The returned value is 00h, indicating this page.

Page Length – The returned value is 0002h.

The page codes for all the supported pages (including this one) follow the page length field.

Tape Alert Log Page (2Eh)

The Tape Alert log page follows the standard log page format. Each Tape Alert is returned as an individual log parameter, with its state reflected in bit zero of the one-byte Parameter Value field of the log parameter. When this bit is set to one, the alert is active.

When requesting the Tape Alert log page, the Parameter Pointer determines from what point in the Tape Alert table the alerts are returned. The value zero specifies that all tape alerts should be returned. If the Parameter Pointer is set from 1 to 64, all tape alerts from that point to the end of the list are returned. The various log parameters are listed in the following table.

Table 29 Tape Alert Log Page Parameters

Log Parameter	Parameter Code	DU	DS	TSD	ETC	TMC	LBIN	LP	Parameter Length
Tape Alert Flag 1	0001h	0	1	0	0	0	0	0	1
Tape Alert Flag 2	0002h	0	1	0	0	0	0	0	1
:		0	1	0	0	0	0	0	1
Tape Alert Flag 63	003Fh	0	1	0	0	0	0	0	1
Tape Alert Flag 64	0040h	0	1	0	0	0	0	0	1

The severity of the flags has the following meaning:

- Critical (C)
- Warning (W)
- Informational (I)

The supported Tape Alert flags are:

Flag 1: **Drive Communication Failure (C) -** This flag is set to indicate a drive communication failure.

Flag 2: **Library Hardware B (W)** - This flag is set for any unrecoverable mechanical error.

Flag 4: **Library Hardware D (C)** - This flag is set when the internal Power-On-Self-Tests (POST) fail or when a mechanical error occurs that requires a power cycle to recover, and is not internally cleared until the device is powered off.

Flag 13: **Library Pick Retry (W)** - This flag is set when a high retry count threshold is passed when performing an operation to pick a cartridge from a slot before the operation succeeds. It is internally cleared when another pick operation is attempted.

Flag 14: **Library Place Retry (W)** - This flag is set when a high retry count threshold is passed when performing an operation to place a cartridge back into a slot before the operation succeeds. It is internally cleared when another place operation is attempted.

Flag 15: **Library Load Retry (W)** - This flag is set when a high retry count threshold is passed when performing an operation to load a cartridge into a drive before the operation succeeds. It is internally cleared when another load operation is attempted. Note that if the load actually fails due to a media or drive problem, the appropriate TapeAlert flags should be set by the drive.

Flag 16: **Library Door (C)** - This flag is set when media move operations cannot be performed because a door is open, and is internally cleared when the door is closed. (**Note**: This flag is not supported by the Scalar i40 and Scalar i80 libraries.)

Flag 17: **Mailbox Mechanical Problem (C) -** This flag is set when a mailbox station mechanical problem is detected.

Flag 23: **Library Scan Retry (W)** - This flag is set when a high retry count threshold is passed when performing an operation to scan the barcode on a cartridge before the operation succeeds. It is internally cleared when another barcode scanning operation is attempted.

Flag 27: **Cooling Fan Failure (W) -** This flag is set when a cooling fan has failed within a library component. (**Note**: This flag is only supported by the Scalar i40 and Scalar i80 libraries.)

Flag 28: **Power Supply Failure (W) -** This flag is set when a redundant power supply has failed within the library. (**Note**: This flag is only supported by the Scalar i40 and Scalar i80 libraries.)

Flag 32: **Barcode Label Unreadable (I) -** This flag is set when a tape cartridge barcode label could not be read. (**Note**: This flag is only supported by the Scalar i40, Scalar i80, and Scalar i500 libraries.)

Mode Select (6) - 15h

What the Library Does With This Command

The library does not support any changeable parameters, and this command is supported for compatibility only. This command can be issued to both the controller device logical unit as well as a media changer device logical unit. The mode pages supported by each device vary however.

Command Usage

A MODE SENSE command with the PC field set to 1h and the Page Code field set to 3Fh can be issued before the MODE SELECT command is issued to determine which mode parameters are supported, which mode parameters are changeable, and the supported length of each page. Since the library does not support any changeable parameters, use of MODE SELECT provides limited value. For a list of available mode pages, see Table 40 on page 41.

Mode Select (6) CDB Format

The six-byte MODE SELECT CDB format is shown in the following table.

Table 30 MODE SELECT CDB format

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

Page Format (PF) - This bit indicates that the data sent by the initiator after the MODE SELECT header and block descriptors complies with the definition of pages in the SCSI standard. The value must be set to 1.

Save Parameters (SP) - Savable pages are not supported and this field must be set to 0.

Note — The SP bit is not tested for validity if the Parameter List Length field indicates that saveable parameter data is not sent.

Parameter List Length - This field specifies the number of bytes that will be transferred for the MODE SELECT parameter list, and should be equal to the length of a single Parameter List Header plus the lengths of all pages to be transferred. A length of zero indicates that no data is transferred. This is not considered to be an error.

Mode Parameter Header

Following the MODE SELECT CDB, a single Mode Parameter Header should be sent as shown in the following table. For both the controller and media changer devices, none of the fields are actually used however, and should all be set to zero.

Table 31 Mode Parameter Header format for Mode Select (6)

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

Mode Select (10) - 55h

What the Library Does With This Command

The library does not support any changeable parameters, and this command is supported for compatibility only. This command can only be issued to the controller device logical unit.

Libraries without DA blades do not support this command.

Command Usage

A MODE SENSE command with the PC field set to 1h and the Page Code field set to 3Fh can be issued before the MODE SELECT command is issued to determine which mode parameters are supported, which mode parameters are changeable, and the supported length of each page. Since the library does not support any changeable parameters, use of MODE SELECT provides limited value. For a list of available mode pages, see Table 40 on page 41.

Mode Select (10) CDB Format

The ten-byte MODE SELECT CDB format is shown in the following table.

Table 32 MODE SELECT CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (55h)							
1	Logical Unit Number			PF	Reserved			SP
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Parameter List Length							
8								
9	Control							

Page Format (PF) - This bit indicates that the data sent by the initiator after the MODE SELECT header and block descriptors complies with the definition of pages in the SCSI standard. The value must be set to 1.

Save Parameters (SP) - Savable pages are not supported and this field must be set to 0.

Note — The SP bit is not tested for validity if the Parameter List Length field indicates that saveable parameter data is not sent.

Parameter List Length - This field specifies the number of bytes that will be transferred for the MODE SELECT parameter list, and should be equal to the length of a single Parameter List Header plus the lengths of all pages to be transferred. A length of zero indicates that no data is transferred. This is not considered to be an error.

Mode Parameter Header

Following the MODE SELECT CDB, a single Mode Parameter Header should be sent as shown in the following table. For the controller device, none of the fields are actually used however, and should all be set to zero.

Table 33 Mode Parameter Header format for Mode Select (10)

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

Mode Sense (6) - 1Ah

What the Library Does With This Command

The library will return the current settings for the supported mode pages. This command can be issued to the DA blade controller device logical unit as well as the media changer device logical units. The mode pages supported by each device vary.

Command Usage

This command can be used to determine certain operational settings governing the behavior of the library. For example, the number of elements and their assigned addresses can be obtained through use of MODE SENSE, which allows an application to adapt to a library configuration instead of using fixed values. Use of MODE SENSE to obtain these parameters during initialization is highly recommended to facilitate the most flexibility in supporting the library.

Mode Sense (6) CDB Format

The six-byte MODE SENSE CDB format is shown in the following table.

Table 34 MODE SENSE CDB format

Bit / Byte	7	6	5	4	3	2	1	0
0	Op Code (1Ah)							
1	Logical Unit Number			Rsvd	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Allocation Length							
5	Control							

Disable Block Descriptors (DBD) - A value of 0 or 1 is supported, although block descriptors are not returned.

Page Control (PC) - This field indicates the type of mode page parameter values to return as shown in the following table

Table 35 Page Control (PC) field

Page Control		Description
0	0	Report current values defined by: • The values set by the last successful MODE SELECT command. • The default values if no saved values exist.
0	1	Report changeable values
1	0	Report default values
1	1	Report saved values (report default values if no pages are previously saved)

Note: Although the library may support changes for various mode parameters via the library user interface configuration settings, a mode parameter will be reported as non-changeable if not supported to be changeable via SCSI control.

Page Code - This field determines which pages should be reported. For a list of available mode pages, see Table 40 on page 41.

Allocation Length - This field specifies the number of bytes that the initiator allocated for returned MODE SENSE data. A length of 0 means that the library will return no MODE SENSE data. This is not considered to be an error.

Mode Sense (6) Response

The six-byte MODE SENSE response consists of a single four-byte Mode Parameter Header, followed by zero or more mode pages. Each page is individually described in “Mode Pages.”

Mode Parameter Header

The following table lists the format of the Mode Parameter Header for the six-byte MODE SENSE command.

Table 36 Mode Parameter Header format for Mode Sense (6)

Bit / Byte	7	6	5	4	3	2	1	0
0	Mode Data Length							
1	Reserved							
2	Reserved							
3	Reserved							

Mode Data Length - This specifies the length in bytes that is available to be transferred as part of the response. The Mode Data Length does not include itself but does include the remaining 3 bytes of the parameter header, as well as the overall total number of bytes being sent for all requested pages.

Mode Sense (10) - 5Ah

What the Library Does With This Command

The library will return the current settings for the supported mode pages. This command can only be issued to the DA blade controller device logical unit.

Command Usage

This command can be used to determine certain operational settings governing the behavior of the library. Use of MODE SENSE to obtain these parameters during initialization is highly recommended to facilitate the most flexibility in supporting the library.

Mode Sense (10) CDB Format

The ten-byte MODE SENSE CDB format is shown in the following table.

Table 37 MODE SENSE CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (5Ah)							
1	Logical Unit Number			Rsvd	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Allocation Length							
8								
9	Control							

Disable Block Descriptors (DBD) - A value of 0 or 1 is supported, although block descriptors are not returned.

Page Control (PC) - This field indicates the type of mode page parameter values to return as shown in the following table.

Table 38 Page Control (PC) field

Page Control		Description
0	0	Report current values defined by: • The values set by the last successful MODE SELECT command. • The default values if no saved values exist.
0	1	Report changeable values
1	0	Report default values
1	1	Report saved values (report default values if no pages are previously saved)

Note: Although the library may support changes for various mode parameters via the library user interface configuration settings, a mode parameter will be reported as non-changeable if not supported to be changeable via SCSI control.

Page Code - This field determines which pages should be reported. A list of the supported pages is shown in the previous table.

Allocation Length - This field specifies the number of bytes that the initiator allocated for returned MODE SENSE data. A length of 0 means that the library will return no MODE SENSE data. This is not considered to be an error.

Mode Sense (10) Response

The ten-byte MODE SENSE response consists of a single eight-byte Mode Parameter Header, followed by zero or more mode pages. Each page is individually described in “Mode Pages.”

Mode Parameter Header

The following table shows the format of the Mode Parameter Header for the ten-byte MODE SENSE command.

