XLS Series of Tape Libraries

Interface Manual

Document No. 501611 Rev. 07-01-19

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Notices

Qualstar products are covered by one or more of the following patents: 6,271,982 and 6,560,061. Other patents pending.

Qualstar equipment is manufactured from new parts, or new and used parts. In some cases, Qualstar equipment may not be new and may have been previously installed. Regardless, Qualstar's warranty terms apply unless the equipment is specifically identified by Qualstar as "used" or "refurbished."

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Shielded cables are required for this device to comply with FCC Rules. Use shielded cables when connecting this device to others.

European Union Directive 89/336/EEC and Standard EN55022 (Electromagnetic Compatibility)

This product has been tested and is certified to be compliant with the Class A provisions of the U.S., Canadian, and European standards for electromagnetic compatibility (EMC).

European Directive on Waste Electrical and Electronic Equipment (WEEE)

Qualstar encourages its customers to use current recycling practices in order to reduce the burden that waste electronic products place on the environment.

If you are retiring a fully functional tape library, you are encouraged to transfer the functional unit to a new user, thereby extending the useful life of the tape library. The manufacture of all products requires the consumption of energy. By extending the life of the tape library, energy is conserved.

In accordance with environmental directives that are being implemented in many countries (refer to the European Directive on Waste Electrical and Electronic Equipment - WEEE), Qualstar provides customers with **"End of Life Instructions"** that identify the process for recycling the materials and components that make up a Qualstar tape library.

End of Life Instructions

Tools required

- P1 and P2 Phillips head screwdrivers
- T20 Torx head screwdriver
- Hex head (Allen) wrench/driver set
- 1/4-inch hex nut driver

Disassembly procedure

1. Remove the doors.
2. Remove the front panel.
3. Remove the external side panels.
4. Remove the internal subassemblies.

Items recyclable using conventional methods

- **Aluminum:** Front panel, exterior side and rear panels, robotics, cartridge and drive bays, carousel and shroud panels
- **Stainless steel:** Robot guides
- **Steel:** Frames, fasteners
- **Plastic:** Windows, cartridge magazines, tape cassettes
- **Copper:** Internal wiring, motors, SCSI cables
- **Paper:** Manuals

Items requiring special disposal due to lead-based solder

- **Printed circuit boards:** Controller card, miscellaneous small printed circuit boards

Items that may have salvage or resale value

- Tape drives
- EMI line power filter

Reduction of Hazardous Substances (RoHS)

Qualstar is committed to the implementation of RoHS (Restriction of the use of certain hazardous substances in electrical and electronic equipment) in accordance with the European Directive. The effectivity date for compliance is July 1, 2006, at which time Qualstar will certify that its tape library products are compliant with the RoHS standard. With the exception of lead-based solder, Qualstar will certify that its products are free of all other substances listed in the Directive.

Qualstar tape libraries fall under the category of "Information Technology Storage Array Systems" for which the RoHS Directive provides for a lead solder exemption until the year 2010. Insofar as lead-free solders are new to the electronics industry and no quality or reliability data is available, Qualstar will invoke the lead-based solder exemption until such time as industry data verifies that lead-free solders are capable of meeting or exceeding the documented reliability and quality standards achieved with lead-based solders.

Until such time as Qualstar replaces lead-based solder with lead-free solder, affected subassemblies must be disposed of appropriately.

Technical Support

The best source for service-related information is your system reseller. Alternately, you can reach the Qualstar Technical Support Department at:

Qualstar Corporation
1267 Flynn Road
Camarillo, CA 93012

Monday - Friday 7:00 a.m. to 4:00 p.m. PST
Phone: (805) 416 - 7055
Toll Free: (877) 886-2758

E-mail: support@qualstar.com
E-mail: sales@qualstar.com

www.qualstar.com

Table of Contents

Notes:

1 About This Manual

This manual provides reference information for creating and modifying device drivers and software applications to control the operation of the Qualstar® XLS Library. It is intended for use by software developers and system integrators who have an understanding of the Small Computer Systems Interface (SCSI). This manual describes the XLS's implementation of the ANSI SCSI-3 standard.

> **Important:** Although Qualstar has made every effort to ensure the accuracy of the information contained in this manual, no guarantee is expressed or implied that the manual is error free. Qualstar reserves the right to make changes at any time without prior notification.

1.1 How This Manual is Organized

Table 1-1 is a quick reference for locating the information in this manual.

Refer to...	For...
Chapter 2, "About the XLS Library"	General description of XLS features and functions.
Chapter 3, "General Information"	General information about how the XLS implements SCSI command and messages.
Chapter 4, "Modifying Qualstar Device Drivers for the XLS"	A summary of the differences between how the XLS supports SCSI and how the Qualstar RLS library supports SCSI.
Chapter 5, "Initialize Element Status - 07h" through Chapter 24, "Test Unit Ready - 00h"	Descriptions of how the XLS implements SCSI commands. Each chapter includes field definitions for the command descriptor block (CDB), any additional pages, and any returned data. The chapters conclude with error information for each command as required.
Appendix A, "Using the I/O Port"	Information about using the I/O port to import and export cartridges from the library.
"Glossary"	Definitions of the specialized terminology used in this manual.
" Index"	Alphabetized quick reference for specific topics and terms.

Table 1-1 Information included in the *XLS Library Interface Manual*

1.2 Conventions Used in This Manual

This section lists the terminology and organizational conventions used in this manual.

1.2.1 Specialized Terminology

This manual uses the following specialized terminology; for more information about these concepts, refer to Section 3.1 on page 3-1.

Cartridge slot Any of the locations in the XLS that can store a cartridge. A cartridge slot is referred to as a *storage element* in the SCSI standard.

Handler The library assembly that includes the gripper mechanism and the barcode reader. The handler moves side to side on the x-axis, up and down on the y-axis, and in and out on the z-axis. It rotates on the theta-axis. The handler is referred to as a *medium transport element* in the SCSI standard.

Logical library One of up to eight partitions of the XLS physical library. Logical libraries ensure that each software application has dedicated and secure access to its own tape drives, cartridge slots, and physical I/O ports. All logical libraries share the handler on a first-come, first-served basis.

Logical I/O port: All physical I/O ports that have been assigned to the logical library. A logical library can control zero, one, or more physical I/O ports. It cannot share physical I/O ports with any other logical library partition.

Medium changer The library's SCSI controller. The medium changer responds to SCSI commands sent by initiators (software applications) to return status and inventory information and to move cartridges.

Physical I/O port One of up to four openings on the front of the library through which cartridges can be inserted or removed without exposing internal library components. Each I/O port contains a removable magazine with 10 cartridge slots; each slot is referred to as an *import/export element* in the SCSI standard.

Physical library The entire XLS, including all tape drives, cartridge slots, robotics, and physical I/O ports.

Tape drive A device used to write and read data. In the XLS, tape drives are mounted in drive carriers, which slide into a drive bay. Tape drives are referred to as *data transfer elements* in the SCSI standard.

Refer to the "Glossary" for the definitions of other specialized terminology.

1.2.2 Hexadecimal and Binary Notation

Unless otherwise specified, all numerical references are decimal. Binary numbers are indicated by a *b* (for example, 01b), and hexadecimal numbers are indicated by an *h* (for example, 1A3h).

1.2.3 Notices

Important notices and notes provide additional information and tips, as described below:

> **Important:** Important notices provide tips for completing a procedure or information that is essential to the understanding of a topic.

Note: Notes provide additional information related to the topic being discussed

1.3 For More Information

This section provides information about related manuals and standards and how to contact Qualstar.

1.3.1 Qualstar XLS Library Documentation

For additional information about the XLS, refer to the Qualstar documents listed in Table 1-2.

Subject	Document	Document Number
Library specifications	*XLS Library Product Specification*	501600
Installation	*XLS Library Installation Manual*	501601
Administration and operation	*XLS Library User's Guide*	501603
Service	*XLS Library Technical Service Manual*	501610
Barcode label specification	*Barcode Label Specification for the Qualstar XLS Library*	PIN-043
Approved data cartridges	*Approved Data Cartridges*	PIN-041

Table 1-2 Qualstar XLS Library documentation

Note: For information about the tape drives within the library, refer to the documentation provided by the tape drive manufacturer.

1.3.2 Standards

Table 1-3 lists the standards used to develop the XLS interface.

Subject	Standard
SCSI-3 architecture model	ANSI X3.270-1995, *SCSI-3 Architecture Model (SAM)*
SCSI-3 primary command set	ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*
SCSI-3 medium changer command set	ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*
Parallel SCSI	ANSI X3.302-1998, *SCSI Parallel Interface-2 (SPI-2)*
Fibre Channel	ANSI X3.269:1996, *Fibre Channel Protocol (FCP)*
TapeAlert	T10/02-142r0, *TapeAlert Diagnostic Specification v3*, Hewlett-Packard Company (available from www.t10.org)

Table 1-3 Related standards

1.3.3 Contacting Qualstar

If you have questions about the XLS, contact your authorized reseller or Qualstar at the address below.

Qualstar Corporation
130 W. Cochran St; Suite C
Simi Valley, CA 93065

Monday - Friday 7:00 a.m. to 4:00 p.m. PST
Phone: (877) 886-2758
Phone: (805) 583-7744

E-mail: support@qualstar.com
E-mail: sales@qualstar.com

www.qualstar.com

2 About the XLS Library

This chapter provides an introduction to the Qualstar XLS Library. It describes the major components of the Library Resource Module (LRM) and the Media Expansion Module (MEM).

2.1 Product Overview

The Qualstar XLS family of enterprise-class tape libraries combines an efficient design with an intelligent system architecture. XLS libraries are designed to accommodate customer storage needs now and in the future.

The XLS uses two building blocks: the Library Resource Module (LRM) and the Media Expansion Module (MEM). The LRM is a fully featured unit that contains the control electronics, the power system, the robotic handler, the tape drives, the I/O ports, and a variable number of cartridge slots. The optional MEM is a rotary tape carousel that derives its power, control, and cartridge handling from an attached LRM.

The LRM accommodates up to 32 tape drives, up to 705 cartridges, and up to four 10-slot I/O ports. Because tape drive and cartridge storage areas within the LRM are interchangeable, the library offers an extremely wide range of cartridge-to-drive ratios.

The LRM can be expanded by adding one or two MEMs, with each MEM holding an additional 1,075 cartridges. A single MEM can also be shared between two LRMs, and groups of LRMs and MEMs can be linked together to form even larger systems. The high-density design can provide up to 90 tapes per square foot of floor space.

A system controller within the LRM oversees the operation of the robotics, tape drives, and power supplies of all interconnected units. It also provides the X-Link interface, which can be accessed locally using the touch screen or remotely across a LAN or the Internet. Remote management is also supported over Ethernet using SNMP. Access to the control functions of the XLS is protected by user names and passwords.

Resources in the XLS can be subdivided into as many as eight independent logical library partitions, with each partition controlled across its own host connection. Initial interface offerings include parallel SCSI and Fibre Channel.

2.2 Library Resource Module (LRM)

Shown in Figure 2-1 (front view), Figure 2-2 (inside view), and Figure 2-3 (rear view), the LRM contains the following components and features:

- Controller/power bay (see Section 2.2.1 on page 2-4)
- System controller (see Section on page 2-4)
- Touch screen and X-Link interface (see Section 2.2.2 on page 2-7)
- Handler and barcode reader (see Section 2.2.3 on page 2-9)
- Tape drives (see Section 2.2.4 on page 2-10)
- I/O ports (see Section 2.2.5 on page 2-12)
- Cartridge slots (see Section 2.2.6 on page 2-13)
- Lockable doors and other security features (see Section 2.2.7 on page 2-15)
- Optional equipment rack (see Section 2.2.8 on page 2-16)

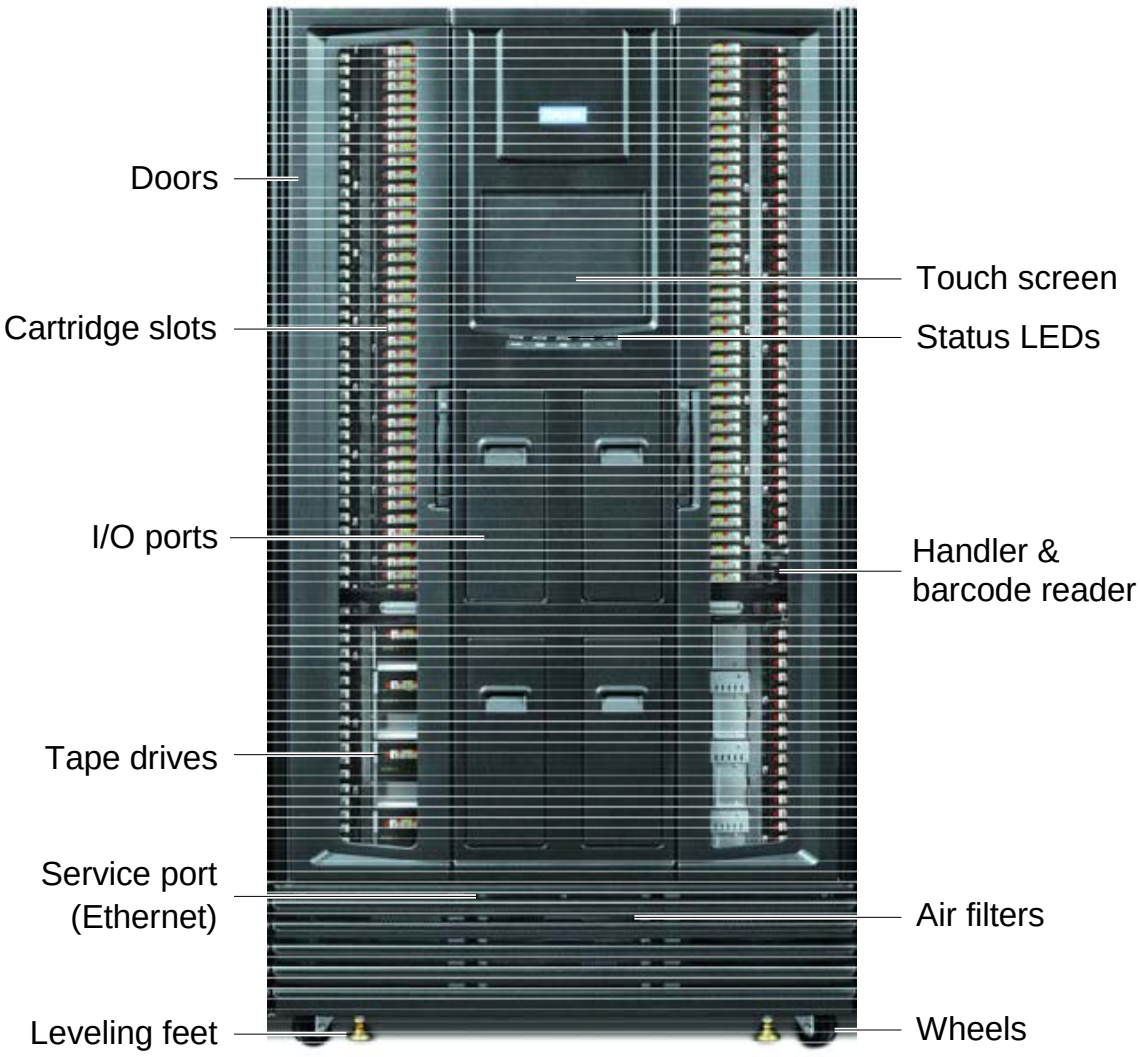

Figure 2-1 Front view of the LRM

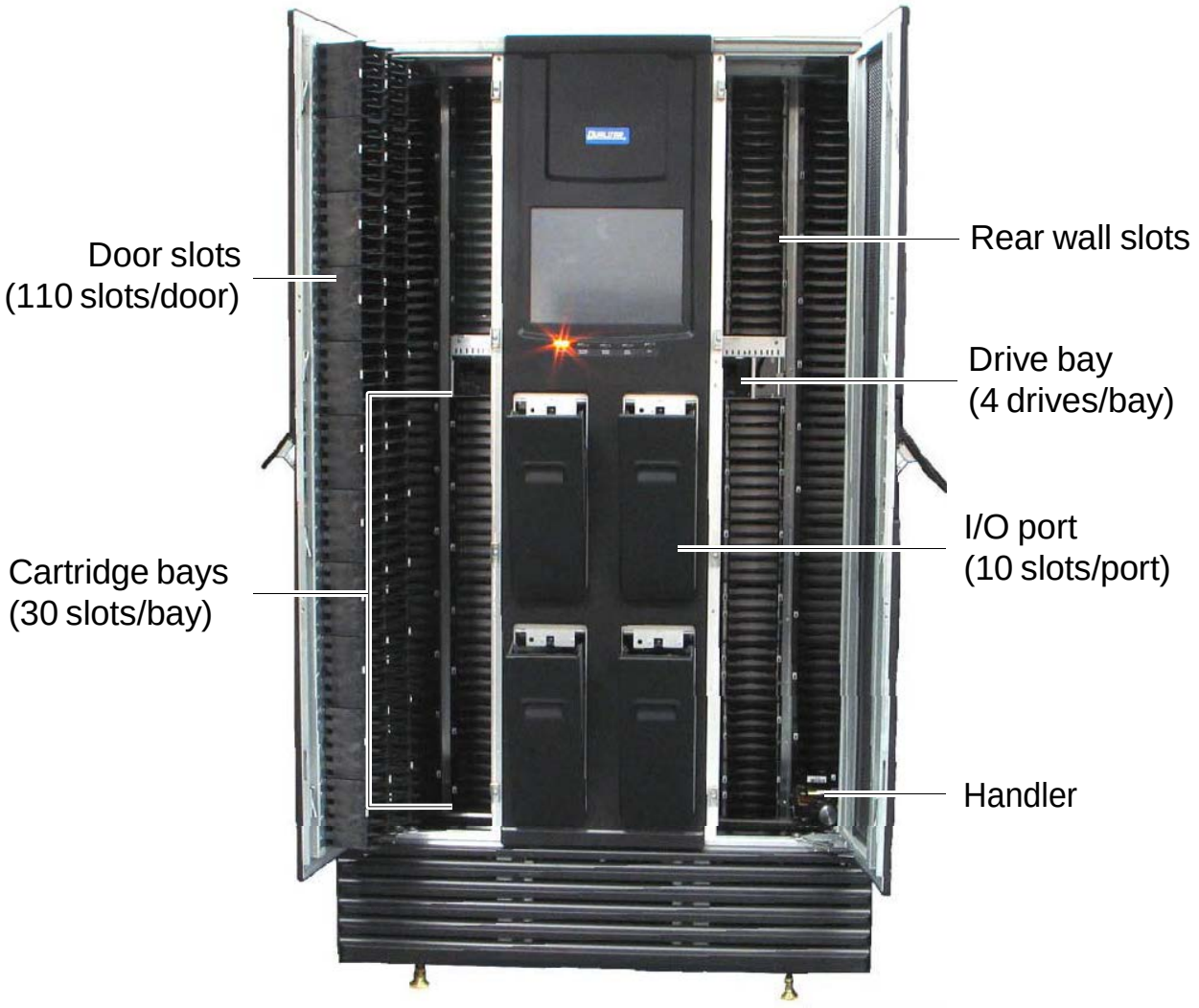

Figure 2-2 Inside view of LRM (I/O ports shown open)

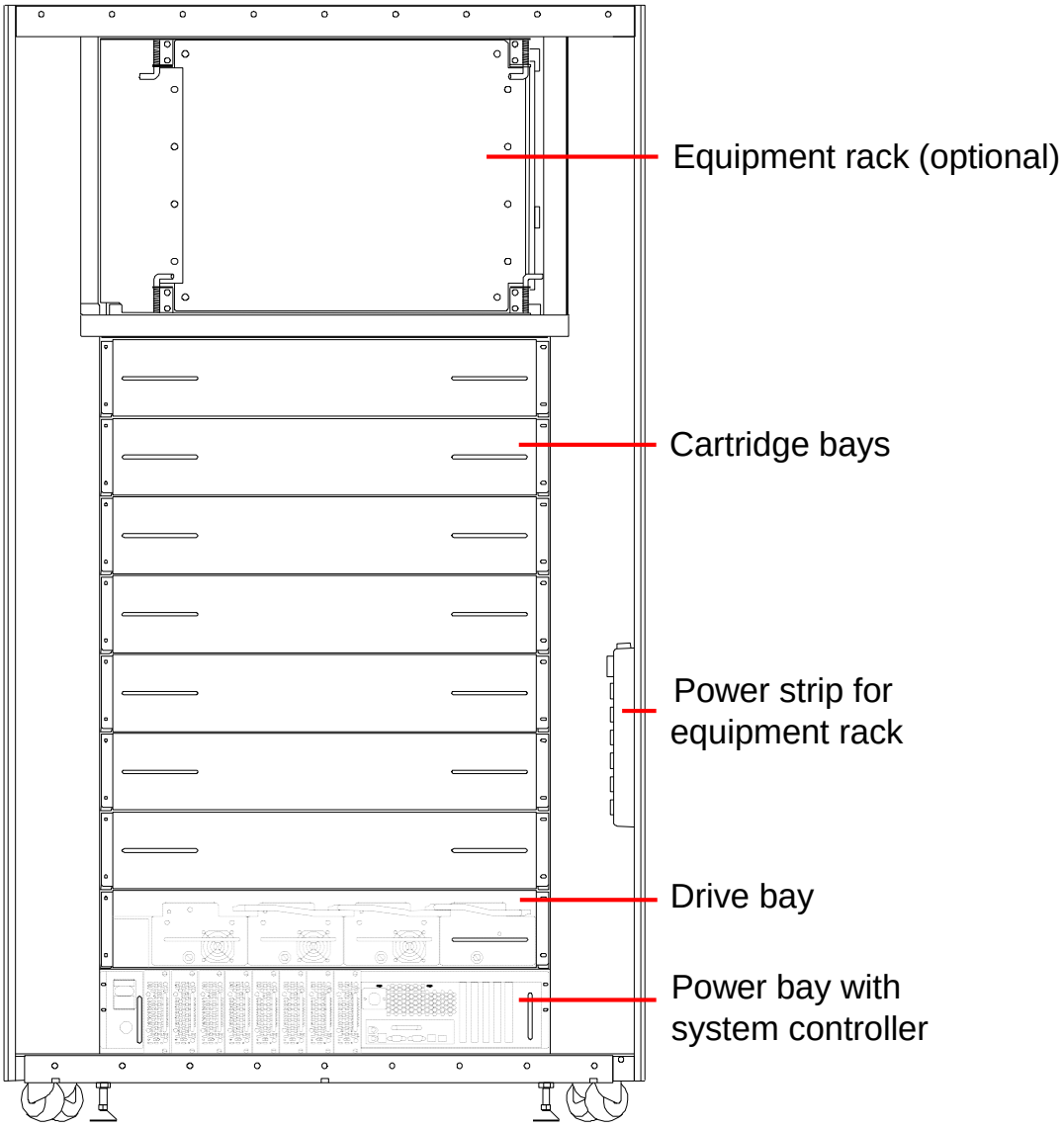

Figure 2-3 Rear view of the LRM

2.2.1 Controller/Power Bay

Figure 2-3 shows the location of the controller/power bay at the rear of the LRM. The controller/power bay houses the system controller and the power components.