Table 39 Mode Parameter Header format for Mode Sense (10)

Bit / Byte	7	6	5	4	3	2	1	0
0	Mode Data Length							
1								
2	Reserved							
3	Reserved							
4	Reserved							
5								
6	Reserved							
7								

Mode Data Length - This specifies the length in bytes that is available to be transferred as part of the response. The Mode Data Length does not include itself but does include the remaining six bytes of the parameter header, as well as the overall total number of bytes being

Mode Pages

The following table lists the mode pages supported by the library.

Table 40 Supported Mode Pages

Page Code	Page Name	Page Description	Device
02h	Disconnect Reconnect	Provides information regarding the physical bus performance characteristics.	• DA blade controller device • media changer device (only if hosted by a tape drive on LUN 0)
18h	Fibre Channel Logical Unit Control	Provides Fibre Channel control information that is associated with the logical unit.	• DA blade controller device • media changer device
19h	Fibre Channel Port Control	Provides Fibre Channel control information that is associated with the port.	• DA blade controller device • media changer device
1Ch	Informational Exceptions Control	Provides information regarding SCSI tape alert processing within the library.	• media changer device
1Dh	Element Address Assignment	Provides information regarding SCSI element address assignments and respective element ranges.	• media changer device
1Eh	Transport Geometry Parameters	Provides information regarding the media changer device's capabilities.	• media changer device
1Fh	Device Capabilities	Provides information regarding cartridge movement possibilities within the library.	• media changer device
3Fh	All Mode Pages	Returns all mode pages.	• DA blade controller device • media changer device

Disconnect-Reconnect Page (02h)

The Disconnect-Reconnect mode page is only supported by the controller device logical unit, and describes the interconnect tenancy characteristics of the Fibre Channel interface. An interconnect tenancy is a period of time during which a SCSI device owns or may access the interface. This page is only available on the Fibre Channel interface.

Table 41 Disconnect-Reconnect Page (02h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	Rsvd	Page Code (02h)					
1	Parameter List Length = 0Eh							
2	Buffer Full Ratio							
3	Buffer Empty Ratio							
4	Bus Inactivity Limit							
5								
6	Disconnect Time Limit							
7								
8	Connect Time Limit							
9								
10	Maximum Burst Size							
11								
12	EMDP	Fair Arbitration			DIMM	DTDC		
13	Reserved							
14	First Burst Size							
15								

Parameters Savable (PS) - This page is not savable, and this field is set to zero.

Page Code - This field identifies the Disconnect-Reconnect mode page and returns 02h.

Parameter List Length - This field is set to 0Eh (14).

Buffer Full Ratio – This field indicates how full the buffer will be (during read operations) prior to requesting an interconnect tenancy. A value of 0 is returned to indicate that requests for an interconnect tenancy are consistent with the Disconnect Time Limit field.

Buffer Empty Ratio – This field indicates how empty the buffer will be (during write operations) prior to requesting an interconnect tenancy (request for the initiator to send data). A value of 0 is returned to indicate that requests for an interconnect tenancy are consistent with the Disconnect Time Limit field.

Bus Inactivity Limit – This field indicates the maximum time limit allowed for maintaining an interconnect tenancy without any data or information transfer. A value of 0 is returned to indicate that there is no bus inactivity limit.

Disconnect Time Limit – This field indicates the minimum wait time between interconnect tenancies. A value of 0 is returned to indicate that there is no disconnect time limit.

Connect Time Limit – This field indicates the maximum duration of an interconnect tenancy. A value of 0 is returned to indicate that there is no connect time limit.

Maximum Burst Size – This field indicates the maximum amount of data that will be transferred during a single data transfer operation. The value is expressed in increments of 512 bytes. A value of 0 is returned if a maximum burst size is not supported.

Enable Modify Data Pointers (EMDP) – This field indicates whether data transfers are allowed to be re-ordered. A value of 0 is returned to indicate that data transfers will always have continually increasing and contiguous data relative offset values. A value of 1 is returned to indicate that data transfers can be re-ordered.

Fair Arbitration – This field indicates whether fair or unfair arbitration is used when requesting an interconnect tenancy. A value of 000b is returned to indicate that the various fairness algorithms may not be used.

Disconnect Immediate (DIMM) – A value of 0 is returned to indicate that data may be transferred for a command during the same interconnect tenancy in which the command was received.

Data Transfer Disconnect Control (DTDC) – A value of 000b is returned to indicate that data transfer disconnect control is not used.

First Burst Size – This field indicates the maximum amount of data that may be transferred along with a command. A value of 0 is returned to indicate that there is no first burst size limit.

Fibre Channel Logical Unit Control Page (18h)

The Fibre Channel Logical Unit Control mode page reports logical unit behavior for the Fibre Channel Protocol. This page is only available on the Fibre Channel interface.

Table 42 Fibre Channel Logical Unit Control Page (18h)

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Rsvd	Page Code (18h)					
1	Parameter List Length = 06h							
2	Reserved				Protocol Identifier (0h)			
3	Reserved							EPDC
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							

Parameters Savable (PS) - This page is not savable, and this field is set to zero.

Page Code - This field identifies the Fibre Channel Logical Unit Control mode page and returns 18h.

Parameter List Length - This field is set to 06h.

Protocol Identifier – This field returns 0 to indicate the Fibre Channel protocol.

Enable Precise Delivery Checking (EPDC) – If this field returns 0, it indicates that the Fibre Channel Command Reference Number is not checked to verify that command packets are received in order. If this field returns 1, it indicates that the precise delivery checking is enabled and that the Fibre Channel Command Reference Number is checked to verify that command packets are received in order.

Fibre Channel Port Control Page (19h)

The Fibre Channel Port Control mode page reports port behavior for the Fibre Channel Protocol. This mode page is only available on the Fibre Channel interface. This mode page is only supported by devices at LUN 0.

Table 43 Fibre Channel Port Control Page (19h)

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Rsvd	Page Code (19h)					
1	Parameter List Length = 06h							
2	Reserved				Protocol Identifier (0h)			
3	DTFD	PLPB	DDIS	DLM	RHA	ALWI	DTIPE	DTOLI
4	Reserved							
5	Reserved							
6	Reserved					RR_TOV Units		
7	Resource Recovery Time-out Value (RR_TOV)							

Parameters Savable (PS) - This page is not savable, and this field is set to zero.

Page Code - This field identifies the Fibre Channel Port Control mode page and returns 19h.

Parameter List Length - This field is set to 06h.

Protocol Identifier – This field returns 0 to indicate the Fibre Channel protocol.

Disable Target Fabric Discovery (DTFD) – A DTFD bit of one indicates that if the target is attached by an arbitrated loop, it will not recognize the presence of a fabric loop port on the loop. The target will perform only the private loop functions defined for targets defined by FC-PLDA and FC-TAPE. When this bit is set to zero, and the target is attached by an arbitrated loop, it will discover a fabric loop port if present on the loop and perform the public loop functions defined for targets by FC-FLA. This field is ignored if the target is not attached to an arbitrated loop.

Prevent Loop Port Bypass (PLPB) – This field is set to zero to indicate that the target allows the Loop Port Bypass (LPB) and Loop Port Enable (PBE) primitive sequences to control the port bypass circuit and participation on the loop as specified by FC-AL-2. When not attached to an arbitrated loop, this field is ignored.

Disable Discovery (DDIS) – This field returns zero to indicate that the target will wait to complete target discovery as defined by FC-PLDA, FC-FLA, and FC-TAPE before allowing processing of tasks to resume. When not attached to an arbitrated loop, this field is ignored.

Disable Loop Master (DLM) – If this field returns zero, it indicates the target may participate in loop master arbitration in the normal manner and, if successful, may become loop master during the loop initialization process. If this field returns 1, it indicates the target does not become loop master, and that the target repeats LISM frames it receives. This allows the Initiator to be loop master during loop initialization. This field is ignored when not attached to an arbitrated loop.

Require Hard Address (RHA) – A RHA bit of one indicates that if the target is attached to an arbitrated loop, it will only attempt to obtain its hard address available in the SCA-2 SFF- 8067 connector or device address jumpers during loop initialization. The target will not attempt to obtain an address during the LISA phase of initialization. If there is a conflict for the hard address selection during loop initialization or the target does not have a valid hard address available, the target shall enter the nonparticipating state. If the target detects loop initialization while in the nonparticipating state, the target will again attempt to get its hard

address. If the hard address has not changed from the address obtained in a previous successful loop initialization, the target will attempt to obtain the address in the LIFA phase if a valid Fabric Login exists or LIPA phase of loop initialization. If the hard address has changed, the target will attempt to obtain the new address in the LIHA phase. When the RHA bit is set to zero, the target follows the normal initialization procedure, including the possibility of obtaining a soft address during the loop initialization process. When not attached to an arbitrated loop, this field is ignored the RHA bit.

Allow Login without Loop Initialization (ALWI) –This field returns zero to indicate the target will perform the normal loop initialization procedure before entering the monitoring mode and accepting a login ELS. This field is ignored when not attached to an arbitrated loop.

Disable Target Initiated Port Enable (DTIPE) –This field returns zero to indicate the target will enable itself onto the loop according to the rules specified in FC-AL-2. This field is ignored when not attached to an arbitrated loop.

Disable Target Originated Loop (DTOLI) –This field returns zero to indicate the target attached by an arbitrated loop will generate LIP(F7,xx) after it enables a port into a loop. If the target is attached to an arbitrated loop and detects loop failure at its input, it shall follow the error initialization process defined by FC-AL-2 regardless of the state of this bit. This field is ignored when not attached to an arbitrated loop.

RR_TOV Units – This field indicates the units for the Resource Recovery Time-out Value field. A value of 3 is returned to indicate the units are in tenths of seconds.

Resource Recovery Time-out Value (RR_TOV) – This field returns the resource recovery time-out value specified in RR_TOV units. For example, an RR_TOV of 14h (20 decimal) with an RR_TOV units value of 3 indicates a resource recovery time-out value of 2 seconds; and an RR_TOV of F0h (240 decimal) with an RR_TOV units value of 3 indicates a resource recovery time-out value of 24 seconds.

Informational Exceptions Control Page (1Ch)

The Informational Exceptions Control mode page describes the capabilities of the library for reporting exception conditions. It was previously known as the Tape Alert mode page when exception conditions were limited to only Tape Alert flags.

The main purpose of this page is to indicate that the library can report exception conditions by being polled. The exception conditions primarily involve the Tape Alert flags, but may include additional conditions as well, as defined by the Sense Data.

Table 44 Informational Exceptions Control Page (1Ch)

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Rsvd	Page Code (1Ch)					
1	Parameter List Length = 0Ah							
2	Perf	Rsvd	EBF	EWasc	Dexcpt	Test	Rsvd	LogErr
3	Reserved				MRIE			
4 : 7	Interval Timer							
8 : 11	Report Count							

Parameters Savable (PS) – This page is not savable, and this field is set to zero.

Page Code – This field identifies the Informational Exceptions Control mode page and returns 1Ch.

Parameter List Length – This field is set to 0Ah (10).

Log Errors (LogErr) – This field is set to 0 to indicate that logging of informational exception conditions is vendor specific (unique to the library in this case).

Test – This field is set to 0 to indicate that test failure indications will not be generated.

Disable Exception Control (Dexcpt) –This field is set to 1, indicating that the initiator must poll the LOG SENSE Tape Alert page.

Enable Warning (EWasc) – This field is set to 0, indicating that reporting of warnings is disabled.