System Controller

Shown in detail in Figure 2-4, the system controller is a PC-based computer and includes two hot-swappable cooling fans. Using custom XLS software, the system controller:

- Controls the operation of the robotics, sensors, power supplies, and any attached MEMs

- Manages all communications between the XLS and the host applications
- Maintains an up-to-date cartridge inventory
- Hosts the X-Link interface
- Provides a control interface to the tape drives for configuration, diagnostics, and servicing

The system controller slides in and out of the LRM to allow easy access to the host bus adapter cards (HBAs) and cooling fans.

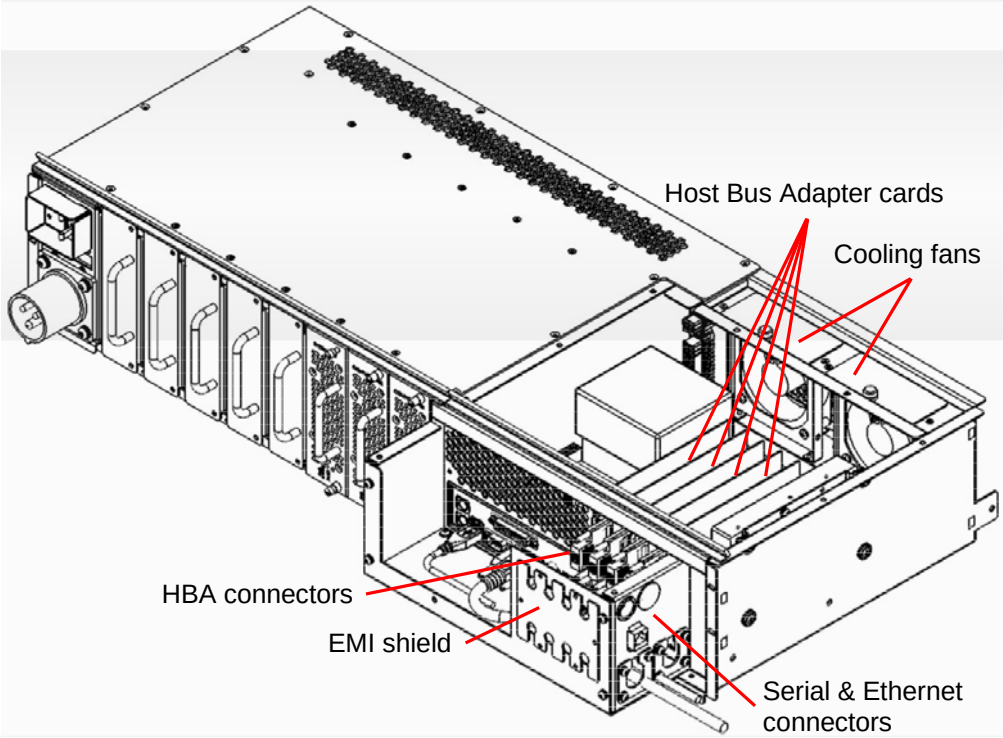

Figure 2-4 Controller/power bay showing system controller components

Power Components

Shown in detail in Figure 2-5, XLS power components include the following:

- **Main power disconnect switch.** The single disconnect switch for the library is a 20-amp circuit breaker. When this switch is shut off, all XLS functions (except any rack-mounted equipment) are immediately powered down.
- **AC power connector.** The power connector is a single-phase, 100 to 240 volt service connection. A single North American or international power cord is provided to power both the LRM and any attached MEMs.

- **Power supplies.** One to seven removable power supply modules provide power to all components within the LRM, the tape drives, and any attached MEMs. N+1 power redundancy is standard. Power module status is monitored by X-Link and alerts are issued if necessary.

The controller/power bay and individual power supplies slide in and out of the back of the LRM for servicing.

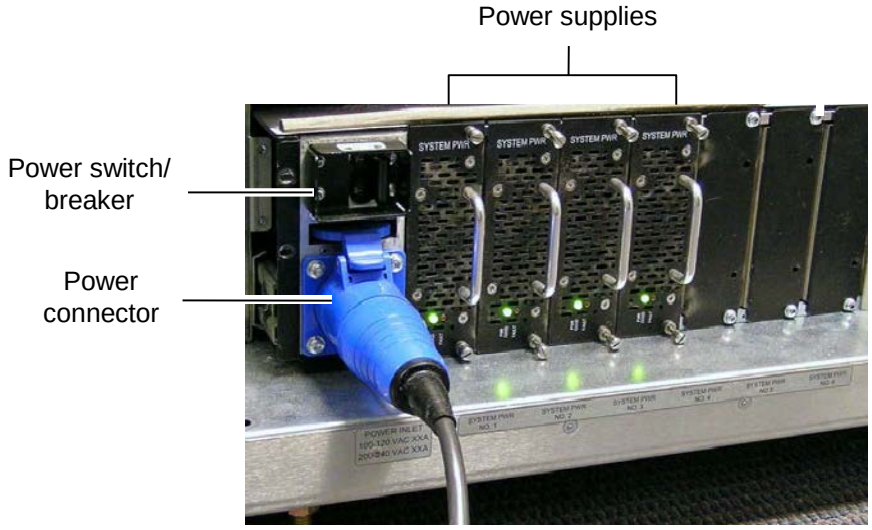

Figure 2-5 Power supplies and power connector

Ethernet Connectors

The system controller includes two Ethernet connectors for communication across 10/100 Base-T Ethernet networks. One of the Ethernet connectors allows the XLS to be connected to a customer network for remote managing and monitoring of XLS functions; the other Ethernet connector (service port) allows the XLS to be connected directly to a laptop or other standalone computer to facilitate local configuration and service operations.

The XLS supports remote management over a LAN or the Internet using the standard SNIA Storage Media Library SNMP MIB and CIM/WBEM protocols (currently not implemented).

Host Bus Adapter Cards

The system controller includes expansion slots for up to four host bus adapter cards (HBAs). Each HBA has two ports, allowing the medium changer interface in the XLS to be concurrently connected to up to eight independent computers. The XLS supports SCSI and Fibre Channel HBAs.

> **Important:** The HBAs in the system controller manage the XLS's medium changer interface only; they do not control or communicate with the tape drives or move data.

Cooling Fans and Air Filters

Two cooling fans in the system controller draw air in through the grille and air filters on the front of the LRM and ventilate it out through the back. (Individual fans are also included in each tape drive assembly and power supply module.) Sensors can detect a failed fan, causing e-mail or pager alerts to be issued to specified users. A calendar-based reminder can be e-mailed to designed maintenance personnel when air filter replacement is due.

Both the system controller fans and the air filters are easily changed without interrupting XLS operations.

2.2.2 Touch Screen and X-Link

Each LRM includes a 15-inch, color touch screen, shown in Figure 2-1. The browser-based X-Link interface can be accessed locally from the touch screen or remotely by using one of the Ethernet connectors to attach the XLS to a LAN or the Internet. The interface and available functions are the same regardless of how they are accessed.

Permission to access X-Link is maintained and configured by an administrator. Access is password protected.

X-Link Home Page

Shown in Figure 2-6, the X-Link Home page provides information for about library status as well as a summary of each logical library partition. It also provides an access point to the following library management tasks:

- **Logical library tasks,** including modifying and monitoring the resources (cartridges, tape drives, and I/O ports) assigned to each logical library partition, editing administrator information, and monitoring events.
- **Physical library tasks,** including viewing hardware status, moving cartridges, managing tape drives, locking and unlocking doors, and shutting down the library.

- **Configuration tasks,** including managing administrator and network connection information.
- **User and user group tasks,** including adding and modifying information about library users and setting up permissions for different user groups.
- **Settings and policies tasks,** including managing e-mail, SNMP, and event log settings.
- **Event tasks,** including viewing the library's event log.
- **Service tasks,** including performing diagnostics, uploading and installing firmware and other files, and performing audits

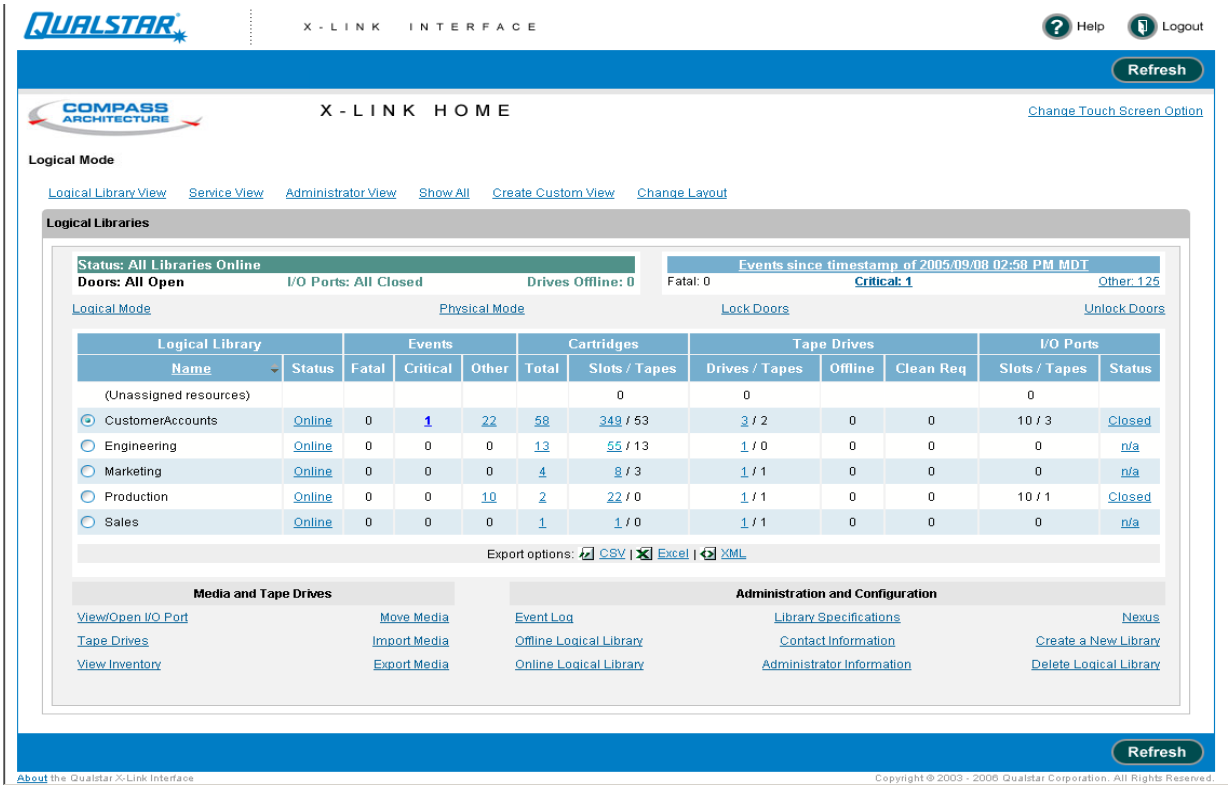

Figure 2-6 X-link Home page (Logical Libraries View selected)

A context-sensitive, searchable help system is available from every page and provides detailed information about each option.

LEDs

Located directly below the touch screen, the five status LEDs indicate the library's operational status at a glance. See Figure 14-1 on page 14-1. In addition to the front panel LEDs, status LEDs are included on the back of each tape drive assembly and each power supply.

2.2.3 Robotic Handler and Barcode Reader

Shown in Figure 2-7, a robotic tape handler within each LRM moves on four axes to access cartridges anywhere in the LRM or within an attached MEM. The handler is controlled by the medium changer interface and shared by all host software applications on a first-come, first-served basis.

The servos are self-calibrating and require no adjustments. All servos are closed loop and digitally controlled with optical position sensors to ensure fast, smooth, trouble-free cartridge handling.

The barcode reader scans barcode labels on all cartridges to establish and maintain an up-to-date cartridge inventory. The system controller stores the cartridge inventory in a database and makes it available to the host applications.

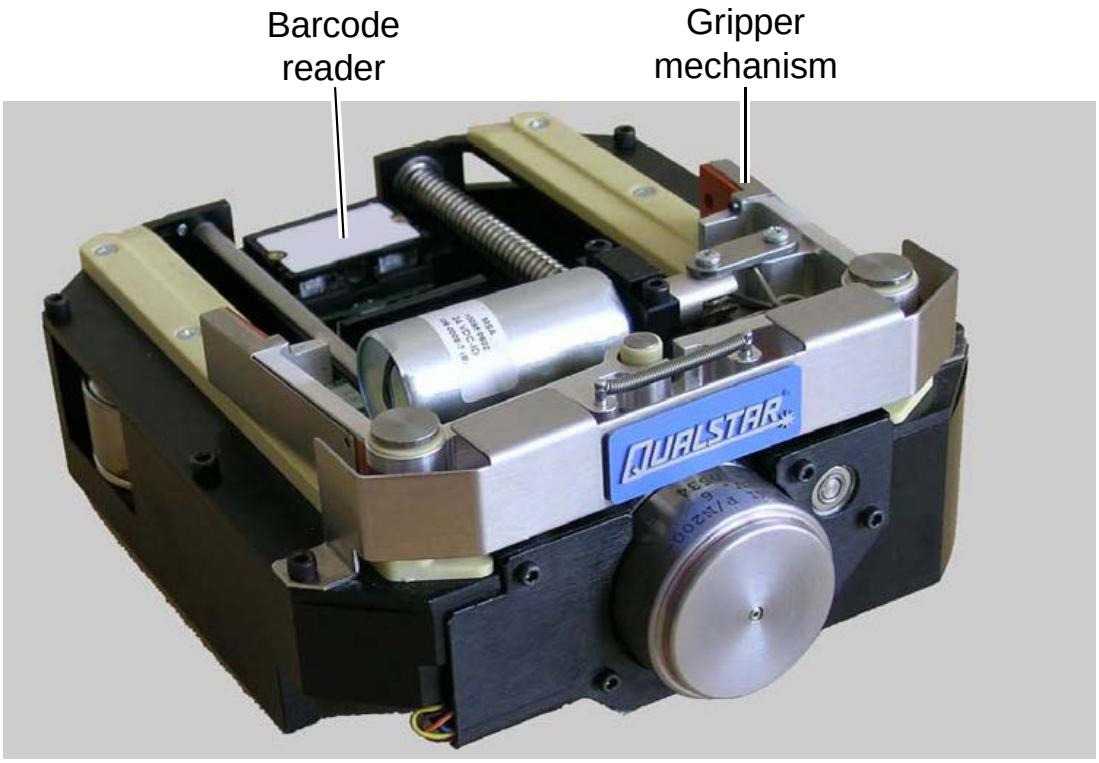

Figure 2-7 Robotic handler

Barcode Labels

Barcode labels must conform to the ANSI/AIM BCI-1995, Uniform Symbol Specification (USS-39). Detailed specifications for XLS barcodes and labels can be found in Qualstar Product Information Note 043, "Bar Code Label Specification for the Qualstar XLS Library." To obtain this document, go to www.qualstar.com and click on the Support tab.

Pre-printed barcode labels, which are both human- and machine-readable, are available from a number of sources.

2.2.4 Tape Drives

The LRM can accommodate up to 32 tape drives, which are installed in one to eight drive bays (four tape drive assemblies per bay). The tape drive data paths are independent of the medium changer interface.

Drive Bays

Figure 2-8 shows the front view of two drive bays and eight tape drives. Drive bays can be installed at the factory or exchanged with cartridge bays in the field, allowing for customized capacity and performance. A drive bay (4 tape drives) can be swapped with a cartridge bay (30 cartridges) and vice versa.

Figure 2-8 Two drive bays (front panel removed)

Each drive bay can hold up to four tape drive assemblies, which are installed from the rear of the LRM. For safety reasons, any unused slots must be filled with a blank drive cover. (The handler is prevented from moving if any of the tape drive slots are unoccupied.)

Tape Drive Assemblies

Shown in Figure 2-9, an XLS tape drive assembly consists of a tape drive enclosed in a drive carrier.

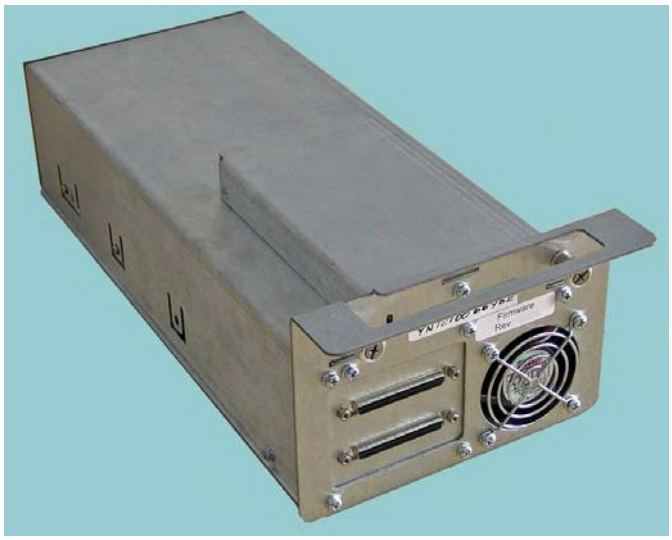

Figure 2-9 SCSI tape drive assembly (rear view)

The drive carrier provides regulated and switched power to the tape drive and a cooling fan. SCSI tape drive assemblies include dual SCSI HD68 connectors and a single status LED, while Fibre Channel tape drive assemblies include a duplex LC multi-mode Fibre Channel receptacle and three LEDs.

The XLS communicates with each tape drive within the drive carrier and can monitor tape drive status, set target IDs, receive tape drive alerts, and so on.

Depending on the capabilities of the application software being used, the Fibre Channel tape drive assemblies can be hot swapped. That is, you can remove and replace tape drive assemblies without powering down the library. The library automatically detects the presence of a new tape drive.

LTO 3 tape drive assemblies with either SCSI or Fibre Channel interfaces are currently available. Other drives may be supported in the future. Refer to Qualstar Product Information Note 014, "Supported Tape Drives," for an up-to-date list of supported tape drives (go to www.qualstar.com and click on the Support tab).

CAUTION

To avoid damaging the equipment and voiding your warranty, do not attempt to remove the tape drives from the drive carriers. The tape drives used in the XLS must be installed into drive carriers at the factory.

2.2.5 I/O Ports

As shown in Figure 2-10, I/O ports on the front of the LRM allow cartridges to be imported or exported without opening the doors and interrupting XLS operations. Each I/O port holds 10 cartridges in a removable magazine. The XLS can include two or four I/O ports. For each I/O port that is not installed, the library includes 10 additional cartridge storage slots.

Access to the I/O ports is controlled by the application software and X-Link.

Figure 2-10 I/O port

Each I/O port uses a removable magazine suitable for long-term storage. Removable dust covers are provided with each I/O port magazine. See Figure 2-11.

Figure 2-11 I/O port magazine

2.2.6 Cartridge Slots

Shown in Figure 2-12, the library includes storage slots for up to 705 cartridges. Depending on their storage needs, customers can use the following cartridge locations:

- **Cartridge bays.** The library accommodates up to seven cartridge bays (see Figure 2-13). Each cartridge bay provides storage slots for 30 cartridges. Cartridge bays can be installed at the factory or exchanged with drive bays in the field, allowing for customized capacity and performance.
- **Rear wall slots.** The rear wall contains 235 fixed cartridge slots.
- **Door slots.** As an option, 110 cartridge slots can be installed on each door, providing an additional 220 slots. The door slots block the front windows.

- **Front panel slots.** For each I/O port that is not installed, the library includes 10 additional cartridge slots on the inside of the LRM's front panel.