Enable Background Function (EBF) – This field is set to 0 indicating that background functions are not enabled.

Performance (Perf) – This field is set to 0 to indicate that informational exception operations that are the cause of delays are acceptable.

Method of Reporting Informational Exceptions (MRIE) – This field is set to 0h to indicate that exception conditions or warnings will not be reported, and that the initiator must poll.

Interval Timer – This field is set to 0000 0000h to indicate that the interval is vendor specific. The library does not support a timer interval.

Report Count – This field is set to 0000 0000h to indicate that there is no limit on the number of exception conditions reported.

Element Address Assignment Page (1Dh)

The Element Address Assignment mode page returns the first element address and the element quantity for each element type. The quantity is based on the number of elements configured in the library, some of which may be temporarily removed (like a storage magazine or drive). Elements that are temporarily removed will not change the overall number of elements for that element type. Table 45 shows the format of the page. Initiators should always retrieve this page and use these values when communicating element-based commands with the library. The addresses and quantities of elements should never be assumed or hard-coded by the initiator, as they are subject to change.

Table 45 Element Address Assignment Page (1Dh)

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Rsvd	Page Code (1Dh)					
1	Parameter List Length = 12h							
2	First Medium Transport Element Address (0001h)							
3								
4	Number of Medium Transport Elements							
5								
6	First Storage Element Address (1000h)							
7								
8	Number of Storage Elements							
9								
10	First Import/Export Element Address (0010h)							
11								
12	Number of Import/Export Elements							
13								
14	First Data Transfer Element Address (0100h)							
15								
16	Number of Data Transfer Elements							
17								
18	Reserved							
19								

Parameters Savable (PS) – This page is not savable, and this field is set to zero.

Page Code – This field identifies the Element Address Assignment mode page and returns 1Dh.

Parameter List Length – This field is set to 12h (18).

First Medium Transport Element Address – This returns 0001h, which is the address of the first medium transport element (accessor).

Number of Medium Transport Elements – This field returns 0001h.

First Storage Element Address – This field returns 1000h, which is the address of the first storage element.

Number of Storage Elements – This field varies, depending on the configuration of the subsystem.

First Import/Export Element Address – This field returns 0010h, which is the address of the first Import/Export element.

Number of Import/Export Elements – This field varies, depending on the configuration of the subsystem. If no Import/Export elements are installed, this field returns zero.

First Data Transfer Element Address – This field returns 0100h, which is the address of the first data transfer element (drive).

Number of Data Transfer Elements – This field varies, depending on the configuration of the subsystem.

Transport Geometry Parameters Page (1Eh)

The Transport Geometry Parameters page describes whether a medium transport element is a member of a set of elements that share a common robotics subsystem, and whether it is capable of handling double-sided media. Libraries currently contain a single medium transport element, so all are the first element in a set of one.

Table 46 Transport Geometry Parameters Page (1Eh)

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Rsvd	Page Code (1Eh)					
1	Parameter List Length = 02h							
2	Reserved							Rotate
3	Member Number In Transport Element Set							

Parameters Savable (PS) – This page is not savable, and this field is set to zero.

Page Code – This field identifies the Transport Geometry Parameters mode page and returns 1Eh.

Parameter List Length – This field is set to 02h, since only a single medium transport is reported.

Rotate – This field returns 0, since double-sided media is not supported.

Member Number In Medium Transport Element Set – This field returns 0, since the library has a single medium transport.

Device Capabilities Page (1Fh)

The Device Capabilities page defines the rules governing cartridge movement within the library. It describes from which element type to the next a cartridge can be moved, directly defining which element types can be used as either source or target elements. The library does not allow the medium transport element (accessor) to be a target, and only as a source on a limited basis.

Table 47 Device Capabilities Page (1Fh)

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Rsvd	Page Code (1Fh)					
1	Parameter List Length = 0Eh							
2	Reserved				DT 1	I/E 1	ST 1	MT 0
3	Reserved							
4	Reserved				MT to DT 0	MT to I/E 1	MT to ST 1	MT to MT 0
5	Reserved				ST to DT 1	ST to I/E 1	ST to ST 1	ST to MT 0
6	Reserved				I/E to DT 1	I/E to I/E 1	I/E to ST 1	I/E to MT 0
7	Reserved				DT to DT 1	DT to I/E 1	DT to ST 1	DT to MT 0
8 : 15	Reserved							

Parameters Savable (PS) – This page is not savable, and this field is set to zero.

Page Code – This field identifies the Device Capabilities mode page and returns 1Fh.

Parameter List Length – This field is set to 0Eh (14).

Data Transfer (DT) – This field is set to 1 to indicate that the data transfer elements (drives) can store cartridges.

Import/Export (I/E) – This field is set to 1 to indicate that the Import/Export elements can store cartridges.

Storage (ST) – This field is set to 1 to indicate that the storage elements can store cartridges.

Medium Transport (MT) – This field is set to 0 to indicate that the accessor cannot store cartridges.

The remaining **element type to element type fields** describe the allowable source to target transitions. A zero is returned for any transition involving the Medium Transport (MT) except for when the MT is a source and the destination is either I/E or Storage. A one is returned for all other transitions.

All Mode Pages (3Fh)

When this page is requested, all supported mode pages are returned in ascending order.

Move Medium – A5h

What the Library Does With This Command

The library will attempt to physically move a cartridge from the requested source element to the requested destination. The library will make reasonable attempts to retry this operation within the scope of its capabilities, but if unsuccessful, will try to return the cartridge to its source element. If the source element was a drive, the library will attempt to leave the cartridge in either a storage or I/E element if the configuration supports it (not partitioned in the case of the I/E), otherwise it may remain in the picker.

If the library includes towers, any required movement of the towers will be provided automatically by the library.

When the source and destination addresses are the same, the library will still do a full Get and Put, even if it is a drive (data transfer element).

The library will check that the source element is occupied and that the destination element is empty. It will also check for media compatibility between the source and destination elements. Failures in either of these will result in a Check Condition.

Command Usage

Storage, data transfer, and import/export elements can be used as valid source or destination elements. The medium transport element (picker) cannot be a destination element. It can be a source element to recover stranded media.

This is the primary command for the library, and should be used to accomplish any media movement within the system. If the library indicates a failure due to element status problems (source empty, destination full, media incompatible, etc.), element status should be re-initialized and re-synchronized. This would apply to both hardware errors and illegal requests.

Move Medium CDB Format

The MOVE MEDIUM CDB format is shown in the following table.

Table 48 MOVE MEDIUM CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (A5h)							
1	Logical Unit Number			Reserved				
2	Medium Transport Element Address							
3								
4	Source Element Address							
5								
6	Destination Element Address							
7								
8	Reserved							
9								
10	Reserved							Invert
11	FO		Control					

Medium Transport Element Address – This field contains the address of the Medium Transport element to use for the move. A value of 0001h is the address for all Medium Transport elements, but a value of 0000h is also supported to select the default Medium Transport element.

Source Element Address – This field specifies the element address from where the cartridge is retrieved.

Destination Element Address – This field specifies the element address for where the cartridge is to be placed.

Invert – This field must be set to 0 since the library does not support double-sided media.

Failover (FO) - Set to 0 to indicate no failover sequence identified.

Persistent Reserve In – 5Eh

What the Library Does With This Command

The library returns information about persistent reservation and reservation keys that are currently active.

This command is only supported if the library control path is provided by a tape drive.

Note — IO blades connected to drives configured with a control path may report certain library ready conditions differently than drives without a control path configured.

Command Usage

This command is used in conjunction with PERSISTENT RESERVE OUT to manage persistent reservations. It can be used to retrieve a list of the current reservations and the registered reservation keys. The PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands should not be used with the RESERVE ELEMENT and RELEASE ELEMENT commands.

Persistent Reserve In CDB Format

The PERSISTENT RESERVE IN CDB format is shown in the following table.

Table 49 PERSISTENT RESERVE IN CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (5Eh)							
1	Logical Unit Number			Service Action				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Allocation Length							
8								
9	Control							

Service Action – This field specifies the type of request being made as follows:

- 0h – Read all registered reservation keys.
- 1h – Read all current persistent reservations.
- 2h – Report capabilities of the supported persistent reservation features (only supported if the command is issued to a media changer device hosted by a tape drive).
- 3h – Report full status of registration and reservation status for each registered I_T nexus (only supported if the command is issued to a media changer device hosted by a tape drive).

Allocation Length – This field specifies the byte length allowed for returning the requested data. The number of bytes returned is the lesser of the available data to return or the allocation length.

Persistent Reserve In Response

Response data is returned depending on the requested service action.

Read Keys Response

The response for a Read Keys service action is shown the following table.

Table 50 Read Keys Response

Byte \ Bit	7	6	5	4	3	2	1	0
0 : 3	Generation							
4 : 7	Additional Length (n-7)							
Reservation Key List								
8 : 15	First Reservation Key							
:								
n-7 : n	Last Reservation Key							

Generation – This field is a 32-bit counter that is incremented every time a PERSISTENT RESERVE OUT command requests a Register, a Register and Ignore Existing Key, a Clear, a Preempt, or a Preempt and Abort service action. This counter is not maintained across power cycles.

Additional Length – This field indicates the length in bytes of the Reservation Key List.

Reservation Key List – This is a list of all the 8-byte reservation keys that have been registered through the PERSISTENT RESERVE OUT command.

Read Reservations Response

The response for a Read Reservations service action is shown in the following table.

Table 51 Read Reservations Response

Byte \ Bit	7	6	5	4	3	2	1	0
0 : 3	Generation							
4 : 7	Additional Length (0 or 0010h)							
Reservation Descriptor								
8 : 15	Reservation Key							
16 : 19	Scope-Specific Address							
20	Reserved							
21	Scope				Type			
22	Obsolete							
23								

Generation – This field is a 32-bit counter that is incremented every time a PERSISTENT RESERVE OUT command requests a Register, a Register and Ignore Existing Key, a Clear, a Preempt, or a Preempt and Abort service action. This counter is not maintained across power cycles.

Additional Length – This field indicates the length in bytes of the Reservation Descriptor, which may return 0 or 0010h (16).

Since element reservations are not supported, a single reservation descriptor is returned for logical unit.

Reservation Key – This is the 8-byte reservation key that was registered through the PERSISTENT RESERVE OUT command.

Scope-Specific Address – Element reservations are not supported and this field returns 0000h.

Scope – This field returns a 0h, indicating logical unit scope. Element scope is not supported.

Type – This field returns the type of reservation as follows:

- 3h Exclusive Access – The initiator holding the persistent reservation has exclusive read and write access. Requests from any other initiators to transfer data to or from the logical unit will result in a Reservation Conflict.
- 6h Exclusive Access, Registrants Only – Any currently registered initiator has exclusive data transfer access. Requests from unregistered initiators to transfer data to or from the logical unit will result in a Reservation Conflict.
- 8h Exclusive Access, All Registrants (only supported if the command is issued to a media changer device hosted by an HP tape drive).

Report Capabilities Response

The response for a Report Capabilities service action is shown in the following table.