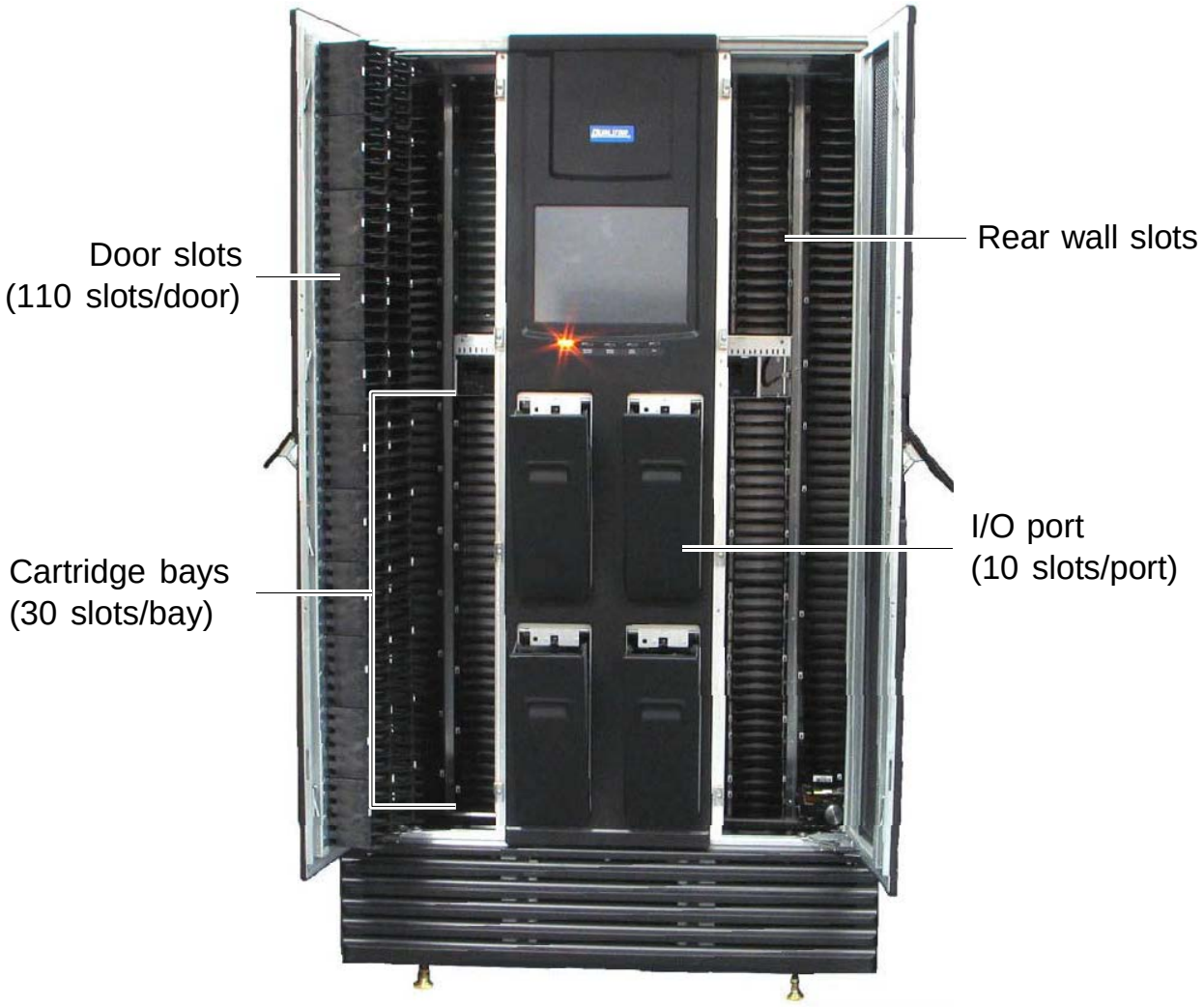

Figure 2-12 Cartridge slots in LRM (front panel slots not shown)

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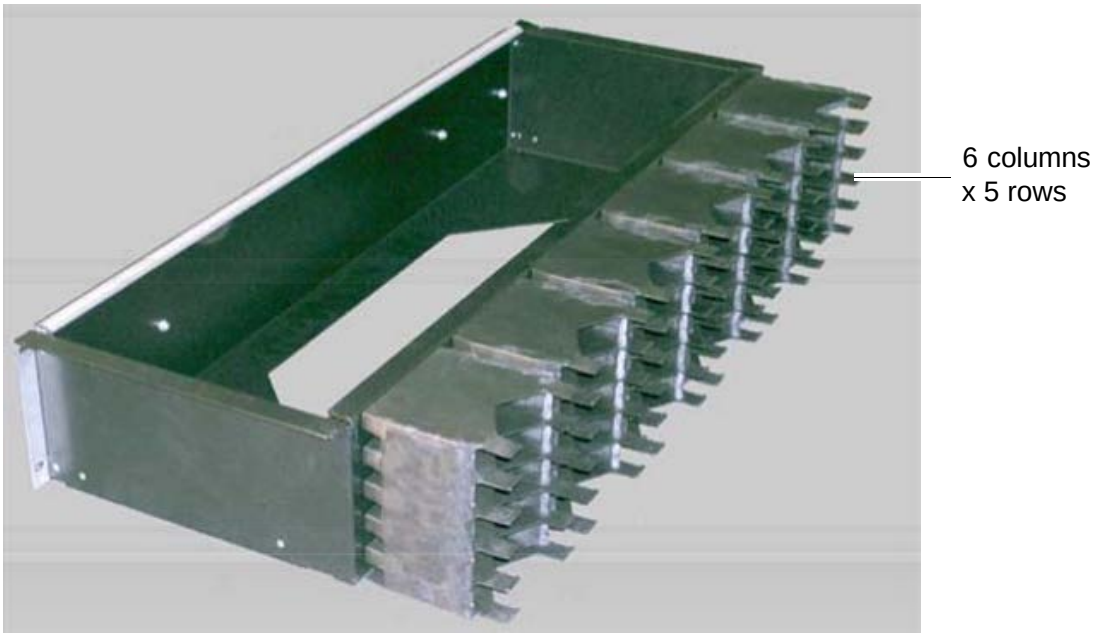


Figure 2-13 Cartridge bay

2.2.7 Doors, Windows, Locks, and Security Features

Doors and Windows

The LRM has two doors. Each MEM has two doors. All doors have windows for viewing robot operations; the front windows in the LRM are blocked if the optional door slots are installed. There are also smaller viewing windows on the sides of the LRM; these windows are moved to the side of a MEM when it is attached.

Door Locks

All doors include key locks. Electronic locks are optional. When the electronic locks are installed, a user name and password are required to unlock the doors. With electronic locks, pending operations are completed and the handler is parked in a safe location before the doors are unlocked.

Inventory Sentry Feature

The Inventory Sentry feature consists of a highly sensitive "light curtain," which allows the XLS to precisely monitor all areas within the LRM and MEM cabinets, as follows:

- When the doors are closed, the Inventory Sentry can detect if a cartridge is protruding out of a slot. If this is the case, the XLS prevents the handler from moving to avoid damage.

- When the doors are open, the Inventory Sentry can detect when someone reaches into the cabinet, possibly to add or remove a cartridge. If the light curtain is violated, the XLS reestablishes its cartridge inventory as soon as all doors are locked. To speed the time it takes to become ready, the XLS scans only the potentially affected areas of the cabinet, including all slots on the doors.

Door-Opened Sensors

Each door includes a door-opened sensor to protect the integrity of the cartridge inventory. The sensor detects if the door was opened while the library power is off, thus reducing the time required to recover from a power-off event.

When the power is reapplied, the XLS checks the state of the door-opened sensors and performs one of the following actions:

- If a sensor indicates that a door was opened while the power was off, the XLS scans all cartridge locations before becoming ready.

- If the sensors indicate that the doors were not opened while the power was off, the XLS bypasses the inventory scan, thus minimizing the time to become ready.

The sensors will function for at least 24 hours after a power outage.

2.2.8 Equipment Rack

Shown in **Figure 2-14**, the back of the LRM includes space for an optional EIA 19-inch equipment rack installed in a vertical orientation (equipment installed on its side). The rack can accommodate equipment up to 26 inches deep (66 cm). Installed equipment could include a Fibre Channel switch or other ancillary equipment.

Two versions of the rack option are available. The 6U rack (10.5-inches) resides entirely within the LRM cabinet. The 8U (14-inches) rack protrudes 3.5 inches beyond the rear of the LRM cabinet. A 15-amp power strip with six grounded outlets and circuit breaker is supplied with either equipment rack. This power strip must be connected to an external power source.

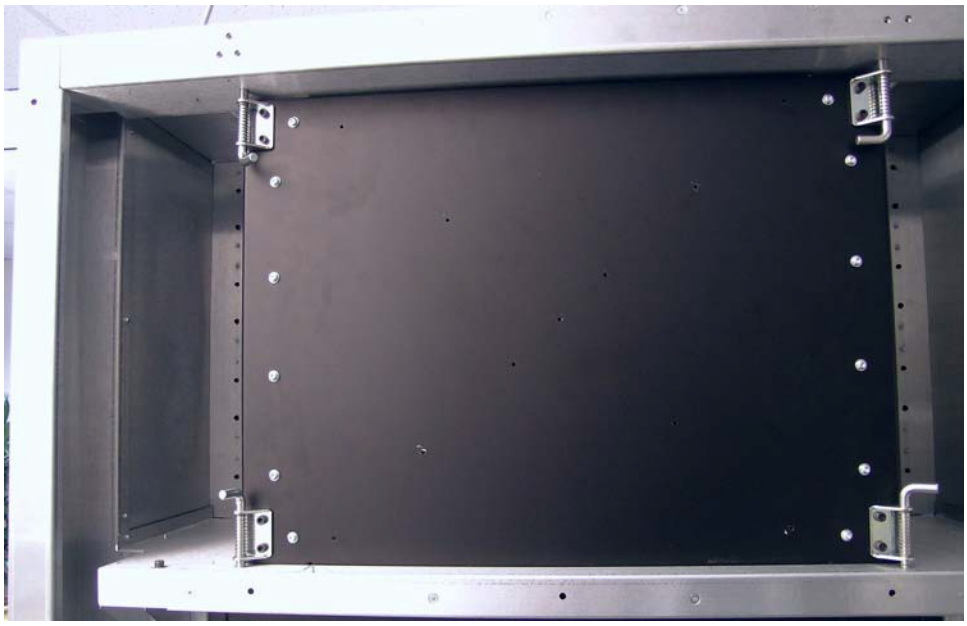


Figure 2-14 Equipment rack option (6U rack shown)

2.3 Media Expansion Module (MEM)

Shown in Figure 2-15, the Media Expansion Module (MEM) includes a motor-driven carousel containing 1,075 cartridge slots. One or two MEMs can be attached to a single LRM.

Like the LRM, the MEM includes the following features:

- Air filters behind the front grille
- Two doors with windows, key locks, and optional electronic locks
- Inventory Sentry feature
- Door-opened sensors

The handler from an attached LRM can reach into the MEM to pick, place, and scan the barcode of any cartridge. The carousel rotates in either direction to minimize the cartridge access time.

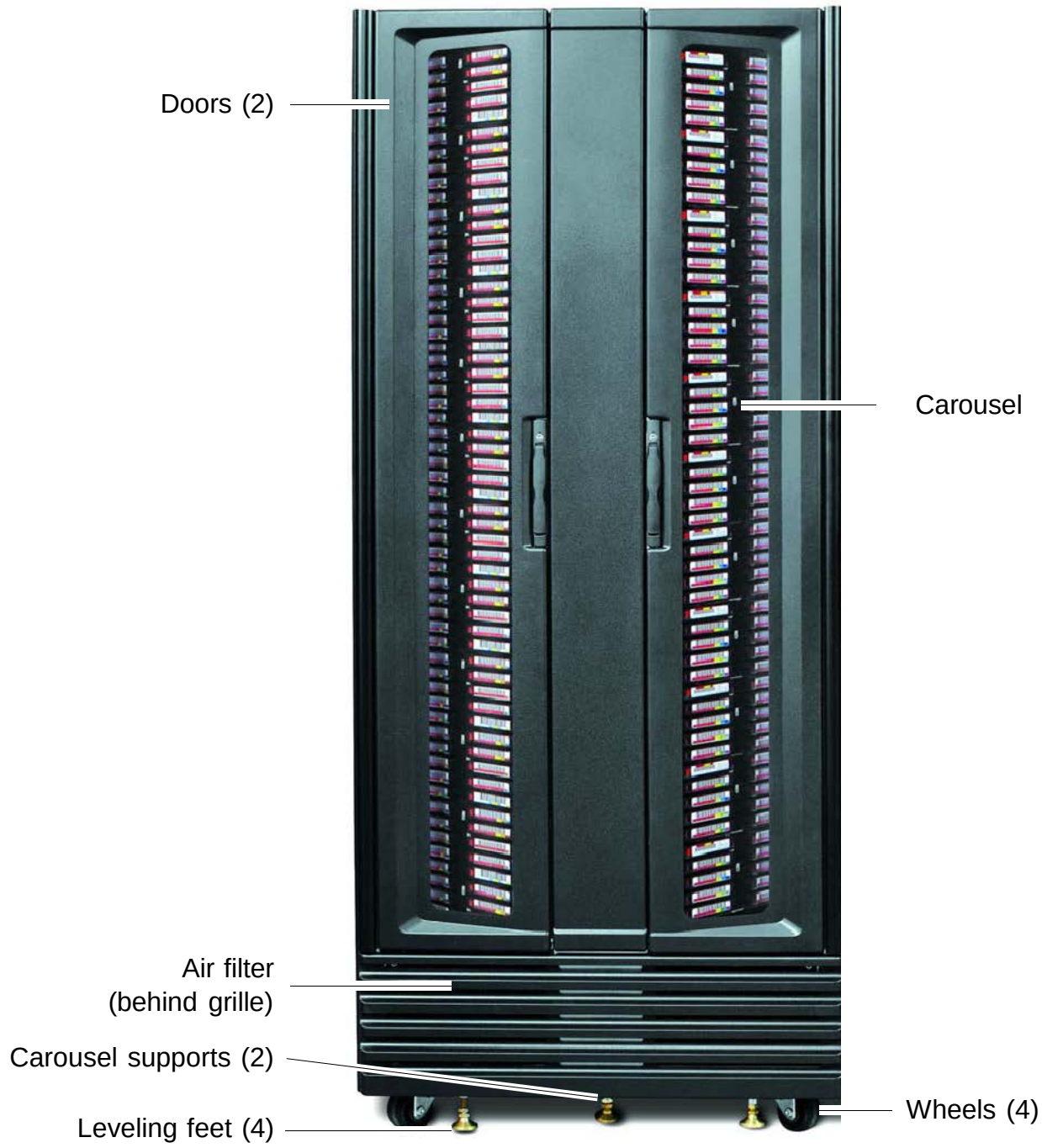


Figure 2-15 Front view of the Media Expansion Module (MEM)

3 General Information

This chapter provides a general overview of the medium changer's support for SCSI including information about the following:

- *Logical libraries,* which are partitions of the XLS's total available resources (see Section 3.1)
- Element addresses (see Section 3.2 on page 3-5)
- Supported messages and commands, including information about command and reset processing (see Section 3.3 on page 3-5)
- General errors (see Section 3.4 on page 3-9)

3.1 Understanding XLS Logical Libraries

As described in Chapter 2, "About the XLS Library," the XLS can contain up to four host bus adapter cards (HBAs), with each HBA containing two ports. These ports allow multiple software applications (*initiators*) to communicate with the XLS's system controller (the *medium changer*) concurrently, using both SCSI and Fibre Channel protocols.

Note: The HBAs allow communication with the medium changer only; they do not allow communication with the tape drives for data transfer.

While all initiators share access to the medium changer and the robotic handler (the *medium transport element)* on a first-come, first-served basis, the other elements in the XLS physical library can be subdivided into up to eight partitions, which are called *logical libraries*. Logical libraries ensure that each software application has dedicated and restricted access to its own:

- Tape drives (data transfer elements)
- Cartridge slots (storage elements)
- I/O port (import/export elements)

Physical library resources are partitioned into logical libraries by an XLS administrator before the software applications are connected.

Figure 3-1 depicts an example configuration that illustrates the high-level relationship between the XLS physical library, logical libraries, and the software applications. In the figure:

- Three host computers and software applications share the XLS physical library.
- Each host computer connects to an HBA in the XLS. The software applications use the HBA connections to access the library's medium changer.
- All software applications share control of the medium changer and the robotic handler on a first-come, first-served basis.
- To ensure that each software application has its own dedicated set of resources, the physical library has been partitioned into three logical libraries. Each software application controls its own logical library.
- Each of the three logical libraries contains a subset of the total available tape drives and cartridge slots.
- Logical Libraries 1 and 3 have been assigned one and three physical I/O ports, respectively; Logical Library 2 does not have an assigned I/O port.

> **Important:** The 10 slots in a single I/O port cannot be shared among logical libraries. If a logical library needs access to an I/O port, it must be assigned the entire port when the logical library is created.

- By default, each logical library has a single logical unit number (LUN) of 0; an XLS administrator can use the XLS Management Interface to change the default LUN or to assign additional LUNs.
- The software applications and the host computers connect to and communicate with the tape drives independently of the medium changer.

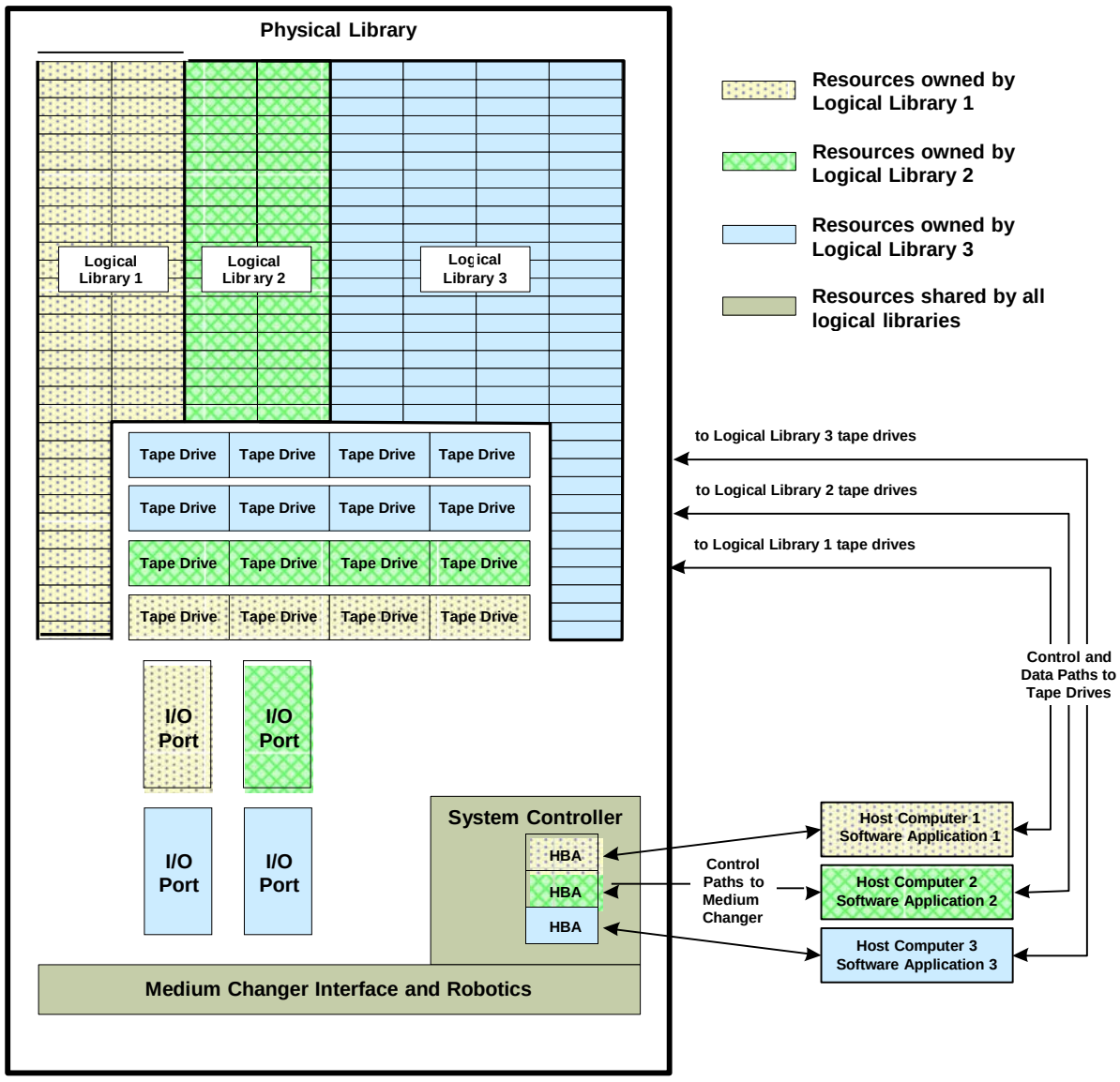


Figure 3-1 Relationship between the physical library, logical libraries, and software applications

3.1.1 More Complex Configurations

Figure 3-1 depicts a relatively simple configuration—one in which three host computers, each running a single software application, are connected to three HBA ports on the XLS. In the example, each host controls one logical library. While this one-host-to-one-logical-library configuration is the most typical, the XLS is capable of supporting more complex configurations, including more than one host per logical library and more than one logical library per host. See Table 3-1.

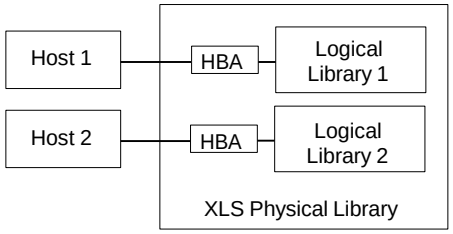
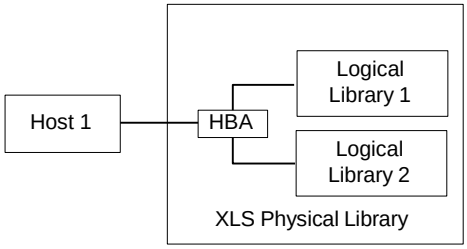
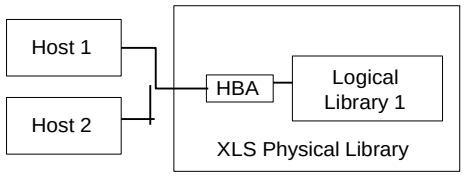
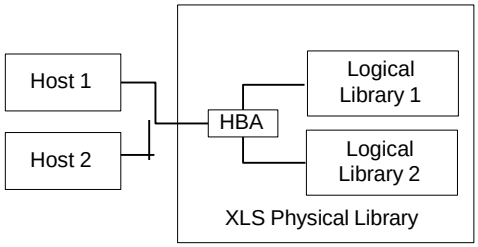
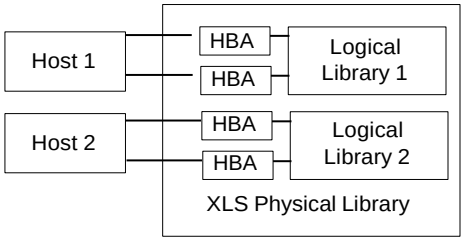
Configuration	Description	Example
One to one	Each host computer controls a single logical library across one of the XLS's HBA ports. This is the most typical and the recommended configuration.	
One to many	A single host computer controls more than one logical library across a single HBA port. Each logical library has been assigned a different logical unit number (LUN).	
Many to one	More than one host computer controls one logical library. Typically, the host computers are connected via a Fibre Channel switch. **Note:** The host software must manage any conflicts between the multiple hosts (initiators).	
Many to many	More than one host computer controls more than one logical library. Typically, the host computers are connected via a Fibre Channel switch. **Note:** The host software must manage any conflicts between the multiple hosts (initiators).	
Multiple HBAs for failover	The host computers control the logical libraries across more than one HBA port. The additional HBA ports are used as redundant paths for failover.	

Table 3-1 Host/logical library configurations

To create these more complex configurations, an XLS administrator must edit the *nexus setting* for each logical library, which is the unique combination of HBA port ID, target ID, and logical unit number (LUN) describing each connection. For information, refer to the *XLS Library User's Guide*. In addition, the host software applications must manage any conflicts between multiple hosts by using such SCSI commands as Reserve Element and Release Element.

3.2 Element Addresses

Resources under control of the medium changer are referred to as *elements*. The SCSI standard defines four types of elements: Data Transfer, Import/Export, Medium Transport, and Storage. Table 3-2 shows how the four element types map to locations in the XLS.

Type of element	XLS locations
Data Transfer	Tape drives
Import/Export	I/O port slots
Medium Transport	Handler
Storage	Cartridge slots

Table 3-2 Mapping of element types to XLS locations

Each location within the XLS has a fixed *physical address* that cannot be changed. Each element also has a unique identifier that the SCSI standard refers to as an *element address*. The mapping of physical addresses to element addresses is controlled by the medium changer when the logical library is first created.

Each type of element has a defined starting address. When the logical library is created, element addresses are assigned consecutively to the range of elements of that type, beginning with the starting address. Element addresses are 16-bit binary numbers and can range from 0 to 65,535 (they do not wrap from 65,535 to 0). The assigned element addresses can be changed using a Mode Select command.

While the element addresses are unique within a logical library, the same element addresses can be used multiple times within the physical library. For example, if the physical library has been partitioned into eight logical libraries, each logical library will use 40,000 (9C40h) as the default element address for its first tape drive.

For a list of default element addresses, refer to Table 9-4, "Default element addresses," on page 9-8; for graphics showing the physical addresses for each location in the library, refer to the *XLS Library User's Guide*.

3.3 Supported Messages and Commands

The medium changer conforms to the following standards, with the exceptions and options described in this manual:

- ANSI X3.302-1998, *SCSI Parallel Interface-2 (SPI-2)*
- ANSI X3.269:1996, *Fibre Channel Protocol (FCP)*
- ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*
- ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*

3.3.1 Supported Messages

Table 3-3 lists the SCSI messages supported by the medium changer. The messages are listed in hexadecimal order by message code.

Message Code	Description
00h	COMMAND COMPLETE
01h	EXTENDED MESSAGE PREFIX
02h	SAVE DATA POINTER
03h	RESTORE POINTERS
04h	DISCONNECT
05h	INITIATOR DETECTED ERROR
06h	ABORT
07h	MESSAGE REJECT
08h	NO OPERATION
09h	MESSAGE PARITY ERROR
0Ch	BUS DEVICE RESET
23h	IGNORE WIDE RESIDUE
80–87h or C0–C7h	IDENTIFY
***	SYNCHRONOUS DATA TRANSFER REQUEST
***	WIDE DATA TRANSFER REQUEST

*** Extended message.

Table 3-3 Supported messages

3.3.2 Supported Commands

Table 3-4 lists the SCSI commands supported by the medium changer. The commands are listed in hexadecimal order by operation code.

Operation Code	Command	Refer to...
00h	Test Unit Ready	Chapter 24, "Test Unit Ready - 00h"
03h	Request Sense	Chapter 18, "Request Sense - 03h"
07h	Initialize Element Status	Chapter 5, "Initialize Element Status - 07h"
12h	Inquiry	Chapter 7, "Inquiry - 12h"
15h	Mode Select	Chapter 9, "Mode Select - 15h"

Table 3-4 Supported commands

Operation Code	Command	Refer to...
16h	Reserve Element (6)	Chapter 20, "Reserve Element (6) - 16h"
17h	Release Element (6)	Chapter 15, "Release Element (6) - 17h"
1Ah	Mode Sense	Chapter 10, "Mode Sense - 1Ah"
1Dh	Send Diagnostic	Chapter 22, "Send Diagnostic - 1Dh"
1Eh	Prevent/Allow Medium Removal	Chapter 13, "Prevent/Allow Medium Removal - 1Eh"
2Bh	Position to Element	Chapter 12, "Position to Element - 2Bh"
4Dh	Log Sense	Chapter 8, "Log Sense - 4Dh"
56h	Reserve Element (10)	Chapter 21, "Reserve Element (10) - 56h"
57h	Release Element (10)	Chapter 16, "Release Element (10) - 57h"
A0h	Report LUNs	Chapter 17, "Report LUNs - A0h"
A5h	Move Medium	Chapter 11, "Move Medium - A5h"
B5h	Request Volume Element Address	Chapter 19, "Request Volume Element Address - B5h"
B6h	Send Volume Tag	Chapter 23, "Send Volume Tag - B6h"
B8h	Read Element Status	Chapter 14, "Read Element Status - B8h"
E7h	Initialize Element Status with Range	Chapter 6, "Initialize Element Status with Range - E7h"

Table 3-4 Supported commands (*continued*)

Control Byte

The last byte of each command descriptor block (CDB) is known as the Control byte. Table 3-5 shows the format of this byte.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	Vendor Specific (0)		Reserved (0)			NACA (0)	Flag (0)	Link (0)

Table 3-5 Format of the Control byte

NACA The medium changer supports a value of 0 for the NACA (Normal ACA) bit, indicating that a contingent allegiance is established if the command returns Check Condition status.

Flag The medium changer supports a value of 0 for the Flag bit, indicating that it does not support linked commands.

Link The medium changer supports a value of 0 for the Link bit, indicating that it does not support linked commands.

3.3.3 Reset Processing

The medium changer implements the hard reset option. Upon detection of a reset condition, the medium changer:

1. Immediately clears all incomplete or pending operations.
2. Releases all SCSI device reservations.
3. Returns any SCSI device operating modes (Mode Select and so on) to their power-on conditions.
4. Performs a limited set of self-test diagnostics.
5. Sets the Unit Attention condition (see "Unit Attention Condition" on page 3-9).

3.3.4 Command Processing

The medium changer in the XLS functions as a SCSI target. An initiator sends a command to the medium changer by sending a command descriptor block (CDB) that defines the command and its parameters. The medium changer examines the CDB. If any fields are invalid, it reports an error. If not, it attempts to execute the command. When complete, it returns one of the status codes listed in Table 3-6.

Status Code	Status Name	Indicates that...
00h	Good	The medium changer has completed the command without errors.
02h	Check Condition	The command terminated with an error, exception, or abnormal condition, and this condition should be checked. Check Condition status is reported when the error is detected. Refer to Section 3.4.1, "Check Condition Status," on page 3-9.
08h	Busy	The medium changer is unable to accept a command.
18h	Reservation Conflict	An initiator attempted to access the logical library or an element in the logical library in a way that conflicts with an existing reservation. Refer to Section 21.4, "Reservation Conflict Status," on page 21-5.

Table 3-6 Values of the status codes

3.4 Error Handling

If an error occurs during the receipt or execution of a command, the medium changer returns Check Condition status (status code 02h). To determine the source of the error, the initiator can issue a Request Sense command and look at the returned sense data. See Table 18.2, "Sense Data Format," on page 18-2 for more information.

3.4.1 Check Condition Status

Conditions that can cause Check Condition status include the following:

- A parity error occurred while the medium changer was receiving the command and the message system is not enabled (parallel SCSI only).
- The message system is enabled and a message error occurred while the medium changer was processing the command.
- The medium changer received a command in which a reserved field is not 0.
- The medium changer received a command with an invalid parameter.
- The medium changer is not ready.
- The initiator sent a command other than an Inquiry or Request Sense command while a pending Unit Attention condition exists. See "Unit Attention Condition".
- The medium changer has an unrecoverable hardware error and received a command that requires motion.
- A special condition unique to the command being processed has occurred. These special conditions are explained in the individual command chapters.

Unit Attention Condition

The medium changer generates a Unit Attention condition when:

- The physical library is power cycled.
- The logical library is brought online.
- The SCSI bus is reset or it receives a BUS DEVICE RESET message (parallel SCSI only). See Section 3.3.3 on page 3-8 for more information.
- The inventory of the logical library could have been altered by manual intervention (for example, a door or an I/O port is closed).

- It receives a Mode Select command that alters its configuration (the Unit Attention is sent to any other initiators).

Possible initiator responses to these events are:

- Request Sense
- Inquiry
- Any other command

3.4.2 General Errors

Errors fall into two categories: general and command specific. The sense data for general errors is described in Table 3-7. Where applicable, the sense data for command-specific errors is described at the end of each command chapter.

In Table 3-7 (and all others throughout this document):

- A C/D Bit entry that is blank indicates that the SKSV field of the Request Sense data is 0 (and therefore there is no Sense Key Specific data).
- A Bit Pointer entry that is blank indicates that the BPV field is 0 (and therefore there is no Bit Pointer).
- Field and Bit Pointer entries that contain *x* indicate that many errors of that type may occur in different fields and so there is more than one possible value.

Sense Key	ASC	ASCQ	C/D	Field Pointer	Bit Pointer	Description
2h (Not Ready)	04h	00h				Logical unit not ready, cause not reportable.
	04h	01h				Logical unit is in process of becoming ready. An inventory scan is in process. For example, the library was just powered on or a door or I/O port was closed.
	04h	82h				Logical unit not ready. An I/O port is extended or open.
	04h	83h				Logical unit not ready. Door is open.
4h (Hardware Error)	00h	00h				General unit hardware failure.

Table 3-7 General errors

Sense Key	ASC	ASCQ	C/D	Field Pointer	Bit Pointer	Description
5h (Illegal Request)	20h	00h	1	0000h		Invalid operation code in command.
	24h	00h	1	*x*	*x*	Invalid field in CDB.
	25h	00h				Logical unit not supported. A CDB for a LUN other than the configured LUN was received.
	3Dh	00h				Invalid bits in Identify message.
6h (Unit Attention)	28h	00h				Not ready-to-ready transition—medium may have changed.
	28h	01h				Import or export element accessed.
	29h	00h				Power-on, reset, or bus device reset occurred.
Bh (Aborted Command)	43h	00h				Message error. Initiator sent an improper message sequence.
	47h	00h				SCSI parity error.
	48h	00h				Initiator detected error message received.
	4Eh	00h				Overlapped commands attempted. The initiator sent a CDB while it was disconnected from a previous CDB.

Table 3-7 General errors (*continued*)

Notes:

4 Modifying Qualstar Device Drivers for the XLS

This chapter compares the XLS's support for SCSI commands to the Qualstar RLS library's support for SCSI commands. This information is provided as a reference for programmers who are modifying existing Qualstar device drivers for use with the XLS.

> **Important:** When setting up an XLS logical library partition, the XLS administrator can specify whether the logical library should operate in XLS-8000 mode or in XLS-8100 mode. This manual describes how the medium changer responds to SCSI commands when it is in XLS-8000 mode.

4.1 Differences between the Qualstar XLS and RLS Libraries

This section lists the differences between how the XLS supports SCSI commands and the Qualstar RLS library supports SCSI commands.

4.1.1 Changes Affecting All Commands

The RLS library conforms to SCSI-2 standards. In contrast, the XLS library conforms to the following SCSI-3 standards:

Subject	Standard
SCSI-3 architecture model	ANSI X3.270-1995, *SCSI-3 Architecture Model (SAM)*
SCSI-3 primary command set	ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*
SCSI-3 medium changer command set	ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*
Parallel SCSI	ANSI X3.302-1998, *SCSI Parallel Interface-2 (SPI-2)*
Fibre Channel	ANSI X3.269:1996, *Fibre Channel Protocol (FCP)*

Table 4-1 SCSI standards used by the XLS Library

In most cases, the effects of switching to SCSI-2 to SCSI-3 are relatively minimal and are described in Section 4.1.2. For all commands, the LUN field in byte 1 of the CDB is now reserved, and the Control byte now includes the NACA bit (bit 2), which must be 0.

4.1.2 Changes Affecting Specific Commands

Table 4-2 provides specific details about how the Qualstar XLS, operating in XLS-8000 mode, differs from the SCSI implementation used by the Qualstar RLS library.

Command	How the XLS library compares to the RLS library
Exchange Media - A6h	The XLS does not support this command.
Initialize Element Status - 07h	Included for backward compatibility, but does not cause any action to be taken. Since the XLS always includes a barcode reader, it is not an error to set the NBL bit to 0.
Initialize Element Status with Range - E7h	Included for backward compatibility, but does not cause any action to be taken. Since the XLS always includes a barcode reader, it is not an error to set the NBL bit to 0.
Inquiry - 12h	• When the logical library is set to operate in XLS-8000 mode, the value returned in the Product Identification field is **XLS-8000.** • When the logical library is set to operate in XLS-8100 mode (not described in this manual), the value returned in the Product Identification field is **XLS-8100.** • The XLS supports the CmdDT bit. If CmdDT is 1, the medium changer returns Command Support Data for the CDB specified in the Operation Code field. • If CmdDT and EVPD are both 0, the medium changer returns the Standard Inquiry Data. The returned data is similar to what is returned for the RLS library with several exceptions. See Section 7.2 on page 7-3.
Log Sense - 4Dh	• The XLS supports the TapeAlert Log page. See Section 8.3.2 on page 8-5. • The XLS supports the Event History Page; however, a history of XLS events is currently not available over SCSI.
Mode Select - 15h	• The XLS supports the TapeAlert mode page. See Section 9.3.1 on page 9-4. • The default element address values have changed. See Section 9.3.2 on page 9-5. • The XLS does not support the LCD Page. • The XLS does not support the Configuration page.

Table 4-2 Differences between the XLS and the RLS libraries

Command	How the XLS library compares to the RLS library
Mode Sense - 1Ah	• The XLS supports the TapeAlert mode page. See Section 10.3.1 on page 10-4. • The default element address values have changed. See Section 10.3.2 on page 10-6. • The medium transport element is no longer considered a storage element and cannot be the source or a destination of a Move Medium command. • Because there can be multiple I/O port slots, an import/export element can be both the source and a destination of a Move Medium command. • The XLS does not support the Exchange Medium command, so the medium changer always returns 0 for bytes 12 through 15. • The XLS does not support the LCD Page. • The XLS does not support the Configuration page.
Move Medium - A5h	The meaning of the vendor-unique I/O Port Code bits have changed: • **00b:** Perform a normal move. • **01b**: "Extend" but do not open, the I/O port by returning Not Ready status to all motion or inventory commands. • **10b**: Ignored • **11b:** Illegal Request See Appendix A, "Using the I/O Port."
	The medium transport element cannot be the source or destination of a Move Medium command.
Position to Element - 2Bh	The medium transport element cannot be the destination of a Position to Element command.
Prevent/Allow Medium Removal - 1Eh	This command cannot be used to prevent the doors from being unlocked; however, it can be used to prevent the I/O port from being opened from the XLS Management Interface. See Chapter 13, "Prevent/Allow Medium Removal - 1Eh."
Read Buffer - 3Ch	The XLS does not support this command.
Read Element Status - B8h	• The DVCID bit determines the format of the Data Transfer Element Descriptor, which always includes the tape drive's serial number. See Section 14.3.4 on page 14-16. • The new CurData bit specifies whether the medium changer should move the element to confirm the current status before returning data.
Release Element (6) - 17h	• The Release Element (6) command is now supported (the RLS library supports the Release command). • The 3rd Party and 3rd Party Device ID bits are obsolete. For information about third-party reservations, see Chapter 16, "Release Element (10) - 57h."
Release Element (10) - 57h	The Release Element (10) command is now supported. This command allows reservations to be released for a third-party.

Table 4-2 Differences between the XLS and the RLS libraries (*continued*)

Command	How the XLS library compares to the RLS library
Report LUNs - A0h	The Report LUNs command is now supported. This command instructs the XLS to return an inventory of all LUNs connected to the addressed target ID.
Request Sense - 03h	Per the SCSI-3 standard, the Error Code field (byte 0 of the sense data) is now called the Response Code field; however, the name change does not affect the data returned.
Request Volume Element Address - B5h	The XLS does not return Illegal Request if either of the following is true: • It has not successfully completed a Send Volume Tag command since the last power-on or reset event. • The Send Action Code of the previous Send Volume Tag command was Assert, Replace, or Undefine.
Reserve Element (6) - 16h	• The Reserve Element (6) command is now supported (the RLS library supports the Reserve command). • The 3rd Party and 3rd Party Device ID bits are obsolete. For information about third-party reservations, see Chapter 21, "Reserve Element (10) - 56h."
Reserve Element (10) - 56h	The Reserve Element (10) command is now supported. This command allows reservations to be made for a third-party.
Rezero Unit - 01h	The XLS does not support this command.
Send Diagnostic - 1Dh	No changes
Send Volume Tag - B6h	No changes
Test Unit Ready - 00h	No changes
Write Buffer - 3Bh	The XLS does not support this command.

Table 4-2 Differences between the XLS and the RLS libraries (*continued*)

5 Initialize Element Status - 07h

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

5.1 Command Description

The Initialize Element Status command is included for backward compatibility with the Qualstar RLS library.

> **Important:** Because the XLS medium changer always maintains an accurate and up-to-date inventory, this command does not cause any action to be taken.

5.1.1 NBL

The vendor-specific No Barcode Labels bit instructs the medium changer not to scan each element for a barcode label, as follows:

0 – Scan each element for a barcode label.
1 – Do not scan for barcode labels.

5.2 For More Information

For more information about the Initialize Element Status command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC).*

Notes:

6 Initialize Element Status with Range - E7h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (E7h)							
1	Reserved (0)							Range
2-3	Element Address							
4-5	Reserved (0)							
6-7	Number of Elements							
8	Reserved (0)							
9	NBL	Control (0)						

6.1 Command Description

The Initialize Element Status with Range command is a vendor-specific command that is included for backward compatibility with the Qualstar RLS library.

> **Important:** Because the medium changer in the XLS always maintains an up-to-date inventory, this command does not cause any action to be taken.

6.1.1 Range

The Range field specifies which elements are to be scanned, as follows:

0 – Scan all elements.

1 – Scan a range of elements, as specified by the Element Address and Number of Elements fields.

6.1.2 Element Address

If the Range field is 1, the Element Address field specifies the starting element address for the range of elements to be scanned. This field is ignored if Range is 0.

6.1.3 Number of Elements

If the Range field is 1, the Number of Elements field specifies the maximum number of elements to be scanned. This field is ignored if Range is 0.

6.1.4 NBL

The vendor-specific No Barcode Labels bit instructs the medium changer whether to scan each element for a barcode label, as follows:

0 – Scan each element for a barcode label.
1 – Do not scan for barcode labels.

7

Inquiry - 12h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (12h)							
1	Reserved (0)						CmdDT	EVPD
2	Page or Operation Code							
3	Reserved (0)							
4	Allocation Length							
5	Control (0)							

7.1 Command Description

The Inquiry command instructs the medium changer to return information either about its parameters or about its support for SCSI commands. The returned information consists of a set of fields that describe the XLS.

7.1.1 CmdDT

The Command Support Data bit instructs the medium changer to return information about the SCSI commands it supports, as follows:

0 – The medium changer should not return command support data.

1 – The medium changer should return command support data, as specified by the value in the Page or Operation Code field.

7.1.2 EVPD

The Enable Vital Product Data bit instructs the medium changer to return vital product data, as follows:

0 – The medium changer should not return vital product data.

1 – The medium changer should return vital product data, as specified by the value in the Page or Operation Code field.

7.1.3 Page or Operation Code

The Page or Operation Code byte specifies what type of information the medium changer should return, as shown in Table 7-1.

CmdDT	EVPD	Page or Operation Code	Information Returned
0	0	0	Standard Inquiry Data (see Table 7-2 on page 7-3)
1	0	CDB Operation Code	Information about the requested CDB (see Table 7-12 on page 7-15)
0	1	00h	Supported Vital Product Data page (see Table 7-5 on page 7-8)
0	1	80h	Unit Serial Number page (see Table 7-6 on page 7-9)
0	1	83h	Device Identification page (see Table 7-7 on page 7-10)

Table 7-1 Valid values for the Page or Operation Code field

Note: If the CmdDT and EVPD bits are both 0, the Page or Operation Code must be 0. If the CmdDT and EVPD bits are both 1, the medium changer returns Check Condition status.

7.1.4 Allocation Length

The Allocation Length field specifies the number of bytes the initiator has allocated for the return of Inquiry data. The medium changer returns the specified number of bytes or all available data, whichever is less.

7.2 Standard Inquiry Data

When the CmdDT and EVPD bits are both 0, the medium changer returns the standard Inquiry data, as shown in Table 7-2.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier			Peripheral Device Type (8)				
1	RMB (1)	Reserved (0)						
2	ISO/IEC Version (0)		ECMA Version (0)			ANSI Version (3)		
3	RSVD (0)	TrmTsk (0)	NormACA (0)	RSVD (0)	Response Data Format (2)			
4	Additional Length (33h)							
5	Reserved (0)							
6	RSVD (0)	EncServ (0)	VS (0)	MultiP	MChngr (0)	AckReqQ (0)*	Addr32 (0)*	Addr16*
7	RelAdr (0)	Wbus32 (0)*	Wbus16*	Sync*	Linked (0)	TranDis(0)	CmdQue (0)	VS (0)
8-15	Vendor Identification							
16-31	Product Identification							
32-35	Product Revision Level							
36-54	Vendor Specific (00h)							
55	Vendor Specific (0)							BarC

* These fields apply to parallel SCSI only.