Table 52 Report Capabilities Response

Byte \ Bit	7	6	5	4	3	2	1	0
0	Length (0008h)							
1								
2	Reserved			CRH	SIP_C	ATP_C	Rsvd	PTPL_C
3	TMV	Reserved						PTPL_A
4	WR_EX_AR	EX_AC_RO	WX_EX_RO	Rsvd	EX_AC	Rsvd	WE_EXC	Rsvd
5	Reserved							EX_AC_AR
6	Reserved							
7								

Length – This field reports 8 bytes of data.

CRH – This field returns a 1 (refer to the appropriate SCSI standard for information regarding this field).

SIP_C – This field returns a 1 (refer to the appropriate SCSI standard for information regarding this field).

ATP_C – This field returns a 0 to indicate (refer to the appropriate SCSI standard for information regarding this field).

PTPL_C – This field returns a 1 to indicate (refer to the appropriate SCSI standard for information regarding this field).

TMV – This field returns a 1 to indicate (refer to the appropriate SCSI standard for information regarding this field).

PTPL_A – Set to 0 to indicate that Persist Through Power Loss has not been activated. Set to 1 to indicate that the most recent successfully completed PERSISTENT RESERVE OUT command with Register or Register and Ignore Existing Key service action had the APTPL bit set to one in the parameter data.

WR_EX_AR – This field returns a 0 to indicate (refer to the appropriate SCSI standard for information regarding this field).

EX_AC_RO – This field returns a 1 to indicate (refer to the appropriate SCSI standard for information regarding this field).

WX_EX_RO – This field returns a 0 to indicate (refer to the appropriate SCSI standard for information regarding this field).

EX_AC – This field returns a 1 to indicate (refer to the appropriate SCSI standard for information regarding this field).

WE_EXC – This field returns a 0 to indicate (refer to the appropriate SCSI standard for information regarding this field).

EX_AC_AR – This field returns a 1 to indicate (refer to the appropriate SCSI standard for information regarding this field).

Report Full Status

The response for a Report Full Status service action is shown in the following table.

Table 53 Report Full Status

Byte \ Bit	7	6	5	4	3	2	1	0
0 : 3	Generation							
4 : 7	Additional Length (n-7)							
Full Status Descriptors (see Table 54)								
8 : 15	First Full Status Descriptor							
:								
n - 7 : n	Last Full Status Descriptor							

The response for a Full Status Descriptor is shown in the following table.

Table 54 Full Status Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0 : 7	Reservation Key							
8 : 11	Reserved							
12	Reserved						ALL_TG _PT (0)	R_Holde r
13	Scope				Type			
14 : 17	Reserved							
18	Relative Target Port Identifier							
19								

Table 54 Full Status Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
20 : 23	Additional Descriptor Length							
24 : n	Transport ID							

R_Holder – Set to 1 to indicate that the I-T nexus is a Persistent Reservation Holder.

Transport _ID – See details in PERSISTENT RESERVE OUT command (Table 59 and Table 60).

Persistent Reserve Out – 5Fh

What the Library Does With This Command

The library will perform service actions relative to persistent reservations as requested. This includes creating and clearing reservations.

An I_T nexus performing Persistent Reserve Out service actions is identified by a reservation key.

This command is only supported if the library control path is provided by a tape drive.

Note — IO blades connected to drives configured with a control path may report certain library ready conditions differently than drives without a control path configured.

Command Usage

This command is used in conjunction with PERSISTENT RESERVE IN to manage persistent reservations. It can be used to request exclusive access to the device. The PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands should not be used with the RESERVE ELEMENT and RELEASE ELEMENT commands.

Persistent Reserve Out CDB Format

The PERSISTENT RESERVE OUT CDB format is shown in the following table.

Table 55 PERSISTENT RESERVE OUT CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (5Fh)							
1	Logical Unit Number			Service Action				
2	Scope				Type			
3 : 6	Reserved							
7	Parameter List Length (18h)							
8								
9	Control							

Service Action – This field specifies what reservation action to take as follows:

- 00h Register – Register a reservation key without making a reservation.
- 01h Reserve – Create a persistent reservation of the specified scope and type.
- 02h Release – Releases the selected reservation for the requesting initiator.
- 03h Clear – Clears all reservations keys and all persistent reservations.
- 04h Preempt – Preempt reservations from another initiator.

- 05h Preempt and Abort – Preempt reservations from another initiator and abort all tasks for all initiators with the specified reservation key.
- 06h Register and Ignore Existing Key – Register a new reservation key and discard existing reservation key.
- 07h – Register and Move Registers a reservation key for another I_T nexus and moves the persistent reservation to that I-T nexus.

Scope – Only logical unit scope is supported, and this field must be a 0h.

Type – This field specifies the type of reservation as follows:

- 3h Exclusive Access – The initiator holding the persistent reservation has exclusive read and write access. Requests from any other initiators to transfer data to or from the logical unit will result in a Reservation Conflict.
- 6h Exclusive Access, Registrants Only – Any currently registered initiator has exclusive data transfer access. Requests from unregistered initiators to transfer data to or from the logical unit will result in a Reservation Conflict.
- 8h Exclusive Access, All Registrants (only supported if the command is issued to a media changer device hosted by an HP tape drive).

Parameter List Length – This field returns 18h (24) to indicate the length of the PERSISTENT RESERVE OUT parameter list, which is shown in the following table.

Table 56 PERSISTENT RESERVE OUT Parameter List

Byte \ Bit	7	6	5	4	3	2	1	0
0 : 7	Reservation Key							
8 : 15	Service Action Reservation Key							
16 : 19	Scope-Specific Address							
20	Reserved				SPEC-1_PT	ALL_TG_PT	Rsvd	APTPL
21	Reserved							
22 : 23	Obsolete							
24 : n	Additional Parameter Data (see Table 57 and Table 58)							

Reservation Key – This is an 8-byte reservation key that identifies the initiator. The value must match the registered reservation key for the I_T nexus except for:

- The Register and Ignore Existing Key service action, where this field is ignored.
- The Register service action for an unregistered I_T nexus, where this field is 0.

If the Reservation Key does not match with the one registered in the device server for the I_T nexus, the device server returns Reservation Conflict.

Service Action Reservation Key – This field only applies to the following service actions as follows:

- Register – This is the new reservation key to register.
- Register and Ignore Existing Key – This is the new reservation key to register.
- Preempt – This is the reservation key of the persistent reservation to preempt.
- Preempt and Abort – This is the reservation key of the persistent reservation to preempt.

For the Register and Register and Ignore Existing Key service actions:

- 0 – Unregisters the registered reservation key specified in the Reservation Key field.
- n – The new reservation key to replace the existing one as specified in the Reservation Key field for the I_T nexus.

For the Preempt and Preempt and Abort service actions, this field contains:

- n – The reservation key of registrations to be removed or, if this field also identifies a persistent reservation holder, the persistent reservation to be pre-empted.

For the Register and Move service action, this field contains:

- n – The reservation key to be registered on the specified I_T nexus.

Scope-Specific Address – Element reservations are not supported and this field must be 0000h.

SPEC_I_PT – This bit is valid for the Register and Register and Ignore Existing Key service actions. Set to 0 to ignore the additional parameter data and apply the registration to the I_T nexus that sent the command. Set to 1 to have the additional parameter data include a list of transport IDs and apply the registration to the I_T nexus for every initiator port specified in the transport list

ALL_TG_PT – This bit is not supported and is ignored.

Activate Persist Through Power Loss (APTPL) – This bit is only valid for the Register, Register and Ignore Existing Key and Register and Move service actions. If set to 1, the logical unit preserves any persistent reservation and all registrations if power is lost and later returned. If the EEPROM (non-volatile memory) is unable to store data anymore, a CHECK CONDITION will be returned to reject the request.

If a library media changer device control path is configured via a DA blade, persistent reservations are not supported across power cycles, so this field must be set to 0.

Table 57 Additional Parameter Data

Byte \ Bit	7	6	5	4	3	2	1	0
24 : 27	Transport Parameter Data length (n - 27)							
Transport ID List (see Table 59 and Table 60)								
28 :	First Transport ID							
:								
: n	Last Transport ID							

Transport Parameter Data Length – Specifies the number of bytes of Transport IDs to follow.

Transport IDs – See Section Transport IDs below.

Table 58 Parameter Data for the Register and Move Service Action

Byte \ Bit	7	6	5	4	3	2	1	0
0 : 7	Reservation Key							
8 : 15	Service Action Reservation Key							
16	Reserved							
17	Reserved						Unreg	APTPL
18	Relative Target Port Identifier							
19								
20 : 23	Additional Descriptor Length (18h)							
24 : n	Transport ID							

Unreg – Set to 1 to indicate that the I-T nexus on which the command was received be unregistered.

Service Action Registration Key – Specifies the reservation key to be registered on the specified I_T nexus.

APTPL – Set to 1 to indicate that the logical unit preserve any persistent reservation and all registrations if power is lost and later returned. If the EEPROM (non-volatile memory) is unable to store data anymore, a CHECK CONDITION will be returned to reject the request

Transport IDs

Table 59 Fibre Channel Transport IDs

Byte \ Bit	7	6	5	4	3	2	1	0
0	Format Code (00b)		Reserved			Protocol Identifier (0)		
1 : 7	Reserved							
8 : 15	World Wide Port Name (WWPN)							
16 : 23	Reserved							

Table 60 SAS Transport IDs

Byte \ Bit	7	6	5	4	3	2	1	0
0	Format Code (00b)		Reserved		Protocol Identifier (6h)			
1 : 3	Reserved							
4 : 11	SAS Address							
12 : 23	Reserved							

Position to Element – 2Bh

What the Library Does With This Command

The library will move the picker in front of the specified element at the current media Get position.

Command Usage

This command can be used to pre-position the robotics to an element to enhance performance, or it can be used as a general-purpose way to relocate the robotics without involving media movement. This might be useful for diagnostic or demonstration purposes.

Position to Element CDB Format

The POSITION TO ELEMENT CDB format is shown in the following table.

Table 61 POSITION TO ELEMENT CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (2Bh)							
1	Logical Unit Number			Reserved				
2	Medium Transport Element Address							
3								
4	Destination Element Address							
5								
6	Reserved							
7								
8	Reserved							Invert
9	Control							

Medium Transport Element Address – This field contains the address of the Medium Transport element to position. A value of 0001h is the address of the Medium Transport element, but a value of 0000h is also supported (which selects the default Medium Transport element).

Destination Element Address – This field contains the element address of the target to position to. It can be a storage, data transfer, or import/export element.

Invert – This field must be set to 0.

Prevent Allow Medium Removal – 1Eh

What the Library Does With This Command

The library will prohibit movement of media to an Import/Export element when media removal has been prevented. MOVE MEDIUM commands requesting such a move will be rejected with a Check Condition indicating Medium Removal Prevented. This command does not control locking or unlocking of a mailbox. The library automatically locks mailboxes during robotic access, and unlocks them afterwards.

While media removal is prevented, importing of media can still occur. The medium removal setting does not persist across power cycles of the library.

Any initiator issuing this command to allow medium removal (Prevent set to 00b) will allow medium removal for all initiators. This is done to maintain compatibility with certain bridged environment behavior (e.g., Fibre Channel to Parallel SCSI).