Table 7-2 Default Inquiry data

7.2.1 Peripheral Qualifier

The medium changer returns 0 or 3 for the Peripheral Qualifier field, as defined in Table 7-3.

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

Table 7-3 Peripheral Qualifier values

7.2.2 Peripheral Device Type

The medium changer returns a value of 08h (medium changer device) for the Peripheral Device Type field. If an unsupported LUN is used by the initiator, the medium changer returns a value of 1Fh (unknown or no device type).

7.2.3 RMB

The medium changer returns a value of 1 for the Removable Medium bit.

7.2.4 ISO/IEC Version

The medium changer returns a value of 0 in the ISO/IEC Version field.

7.2.5 ECMA Version

The medium changer returns a value of 0 in the ECMA Version field.

7.2.6 ANSI Version

The medium changer complies with the ANSI X3.301:1997 (SPC) standard. It returns a value of 3 in the ANSI Version field.

7.2.7 TrmTsk

The medium changer returns a value of 0 for the Terminate Task (TrmTsk) bit, indicating that it does not support the Terminate Task function as defined in the *SCSI-3 Architecture Model* (SAM).

7.2.8 NormACA

The medium changer returns a value of 0 in the Normal ACA (Auto Contingent Allegiance) Supported bit.

7.2.9 Response Data Format

The medium changer returns a value of 2 in the Response Data Format field.

7.2.10 Additional Length

The Additional Length field specifies how many more bytes will follow Byte 4 in the Inquiry Data. The medium changer returns 33h for this field. If the Allocation Length in the Inquiry CDB is less than the number of bytes in the Inquiry Data, the medium changer truncates the Inquiry Data but does not adjust the Additional Length value to reflect the truncation.

7.2.11 EncServ

The medium changer returns a value of 0 in the Enclosure Services field.

7.2.12 VS

The medium changer returns a value of 0 in the first Vendor Specific field.

7.2.13 MultiP

The medium changer returns a value of 1 in the MultiPort field, indicating that it is capable of supporting two or more ports and that it conforms to SCSI-3 multi-port device requirements.

7.2.14 MChngr

The medium changer returns a value of 0 in the Medium Changer field.

7.2.15 AckReqQ

The medium changer returns a value of 0 in the Ack/ReqQ field.

7.2.16 Addr32

The medium changer returns a value of 0 in the Addr32 field.

7.2.17 Addr16

- **Parallel SCSI:** The medium changer supports 16-bit wide SCSI addresses and returns a value of 1 in the Addr16 field.
- **Fibre Channel:** This field applies to parallel SCSI only, so the medium changer returns a value of 0.

7.2.18 RelAdr

The medium changer does not support relative addressing and returns a value of 0 in the Relative Addressing field.

7.2.19 WBus32

The medium changer returns a value of 0 in the Wide Bus 32 field.

7.2.20 WBus16

- **Parallel SCSI:** The medium changer supports 16-bit wide data transfers and returns a value of 1 in the Wide Bus 16 field.
- **Fibre Channel:** This field applies to parallel SCSI only, so the medium changer returns a value of 0.

7.2.21 Sync

- **Parallel SCSI:** The medium changer supports synchronous data transfer and returns a value of 1 in the Synchronous Transfer field.
- **Fibre Channel:** This field applies to parallel SCSI only, so the medium changer returns a value of 0.

7.2.22 Linked

The medium changer does not support linked commands and returns a value of 0 in the Linked field.

7.2.23 TranDis

The medium changer returns 0 for the Transfer Disable (TranDis) bit, indicating that it does not support the CONTINUE TASK and TARGET TRANSFER DISABLE messages.

7.2.24 CmdQue

The medium changer does not support command queuing and returns a value of 0 in the Command Queuing field.

7.2.25 VS

The medium changer returns a value of 0 in the second Vendor Specific field.

7.2.26 Vendor Identification

This field contains eight ASCII characters specifying “QUALSTAR” as the vendor of the product.

7.2.27 Product Identification

This field contains 16 ASCII characters identifying the product name. The value in this field is left justified and padded with space characters (20h). As shown in Table 7-4, the value returned for this field depends on whether the library is operating in XLS-8000 mode (described in this manual), or XLS-8100 mode (not described).

Operating mode	Product ID
XLS-8000	XLS-8000
XLS-8100	XLS-8100

Table 7-4 Predefined Inquiry Strings

Note: The operating mode is set from the XLS Management Interface when the logical library partition is defined.

7.2.28 Product Revision Level

This field contains four ASCII characters identifying the product revision. The revision format is *dddd*, where *d* represents a decimal digit).

7.2.29 Vendor Specific

The medium changer returns 00h for the Vendor Specific field.

7.2.30 BarC

The medium changer returns 1 for the BarCode bit, indicating that the library contains a barcode reader.

7.3 Supported Vital Product Data Pages Page

When the CmdDT bit is 0, the EVPD bit is 1, and the Page Code is 00h, the medium changer returns the Supported Vital Product Data Pages page, as shown in Table 7-5.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier			Peripheral Device Type (8)				
1	Page Code (0)							
2	Reserved (0)							
3	Page Length (3h)							
4	First Page Code Supported (0)							
5	Second Page Code Supported (80h)							
6	Third Page Code Supported (83h)							

Table 7-5 Supported Vital Product Data Page

7.3.1 Peripheral Qualifier

The medium changer returns 0 or 3 for the Peripheral Qualifier field, as defined in Table 7-3 on page 7-4.

7.3.2 Peripheral Device Type

The medium changer returns a value of 8 (Medium Changer device) for the Peripheral Device Type field. If an unsupported LUN is used by the initiator, the medium changer returns a value of 1Fh (unknown or no device type).

7.3.3 Page Code

The medium changer returns a value of 0 for the Page Code field.

7.3.4 Page Length

The medium changer returns a value of 3h for the Page Length field, indicating the number of remaining bytes on this page.

7.3.5 First Page Code Supported

The medium changer returns a value of 0 for this field, indicating support for the Vital Product Data page.

7.3.6 Second Page Code Supported

The medium changer returns a value of 80h for this field, indicating support for the Unit Serial Number page.

7.3.7 Third Page Code Supported

The medium changer returns a value of 83h for this field, indicating support for the Device Identification page.

7.4 Unit Serial Number Page

When the CmdDT bit is 0, EVPD bit is 1, and the Page Code is 80h, the medium changer returns the Unit Serial Number page, as shown in Table 7-6.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier			Peripheral Device Type (8)				
1	Page Code (80h)							
2	Reserved (0)							
3	Page Length (*n*-3)							
4-n	Product Serial Number							

Table 7-6 Unit Serial Number page

7.4.1 Peripheral Qualifier

The medium changer returns a value of 0 for the Peripheral Qualifier field.

7.4.2 Peripheral Device Type

The medium changer returns a value of 8 (medium changer device) for the Peripheral Device Type field.

7.4.3 Page Code

The medium changer returns a value of 80h for the Page Code field.

7.4.4 Page Length

The Page Length field indicates the length of the Unit Serial Number field in bytes.

7.4.5 Product Serial Number

This field contains the serial number for the XLS.

7.5 Device Identification Page

When the CmdDT bit is 0, the EVPD bit is 1, and the Page Code is 83h, the medium changer returns the Device Identification page, which includes three Identification Descriptors, as shown in Table 7-7.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier			Peripheral Device Type (8)				
1	Page Code (83h)							
2	Reserved (0)							
3	Page Length (*n*-3)							
4-n	Identification Descriptors 1–3							

Table 7-7 Device Identification Page

7.5.1 Peripheral Qualifier

The medium changer returns 0 or 3 for the Peripheral Qualifier field, as defined in Table 7-3 on page 7-4.

7.5.2 Peripheral Device Type

The medium changer returns a value of 8 (medium changer device) for the Peripheral Device Type field. If an unsupported LUN is used by the initiator, the medium changer returns a value of 1Fh (unknown or no device type).

7.5.3 Page Code

The medium changer returns a value of 83h for the Page Code field.

7.5.4 Page Length

The Page Length field indicates total length in bytes of Identification Descriptors 1 through 3.

7.5.5 Identification Descriptor 1

Table 7-8 shows the format of the first Identification Descriptor on the Device Identification page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (0)				Code Set (2)			
1	Reserved (0)				Identifier Type (1h)			
2	Reserved (0)							
3	Identifier Length (*n*-3)							
4 to (n+1)	Identifier 1							

Table 7-8 Identification Descriptor 1

Code Set

The medium changer returns a value of 2 for the Code Set field, indicating that Identifier 1 contains ASCII data.

Identifier Type

The medium changer returns a value of 1 for the Identifier Type field, indicating that the first eight bytes of Identifier 1 are the Vendor ID.

Identifier Length

The value returned for the Identification Length field indicates the length of Identifier 1 in bytes.

Identifier 1

The Identifier 1 field includes the following information:

- **Vendor Identification.** This field contains 8 ASCII characters specifying "QUALSTAR" as the vendor of the product.
- **Product Identification.** This field contains 16 ASCII characters identifying the product name ("XLS"). The value in this field is left justified and padded with 13 space characters (20h).

- **Unit Serial Number.** This field contains a variable number of ASCII characters, as follows:

  – The first 1 to *n* characters represent the XLS's serial number.

  – The last character (*n* + 1) is the unique number for the logical library (partition). Because the XLS can be partitioned into up to eight logical libraries, this number can range from 0 to 7. (For more information, refer to "Understanding XLS Logical Libraries" on page 3-1.)

  For example, Logical Library 2 in an XLS with the 7-digit serial number 1234567 would return the following information in the Unit Serial Number field:

  ```
  31h 32h 33h 34h 35h 36h 37h 32h
  ```

7.5.6 Identification Descriptor 2

Table 7-9 shows the format of the second Identification Descriptor on the Device Identification page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (0)				Code Set (1)			
1	Reserved (0)				Identifier Type (2h)			
2	Reserved (0)							
3	Identifier Length (08h)							
4-6	IEEE Company ID (00h 08h 4Fh)							
7	Vendor Specific Extension Identifier							
8								
9								
10								
11								

Table 7-9 Identification Descriptor 2

Code Set

The medium changer returns a value of 1 for the Code Set field, indicating that Identifier 2 contains binary data.

Identifier Type

The medium changer returns a value of 2 for the Identifier Type field, indicating that Identifier 2 contains an IEEE Extended Unique Identifier, 64-bit (EUI-64).

Identifier Length

The medium changer returns a value of 08h for the Identifier Length field, indicating that Identifier 2 contains 8 bytes.

IEEE Company ID

The medium changer returns a value of 00h 08h 4Fh for the IEEE Company ID field, which is Qualstar's IEEE company ID triplet. This is a globally unique value assigned to Qualstar by the IEEE organization.

Vendor Specific Extension Identifier

The XLS can be partitioned into up to eight logical libraries (partitions). This field contains a binary identifier for each logical library, which is calculated using the following formula:

```
(Serial Number * 10) + Logical Library Number
```

For example, Logical Library 2 in an XLS with the 7-digit serial number 1234567 would return the following information for the five-byte Vendor Specific Extension Identifier field:

```
00h 00h BCh 61h 48h (12345672)
```

Identification Descriptor 3

Table 7-10 shows the format of the third Identification Descriptor on the Device Identification page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (0)				Code Set (1)			
1	Reserved (0)				Identifier Type (3h)			
2	Reserved (0)							
3	Identifier Length (08h)							
4-11	Identifier 3							

Table 7-10 Identification Descriptor 3

Code Set

The medium changer returns a value of 1 for the Code Set field, indicating that Identifier 3 contains binary data.

Identifier Type

The medium changer returns a value of 3 for the Identifier Type field, indicating that Identifier 3 contains an FC-PH Name Identifier.

Identifier Length

The medium changer returns a value of 08h for the Identifier Length field, indicating that Identifier 3 contains 8 bytes.

Identifier 3

Table 7-11 shows the format of Identifier 3 (note that the byte numbers start at 4 to reflect the field's position within Identification Descriptor 3).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	NAA (5)							
5	IEEE Company ID (0h 00h 84h Fh)							
6								
7								
8	Vendor Specific Extension Identifier							
9								
10								
11								

Table 7-11 Identifier 3

Name Address Authority The medium changer returns 5 for the NAA field in Identifier 3, signifying an IEEE Registered Name Address Authority.

IEEE Company ID The medium changer returns a value of 0h 00h 84h Fh for the IEEE Company ID field, which is Qualstar's IEEE company ID triplet. This is a globally unique value assigned to Qualstar by the IEEE organization.

Vendor Specific Extension Identifier The XLS can be partitioned into up to eight logical libraries (partitions). The last four bytes of Identifier 3 contain a hexadecimal identifier for each logical library, which is calculated using the following formula:

```
(Serial Number * 10) + Logical Library Number
```

For example, Logical Library 2 in an XLS with the 7-digit serial number 1234567 would return the following information for the Vendor Specific Extension Identifier field:

```
0h 00h BCh 61h 48h (12345672)
```

7.6 Command Support Data

When the CmdDT bit is 1 and the EVPD bit is 0, the medium changer returns the Command Support Data for the SCSI command specified in the Operation Code field, as shown in Table 7-12.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier			Peripheral Device Type (8)				
1	Reserved (0)					Support		
2	ISO/IEC Version (0)		ECMA Version (0)			ANSI Version (3)		
3	Reserved (0)							
4	Reserved (0)							
5	CDB Size (*m*–5)							
6-m	CDB Usage Data							

Table 7-12 Command Support Data

7.6.1 Peripheral Qualifier

The medium changer returns 0 or 3 for the Peripheral Qualifier field, as defined in Table 7-3 on page 7-4.

7.6.2 Peripheral Device Type

The medium changer returns a value of 8 (medium changer device) for the Peripheral Device Type field. If an unsupported LUN is used by the initiator, the medium changer returns a value of 1Fh (unknown or no device type).

7.6.3 Support

Table 7-13 shows the values the medium changer can return for the Support field.

Support	Meaning
000b	Data about the requested SCSI command is not available. All data after Byte 1 is invalid.
001b	The medium changer does not support the requested SCSI command. All data after Byte 1 is undefined.
011b	The medium changer supports the requested SCSI command in conformance with the SCSI standard. Returned data is in the format specified by Table 7-12.
101b	The medium changer supports the requested SCSI command in a vendor-specific manner. Returned data is in the format specified by Table 7-12.

Table 7-13 Valid values for the Support field

7.6.4 ISO/IEC Version

The medium changer returns a value of 0 in the ISO/IEC Version field.

7.6.5 ECMA Version

The medium changer returns a value of 0 in the ECMA Version field.

7.6.6 ANSI Version

The medium changer complies with the ANSI X3.301:1997 (SPC) standard. It returns a value of 3 in the ANSI Version field.

7.6.7 CDB Size

The medium changer returns the length in bytes of the requested command in the CDB Size field.

7.6.8 CDB Usage Data

The medium changer returns information about the requested command in the CDB Usage Data field. The first byte is the Operation Code of the requested command; subsequent bytes are a map indicating which bits are implemented by the command. In the usage map, 1 indicates that the field is implemented; 0 indicates that the field is undefined or reserved.

For example, the CDB Usage Data for the Initialize Element Status command is 07h, 00h, 00h, 00h, 00h, 80h. The CDB Usage Data for the Log Sense command is 4Dh, 03h, FFh, 00h, 00h, FFh, FFh, FFh, FFh, 00h.

7.7 Inquiry Errors

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	BPV	Description
5	24h	00h	1	0001h	1	1	Invalid field in CDB. Both CmdDT and EVPT are set.
5	24h	00h	1	0002h	0	0	Invalid field in CDB. Invalid value for Page or Operation Code.

Table 7-14 Command errors for the Inquiry command

7.8 For More Information

For more information about the Inquiry command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*.

Notes:

8 Log Sense - 4Dh

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (4Dh)							
1	Reserved (0)						PPC (0)	SP (0)
2	PC (1)		Log Sense Page Code					
3-4	Reserved (0)							
5-6	Parameter Pointer							
7-8	Allocation Length							
9	Control (0)							

8.1 Command Description

The Log Sense command instructs the medium changer to return a log page containing operational information about the library. The supported log pages are described in Section 8.3 on page 8-5.

8.1.1 PPC

The value of the Parameter Pointer Control field must be 0, indicating that the medium changer should return all log parameters, beginning with the Parameter Code specified in the Parameter Pointer field and continuing until it returns the number of bytes specified in the Allocation Length field. The medium changer returns all available log parameters for the specified log page until the Allocation Length is exceeded.

8.1.2 SP

The value of the Save Parameters field must be 0, indicating that the medium changer does not save log parameters.

8.1.3 PC

The value of the Page Control field must be 1, indicating that the medium changer maintains cumulative values only.

8.1.4 Log Sense Page Code

The Log Sense Page Code field instructs the medium changer which log page to return. The medium changer supports the Log Sense Page Codes shown in Table 8-1.

Page Code	Page Name	Description
00h	Supported Log Page	Returns a list of log pages supported by the medium changer.
2Eh	TapeAlert Log Page	Returns a list of TapeAlert flags indicating errors or potential problems with the library.
32h	Event History Log Page	Returns a history of the most recent events that occurred during library operation.

Table 8-1 Valid Log Sense Page Codes

8.1.5 Parameter Pointer

The Parameter Pointer field specifies the Parameter Code of the first log parameter the medium changer is to return (described in Section 8.2.2 on page 8-3). The medium changer stops returning data after returning either the log parameter corresponding to the maximum supported Parameter Code or the number of bytes specified by the Allocation Length, whichever is less.

8.1.6 Allocation Length

The Allocation Length field specifies the maximum number of bytes the medium changer should return. The medium changer returns the specified number of bytes or all requested data, whichever is less.

The medium changer does not return partial log parameters. If the Allocation Length would cause the last requested log parameter to be truncated, the medium changer stops after sending the last complete log parameter.

8.2 Log Page Format

A *log page* is a collection of data pertaining to the medium changer. Each log page begins with a four-byte header, followed by zero or more log parameters.

8.2.1 Log Page Header

Table 8-2 shows the general format of a log page header.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (0)		Page Code					
1	Reserved (0)							
2-3	Page Length (*n*-3)							

Table 8-2 General format of a log page header

Page Code

The Page Code field identifies the log page. Table 8-1 on page 8-2 lists the supported Page Codes.

Page Length

The Page Length field indicates how many bytes follow on this log page. It equals the total number of bytes on the page (*n*) minus 3. For example, for a 32-byte log page, *n* equals 31 and the Page Length field equals 28.

8.2.2 Log Parameters

The individual log parameters are returned immediately after the log page header. Each log parameter includes four bytes of descriptive information (bytes 0–3), followed by one or more bytes of data (the Parameter Value).

Table 8-3 shows the general format of a log parameter.

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

Table 8-3 General format of a log parameter

Parameter Code

The Parameter Code field identifies which log parameter is being returned.

Parameter Control Byte

The parameter control byte contains six fields that provides more detailed information about the log parameter, as follows:

DU – Disable Update The value returned for this field, indicates whether the log parameter has been updated to reflect all events, as follows:

0 – Before the medium changer returns the value, it updates it to reflect all events that should be noted by that parameter.

1 – The medium changer does not update the log parameter.

DS – Disable Save The medium changer always returns 1 in this field, indicating that it cannot save the value of the log parameter.

TSD – Target Save Disable The medium changer always returns 0 in this field, indicating that it provides a self-defined method for saving log parameters.

ETC – Enable Threshold Comparison The medium changer always returns 0 in this field, indicating that a comparison to the threshold value is not performed when the cumulative value is updated.

TMC – Threshold Met Criteria Since the ETC bit is 0, the TMC bit is ignored. The medium changer returns 0 for this field.

LP – List Parameter The value returned for this field indicates the parameter type, as follows:

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

Parameter Length

The Parameter Length field indicates the length of the log parameter in bytes.

Parameter Value

The Parameter Value field contains the actual log parameter data.

8.3 Log Pages

This section describes the log pages supported by the medium changer.

8.3.1 Supported Log Pages Page

Table 8-4 shows the format of the Supported Log Pages Page (Page Code 00h). This page lists the log pages supported by the medium changer. The Supported Log Pages Page does not include log parameters.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (0)		Page Code (00h)					
1	Reserved (0)							
2-3	Page Length (3h)							
4	Supported Log Page (00h)							
5	TapeAlert Log Page (2Eh)							
6	Event History Log Page (32h)							

Table 8-4 Format of the Supported Log Pages Page

8.3.2 TapeAlert Log Page

The TapeAlert Log Page allows the medium changer to report internal errors and potential operating problems. When an error or potential problem occurs, the medium changer sets a flag on the TapeAlert Log Page. The TapeAlert Log Page consists of a four-byte header, followed by 64 TapeAlert flags.

TapeAlert Log Page Header

Table 8-5 shows the format of the four-byte header for the TapeAlert Log Page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (0)		Page Code (2Eh)					
1	Reserved (0)							
2-3	Page Length (140h)							

Table 8-5 Format of the TapeAlert Log Page header

Page Code The Page Code for the TapeAlert Log Page is 2Eh.

Page Length The Page Length field for the TapeAlert Log Page is 140h (320 bytes).

TapeAlert Flag

After returning the TapeAlert Log Page header, the medium changer returns 320 bytes of data, representing 64 five-byte flags. The flags are returned in Flag Code order. Table 8-6 shows the format of a TapeAlert flag.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0–1	TapeAlert Flag Code							
2	DU (0)	DS (1)	TSD (0)	ETC (0)	TMC (0)		0	LP (0)
3	Parameter Length (1)							
4	Flag Value							

Table 8-6 Format of a TapeAlert flag

TapeAlert Flag Code Table 8-7 lists the TapeAlert Flag Codes supported by the medium changer.

Note: The medium changer returns information for all 64 flags, whether or not they are supported.

Flag Code	Name	Set by the medium changer when...
1	Library Hardware A	The library mechanism is having difficulty communicating with the drive.
2	Library Hardware B	The library has a hardware fault.
3	Library Hardware C	The library has a hardware fault that requires reset to recover.
4	Library Hardware D	The library has a hardware fault that is not mechanically related, or requires a power cycle to recover.
13	Library Pick Retry	There is a potential problem with a tape drive ejecting cartridges or with the library mechanism picking a cartridge from a slot.
14	Library Place Retry	There is a potential problem with the library mechanism placing a cartridge into a slot.
15	Library Load Retry	There is a potential problem with a tape drive or the library mechanism loading cartridges, or an incompatible cartridge.
16	Library Door	The operation has failed because a door is open.
17	Library Mailslot	The is a mechanical problem with an I/O port.
20	Library Security Mode	The library security mode has changed.
23	Library Scan Retry	There is a potential problem with the barcode label or the barcode reader.
28	Power Supply	A redundant power supply has failed inside the library.

Table 8-7 TapeAlert flag codes and descriptions

Parameter Length The medium changer returns 1 for the Parameter Length field.

Flag Value Bit 0 of the Flag Value field indicates whether the flag is set, as follows:

0 – The flag is not set, or it is not supported by the medium changer.
1 – The flag is set.

Clearing TapeAlert Flags

TapeAlert flags are cleared to 0 after the following events:

- The medium changer is powered on or reset.
- The TapeAlert Log Page is read.
- The specified corrective action is taken.

8.3.3 Event History Log Page

The Event History Log Page is included for compatibility with the Qualstar RLS library. The page returns information about how to access the event log for the medium changer.

Event History Log Page Header

Table 8-8 shows the format of the four-byte header for the Event History Log Page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (0)		Page Code (32h)					
1	Reserved (0)							
2-3	Page Length							

Table 8-8 Format of the Event History Log Page header

Page Code The Page Code for the Event History Log Page is 32h.

Page Length The Page Length for the Event History Log Page is the total length of the variable-length string that follows this header.

Event History String

After returning the Event History Log Page header, the medium changer returns a variable-length string describing where to access event log information for the medium changer.

8.4 For More Information

For more information about the Log Sense command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*.

9 Mode Select - 15h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (15h)							
1	Reserved (0)			PF (1)	Reserved (0)			SP
2-3	Reserved (0)							
4	Parameter List Length							
5	Control (0)							

9.1 Command Description

The Mode Select command enables an initiator to specify various operating parameters for the library. You specify the parameters in a Mode Parameter List that consists of a four-byte header followed by zero or more optional mode pages (described in Section 9.3 on page 9-4). Changes are effective as soon as you make them, and the changes can be saved in nonvolatile RAM for use after the next power-on or reset event.

If the value of any Mode Select parameter is invalid, the medium changer returns the appropriate error and does not change the parameters associated with the command.

> **Important:** If an initiator sends a Mode Select command that changes any parameter, the medium changer returns Check Condition status to all other affected initiators that issue a request to the medium changer. The sense key is set to Unit Attention, and the ASC and ASCQ fields indicate Mode Parameters Changed.

9.1.1 PF

The Page Format field must be 1, indicating that the Mode Select parameters following the header and block descriptor are structured as pages of related parameters and are as specified in the SCSI-3 standard.

9.1.2 SP

The Save Page bit specifies whether the medium changer should save the Mode Select values in nonvolatile RAM for use after the next power-on or reset event.

0 – The medium changer should change the current configuration to the specified values, but it should not save the values in nonvolatile RAM.

1 – The medium changer should change the current configuration to the specified values, and it should save the values in nonvolatile RAM for use after the next power-on or reset event.

> **Important:** The External Data page can change nonvolatile memory, regardless of the setting of the SP bit.

Relationship Between Current and Saved Data

This section explains the relationship between current and saved data.

Current Data Current data reflects the current operating condition of the medium changer. It is stored in volatile RAM and persists until the next time the library is powered on or reset. Upon either of these events, the saved data values overwrite the current values.

You can change the current data by sending a Mode Select command with the SP bit set to 1. Changes are effective as soon as you make them.

Saved Data Saved data is stored in nonvolatile RAM. Each time the medium changer is powered on or reset, any saved data is copied over the current data.

You can change the saved data by sending a Mode Select command with the SP bit set to 2. Changes are effective as soon as you make them and are saved in nonvolatile RAM for use after the next power-on or reset event.

9.1.3 Parameter List Length

The Parameter List Length field specifies how many bytes the initiator will transfer to the medium changer.

0 – Transfer no data.

n – Transfer *n* bytes, where *n* is the length of all mode pages to be transferred, plus four bytes for the header.

Note: If the Parameter List Length would cause a mode page or the header to be truncated, the medium changer returns Check Condition status with the sense key set to Illegal Request. The ASC and ASCQ fields are set to Parameter List Length Error.

9.2 Mode Parameter List

Table 9-1 shows the format of the Mode Parameter List. Bytes 0 through 3 are the four-byte Parameter List Header.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Mode Data Length (0)							
1	Medium Type (0)							
2	Device-Specific Parameter (0)							
3	Block Descriptor Length (0)							
4-n	Mode Page(s)							

n = The total length of all of the Mode pages; n + 1 equals the Parameter List Length in the CDB

Table 9-1 Mode Parameter List

9.2.1 Mode Data Length

This field is reserved for the Mode Select command and must be 0.

9.2.2 Medium Type

This field is reserved for the Mode Select command and must be 0.

9.2.3 Device-Specific Parameter

This field is reserved for the Mode Select command and must be 0.

9.2.4 Block Descriptor Length

This field is reserved for the Mode Select command and must be 0.

9.2.5 Mode Pages

The medium changer supports the following mode pages in a Mode Select command:

- TapeAlert Page (1Ch)
- Element Address Assignment Page (1Dh)
- External Data Page (3Eh)

You can send any number of pages (including none) in one command, but each page can appear only once. You can send the pages in any order.

9.3 Mode Pages

> **Important:** Each logical library in the XLS has its own copy of the TapeAlert, Element Address Assignment, and External Data pages. That is, the data on these pages applies at the logical library level. However, the pages are shared by all SCSI initiators who access the logical library.

9.3.1 TapeAlert Page

The TapeAlert Page lets the initiator specify how the medium changer should report its information exception conditions (also known as *TapeAlerts*). An information exception condition occurs when a certain internal error or potential operating problem takes place and the medium changer sets a TapeAlert flag on the TapeAlert Log Page. Refer to Table 8-7, "TapeAlert flag codes and descriptions," on page 8-6 for a list of supported TapeAlert conditions.

Note: Each logical library can send its own copy of the TapeAlert Page.

To access the information exception information, the initiator can periodically issue Log Sense commands that request the TapeAlert Log Page to determine if a flag has been set.

Table 9-2 shows the format of the TapeAlert Page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	RSVD (0)	RSVD (0)	Page Code (1Ch)					
1	Parameter List Length (0Ah)							
2	Perf (0)	Reserved (0)			DExcept	Test (0)	RSVD (0)	LogErr (0)
3	Reserved (0)				MRIE (0)			
4-7	Interval Timer (0)							
8-11	Report Count/Test Flag Number (0)							

Table 9-2 TapeAlert Page

Page Code

The Page Code field must be 1Ch, indicating that this is the TapeAlert Page.

Parameter List Length

The Parameter List Length field must be 0Ah, indicating that there are 10 more bytes on this page.

Perf (Performance)

The Perf field must be 0.

DExcept (Disable Exception Reporting)

The DExcept bit specifies the exception reporting method to be used, as follows:

0 – Use the reporting method specified by the MRIE field.
1 – Ignore the MRIE field. (This is the default setting.)

Test

The Test bit must be 0, indicating that the medium changer will not generate false (test) information exception conditions.

LogErr (Log Errors)

The LogErr bit must be 0.

MRIE (Method of Reporting Exceptions)

The MRIE field must be 0, indicating that the medium changer should report TapeAlert information on the TapeAlert Log Page only. To access this information, the initiator must periodically issue Log Sense commands.

Interval Timer

The Interval Timer field must be 0.

Report Count/Test Flag Number

The Report Count/Test Flag Number field must be 0.

9.3.2 Element Address Assignment Page

The Element Address Assignment Page lets an initiator assign SCSI element addresses to the elements contained in its logical library. Each logical library has its own copy of the Element Address Assignment Page, and the addresses assigned to one logical library do not affect the addresses in any other logical library.

Note: Each element in the logical library must have a unique address. If the address ranges defined for any of the element types overlap, the medium changer returns Check Condition status. The sense key is Illegal Request and the additional sense code is Invalid Element Address.

The default element addresses, shown in Table 9-4 on page 9-8, are the same for all logical libraries.

Table 9-3 shows the format of the Element Address Assignment Page. This page applies only to those elements assigned to the logical library

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

Table 9-3 Element Address Assignment Page

Page Code

The Page Code field must be 1Dh, indicating that this is the Element Address Assignment Page.

Parameter List Length

The Parameter List Length field must be 12h, indicating that there are 18 more bytes on this page.

First Medium Transport Element Address

This field specifies the address to be assigned to the medium transport element (the handler).

Number of Medium Transport Elements

The library contains one medium transport element, so this field must be 1.

First Storage Element Address

This field specifies the address to be assigned to the first storage element (the first cartridge slot). The medium changer assigns addresses to the remaining cartridge slots in sequential order.

Number of Storage Elements

This field indicates how many cartridge slots are in the logical library. The value of this field is determined when the logical library is created or modified using the XLS Management Interface. It cannot be changed with a Mode Select command.

Note: If you specify a number equal to or less that the actual value, the number is ignored. If you specify a number greater than the actual value, the medium changer returns Check Condition status. The sense key is set to Illegal Request.

First Import/Export Element Address

This field specifies the address to be assigned to the first import/export element assigned to the logical library (the first slot in the first I/O port). The medium changer assigns addresses to the remaining I/O port slots in sequential order.

Note: Each I/O port contains 10 slots, so I/O port elements are assigned in sets of 10.

Number of Import/Export Elements

This field indicates the number of I/O port slots in the logical library. The value of this field is determined when the logical library is created or modified using the XLS Management Interface. It cannot be changed with a Mode Select command.

Note: If you specify a number equal to or less that the actual value, the number is ignored. If you specify a number greater than the actual value, the medium changer returns Check Condition status. The sense key is set to Illegal Request.

First Data Transfer Element Address

This field specifies the address to be assigned to the first data transfer element (the first tape drive). The medium changer assigns addresses to the remaining tape drives in sequential order.

Number of Data Transfer Elements

This field indicates the number of tape drives in the logical library. The value of this field is determined when the logical library is created or modified using the XLS Management Interface. It cannot be changed with a Mode Select command.

Note: If you specify a number equal to or less that the actual value, the number is ignored. If you specify a number greater than the actual value, the medium changer returns Check Condition status. The sense key is set to Illegal Request.

9.3.3 Default Values for Element Address Assignment Page

Table 9-4 shows the default element addresses.

Field	Default Value
Medium Transport Element Address	1000 (3E8h)
Number of Medium Transport Elements	1
First Storage Element Address	2000 (7D0h)
Number of Storage Elements	per user configuration
First Import/Export Element Address	60000 (EA60h)
Number of Import/Export Elements	0, 10, 20, 30, or 40, per user configuration
First Data Transfer Element Address	40000 (9C40h)
Number of Data Transfer Elements	1–32, per user configuration

Table 9-4 Default element addresses

9.3.4 External Data Page

The External Data Page enables the initiator to store up to 32 bytes of data for that logical library in the medium changer's nonvolatile memory. This data cannot be used or altered by the medium changer or any other logical library. The memory can be changed only by issuing a Mode Select command and sending the External Mode Page. The memory can be read by a Mode Sense command.

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

Table 9-5 External Data Page

Page Code

The Page Code field must be 3Eh, indicating that this is the External Data Page.

Parameter List Length

The Parameter List Length field must be 20h, indicating that there are 32 more bytes on this page.

External Data

The External Data field contains 32 bytes of data to be saved by the medium changer in nonvolatile RAM.

9.4 Mode Select Errors

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	1Ah	00h	1	0004h		Parameter list length error.
5	26h	00h	0	x		Invalid field in parameter list.

9.5 For More Information

For more information about the Mode Select command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)* and ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*.

Notes:

10 Mode Sense - 1Ah

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

10.1 Command Description

The Mode Sense command is the complement to the Mode Select command. An initiator can send a Mode Sense command to receive a list of operating parameters from the library. The returned data (the Mode Parameter List) contains a four-byte header followed by zero or more mode pages.

10.1.1 DBD

The medium changer does not support block descriptors, so the Disable Block Descriptors field is ignored.

10.1.2 PC

The Page Control field specifies what type of parameters the medium changer should return. Table 10-1 lists the values for the Page Control field.

PC	Meaning	Result
0	Current Values	The medium changer returns the requested pages with each supported parameter set to its current value. Current values are one of the following: • The parameters set in the last successful Mode Select command. • The saved values, if a Mode Select command has not been executed since the last power-on or reset event. • The default values, if saved values are not available.
1	Changeable Values	The medium changer returns the requested pages with each bit of each field set as follows: • 0 if the field is not changeable • 1 if the field is changeable The Page Code and Parameter List Length fields contain their actual values.
2	Default Values	The medium changer returns the requested pages with each supported parameter set to its default value. The medium changer returns 0 for all unsupported parameters.
3	Saved Values	The medium changer returns the requested pages with each supported parameter set to its saved value. The medium changer returns 0 for all unsupported parameters. If no page has been saved, the medium changer returns default values.

Table 10-1 Values for the Page Control field

10.1.3 Page Code

The Page Code field specifies which mode page the medium changer should return. Table 10-2 lists the mode pages supported by the medium changer.

Page Code	Page Name
1Ch	TapeAlert
1Dh	Element Address Assignment
1Eh	Transport Geometry Parameters
1Fh	Device Capabilities
3Eh	External Data
3Fh	All pages in page code order

Table 10-2 Page Codes for the Mode Sense command

10.1.4 Allocation Length

The Allocation Length specifies the number of bytes the initiator has allocated for returned Mode Sense data. If the medium changer receives an Allocation Length of 0, it does not transfer any data.

The medium changer transfers the requested amount of data or the number specified by the Allocation Length, whichever is less.

10.2 Mode Parameter List

Table 10-3 shows the format of the Mode Parameter List.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Mode Data Length (*n*)							
1	Medium Type (0)							
2	Device-Specific Parameter (0)							
3	Block Descriptor Length (0)							
4-n	Mode Page(s)							

Table 10-3 Mode Parameter List

10.2.1 Mode Data Length

The Mode Data Length field indicates the total number of bytes the medium changer is returning, not including this byte.

10.2.2 Medium Type

The medium changer returns 0 for the Medium Type field.

10.2.3 Device-Specific Parameter

The medium changer returns 0 for the Device-Specific Parameter field.

10.2.4 Block Descriptor

The medium changer returns 0 for the Block Descriptor Length field.

10.3 Mode Pages

> **Important:** Each logical library in the XLS has its own copy of the TapeAlert, Element Address Assignment, and External Data pages. That is, the data on these pages applies at the logical library level. However, the pages are shared by all SCSI initiators who access the logical library.

10.3.1 TapeAlert Page

The TapeAlert Page provides information to the initiator about how the medium changer will report its information exception conditions (also known as *TapeAlert conditions*). An information exception condition occurs when a certain internal error or potential operating problem takes place and the medium changer sets a TapeAlert flag on the TapeAlert Log Page. Refer to Table 8-7, "TapeAlert flag codes and descriptions," on page 8-6 for a list of supported TapeAlert conditions.

Table 10-4 shows the format of the TapeAlert Page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (1)	RSVD (0)	Page Code (1Ch)					
1	Parameter Length (0Ah)							
2	Perf (0)	Reserved (0)			DExcpt	Test (0)	RSVD (0)	LogErr (0)
3	Reserved (0)				MRIE (0)			
4-7	Interval Timer (0)							
8-11	Report Count/Test Flag Number (0)							

Table 10-4 TapeAlert Page

PS

The medium changer returns 1 for the parameters savable (PS) bit, indicating that it can save the TapeAlert page in a nonvolatile location.

Page Code

The medium changer returns 1Ch for the Page Code field, indicating that this is the TapeAlert Page.

Parameter List Length

The medium changer returns 0Ah for the Parameter List Length field, indicating that there are 10 more bytes on this page.

Perf (Performance)

The medium changer returns 0 for the Perf field.

DExcept (Disable Exception Reporting)

The DExcept bit specifies the exception reporting method to be used, as follows:

0 – Use the reporting method specified by the MRIE field.
1 – Ignore the MRIE field. (This is the default setting.)

Test

The medium changer returns 0 for the Test bit, indicating that it will not generate false (test) information exception conditions.

LogErr (Log Errors)

The medium changer returns 0 for the LogErr bit.

MRIE (Method of Reporting Exceptions)

The medium changer returns 0 for the MRIE field, indicating that it reports TapeAlert information on the TapeAlert Log Page only. To access this information, the initiator must periodically issue Log Sense commands.

Interval Timer

The medium changer returns 0 for the Interval Timer field.

Report Count

The medium changer returns 0 for the Report Count/Test Flag Number field.

10.3.2 Element Address Assignment Page

The Element Address Assignment Page provides information to the initiator about the medium changer's assigned element addresses. Table 10-5 shows the format of the Element Address Assignment Page.

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

Table 10-5 Element Address Assignment Page

PS

The medium changer returns a value of 1 in the Parameters Savable field, indicating that it can save the Element Address Assignment Page in a nonvolatile location.

Page Code

The medium changer returns 1Dh in the Page Code field, indicating that this is the Element Address Assignment Page.

Parameter Length

The medium changer returns 12h for the Parameter Length field, indicating that there are 18 more bytes of data on this page.

First Medium Transport Element Address

This field indicates the address assigned to the medium transport element (the handler). Refer to Table 9-4 on page 9-8 for the default element address.

Number of Medium Transport Elements

The library contains one medium transport element, so the medium changer returns 1 for this field.

First Storage Element Address

This field indicates the address assigned to the first storage element (the first cartridge slot). Refer to Table 9-4 on page 9-8 for the default element addresses.

Number of Storage Elements

This field indicates the number of cartridge slots in the logical library. The value of this field is determined when the logical library is created or modified using the XLS Management Interface. It cannot be changed with a Mode Select command.

First Import/Export Element Address

This field indicates the address assigned to the first import/export element assigned to the logical library (the first slot in the first I/O port). Refer to Table 9-4 on page 9-8 for the default element addresses.

Number of Import/Export Elements

This field indicates the number of I/O port slots in the logical library. The value of this field is determined when the logical library is created or modified using the XLS Management Interface. It cannot be changed with a Mode Select command.

First Data Transfer Element Address

This field indicates the address assigned to the first data transfer element (the first tape drive). Refer to Table 9-4 on page 9-8 for the default element addresses.

Number of Data Transfer Elements

This field indicates the number of tape drives in the logical library. The value of this field is determined when the logical library is created or modified using the XLS Management Interface. It cannot be changed with a Mode Select command.

10.3.3 Transport Geometry Parameters Page

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

Table 10-6 Transport Geometry Parameters Page

PS

The medium changer returns a value of 0 in the Parameters Savable field, indicating that it cannot save the Transport Geometry Parameters Page in a nonvolatile location.

Page Code

The medium changer returns 1Eh in the Page Code field, indicating that this is the Transport Geometry Parameters Page.

Parameter Length

The medium changer returns 02h for the Parameter Length field, indicating that there are two more bytes of data on this page.

Rotate

The medium changer returns 0 for the Rotate bit, indicating that it does not support media rotation.

Member Number in Transport Element Set

The medium changer returns 0 for this field because it has one Transport Element.

10.3.4 Device Capabilities Page

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

Legend:
DT = Data Transfer element (tape drive)
I/E = Import/Export element (I/O port slot)
MT = Medium Transport element (handler)
ST = Storage element (cartridge slot)
⇒ = Source of move is the first element; destination of move is the second element
⇔ = Exchange between two elements

Table 10-7 Device Capabilities Page

PS

The medium changer returns a value of 0 in the Parameters Savable field, indicating that it cannot save the Device Capabilities Page in nonvolatile location.

Page Code

The medium changer returns 1Fh in the Page Code field, indicating that this is the Device Capabilities Page.

Parameter Length

The medium changer returns 12h for the Parameter Length field, indicating that there are 18 more bytes of data on this page.

Byte 2 - Medium Storage Capability

Byte 2 indicates which elements of the medium changer can store cartridges, as follows:

0 – The element cannot store a cartridge.
1 – The element can store a cartridge.

As shown in Table 10-7 on page 10-9, the library can store cartridges in all elements except the Medium Transport element (the handler).

Bytes 4 through 7 - Medium Movement Capabilities

Bytes 4 through 7 describe the medium changer's support for the Move Medium command, as follows:

0 – The medium changer does not support a Move Medium command when the source is the first specified element and the destination is the second.

1 – The medium changer does support a Move Medium command when the source is the first specified element and the destination is the second.

For example: as shown in Table 10-7 on page 10-9, the value of byte 5, bit 3, is 1 because the medium changer can move a cartridge from a Storage element (a cartridge slot) to a Data Transfer element (a tape drive). The value of byte 5, bit 0, is 0 because the Medium Transport element cannot be the destination of a move.

Note: If the logical library does not include an I/O port, Medium Movement Capabilities fields with "I/E" as the source or destination are 0.

Bytes 12 through 15 - Medium Exchange Capabilities

The medium changer does not support the Exchange Medium command and returns 0 for bytes 12 through 15.

10.3.5 External Data Page

The External Data Page returns the contents of a portion of the library's nonvolatile memory, which can be used by initiator to store up to 32 bytes of data. This data is not used or altered by the medium changer in any way. The memory can be changed only by issuing a Mode Select command and sending the External Data Page.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (1)	RSVD (0)	Page Code (3Eh)					
1	Parameter Length (20h)							
2-33	External Data							

Table 10-8 External Data Page

PS

The medium changer returns a value of 1 in the Parameters Savable field, indicating that it can save the External Data Page to nonvolatile memory.