Note

The prevention of medium removal condition terminates after:

- one of the following occurs for each I_T nexus that had previously prevented medium removal:
  - successful completion of a PREVENT ALLOW MEDIUM REMOVAL command with the PREVENT field set to 00b; or
  - an I_T nexus loss.
- a power on
- a hard reset
- a logical unit reset

Command Usage

In conjunction with keyed access to the physical library doors, this command can be used to secure the library against unauthorized removal of media.

Prevent Allow Medium Removal CDB Format

The PREVENT ALLOW MEDIUM REMOVAL CDB format is shown in the following table.

Table 62 PREVENT ALLOW MEDIUM REMOVAL CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (1Eh)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							Prevent
5	Control							

Prevent – This field controls medium removal as follows:

- 00b – Allow medium removal
- 01b – Prohibit medium removal
- 10b – Not supported
- 11b – Not supported

Read Buffer – 3Ch

What the Library Does With This Command

The library will return requested buffer descriptor information or buffer data.

Command Usage

This command can be used primarily for enhanced domain validation. The initiator can use Descriptor mode first to determine the size of the data available to read, followed by Data mode to then read it. Depending on the size of the requested buffer, it can also be retrieved in blocks, utilizing offsets into the buffer.

Read Buffer CDB Format

The READ BUFFER CDB format is shown in the following table.

Table 63 READ BUFFER CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (3Ch)							
1	Logical Unit Number			Rsvd	Mode			
2	Buffer ID							
3 : 5	Buffer Offset							
6 : 8	Allocation Length							
9	Control							

Mode – The supported modes are:

- 2h – Data
- 3h – Descriptor
- Ah – Echo Buffer
- Bh – Echo Buffer Descriptor

In *Data Mode*, data is transferred from the buffer specified by the Buffer ID field. Buffer IDs are assigned beginning with zero, and are assigned contiguously. Buffer ID code assignments for the READ BUFFER command are the same as for the WRITE BUFFER command.

In *Descriptor Mode*, a maximum of four bytes of READ BUFFER descriptor information is returned. The library returns the descriptor information for the buffer specified by the buffer ID. If there is no buffer associated with the specified Buffer ID, all zeros are returned in the READ BUFFER descriptor. The Buffer Offset field is reserved in this mode. The allocation length should be set to at least four for this mode. See Table 64 on page 66 for a definition of the READ BUFFER descriptor.

In *Echo Buffer Mode*, data is transferred to the initiator from the echo buffer. The echo buffer will transfer the same data that was received from the last WRITE BUFFER command sent with Echo Buffer Mode. If the allocation length is insufficient to accommodate the number of bytes of data as received in the prior echo buffer mode WRITE BUFFER command, the returned data will be truncated. This is not considered an error. If a prior echo buffer mode WRITE BUFFER command was not successfully completed the echo buffer mode READ BUFFER will return a Check Condition, with a Sense Key of Illegal Request and additional sense code of Command Sequence Error. The data may be read from the echo buffer multiple times.

In *Echo Buffer Descriptor Mode*, a maximum of four bytes of READ BUFFER descriptor information is returned for the echo buffer. The Buffer Offset field is reserved in this mode. The allocation length should be set to at least four for this mode. See Table 65 for a definition of the READ BUFFER descriptor. See Table 67 for a definition of the Echo Buffer descriptor.

Note: The Echo Buffer is supported only if the library control path is provided by a tape drive.

Buffer ID – This field specifies which buffer the request is for. A Buffer ID is currently not supported. The library currently only supports Echo Buffer communication. The IDs are the same for both the READ BUFFER and WRITE BUFFER commands. The IDs supported by the library, along with their primary use (data or download modes), are listed in the following table.

Table 64 Supported Buffer IDs

Buffer ID	Description	Read/Write
N/A	No buffer ID support	N/A

Additional Buffer IDs beyond those listed are reserved. Descriptor Mode can be used to determine the size or capacity of a given buffer.

Buffer Offset – This field contains the byte offset within the specified buffer from which data shall be transferred. The initiator should conform to the offset boundary requirements returned in the READ BUFFER descriptor described in “Read Buffer Response.”

Allocation Length – In Data Mode, this field should be set to accommodate the amount of data being requested for return. In Descriptor Mode, this field should be set to at least four.

Read Buffer Response

In Data Mode, the requested buffer of data is returned per the buffer offset and allocation length.

In Descriptor Mode, a buffer descriptor is returned as shown in the following table.

Table 65 Read Buffer Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Offset Boundary							

Table 65 Read Buffer Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
1 : 3	Buffer Capacity							

Offset Boundary – This field returns the boundary alignment (byte boundary) within the selected buffer for subsequent READ BUFFER commands. The value contained in this field is interpreted as a power of two.

Therefore the value contained in the Buffer Offset field of subsequent READ BUFFER commands should be a multiple of $2^{\text{offset boundary}}$ as shown in the following table.

Table 66 Offset Boundary

Offset Boundary	$2^{\text{offset boundary}}$	Buffer Offsets
0h	$2^0 = 1$	Byte boundaries
1h	$2^1 = 2$	Even-byte boundaries
2h	$2^2 = 4$	Four-byte boundaries
3h	$2^3 = 8$	Eight-byte boundaries
4h	$2^4 = 16$	16-byte boundaries
:	:	Etc.
FFh	Not applicable	0 is the only supported buffer offset

Buffer Capacity – This field returns the size of the requested buffer in bytes.

The Return Buffer stops being filled when the number of allocation length bytes has been transferred or when all the available data from the buffer has been transferred, whichever amount is less. This holds true for either mode.

In Echo Buffer Descriptor Mode, an echo buffer descriptor is returned as shown in the following table.

Table 67 Echo Buffer Descriptor

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

Echo Buffer Overwritten Supported (EBOS) – This field returns a 0 to indicate that other initiators or intervening commands may overwrite the echo buffer.

An EBOS bit set to 1 indicates either:

- the target returns the ECHO BUFFER OVERWRITTEN extended sense code if the data being read from the echo buffer is not the data previously written by the same initiator, or
- the target ensures echo buffer data from each initiator is the same as that previously written by the same initiator..

Buffer Capacity – This field returns 252, which is the size of the echo buffer (in bytes).

Read Element Status – B8h

What the Library Does With This Command

The library returns current status and information regarding the requested elements. The data is primarily derived from having done an Inventory operation (using INITIALIZE ELEMENT STATUS or INITIALIZE ELEMENT STATUS WITH RANGE), but in the case of data transfer elements is also augmented by communication with the drives. Element status remains valid as long as the subsystem integrity has not been breached, such as by opening a door or through a power cycle.

Element status will be reported for all elements, including those represented by only a placeholder, as in the case of uninstalled drives or magazines that physically have a place reserved in the configuration. As such, it is important to process the fields governing accessibility and exception conditions.

Command Usage

This command should be issued whenever new element status information is needed, or the library has indicated that status may have changed. If the status information is suspect, an INITIALIZE ELEMENT STATUS WITH RANGE command should be issued to refresh it.

Read Element Status CDB Format

The READ ELEMENT STATUS CDB format is shown in the following table.

Table 68 READ ELEMENT STATUS CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (B8h)							
1	Logical Unit Number			VolTag	Element Type Code			
2	Starting Element Address							
3								
4	Number of Elements							
5								
6	Reserved						CurData	DVCID
7 : 9	Allocation Length							
10	Reserved							
11	Control							

Volume Tag (VolTag) – This field indicates whether the volume tag (bar code label) information should be returned. A value of one will return the labels, a value of zero will not.

Element Type Code – This field specifies the element types selected for the returned information, as shown in the following table.

Table 69 Element Type Code

Code	Selected Element Type
0000b (0)	All element types reported
0001b (1)	Medium transport element (accessor)
0010b (2)	Storage element
0011b (3)	Import/Export element
0100b (4)	Data transfer element (drives)

Starting Element Address – This field specifies the minimum element address to report. Only elements with an element type code specified by the Element Type Code field, and with an address greater than or equal to the starting element address will be reported. The starting element address must be a valid element address, but not have to be within the range specified by the Element Type Code field.

Number of Elements – This field specifies the maximum number of element descriptors to return. Only those descriptors that can be completely transferred within the allotted allocation length will be returned.

Current Data (CurData) – This field specifies whether the library may cause device motion to confirm element status data. The library will not cause device motion if this field is set to either 0 or 1.

Device ID (DVCID) – This field indicates whether device identifiers (inquiry page information or serial numbers) are returned for the specified range. Identifiers are returned if this field is set to 1. They are not returned if this field is set to 0. Only data transfer elements can return device identifiers.

Allocation Length – This field specifies the byte length allowed for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until one of the following conditions are met:

- All available element descriptors have been returned
- The number of element descriptors specified in the Number of Elements field have been returned
- The number of bytes specified in the Allocation Length field have been returned
- There is less allocation length space available than is required by the next complete element descriptor

Read Element Status Response

Element status data consists of an eight-byte header, followed by one or more element status pages (per element type). Each element status page consists of a header, followed by one or more element descriptor blocks. A complete response then looks like:

```
Element Status Header
    Element Status Page Header (first element type)
        Element Descriptor
        …(more descriptors)…
        Element Descriptor
    …(more status pages)…
    Element Status Page Header (next element type)
        Element Descriptor
        …
        Element Descriptor
```

There are only up to four Element Status Pages, one for each element type.

Element Status Header

One header is returned for each READ ELEMENT STATUS command. The format is shown in the following table.

Table 70 Element Status Header format

Byte \ Bit	7	6	5	4	3	2	1	0
0	First Element Address Reported							
1								
2	Number of Elements Available							
3								
4	Reserved							
5 : 7	Byte Count of Report Available							

First Element Address Reported – This field indicates the lowest element address found that meets the CDB request.

Number of Elements Available – This field indicates the number of elements found that meet the CDB request.

Byte Count of Report Available – This field indicates the number of available element status bytes that meet the CDB requirements. The value does not include the eight-byte element status header, and is not adjusted to match the value specified in the Allocation Length field of the CDB. This facilitates first issuing a READ ELEMENT STATUS command with an allocation length of eight bytes in order to determine the allocation length required to transfer all the element status data specified by the command.

Element Status Page

Each element status page consists of an eight-byte header, followed by one or more element descriptor blocks. One Element Status Page header is returned for each grouping of element descriptor blocks, by element type. The format of the Element Status Page header is shown in the following table.

Table 71 Element Status Page

Byte \ Bit	7	6	5	4	3	2	1	0
0	Element Type Code							
1	PVolTag	AVolTag	Reserved					
2	Element Descriptor Length							
3								
4	Reserved							
5 : 7	Byte Count of Descriptor Data Available							

Element Type Code – This field indicates the specific element type being returned by the element descriptors for this page.

PVolTag – A value of one indicates that the primary volume tag field (barcode label) is present in each of the element descriptor blocks that follow. A value of zero indicates that they are not present.

AVolTag – Alternate Volume Tags are not supported. The returned value for this field is 0, and the alternate volume tag fields are omitted from the element descriptors.

Element Descriptor Length – This field indicates the number of bytes contained in a single element descriptor. Refer to the individual element descriptor descriptions for each element type for their respective possible lengths.

Byte Count of Descriptor Data Available – This field indicates the number of element descriptor data bytes available for the elements of this element type that meet the CDB requirements. This value represents the Element Descriptor Length field multiplied by the number of element descriptors for this element type. This value does not include the 8-byte Element Status Page header, nor is it adjusted to match the allocation length.