Page Code

The medium changer returns 3Eh in the Page Code field, indicating that this is the External Data Page.

Parameter Length

The medium changer returns 20h for the Parameter Length field, indicating that there are 32 more bytes of data on this page.

External Data

The medium changer returns 32 bytes of data in the External Data field. This data was stored in the library's nonvolatile memory by a previous Mode Select command.

10.4 Mode Sense Errors

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

10.5 For More Information

For more information about the Mode Sense command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)* and ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC).*

11 Move Medium - A5h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (A5h)							
1	Reserved (0)							
2-3	Medium Transport Address							
4-5	Source Address							
6-7	Destination Address							
8-9	Reserved (0)							
10	Reserved (0)							INV (0)
11	I/O Port Code		Control (0)					

11.1 Command Description

The Move Medium command can perform either of two functions:

- It can instruct the medium changer to move a cartridge from the location specified in Source Address field to the location specified in Destination Address field. The medium changer returns Good status after the cartridge has successfully been placed in its destination.

  The address specified by the Source or Destination Address field can be a cartridge slot, an I/O port slot, or a tape drive. If the destination is a tape drive, the medium changer pushes the cartridge into the tape drive.

> **Important:** The Medium Transport element cannot store a cartridge, so it can be neither the source nor the destination of a Move Medium command.

- It can instruct the medium changer to make the I/O port inaccessible to the software so that the port can be opened by an operator using the XLS Management Interface.

When moving a cartridge, the medium changer first checks the validity of the addresses and the status of the locations. It then performs one of the following actions:

- If the source is occupied and the destination is empty, it moves the cartridge.

> **Important:** If the source is a tape drive and the cartridge has not been ejected from the tape drive, the medium changer holds the command and waits up to 5 minutes for the cartridge to become accessible.
>
> - If the cartridge becomes accessible before the timeout is exceeded, the medium changer performs the requested action and returns Good status.
> - If the cartridge does not become accessible before the timeout value is exceeded, the medium changer returns Check Condition status with the sense key set to Illegal Request.

- If the source is empty or the destination is occupied, it returns Check Condition status and does not move the handler.

- If the source and destination addresses are equal and both are full, it performs no action unless the element is a tape drive. In this case, it reinserts an ejected cartridge into the tape drive.

The medium changer updates the cartridge inventory during the command to reflect the actual location of the cartridge being moved.

For the default element addresses for the library, refer to Table 9-4, "Default element addresses," on page 9-8. For valid combinations of source and destinations for the Move Medium command, refer to Table 10-7, "Device Capabilities Page," on page 10-9.

11.1.1 Medium Transport Address

The Medium Transport Address field specifies the address of the handler, as follows:

0 – The medium changer should use the current address of the handler.

n – The medium changer should use *n* as the address of the handler.

> **Note:** If *n* does not match the current address of the handler, the medium changer returns Check Condition status. Refer to Section 9.3.2, "Element Address Assignment Page," on page 9-5 for more information.

11.1.2 Source Address

The Source Address field specifies the element address from which the cartridge is to be taken.

Note: If the I/O Port field is 01b, the Source Address field is ignored.

11.1.3 Destination Address

The Destination Address field specifies the element address where to place the cartridge.

Note: If the I/O Port field is 01b, the Destination Address field is ignored.

11.1.4 INV

The Invert field must be 0 because the handler cannot invert (turn or rotate) a cartridge.

11.1.5 I/O Port Code

For security purposes, a user must physically open the I/O port by using options on the XLS Management Interface. The I/O Port Code field allows the initiator to extend the I/O port before it is physically opened. When an I/O port is *extended*, the I/O port slots (that is, the import/export elements) become inaccessible to the initiator, but the I/O port remains closed.

> **Important:** The I/O port does not need to be extended by the initiator in order for the user to physically open the I/O port from the XLS Management Interface.

Table 11-1 lists the action performed for each value of the I/O Port Code field.

Bit 7	Bit 6	Definition
0	0	Perform a normal move. Do not make the I/O port inaccessible.
0	1	Extend the I/O port. That is, make the import/export elements inaccessible to the initiator. See "Effect of Extending the I/O Port", below.
1	0	Ignored.
1	1	Illegal Request.

Table 11-1 Values for the I/O Port Code field

Effect of Extending the I/O Port

If I/O port is extended by a Move Medium command (or physically opened from the XLS Management Interface), the medium changer returns Check Condition status to the following motion and inventory commands. The sense key is set to Not Ready and the ASC and ASCQ are set to 04h 82h:

- Initialize Element Status
- Initialize Element Status with Range
- Move Medium
- Position to Element
- Read Element Status
- Request Volume Element Address

- Send Diagnostic (Good status is returned if no motion or inventory access is required)
- Send Volume Tag
- Test Unit Ready

The medium changer continues to report Not Ready to these commands until all physical I/O ports for the logical library partition have been closed and scanned. When the I/O port scan is complete, the medium changer returns Check Condition status with the sense key set to Unit Attention. The ASC and ASCQ are set to 28h 01h (Import or export element accessed).

See Appendix A, "Using the I/O Port," for complete details.

11.2 Move Medium Errors

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	3Bh	0Dh	1	0006h		Medium destination element full. The element specified by Destination Address is full.
5	3Bh	0Eh	1	0004h		Medium source element empty. The element specified by the Source Address is empty.
5	53h	02h				Medium removal prevented. The I/O port cannot be extended because medium removal is prevented. See Section A.4, "Effect of Prevent/Allow Medium Removal Command," on page A-5.
5	21h	01h	1	0002h		Invalid element address. The address specified for the medium transport is invalid.
5	21h	01h	1	0004h		Invalid element address. The address specified for the source is invalid.
5	21h	01h	1	0006h		Invalid element address. The address specified for the destination is invalid.
5	3Bh	90h	1	0004h		Cartridge is not ejected from the tape drive specified by the Source Address.
5	80h	03h	1	0004h		Source element not installed.
5	80h	04h	1	0006h		Destination element not installed.
5	80h	05h				Source tape drive not installed.
5	80h	06h				Destination tape drive not installed.

Table 11-2 Move Medium Command Specific Errors

11.3 For More Information

For more information about the Move Medium command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*.

Notes:

12 Position to Element - 2Bh

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (2Bh)							
1	Reserved (0)							
2-3	Medium Transport Address							
4-5	Destination Address							
6-7	Reserved (0)							
8	Reserved (0)							Invert (0)
9	Control (0)							

12.1 Command Description

The Position to Element command instructs the medium changer to move the handler to a specified destination.The address specified by the Destination Address field can be a cartridge slot, an I/O port slot, or a tape drive.

Note: The medium changer returns Check Condition status if the Medium Transport element is specified as a destination of a Position to Element command.

12.1.1 Medium Transport Address

The Medium Transport Address field specifies the address of the handler, as follows:

0 – The medium changer should use the current address of the handler.

n – The medium changer should use *n* as the address of the handler.

Note: If *n* does not match the current address of the handler, the medium changer returns Check Condition status. Refer to Section 9.3.2, "Element Address Assignment Page," on page 9-5 for more information.

12.1.2 Destination Address

The Destination Address field specifies which element address the handler should be moved to.

12.1.3 Invert

The Invert field must be 0 because the handler cannot invert (turn or rotate) a cartridge.

12.2 Position to Element Errors

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	21h	01h	1	0002h		Invalid element address. The address specified for the handler is invalid.
5	21h	01h	1	0004h		Invalid element address. The address specified for the destination is invalid.

Table 12-1 Position to Element errors

12.3 For More Information

For more information about the Position to Element command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC).*

13 Prevent/Allow Medium Removal - 1Eh

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

13.1 Command Description

The Prevent/Allow Medium Removal command enables an initiator to prevent the I/O port from being physically opened from the XLS Management Interface while the logical library is online.

CAUTION

If the logical library is offline, an operator can open the I/O ports for the physical library regardless of whether a Prevent Medium Removal command has been issued.

13.1.1 Prevent

Table 13-1 lists the action performed for each value of the Prevent field.

Bit 1	Bit 0	Definition
0	0	Allow the I/O port to be opened
0	1	Prevent the I/O port from being opened
1	0 or 1	Illegal Request

Table 13-1 Values for the Prevent field

Following a power-on or reset event, all initiators are set to Allow.

Note: The Prevent field is ignored if the logical library does not have an I/O port.

As shown in Table 13-2, the effect of the Prevent/Allow Medium Removal command varies depending on the state of the I/O port when the command is issued.

If the I/O port has been...		It can be extended by the initiator?	It can be opened from the XLS Management Interface?
Extended[1]	Prevented[2]		
No	No	Yes	Yes
No	Yes	Yes	No
Yes	No	No[3]	Yes
Yes	Yes	No[3]	Yes

1. An I/O port is extended when the initiator sends a Move Medium command with the I/O Port Code field set to 01b.
2. An I/O port is prevented when the initiator sends a Prevent/Allow Medium Removal command with the Prevent field set to 01b.
3. Attempting to extend an already-extended I/O port returns Check Condition status. The sense key is set to Not Ready.

Table 13-2 Effect of Prevent/Allow Medium Removal command on I/O port operation

13.2 Considerations in a Multi-Initiator Environment

When two or more initiators share the logical library, the Prevent/Allow Medium Removal command operates as follows:

- Multiple initiators can issue Prevent commands. For example, initiators A and B can both issue commands to prevent medium removal.
- The medium changer keeps track of the following:
  - Which initiators have issued the Prevent command
  - How many times each initiator has issued the Prevent command.
- To allow medium removal, each initiator must issue as many Allow commands as it issued Prevent commands. That is, if initiator A issued four Prevent commands, it must issue four Allow commands.
- It is never an error to issue an Allow command, even if a Prevent command has not been sent or the logical unit or any elements are reserved.
- If the logical unit or any elements are reserved, the medium changer compares the ID of the initiator issuing the Prevent command to the ID of the initiator controlling the reservation. If the IDs are not the same, the medium changer returns Reservation Conflict status.

  Note: If medium removal is prevented, the logical unit or elements can be reserved by another initiator. However, if the logical unit or element is reserved, another initiator cannot prevent medium removal.

13.3 For More Information

For more information about the Prevent/Allow Medium Removal command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*.

Notes:

14 Read Element Status - B8h

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

14.1 Command Description

The Read Element Status command instructs the medium changer to report current information about its elements to the initiator. The returned information, called e*lement status data*, is described in Section 14.2 on page 14-3.

Upon receiving a Read Element Status command, the medium changer returns element status data for the range of elements specified by the Element Type Code, Starting Element Address, and Number of Elements fields. The size of the data set returned is determined by the command's Allocation Length field, as explained in Section 14.1.7 on page 14-3.

14.1.1 VolTag

The Volume Tag bit specifies whether the medium changer should return volume tag (barcode label) information for each element, as follows:

0 – Do not return volume tag information.
1 – Return volume tag information.

Refer to Section 14.4 on page 14-20 for the format of the volume tag information.

14.1.2 Element Type Code

The Element Type Code field specifies the type of element the medium changer should return data for. Table 14-1 lists the values of this field.

Element Type Code	Type	Description
0h	All element types	Report on all element types in element address order, starting with the Starting Element Address
1h	Medium Transport Element	Report on the handler
2h	Storage Element	Report on one or more cartridge slots
3h	Import/Export Element	Report on one or more slots in an I/O port
4h	Data Transfer Element	Report on one or more tape drives

Table 14-1 Values for the Element Type Code field

14.1.3 Starting Element Address

The Starting Element Address field specifies the first (lowest) element address the medium changer should return data for. The medium changer returns information about those elements specified by Element Type code that have element addresses equal to or greater than the Starting Element Address.

14.1.4 Number of Elements

The Number of Elements field specifies the maximum number of elements the medium changer should return data for.

14.1.5 CurData

The Current Data bit specifies whether the medium changer may move the handler to the element to confirm its status before returning data.

If an initiator sends a Read Element Status command with the CurData bit set to 0 and the element is reserved by another initiator, the medium changer returns a Reservation Conflict error. If the CurData bit is 1, a Reservation Conflict error does not occur.

14.1.6 DVCID

The Device ID bit determines the format of the data returned for the data transfer elements (tape drives). See Section 14.3.4, "Data Transfer Element Descriptor," on page 14-16 for more information.

14.1.7 Allocation Length

The Allocation Length field specifies how many bytes the initiator has reserved for the return of element status data, as follows:

- If the Allocation Length is equal to or greater than the length of the element status data, the medium changer returns all data.
- If the Allocation Length would cause an element descriptor or header to be truncated, the medium changer returns the last complete element descriptor, then stops. It does not return an incomplete element descriptor.

To determine the correct Allocation Length for a given set of element status data, follow these steps:

1. Issue a Read Element Status command with the Allocation Length set to 8.

   The Byte Count of Report Available field (bytes 5 through 7) returned in the Element Status Header indicates the number of bytes available. See **"Byte Count of Report Available" on page 14-5**.

2. Reissue the command with the Allocation Length set to the value of the Byte Count of Report Available field, plus 8.

14.2 Element Status Data

Figure 14-1 illustrates the hierarchical format of element status data. Element status data begins with an eight-byte Element Status Header, which is followed by zero to four Element Status pages (reflecting the four types of elements). Similarly, each Element Status page begins with an eight-byte header, which is followed by one or more element descriptors (reflecting the individual elements).

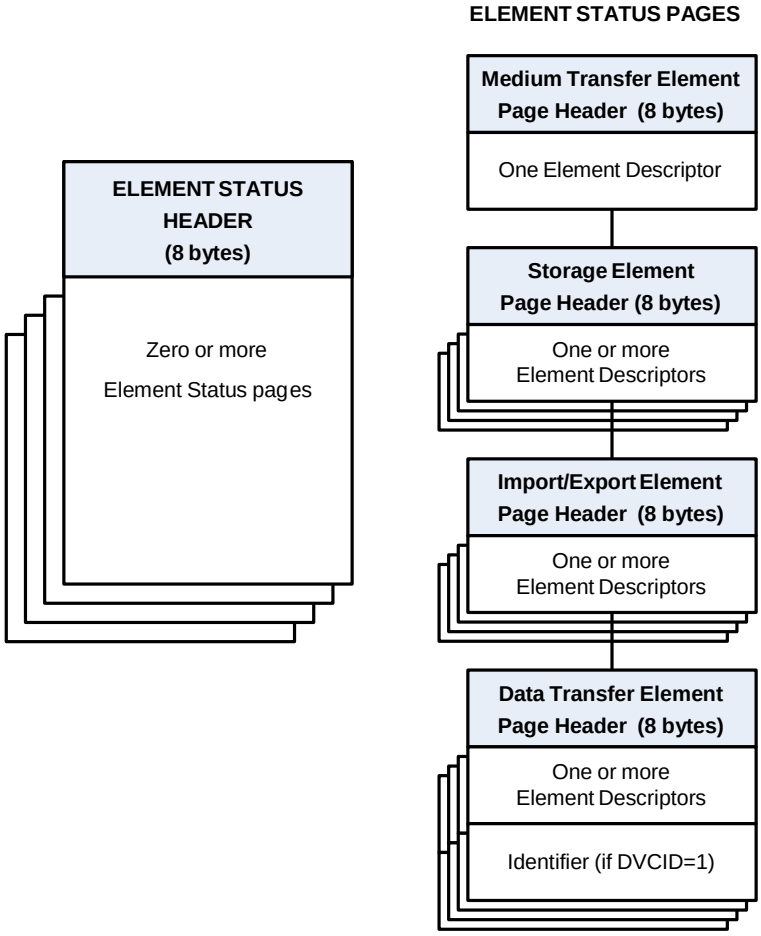


Figure 14-1 Hierarchy of element status data

The medium changer returns Element Status pages and descriptors in element address order. Element Status pages always contain at least one descriptor.

Note: Since you can change the element addresses with a Mode Select command, the medium changer may not return Element Status pages in the same order from command to command

14.2.1 Element Status Header

The medium changer returns one eight-byte Element Status Header for each Read Element Status command. Table 14-2 shows the general format of the Element Status Header.

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

Table 14-2 Format of Element Status Header

First Element Address Reported

The First Element Address Reported field indicates the address of the first element for which the medium changer is returning an element descriptor.

Number of Elements Available

The Number of Elements Available field indicates the total number of element descriptors that meet the requirements of the CDB. If the Allocation Length is sufficient, the medium changer returns element descriptors for this number of elements.

Byte Count of Report Available

The Byte Count of Report Available field indicates the number of bytes of element status data available to be returned. If the Allocation Length is sufficient, the medium changer returns this amount of data.

14.2.2 Element Status Page Header

The medium changer returns one Element Status page for each type of element requested (medium transport, storage, import/export, and data transfer). Each Element Status page begins with an eight-byte header, which is followed by one or more element descriptors. Table 14-3 shows the format of the Element Status Page Header.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Element Type Code							
1	PVolTag	AVolTag (0)	Reserved (0)					
2-3	Element Descriptor Length (*z*)							
4	Reserved (0)							
5-7	Byte Count of Descriptor Data Available (this page, *x*-7)							
⋮	Element Descriptors							

Table 14-3 Format of an Element Status Page Header

Element Type Code

The Element Type Code field indicates the type of element the medium changer is reporting on this Element Status page, as follows:

- 1h – Medium Transport Element (the handler)
- 2h – Storage Element (cartridge slot)
- 3h – Import/Export Element (I/O port slot)
- 4h – Data Transfer Element (tape drive)

PVolTag

The Primary Volume Tag bit indicates whether the element descriptors contain information in the Primary Volume Tag Information field, as follows:

0 – The element descriptors do not contain volume tag information.
1 – The element descriptors do contain volume tag information.

AVolTag

The medium changer returns 0 for the Alternate Volume Tag field.

Element Descriptor Length

The Element Descriptor Length field indicates how many bytes are in a single element descriptor. The value returned for this field depends on the setting of the VolTag and DVCID bits in the Read Element Status CDB (that is, it depends on whether volume tag and device identification information are being returned).

Byte Count of Descriptor Data Available

The Byte Count of Descriptor Data Available field indicates the total number of bytes of element descriptor data that is available to be returned for this element type. If the Allocation Length is sufficient, the medium changer returns this amount of data.

The value returned in this field equals the Element Descriptor Length times the number of element descriptors of the specified type.

14.3 Element Descriptors

For each Element Status page, the medium changer returns one or more element descriptors of the specified element type. The element descriptors are returned immediately after the Element Status Page Header in ascending element address order.

14.3.1 Medium Transport Element Descriptor

The library returns one Medium Transport Element Descriptor for all initiators to report on the status of the handler. Table 14-4 shows the format of the Medium Transport Element Descriptor.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved (0)					Except	RSVD (0)	Full
3	Reserved (0)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	Reserved (0)							
9	SValid	Invert (0)	Reserved (0)					
10-11	Source Storage Element Address							
(36 bytes)	Primary Volume Tag Information (omitted if PVolTag is 0)							
(1 byte)	Reserved (0)				Code Set (0)			
(1 byte)	Reserved (0)				Identifier Type (0)			
(1 byte)	Reserved (0)							
(1 byte)	Identifier Length (0)							

Table 14-4 Medium Transport Element Descriptor

Element Address

The Element Address field indicates the address of the medium transport element (the handler). The default address is 1000 (3E8h).

Except

The Exception bit indicates whether an exception condition exists, as follows:

0 – The handler is in its normal state.

1 – The handler is in an abnormal state. The ASC and ASCQ fields provide more information about the condition (see Section 14.5 on page 14-21). The Full and Primary Volume Tag fields are invalid.

Full

If Except is 0, the Full bit indicates whether the handler contains a cartridge, as follows:

0 – The handler does not contain a cartridge.
1 – The handler contains a cartridge.

If Except is 1, the Full bit is invalid.

Additional Sense Code (ASC)

If Except is 1, the medium changer returns 83h for the Additional Sense Code field.

Additional Sense Code Qualifier (ASCQ)

If Except is 1, the Additional Sense Code Qualifier field describes the specific exception condition. See Section 14.5 on page 14-21.

SValid

The Source Valid field indicates whether the value in the Source Storage Element Address field is valid, as follows:

0 – The Source Storage Element Address field is not valid.
1 – The Source Storage Element Address field is valid.

Invert

The medium changer always returns 0 for the Invert field.

Source Storage Element Address

If the SValid bit is 1, the Source Element Address field indicates the address of the last element this cartridge occupied.

Primary Volume Tag Information

If the PVolTag bit in the Element Status Page Header is 1 (see page 14-6), the Primary Volume Tag Information field contains 36 bytes of information for this element. If the PVolTag bit is 0, this field is omitted.

Section 14.4 on page 14-20 describes the Primary Volume Tag Information field.

Note: If the Full bit is 0, the information in this field is undefined (all 0s).

Code Set

The medium changer returns 0 for the Code Set field.

Identifier Type

The medium changer returns 0 for the Identifier Type field.

Identifier Length

The medium changer returns 0 for the Identifier Length field.

14.3.2 Storage Element Descriptor

The number of Storage Element Descriptors available to be returned depends on the number of cartridge slots assigned to the logical library accessed by this initiator. Table 14-5 shows the format of a Storage Element Descriptor.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved (0)				Access	Except	RSVD (0)	Full
3	Reserved (0)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	Reserved (0)							
9	SValid	Invert (0)	Reserved (0)					
10-11	Source Storage Element Address							
(36 bytes)	Primary Volume Tag Information (omitted if PVolTag is 0)							
(1 byte)	Reserved (0)				Code Set (0)			
(1 byte)	Reserved (0)				Identifier Type (0)			
(1 byte)	Reserved (0)							
(1 byte)	Identifier Length (0)							

Table 14-5 Storage Element Descriptor

Element Address

The Element Address field indicates the element address of the cartridge slot.

Access

If Except is 0, the Access bit indicates whether the cartridge slot can be accessed by the handler, as follows:

0 – The cartridge slot cannot be accessed by the handler.
1 – The cartridge slot can be accessed by the handler.