Element Descriptors

The following sections contain the definitions for the following element descriptors:

- Medium transport element
- Storage elements
- Import/Export elements
- Data transfer elements

Each element descriptor includes the element address, status flags, source storage element address, and barcode label. Some descriptors also contain extended status information. Additional sense code and qualifier information depends on the element type.

Primary Volume Tag Field

Volume tags (returned in the Primary Volume Tag field) are basically barcode labels on the media. The library supports labels from 5 to 16 characters in length. The Primary Volume Tag field contains 32 bytes of label data (space filled to 32 bytes), followed by two reserved bytes, then two bytes of volume sequence number. The library returns zeros for the last four bytes of Primary Volume Tag data.

If the user has configured the library to support media identification, media identifiers will be reported as found on the barcode labels as part of the volume tag. If this feature is not enabled, any media identifiers found will not be reported.

Medium Transport Element Descriptor

Table 72 Primary Volume Tag Field

Byte \ Bit	7	6	5	4	3	2	1	0
0	Element Address							
1								
2	Element Descriptor Length					Except	Rsvd	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 : 8	Reserved							
9	Svalid	Invert	Reserved					
10	Source Storage Element Address							
11								
12 : 47	Primary Volume Tag Information (Field omitted if PVolTag = 0; remaining fields move up)							
48 : 51	Reserved							

Element Address – This field contains the element address of the accessor.

Except – This field is set to 1 if the element is in an abnormal state. Additional information will be available in the Additional Sense Code and Additional Sense Code Qualifier fields. This field is set to 0 if the element is in a normal state.

Full – This field is set to 0 if the element does not contain media. It is set to 1 if it does. Since the medium transport element cannot be a destination element, this field should normally return 0. There may be error situations where media is left in the picker, which would be indicated by this field. In the case of dual pickers, differentiation of state will be provided through the Additional Sense Code and Additional Sense Code Qualifier fields when exception conditions are present (such as stranded media).

Additional Sense Code – If the element is in an abnormal state (no error or exception associated with it), this field will be set to a value as described in Table 83 on page 83.

Additional Sense Code Qualifier – If the element is in an abnormal state, this field will be set to a value as described in Table 83 on page 83.

Source Valid (Svalid) – This field is set to 1 if the Source Storage Element Address field is valid, otherwise it is set to 0.

Invert – This field is set to 0. The library does not support inverting media.

Source Storage Element Address – If the Source Valid field is set to 1, this field will contain the element address of the last storage element the media was in. Since the medium transport element cannot be a destination element, this would be an abnormal condition.

Primary Volume Tag – This field will normally return spaces if the primary volume tag is requested, since the medium transport element cannot be a destination element. In certain error situations, a volume tag will be returned to indicate which cartridge may be stranded within the picker.

Storage Element Descriptor

Table 73 Storage Element Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Element Address							
1								
2	Reserved				Access	Except	Rsvd	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 : 8	Reserved							
9	Svalid	Invert	Reserved					
10	Source Storage Element Address							
11								
12 : 47	Primary Volume Tag Information (Field omitted if PVolTag = 0; remaining fields move up)							
48 : 51	Reserved							

Element Address – This field contains the element address of the storage element.

Access – This field is set to 1 if access by a medium transport element is allowed. It is set to 0 if access is denied.

Except – This field is set to 1 if the element is in an abnormal state. Additional information may be available in the Additional Sense Code and Additional Sense Code Qualifier fields. If this field is 1, the primary volume tag information could be invalid. This field is set to 0 if the element is in a normal state.

Full – This field is set to 0 if the element does not contain media. It is set to 1 if it does.

Additional Sense Code – If the element is in an abnormal state, this field will be set to a value as described in Table 83 on page 83.

Additional Sense Code Qualifier – If the element is in an abnormal state, this field will be set to a value as described in Table 83 on page 83.

Source Valid (Svalid) – This field is set to 1 if the Source Storage Element Address field is valid, otherwise it is set to 0.

Invert – This field is set to 0. The library does not support inverting media.

Source Storage Element Address – If the Source Valid field is set to 1, this field will contain the element address of the last storage element the media was moved from. It may be the same as this element.

Primary Volume Tag – If requested, this field contains the volume tag (bar code label) information for media residing in this element address. Five to sixteen character barcode labels are supported.

Import/Export Element Descriptor

Table 74 Import/Export Element Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Element Address							
1								
2	Reserved		InEnab	ExEnab	Access	Except	Imp/Exp	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 : 8	Reserved							
9	Svalid	Invert	Reserved					
10	Source Storage Element Address							
11								
12 : 47	Primary Volume Tag Information (Field omitted if PVolTag = 0; remaining fields move up)							
48 : 51	Reserved							

All fields are the same as for the Storage Element Descriptor except:

Element Address – This field contains the element address of the import/export element.

Import Enable (InEnab) – A value of one indicates that the element supports movement of media into the scope of the media changer device. A value of zero indicates that this element does not support import actions. The library returns a value of one for all import/export elements.

Export Enable (ExEnab) – A value of one indicates that the element supports movement of media out of the scope of the media changer device. A value of zero indicates that this element does not support export actions. The library returns a value of one for all import/export elements.

Import/Export (ImpExp) – A value of one indicates that media present in the element was placed there by an operator. A value of zero indicates that media present in the element was placed there by a medium transport element.

Data Transfer Element Descriptor

Table 75 Data Transfer Element Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	Element Address							
1								
2	Reserved				Access	Except	Rsvd	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	NotBus	Rsvd	IDValid	LUValid	Rsvd	Logical Unit Number		
7	SCSI Bus Address							
8	Reserved							
9	SValid	Invert	Reserved					
10	Source Element Address							
11								
12 : 47	Primary Volume Tag Information (Field omitted if PVolTag = 0; remaining fields move up)							
48	Reserved				Code Set			
49	Reserved				Identifier Type			
50	Reserved							
51	Identifier Length = x where x is 0h to 40h (valid identifier data)							
52 : 115	Device Identifier (Field omitted if DVCID = 0, remaining fields move up) (Always padded to 64 byte length if DVCID = 1)							

Element Address – This field contains the element address of the storage element.

Access – This field is set to 1 if access by a medium transport element is allowed. It is set to 0 if access is denied. When set to 1, it implies that cartridges are unloaded and accessible if present. When set to 0, it implies that cartridges are not unloaded if present.

Except – This field is set to 1 if the element is in an abnormal state. Additional information may be available in the Additional Sense Code and Additional Sense Code Qualifier fields. If this field is 1, the primary volume tag information could be invalid. This field is set to 0 if the element is in a normal state.

Full – This field is set to 0 if the element does not contain media. It is set to 1 if it does.

Additional Sense Code – If the element is in an abnormal state, this field will be set to a value as described in “Additional Sense Codes and Qualifiers.”

Additional Sense Code Qualifier – If the element is in an abnormal state, this field will be set to a value as described in “Additional Sense Codes and Qualifiers.”

Not This Bus (NotBus) – This field is not supported and is set to 0.

IDValid – A value of one indicates that the SCSI Bus Address field is valid. A value of zero indicates that it is not.

LUValid – This field is not supported and is set to 0.

Logical Unit Number – This field is not supported and is set to 0.

SCSI Bus Address – When the IDValid field is set to one, this field contains the tape drive SCSI address. This is only applicable to SCSI tape drives, and does not apply to Fibre Channel tape drives.

Source Valid (Svalid) – This field is set to 1 if the Source Storage Element Address field is valid, otherwise it is set to 0.

Invert – This field is set to 0. The library does not support inverting media.

Source Storage Element Address – If the Source Valid field is set to 1, this field will contain the element address of the last storage element the media was moved from.

Primary Volume Tag – If requested, this field contains the volume tag (bar code label) information for media residing in this element address. Five to sixteen character barcode labels are supported.

Code Set – This field is set to:

- 0h – RESERVED.
- 1h – The device identifier field contains binary values.
- 2h – The device identifier field contains ASCII values.

Identifier Type – This field is set to:

- 0h – The Device Identifier, if the Identifier Length is set, lists the vendor specific device serial number only.
- 1h – The Device Identifier lists the eight-byte Vendor Identification, followed by vendor specific unique identifier information.
- 2h – The Device Identifier contains a Canonical form of IEEE Extended Unique Identifier, 64-bit (EUI-64). In this case, the Identifier Length field is set to 8.
- 3h – The Device Identifier contains an FC-PH Name_identifier.

Identifier Length – This field contains the length in bytes of valid Device Identifier information. If no device identifier is available, or the DVCID bit in the CDB is zero, the Identifier Length field is 0h and the Code Set and Identifier Type fields are also 0h. If the DCVID bit is set, the Identifier Length may be set between 0 and 64 (40h) bytes, depending on the associated drive type.

Device Identifier – This field provides up to 64 bytes of device identifier information for the device associated with the data transfer element. The format is Identifier Type 1, which is equivalent to the drive’s Inquiry page 83h. The Identifier Length specifies the length of valid device identifier information. If the DVCID bit in the CDB is zero, this field is omitted. The Device Identifier field is padded with ASCII character 20h (space) to fill the complete 64 bytes. If the DVCID bit is set and the Identifier Length is 0, this field will still be 64 bytes long.

Release Element (6) – 17h

What the Library Does With This Command

The library releases any outstanding reservation that had previously been made by the same initiator via the RESERVE command. Only whole logical unit reservations are allowed; individual element reservations are not supported.

Command Usage

This command should be used to release the library from any reservations previously made.

Release Element CDB Format

The RELEASE ELEMENT CDB format is shown in the following table.

Table 76 RELEASE ELEMENT CDB format

Bit / Byte	7	6	5	4	3	2	1	0
0	Op Code (17h)							
1	Logical Unit Number			3rdPrty	Third Party Device ID			Element
2	Reservation ID							
3	Reserved							
4								
5	Control							

3rdPrty – This field is not supported, and must be set to 0.

Third Party Device ID – This field is not supported, and must be set to 0.

Element – This field is not supported, and must be set to 0.

Reservation ID – This field is not supported, and must be set to 0.

Release Element (10) – 57h

What the Library Does With This Command

The library releases any outstanding reservation that had previously been made by the same initiator via the RESERVE command. Only whole logical unit reservations are allowed; individual element reservations are not supported.

This command is only supported if the library control path is provided by a tape drive.

Note — IO blades connected to drives configured with a control path may report certain library ready conditions differently than drives without a control path configured.

Command Usage

This command should be used to release the library from any reservations previously made.

Release Element CDB Format

The RELEASE ELEMENT CDB format is shown in the following table.

Table 77 RELEASE ELEMENT CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (57h)							
1	Logical Unit Number			3rdPrty	Reserved		LongID	Rsvd
2	Reserved							
3	Third Party Device ID							
4 : 6	Reserved							
7 : 8	MSB Parameter List Length LSB							
9	Control							

3rdPrty – This field is not supported, and must be set to 0.

LongID – This field is not supported, and must be set to 0 as IDs greater than 255 are not supported.

Third Party Device ID – This field is required and used only when the 3rdPrty bit is set. Since the 3rdPrty bit is not supported, this field must be set to 0.

Parameter List Length – This field is not supported, and must be set to 0.

Report LUNS – A0h

What the Library Does With This Command

The library will return a list of the logical units that it supports. When this command is sent to a DA blade controller device logical unit or media changer device logical unit, at LUN 0, it will return a list of all additional logical units that are available. This list will primarily be media changer devices representing the configured Logical Libraries. When this command is sent to any of the media changer device logical units, they will only report themselves.

Command Usage

This command can be used to retrieve what Logical Unit Numbers are supported to avoid scanning for all possible numbers. It is useful for identifying the various Logical Libraries that may be configured.

Report LUNS CDB Format

The REPORT LUNS CDB format is shown in the following table.

Table 78 REPORT LUNS CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (A0h)							
1	Reserved							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6 : 9	Allocation Length							
10	Reserved							
11	Control							

Allocation Length – This field must be set to a minimum of 10h (16 bytes) to retrieve information for at least a single LUN.

Report LUNS Response

Table 79 Report LUNS Response

Byte \ Bit	7	6	5	4	3	2	1	0
0 : 3	LUN List Length (n-7)							
4 : 7	Reserved							
8 : 15	First LUN							
n-7 : n	Last LUN							

LUN List Length – This field returns the length in bytes of the list of LUNs being returned.

LUN – These fields return each available assigned LUN. The information conforms to the Logical Unit Address Method defined in SCC-2, and supports only First Level addressing (for each LUN, only the second byte is used and contains the assigned LUN).

Request Sense – 03h

What the Library Does With This Command

The library returns eighteen bytes of sense data to the requesting initiator. The data is preserved until either the REQUEST SENSE command or any other command is received. The library can queue multiple Unit Attentions for processing.

Command Usage

This command should be issued whenever the initiator receives a CHECK CONDITION from the library. It should continue to be issued until all check conditions have been cleared.

Request Sense CDB Format

The REQUEST SENSE CDB format is shown in the following table.

Table 80 REQUEST SENSE CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (03h)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Allocation Length							
5	Control							

Allocation Length – This field specifies the number of sense bytes requested by the initiator.

Request Sense Response

Table 81 Request Sense Response

Byte \ Bit	7	6	5	4	3	2	1	0
0	Valid	Response Code (70h)						
1	Reserved							
2	Reserved				Sense Key			
3 : 6	Information							
7	Additional Sense Length (0Ah or 10h)							
8 : 11	Command Specific Information (0000 0000h)							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15	SKSV	C/D	Rsvd	Rsvd	BPV	Bit Pointer		
16	Field Pointer							
17								
18 : 23	Reserved							

Valid – The Valid field is set to 0 if the Information field is not valid. It is set to 1 if the Information field contains valid additional data as described below.

Response Code – The Response Code field is set to 70h to indicate that the library returns current errors.

Sense Key – Table 82 describes the Sense Key values.

Table 82 Sense Key

Sense Key	Description
0h	No Sense. No specific sense key information to report.
2h	Not Ready. The library is not ready to perform motion commands.
4h	Hardware Error. A hardware error was detected and operator intervention may be required.
5h	Illegal Request. The CDB or supplied parameter data contains an unsupported or illegal parameter.
6h	Unit Attention. The library operating status changed. Additional processing may be required.
Bh	Aborted Command. The library aborted the command.

Information – This field returns additional information for certain ASC/ASCQs where a specific device must be identified and the sense data is associated with a Unit Attention condition instead of a specific command. These are described as follows:

- If the ASC/ASCQ is related to Import/Export stations, then byte 6 indicates which I/E station it pertains to (1 to 4).
- If the ASC/ASCQ is related to a specific Data Transfer Element, then bytes 5 and 6 contain the element address of that element.
- If the ASC/ASCQ is related to Towers, then byte 6 indicates which Tower it pertains to (1 to n).

Additional Sense Length – This field specifies the number of additional sense bytes that follow this field. If the media changer device control path is hosted by a DA blade controller device, 0Ah (10 bytes) of additional sense data are returned. If the media changer device control path is hosted by a tape drive, 10h (16 bytes) of additional sense data are returned.

Command Specific Information – This field is not supported and returns 0000 0000h.

Additional Sense Code (ASC) – This field denotes a specific error condition. Additional information is provided in the Additional Sense Code Qualifier (ASCQ) field. Table 83 lists all the codes.

Additional Sense Code Qualifier (ASCQ) – This field provides additional information for the ASC. Refer to Table 83 for more information.

Field Replaceable Unit Code – This field is not used and returns zero.

Sense Key Specific Valid (SKSV) – This field returns a value of 1 if bytes 15-17 contain valid data for a Sense Key of Illegal Request (05h). Otherwise this field returns 0.

Command/Data (C/D) – A value of 1 indicates that the illegal parameter was detected in the CDB. It returns 0 if the illegal parameter was detected in the data parameters. This field only applies if SKSV is 1.

Bit Pointer Valid (BPV) – A value of 0 indicates that the Bit Pointer field is not valid. A value of 1 indicates that the Bit Pointer field is valid. This field only applies if SKSV is 1.

Bit Pointer – This field indicates which bit of the byte designated by the field pointer is in error. For a multi-bit field, it points to the most significant bit of the field. This field only applies if SKSV is 1.

Field Pointer – This field indicates which byte of the CDB or Parameter List (starting with byte zero) was in error. For a multi-byte field, the Field Pointer points to the most significant byte. This field only applies if SKSV is 1.

Additional Sense Codes and Qualifiers

The following table lists the Additional Sense Codes (ASC) and Additional Sense Code Qualifiers (ASCQ) associated with the reported Sense Keys. A sense key of 00h (no sense) has no ASC/ASCQ associated with it. A few ASC/ASCQs can be associated with more than one sense key. The sense keys that can give a particular ASC/ASCQ are indicated with an “x” in the appropriate column.

ASC/ASCQs that can indicate an abnormal element state as part of element descriptor information are shown in bold.

Table 83 Additional Sense Codes and Qualifiers

ASC	ASCQ	Sense Keys					Description
		2	4	5	6	B	
04h	00h	x					The library is not ready due to an unknown cause
04h	00h					x	LU Communication - SCSI Command Communication Failure
04h	01h	x					The library is becoming ready

Table 83 Additional Sense Codes and Qualifiers (Continued)

ASC	ASCQ	Sense Keys					Description
		2	4	5	6	B	
04h	03h	x					The library is not ready and a manual intervention is required
04h	12h	x					Logical unit not ready, offline
04h	83h	x					The library is not ready due to aisle power being disabled
04h	8Dh	x					The library is not ready because it is offline
08h	00h					x	LU Communication Failure
08h	01h					x	LU Communication – Timeout
08h	80h					x	LU Communication – SCSI Failure
08h	82h					x	LU Communication – SCSI Command Execution or Queuing Failure
08h	83h					x	LU Communication – SCSI Command Failed
08h	84h					x	LU Communication – SCSI Time-Out
08h	85h					x	LU Communication – SCSI Autosense Failed
08h	86h					x	LU Communication – SCSI Aborted
08h	87h					x	LU Communication – SCSI Abort Failed
08h	88h					x	LU Communication – SCSI Status Failed
08h	B0h					x	LU Communication – FC Data Underrun
08h	B1h					x	LU Communication – FC DMA Error
08h	B2h					x	LU Communication – FC Reset
08h	B3h					x	LU Communication – FC Data Overrun
08h	B4h					x	LU Communication – FC Queue Full
08h	B5h					x	LU Communication – Port Unavailable
08h	B6h					x	LU Communication - Port Logged Out
08h	B7h					x	LU Communication - Port Configuration Changed
15h	01h		x				A mechanical positioning error occurred
1Ah	00h			x			Parameter list length error
1Bh	00h					x	Synchronous data transfer error
20h	00h			x			Illegal opcode in CDB
21h	01h			x			Invalid element address in CDB
24h	00h			x			Invalid field in CDB
25h	00h			x			Illegal LUN
26h	00h			x			Invalid field in Parameter List

Table 83 Additional Sense Codes and Qualifiers (Continued)

ASC	ASCQ	Sense Keys					Description
		2	4	5	6	B	
26h	04h			x			Invalid release of persistent reservation
28h	00h				x		Not Ready to Ready change, element status may have changed
28h	01h				x		Insert/Eject station opened and closed
29h	00h				x		Power-on or reset occurred
29h	01h				x		Power on occurred
29h	03h				x		Device reset occurred
29h	04h				x		Internal reset occurred
29h	07h					X	Nexxus loss occurred
2Ah	01h				x		Mode parameters have been changed
2Ah	03h				x		Reservations preempted
2Ah	04h				x		Reservations released
2Ah	05h				x		Registrations preempted
2Ch	00h			x			Command sequence error
30h	**00h**			x			Incompatible medium installed
39h	00h			x			Saving parameters not supported
3Bh	0Dh		x	x			The destination element is full
3Bh	0Eh		x	x			The source element is empty
3Bh	**12h**			x			Media magazine not installed
3Bh	**1Ah**			x			Data transfer device removed
3Bh	**A0h**			x			Media type does not match destination media type
3Eh	00h	x					Logical Unit has not self-configured yet
3Fh	01h				x		New firmware loaded
3Fh	03h				x		Inquiry data changed
3Fh	0Fh		x				Echo buffer overwritten
40h	**80h**		x				Component failure
43h	00h					x	Message error
44h	00h		x			x	Firmware detected an internal logic failure
45h	00h					x	Select or reselect failure
47h	00h					x	SCSI parity error
48h	00h					x	Initiator detected error message received

Table 83 Additional Sense Codes and Qualifiers (Continued)

ASC	ASCQ	Sense Keys					Description
		2	4	5	6	B	
49h	00h					x	Invalid message error
4Ah	00h					x	Command phase error
4Bh	00h					x	Data phase error
4Eh	00h					x	Overlapped commands attempted
53h	00h		x				A drive did not load or unload a tape
53h	**01h**		x	x			A drive did not unload a cartridge
53h	**02h**			x			Medium removal prevented
53h	**81h**			x			Insert/Eject area element open for operator access
53h	82h		x				Cannot lock the I/E station
53h	83h		x				Cannot unlock the I/E station
83h	**00h**		x				Label too short or too long
83h	**02h**			x			Barcode label questionable
83h	**03h**			x			Cell status and barcode label questionable
83h	**04h**			x			Data transfer element not installed
83h	**05h**			x			Data transfer element offline or varied off and not accessible for library operations
83h	**06h**			x			Element temporarily inaccessible for library operations

Request Volume Element Address - B5h

What the Library Does With This Command

The library returns element descriptors that match the request made through a SEND VOLUME TAG command. Each element address will only be reported once in response to a SEND VOLUME TAG request. Multiple REQUEST VOLUME ELEMENT ADDRESS commands may be used to retrieve all the elements. If no elements match the SEND VOLUME TAG request, or all elements have already been reported, the response will only contain the volume element address header.

Command Usage

This command is used to receive the results of a SEND VOLUME TAG command.

Request Volume Element Address CDB Format

The REQUEST VOLUME ELEMENT ADDRESS CDB format is shown in the following table.

Table 84 REQUEST VOLUME ELEMENT ADDRESS CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (B5h)							
1	Logical Unit Number			VolTag	Element Type Code			
2	Starting Element Address							
3								
4	Number of Elements							
5								
6	Reserved							
7 : 9	Allocation Length							
10	Reserved							
11	Control							

Volume Tag (VolTag) - This field indicates whether the volume tag (bar code label) information should be returned. A value of one will return the labels, a value of zero will not.

Element Type Code - This field specifies the element types selected for the returned information, as shown in the following table.

Table 85 Element Type Code

Code	Selected Element Type
0000b (0)	All element types reported
0001b (1)	Medium transport element (accessor)
0010b (2)	Storage element
0011b (3)	Import/Export element
0100b (4)	Data transfer element (drives)

Starting Element Address - This field specifies the minimum element address to report. Only elements with an element type code specified by the Element Type Code field, and with an address greater than or equal to the starting element address will be reported. The starting element address must be a valid element address, but not have to be within the range specified by the Element Type Code field.

Number of Elements - This field specifies the maximum number of element descriptors to return. Only those descriptors that can be completely transferred within the allotted allocation length will be returned.

Allocation Length - This field specifies the byte length allowed for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until one of the following conditions are met:

- All available element descriptors have been returned
- The number of element descriptors specified in the Number of Elements field have been returned
- The number of bytes specified in the Allocation Length field have been returned
- There is less allocation length space available than is required by the next complete element descriptor

Request Volume Element Address Response

Element status data consists of an eight-byte header, followed by one or more element status pages (per element type). Each element status page consists of a header, followed by one or more element descriptor blocks. A complete response then looks like:

```
Element Status Header
      Element Status Page Header (first element type)
            Element Descriptor
            …(more descriptors)…
            Element Descriptor
      …(more status pages)…
      Element Status Page Header (next element type)
            Element Descriptor
            …
            Element Descriptor
```

There are only up to four Element Status Pages, one for each element type. The element status pages are identical to those described for the READ ELEMENT STATUS command in Element Status Page. The element descriptors within each page are also the same as those described for READ ELEMENT STATUS in Element Descriptors.

One header is returned for each REQUEST VOLUME ELEMENT ADDRESS command. The format is shown in the following table.

Table 86 Element Status Header

Byte \ Bit	7	6	5	4	3	2	1	0
0	First Element Address Reported							
1								
2	Number of Elements Available							
3								
4	Reserved				Send Action Code (5h)			
5 : 7	Byte Count of Report Available							

First Element Address Reported - This field indicates the lowest element address found that meets the CDB request.

Number of Elements Available - This field indicates the number of elements found that meet the CDB request.

Send Action Code – This field contains the action code that was sent in the SEND VOLUME TAG command. The value is 5h.

Byte Count of Report Available - This field indicates the number of available element status bytes that meet the CDB requirements. The value does not include the eight-byte element status header, and is not adjusted to match the value specified in the Allocation Length field of the CDB. This facilitates first issuing a REQUEST VOLUME ELEMENT ADDRESS command with an allocation length of eight bytes in order to determine the allocation length required to transfer all the element status data specified by the command.

Reserve Element (6) - 16h

What the Library Does With This Command

The library reserves the entire library for the initiator making the request. Only whole logical unit reservations are allowed; individual element reservations are not supported. The reservation remains in effect until either the initiator that made the reservation sends a RELEASE command, or a reset or power-cycle of the library occurs.

Command Usage

This command should be used to reserve the library for extended operations, such as issuing a SEND VOLUME TAG followed by a REQUEST VOLUME ELEMENT ADDRESS sequence. Initiators issuing a RESERVE should follow it with a RELEASE when the extended operation sequence is complete.

Reserve Element CDB Format

The RESERVE ELEMENT CDB format is shown in the following table.

Table 87 RESERVE ELEMENT CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (16h)							
1	Logical Unit Number			3rd Party	Third Party Device ID			Element
2	Reservation ID							
3	Reserved							
4								
5	Control							

3rdPrty – This field is not supported, and must be set to 0.

Third Party Device ID – This field is not supported, and must be set to 0.

Element – This field is not supported, and must be set to 0.

Reservation ID – This field is not supported, and must be set to 0.

Reserve Element (10) - 56h

What the Library Does With This Command

The library reserves the entire library for the initiator making the request. Only whole logical unit reservations are allowed; individual element reservations are not supported. The reservation remains in effect until either the initiator that made the reservation sends a RELEASE command, or a reset or power-cycle of the library occurs.

This command is only supported if the library control path is provided by a tape drive.

Note — IO blades connected to drives configured with a control path may report certain library ready conditions differently than drives without a control path configured.

Command Usage

This command should be used to reserve the library for extended operations, such as issuing a SEND VOLUME TAG followed by a REQUEST VOLUME ELEMENT ADDRESS sequence. Initiators issuing a RESERVE should follow it with a RELEASE when the extended operation sequence is complete.

Reserve Element CDB Format

The RESERVE ELEMENT CDB format is shown in the following table.

Table 88 RESERVE ELEMENT CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (57h)							
1	Logical Unit Number			3rdPrty	Reserved		LongID	Rsvd
2	Reserved							
3	Third Party Device ID							
4 : 6	Reserved							
7 : 8	MSB Parameter List Length LSB							
9	Control							

3rdPrty – This field is not supported, and must be set to 0.

LongID – This field is not supported, and must be set to 0 as IDs greater than 255 are not supported.

Third Party Device ID – This field is required and used only when the 3rdPrty bit is set. Since the 3rdPrty bit is not supported, this field must be set to 0.

Parameter List Length – This field is not supported, and must be set to 0.

Send Diagnostic - 1Dh

What the Library Does With This Command

If the Self Test option is requested, the library executes a pre-defined diagnostic.

Command Usage

This command can be used to verify the operational status of the library and its components.

Send Diagnostic CDB Format

The SEND DIAGNOSTIC CDB format is shown in the following table.

Table 89 SEND DIAGNOSTIC CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (1Dh)							
1	Logical Unit Number			PF	Rsvd	SelfTest	DevOfl	UnitOfl
2	Reserved							
3	Parameter List Length							
4								
5	Control							

Page Format (PF) – Diagnostic pages are not supported and this field should be set to 0.

SelfTest - When set to 1 the library will perform a predefined self-test. The SEND DIAGNOSTIC command will not return until this completes, and command completion status will indicate the results of this test. When set to 0, the self-test is not performed.

Device Offline (DevOfl) - This field is not supported and should be set to 0.

Unit Offline (UnitOfl) - This field is not supported and should be set to 0.

Parameter List Length - This field is not supported and should be set to 0.

Send Volume Tag - B6h

What the Library Does With This Command

The library searches its existing inventory for barcode labels that match the volume tag template passed in with this command. The results of this search can then be retrieved through sending a subsequent REQUEST VOLUME ELEMENT ADDRESS command.

Command Usage

This command can be used to search for specific cartridges or ranges of cartridges within the library. A REQUEST VOLUME ELEMENT ADDRESS command must be sent to retrieve the results of the search. The results only reflect those of the most recent SEND VOLUME TAG command.

Send Volume Tag CDB Format

The SEND VOLUME TAG CDB format is shown in the following table.

Table 90 SEND VOLUME TAG CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (B6h)							
1	Logical Unit Number			Rsvd	Element Type Code			
2	Starting Element Address							
3								
4	Reserved							
5	Reserved			Send Action Code				
6	Reserved							
7								
8	Parameter List Length							
9								
10	Reserved							
11	Control							

Element Type Code - This field specifies the element types selected for the search, as shown in the following table.

Table 91 Element Type Code

Code	Selected Element Type
0000b (0)	All element types reported
0001b (1)	Medium transport element (accessor)
0010b (2)	Storage element
0011b (3)	Import/Export element
0100b (4)	Data transfer element (drives)

Starting Element Address - This field specifies the minimum element address to begin the search. Only elements with an element type code specified by the Element Type Code field, and with an address greater than or equal to the starting element address will be searched.

Send Action Code – This field must be set to 5h to indicate translate and search primary volume tags and ignore sequence numbers. No other action codes are supported.

Parameter List Length – This field is either set to 0 to indicate that no parameter data is sent, or 28h (40) to indicate a Volume Identification Template is sent. A value of 0 is not considered an error.

Volume Identification Template Parameter

The Volume Identification Template parameter is shown in the following table.

Table 92 Volume Identification Template Parameter

Bit / Byte	7	6	5	4	3	2	1	0
0 : 31	Volume Identification Template							
32 : 39	Reserved							

Volume Identification Template – This field specifies the template to apply for the search. Two wildcard characters are supported as follows:

- '?' – Will match any single character.
- '*' – Will match any string of characters. When it appears in the template the remainder of the template at higher offsets in the field is not used.

Test Unit Ready (00h)

What the Library Does With This Command

The library returns status based on its current mode and state. These are defined in the following table.

Table 93 Test Unit Ready statuses

Mode	State	Status
Online	Ready	Good
Online	Not Ready	Check Condition
Offline	Ready	Check Condition
Offline	Not Ready	Check Condition

It will also return any pending Unit Attentions regardless of the current mode and state, to convey changes within the subsystem, such as I/E station accesses, door openings, etc. The various types of Unit Attention conditions are listed in the Request Sense command section in Table 83 on page 83.

Command Usage

The TEST UNIT READY command allows the initiator to verify that the library is ready to accept commands or perform motion tasks. It is a suitable command for general polling to monitor the library, and receive information via Unit Attentions on any changes within the library.

Test Unit Ready CDB Format

The TEST UNIT READY CDB format is shown in the following table.

Table 94 TEST UNIT READY CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (00h)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

Write Buffer (3Bh)

What the Library Does With This Command

The library will receive a requested buffer of data and write it to the appropriate internal storage.

Command Usage

This command can be used primarily for enhanced domain validation (using the echo buffer mode). The initiator can either transfer the data with a single WRITE BUFFER command, or it can also transfer it in blocks utilizing offsets into the buffer.

Write Buffer CDB Format

The WRITE BUFFER CDB format is shown in the following table.

Table 95 WRITE BUFFER CDB format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Op Code (3Bh)							
1	Logical Unit Number			Rsvd	Mode			
2	Buffer ID							
3 : 5	Buffer Offset							
6 : 8	Parameter List Length							
9	Control							

Mode – The supported modes are:

- 2h – Data
- Ah – Echo Buffer

In *Data Mode*, an amount of data specified by the Parameter List Length is targeted for the buffer defined by the Buffer ID field, starting at the specified Buffer Offset. Buffer IDs are assigned beginning with zero, and are assigned contiguously. Buffer ID code assignments for the WRITE BUFFER command are the same as for the READ BUFFER command.

In *Echo Buffer Mode*, the amount of data specified by the Parameter List Length is transferred from the initiator to the echo buffer. The Buffer ID and Buffer Offset fields are ignored in this mode.

Note: The Echo Buffer is supported only if the library control path is provided by a tape drive.

Buffer ID – This field specifies which buffer the request is for. The IDs are the same for both the READ BUFFER and WRITE BUFFER commands. The IDs supported by the library, along with their primary use, are listed in Table 64 on page 66.

Buffer Offset – This field indicates the starting location (byte offset) within the specified buffer to write data. The initiator should conform to the offset boundary requirements returned in the READ BUFFER descriptor described in “Read Buffer Response.”

Parameter List Length – If applicable, this field should be set to indicate the amount of data being written.