If Except is 1, the value of the Access bit is invalid.

Except

The Exception bit indicates whether an exception condition exists, as follows:

0 – The cartridge slot is in its normal state.

1 – The cartridge slot is in an abnormal state. The ASC and ASCQ fields provide more information about the condition (see Section 14.5 on page 14-21). The Full and Primary Volume Tag fields are invalid.

Full

If Except is 0, the Full bit indicates whether the cartridge slot contains a cartridge, as follows:

0 – The cartridge slot does not contain a cartridge.
1 – The cartridge slot contains a cartridge.

If Except is 1, the Full bit is invalid.

Additional Sense Code (ASC)

If Except is 1, the medium changer returns 83h for the Additional Sense Code field.

Additional Sense Code Qualifier (ASCQ)

If Except is 1, the Additional Sense Code Qualifier field describes the specific exception condition. See Section 14.5 on page 14-21.

SValid

The Source Valid field indicates whether the value in the Source Storage Element Address field is valid, as follows:

0 – The Source Storage Element Address field is not valid.
1 – The Source Storage Element Address field is valid.

Invert

The medium changer always returns 0 for the Invert field.

Source Storage Element Address

If the SValid bit is 1, the Source Element Address field indicates the address of the last element this cartridge occupied.

Primary Volume Tag Information

If the PVolTag bit in the Element Status Page Header is 1 (see page 14-6), the Primary Volume Tag Information field contains 36 bytes of information for this element. If the PVolTag bit is 0, this field is omitted.

Section 14.4 on page 14-20 describes the Primary Volume Tag Information field.

Note: If the Full bit is 0, the information in this field is undefined (all 0s).

Code Set

The medium changer returns 0 for the Code Set field.

Identifier Type

The medium changer returns 0 for the Identifier Type field.

Identifier Length

The medium changer returns 0 for the Identifier Length field.

14.3.3 Import/Export Element Descriptor

The number of Import/Export Element Descriptors available to be returned depends on the number of physical I/O ports, if any, assigned to the logical library accessed by this initiator. Each physical I/O port has 10 slots. Table 14-6 shows the format of an Import/Export Element Descriptor.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved (0)		InEnab (1)	ExEnab (1)	Access	Except	ImpExp	Full
3	Reserved (0)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6-8	Reserved (0)							
9	SValid	Invert (0)	Reserved (0)					
10-11	Source Storage Element Address							
(36 bytes)	Primary Volume Tag Information (omitted if PVolTag is 0)							
(1 byte)	Reserved (0)				Code Set (0)			
(1 byte)	Reserved (0)				Identifier Type (0)			
(1 byte)	Reserved (0)							
(1 byte)	Identifier Length (0)							

Table 14-6 Import/Export Element Descriptor

Element Address

The Element Address field indicates the element address of the I/O port slot.

InEnab

The medium changer always returns 1 for the Import Enable bit, indicating that a cartridge can be moved from the I/O port slot into the library.

ExEnab

The medium changer always returns 1 for the Export Enable bit, indicating that a cartridge can be moved from the I/O port slot out of the library.

Access

The Access bit indicates whether the slot in the I/O port can be accessed by the handler, as follows:

0 – The I/O port slot cannot be accessed by the handler. For example, the I/O port is closed, but the magazine is missing.

1 – The I/O port slot can be accessed by the handler.

Except

The Exception bit indicates whether an exception condition exists, as follows:

0 – The I/O port slot is in its normal state.

1 – The I/O port slot is in an abnormal state. For example, the I/O port magazine may be missing. The ASC and ASCQ fields provide more information about the condition (see Section 14.5 on page 14-21).

ImpExp

When the Full bit is 1, the Import/Export bit indicates whether the cartridge currently in the I/O port slot was placed there by the operator or the handler, as follows:

0 – The cartridge was placed there by the handler.
1 – The cartridge was placed there by the operator.

Full

If Except is 0, the Full bit indicates whether the element contains a cartridge, as follows:

0 – The element does not contain a cartridge.
1 – The element contains a cartridge.

If Except is 1, the Full bit is invalid.

Additional Sense Code (ASC)

If Except is 1, the medium changer returns 83h for the Additional Sense Code field.

Additional Sense Code Qualifier (ASCQ)

If Except is 1, the Additional Sense Code Qualifier field describes the specific exception condition. See Section 14.5 on page 14-21.

SValid

The Source Valid field indicates whether the value in the Source Storage Element Address field is valid, as follows:

0 – The Source Storage Element Address field is not valid.
1 – The Source Storage Element Address field is valid.

Invert

The medium changer always returns 0 for the Invert field.

Source Storage Element Address

If the SValid bit is 1, the Source Element Address field indicates the address of the last element this cartridge occupied.

Primary Volume Tag Information

If the PVolTag bit in the Element Status Page Header is 1 (see page 14-6), the Primary Volume Tag Information field contains 36 bytes of information for this element. If the PVolTag bit is 0, this field is omitted.

Section 14.4 on page 14-20 describes the Primary Volume Tag Information field.

Note: If the Full bit is 0, the information in this field is undefined (all 0s).

Code Set

The medium changer returns 0 for the Code Set field.

Identifier Type

The medium changer returns 0 for the Identifier Type field.

Identifier Length

The medium changer returns 0 for the Identifier Length field.

14.3.4 Data Transfer Element Descriptor

Table 14-7 shows the format of a Data Transfer Element Descriptor. The number of Data Transfer Element Descriptors available to be returned depends on how many tape drives are assigned to the logical library. The format and length of each descriptor depends on the following:

- The setting of the PVolTag bit in the Element Status Page Header (see "PVolTag" on page 14-6)
- The setting of DVCID bit in the Read Element Status CDB (see Section 14.1.6 on page 14-2).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved (0)				Access	Except	RSVD (0)	Full
3	Reserved (0)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Not Bus	RSVD (0)	ID Valid	LU Valid	RSVD (0)	Logical Unit Number		
7	SCSI Bus Address							
8	Reserved (0)							
9	SValid	Invert (0)	Reserved (0)					
10-11	Source Storage Element Address							
(36 bytes)	Primary Volume Tag Information (omitted if PVolTag is 0)							
(1 byte)	Reserved (0)				Code Set (0 or 2)			
(1 byte)	Reserved (0)				Identifier Type (0)			
(1 byte)	Reserved (0)							
(1 byte)	Identifier Length (*x*)							
(x bytes)	Identifier (omitted if DVCID is 0)							
(y bytes)	Vendor Specific							

Table 14-7 Data Transfer Element Descriptor

Element Address

The Element Address field indicates the element address for the tape drive.

Access

The Access bit indicates whether the handler can move a cartridge to or from the tape drive, as follows:

0 – Access to the tape drive by the handler is denied (for example, the tape drive has been taken offline from the XLS Management Interface or the cartridge is not ejected from the tape drive).

1 – Access to the tape drive by the handler is allowed.

Except

The Exception bit indicates whether an exception condition exists, as follows:

0 – The tape drive is in its normal state.

1 – The tape drive is in an abnormal state. The ASC and ASCQ fields provide more information about the condition (see Section 14.5 on page 14-21). The Full and Primary Volume Tag fields are invalid.

Full

If Except is 0, the Full bit indicates whether the tape drive contains a cartridge, as follows:

0 – The tape drive does not contain a cartridge.
1 – The tape drive contains a cartridge.

If Except is 1, the Full bit is invalid.

Additional Sense Code (ASC)

If Except is 1, the medium changer returns 83h for the Additional Sense Code field.

Additional Sense Code Qualifier (ASCQ)

If Except is 1, the Additional Sense Code Qualifier field describes the specific exception condition. See Section 14.5 on page 14-21.

Not Bus

The Not This Bus bit indicates whether the Target ID for the tape drive is on the same SCSI bus as the medium changer, as follows:

0 – The Target ID used to select the tape drive is on the same SCSI bus as the medium changer.

1 – The Target ID used to select the tape drive may not be valid on the SCSI bus for the medium changer.

ID Valid

The ID Valid bit indicates whether the SCSI Bus Address field contains valid information, as follows:

0 – The SCSI Bus Address field is not valid.
1 – The SCSI Bus Address field is valid.

LU Valid

The LU Valid bit indicates whether the Logical Unit Number field contains valid information, as follows:

0 – The Logical Unit Number field is not valid.
1 – The Logical Unit Number field is valid.

Logical Unit Number

If LU Valid is 1, the Logical Unit Number field indicates the logical unit number of the tape drive, if known.

SCSI Bus Address

If ID Valid is 1, the SCSI Bus Address field indicates the Target ID of the tape drive.

SValid

The Source Valid field indicates whether the value in the Source Storage Element Address field is valid, as follows:

0 – The Source Storage Element Address field is not valid.
1 – The Source Storage Element Address field is valid.

Invert

The medium changer always returns 0 for the Invert field.

Source Storage Element Address

If the SValid bit is 1, the Source Element Address field indicates the address of the last element this cartridge occupied.

Primary Volume Tag Information

If the PVolTag bit in the Element Status Page Header is 1 (see page 14-6), the Primary Volume Tag Information field contains 36 bytes of information for this element. If the PVolTag bit is 0, this field is omitted.

Section 14.4 on page 14-20 describes the Primary Volume Tag Information field.

Note: If the Full bit is 0, the information in this field is undefined (all 0s).

Code Set

The medium changer returns 2 for the Code Set field, indicating that the Identifier field contains ASCII values. If no device identifier is available or if the DVCID bit in the Read Element Status CDB is 0, the Code Set field is 0.

Identifier Type

The medium changer returns 0 for the Identifier Type field.

Identifier Length

The Identifier Length field indicates the length in bytes of the Identifier field. If the DVCID bit in the Read Element Status CDB is 0, the Identifier Length field is 0.

Identifier

The Identifier field contains the serial number for the tape drive. The length of the serial number is indicated by the Identifier Length field. If the DVCID bit in the Read Element Status CDB is 0, the Identifier field is omitted.

Note: The value returned for the Identifier field is the same as what would be returned by the tape drive in response to an Inquiry command requesting the Unit Serial Number Page (80h).

Vendor Specific

As shown in Table 14-8, the information returned in the Vendor Specific field depends on the setting of the DVCID bit in the Read Element Status command.

If DVCID is...	The Vendor Specific field contains...
0	The tape drive's serial number, reported as a null-terminated ASCII string. This value is the same as what would be returned by the tape drive in response to an Inquiry command requesting the Unit Serial Number Page (80h).
1	Undefined information

Table 14-8 Meaning of the Vendor Specific field

14.4 Primary Volume Tag Information

The Primary Volume Tag Information fields contain information about the cartridge in the element. Typically, this field contains information from the cartridge's barcode label. However, if you have issued a Send Volume Tag command with the Send Action Code set to 8h, Ah, or Ch (Assert, Replace or Undefine), the volume tag is information you specified for the cartridge. See Section 23.1.3, "Send Action Code," on page 23-4 for more information.

Note: The volume tag information is not necessarily the same as the volume identification information recorded on the tape.

Table 14-9 shows the format of the Primary Volume Tag Information fields

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

Table 14-9 Volume Tag information

Volume Identification

If the Full bit is 1, the Volume Identification field contains information for the cartridge located in the element. The information is formatted as 32 bytes of left-justified ASCII characters. Unused positions are filled with spaces (20h). If Full is 0 or the cartridge does not include a barcode label, all 32 bytes of the Volume Identification field are 0.

Volume Sequence Number

The medium changer returns 0 for the Volume Sequence Number field, indicating that it does not use this field.

14.5 ASC and ASCQ Values

Table 14-10 lists the values for the ASC and ASCQ fields in the element descriptors.

ASC	ASCQ	Description
83h	00h	The barcode label information is questionable. The Primary Volume Tag field may contain data, but this data may not be correct.
83h	01h	Barcode label error. A label was scanned but was in error.
83h	02h	Magazine not present.
83h	03h	The value of the Full and Primary Volume Tag fields is questionable. The last known data is returned, but it may not be correct.
83h	04h	Tape drive not present. There is space for the tape drive in the library but no drive is installed.
83h	09h	No barcode label information. The cartridge in this element has no label (or the label is sufficiently damaged that the scanner could not detect its presence).

Table 14-10 Additional Sense Codes for element descriptor data

14.6 For More Information

For more information about the Read Element Status command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*.

Notes:

15 Release Element (6) - 17h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (17h)							
1	Reserved (0)			Obsolete (0)				Element
2	Reservation Identification							
3-4	Reserved (0)							
5	Control (0)							

15.1 Command Description

The Release Element (6) command lets an initiator release reservations made by previous Reserve Element commands from that initiator. The Reserve Element command is explained in Chapter 20, "Reserve Element (6) - 16h" and Chapter 21, "Reserve Element (10) - 56h." An initiator cannot release reservations that were made by other initiators (the request is ignored). Releasing unreserved elements is not an error.

To release a third-party reservation, use the Release Element (10) command. See Chapter 16, "Release Element (10) - 57h."

15.1.1 Element

The Element bit specifies whether to release all reservations made by the initiator or a single reservation, as follows:

0 – Release all previous unit and element reservations made by the initiator except third-party reservations.

1 – Release only the reservation specified in the Reservation Identification field.

15.1.2 Reservation Identification

If Element is 1, the Reservation Identification field specifies the number of the reservation to be released.

If Element is 0, the Reservation Identification field is ignored.

15.2 For More Information

For more information about the Release Element (6) command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*.

16 Release Element (10) - 57h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (57h)							
1	Reserved (0)			3rdPty	Reserved		LongID	Element
2	Reservation Identification							
3	Third Party Device ID							
4-6	Reserved (0)							
7-8	Parameter List Length							
9	Control (0)							

16.1 Command Description

The Release Element (10) command lets an initiator release reservations made by previous Reserve Element commands from the same initiator. The Reserve Element command is explained in Chapter 20, "Reserve Element (6) - 16h" and Chapter 21, "Reserve Element (10) - 56h." Releasing unreserved elements is not an error.

Unlike the Release Element (6) command (see Chapter 15, "Release Element (6) - 17h"), the Release Element (10) command allows an initiator to release the third-party reservations it made for another initiator. However, an initiator cannot release reservations that were made by any other initiator (the request is ignored).

16.1.1 3rdPty

The Third Party bit specifies whether to release a third-party reservation as follows:

0 – Do not release a third-party reservation.
1 – Release a third-party reservation.

16.1.2 LongID

The LongID bit specifies whether the Third Party Device ID is greater than 255 (FFh), as follows:

0 – The Third Party Device ID associated with this reservation is equal to or smaller than 255. Its value is specified in byte 3 of the CDB.

1 – The Third Party Device ID associated with this reservation is greater than 255. Its value is included in the Release Element parameter list.

16.1.3 Element

The Element bit specifies whether to release all reservations made by the initiator or a single reservation, as follows:

0 – Release all previous unit and element reservations.
1 – Release only the reservation specified in the Reservation Identification field.

Note: If 3rdPty is 1 and Element is 0, the medium changer releases all reservations made on behalf of the third party specified by Third Party Device ID. However, no other reservations are released, including other reservations made by the initiator or those held by the third party itself.

16.1.4 Reservation Identification

If Element is 1, the Reservation Identification field specifies the number of the reservation to be released.

If Element is 0, the Reservation Identification field is ignored.

16.1.5 Third Party Device ID

If LongID is 0 (indicating that the Third Party Device ID is equal to or smaller than 255), this field specifies its value.

If Long ID is 1, this field is ignored.

16.1.6 Parameter List Length

The Parameter List Length field specifies the length of the Release Element parameter list, as follows:

0 – The Third Party Device ID is equal to or smaller than 255, and its value is included in byte 3 of the CDB. The Long ID is 0.

8 – The Third Party Device ID is greater than 255, and its value is included in the parameter list. The Long ID is 1.

16.2 Release Element Parameter List

Table 16-1 shows the format of the eight-byte Release Element Parameter List.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-7	Third Party Device ID							

Table 16-1 Release Element (10) parameter list

16.3 For More Information

For more information about the Release Element (10) command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*.

Notes:

17 Report LUNs - A0h

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

17.1 Command Description

The Report LUNs command instructs the medium changer to return a list of the logical unit numbers (LUNs) that are connected to the addressed target ID and that have a Peripheral Qualifier value of 0 (see Section 7.2.1 on page 7-4).

Note: The XLS supports up to four dual-ported host bus adapter cards (HBAs). Each port can have only one target ID, but each target ID can support multiple LUN values. In most cases, the medium changer returns a single LUN value for each logical library. The default is LUN 0. However, if multiple logical libraries are controlled over a single HBA port, the medium changer returns multiple LUNs. See the example configurations in Table 3-1 on page 3-4 for more information.

The medium changer returns Check Condition status only when it is unable to return the requested logical unit inventory.

Section 17.2 on page 17-2 describes the format of the Report LUNs parameter list.

17.1.1 Allocation Length

The Allocation Length field specifies the maximum number of bytes the medium changer should return. For the Report LUNs command, the Allocation Length must be at least 16 bytes, with 8 bytes for the parameter list header and 8 bytes for the first LUN.

The medium changer returns the amount of data available or the number specified by the Allocation Length, whichever is less.

Note: If the Allocation Length is less than 16 bytes, the medium changer returns Check Condition status with the sense key set to Illegal Request and the Additional Sense Code (ASC) set to Invalid Field in CDB.

17.2 Report LUNs Parameter List

Table 17-1 shows the format of the Report LUNs parameter list.

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

Table 17-1 Format of Report LUNs parameter list

17.2.1 LUN List Length

The LUN List Length field indicates the length in bytes of the logical unit inventory available to be transferred. It is the number of LUNs multiplied by eight.

The medium changer transfers the amount of data available or the number specified by the Allocation Length, whichever is less.

17.2.2 First LUN to Last LUN

The First LUN through Last LUN fields list the logical unit numbers (LUNs) of all logical units connected to the HBA port. Each LUN is eight bytes long.

When the XLS is first installed, the medium changer returns a single LUN for each port on any HBAs installed in the XLS. If logical library partitions have been defined for the port and additional LUNs assigned, the medium changer returns these LUN values as well.

17.3 For More Information

For more information about the Report LUNs command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*.

18 Request Sense - 03h

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

18.1 Command Description

The Request Sense command requests that the medium changer return sense data to the initiator. Sense data is available after any of the following events:

- The initiator's previous command terminated unexpectedly.
- The initiator's previous command terminated with Check Condition status (see Section 3.4.1 on page 3-9).

If no sense data is available, the medium changer returns the information shown in Table 18-1.

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

Table 18-1 Sense data for No Sense

The medium changer maintains separate sense data for each initiator. It clears each initiator's sense data when:

- It executes the next command from the same initiator.
- A power-on or reset event occurs.

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

Note: If you are using a parallel SCSI application and a Check Condition occurs during the processing of a command from an unknown initiator (that is, one that does not include its Target ID during the selection phase), the medium changer maintains the sense data and returns it to the next unknown initiator. It is not advisable to have more than one unknown initiator on the bus.

18.1.1 Allocation Length

The Allocation Length field specifies the number of bytes the initiator has allocated for returned sense data. The medium changer returns 18 bytes of sense data or the amount specified by the Allocation Length, whichever is less. If the medium changer receives an Allocation Length of 0, it does not transfer any data.

18.2 Sense Data Format

Table 18-2 shows the format of the sense data returned by the medium changer.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Valid (0)	Response Code (70h)						
1	Segment Number (0)							
2	Reserved (0)		ILI (0)	RSVD (0)	Sense Key			
3-6	Information (0)							
7	Additional Sense Length (0Ah)							
8-11	Command-Specific Information (0)							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code (0)							
15	SKSV	Sense Key Specific						
16-17								

Table 18-2 Format of sense data

18.2.1 Valid

The medium changer returns 0 for the Valid bit, indicating that it does not support the Information field.

18.2.2 Response Code

The medium changer returns 70h for the Response Code field, indicating that the sense data pertains to an error or exception condition on the task that returned the Check Condition status. This could be an error with the command itself or an error that was first detected while the medium changer was processing the command.

18.2.3 ILI

The medium changer returns 0 for the Illegal Length Indicator bit.

18.2.4 Sense Key

The Sense Key field provides general information about the error or exception condition. Table 18-2 shows the sense keys supported by the medium changer. For more information about the conditions that can cause Check Condition status, refer to Section 3.4.1, "Check Condition Status," on page 3-9.

Sense Key	Name	Indicates that...
0h	No Sense	There is no specific sense key information currently stored for the requesting initiator.
2h	Not Ready	The medium changer is not currently ready to process commands. Operator intervention may be required to correct this condition.
4h	Hardware Error	The medium changer detected an unrecoverable hardware error while attempting to perform a command or during a self-test.
5h	Illegal Request	• The CDB or the additional parameters supplied as data for some commands (for example, Mode Select) contained an illegal value. • The medium changer does not support the command.
6h	Unit Attention	• The inventory may have been changed. • A power-on or reset event occurred. See "Unit Attention Condition" on page 3-9 for more information.
Bh	Aborted Command	The command was aborted. Since the medium changer may have experienced state or inventory changes, the initiator should take appropriate remedial actions.

Table 18-3 Supported sense keys

18.2.5 Information

The medium changer returns 0 for the Information field.

18.2.6 Additional Sense Length

The medium changer returns 0Ah for the Additional Sense Length field, indicating that it is returning 10 more bytes of sense data.

18.2.7 Command-Specific Information

The medium changer returns 0 for the Command-Specific Information field.

18.2.8 Additional Sense Code (ASC)

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

18.2.9 Additional Sense Code Qualifier (ASCQ)

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

18.2.10 Field Replaceable Unit Code

The medium changer returns 0 for the Field Replaceable Unit Code field.

18.2.11 SKSV

The Sense Key Specific Valid field indicates whether the information in the Sense Key Specific field is valid, as follows:

0 – The information in the Sense Key Specific field is not valid.
1 – The information is valid.

The SKSV field is 1 only when the sense key is Illegal Request.

18.2.12 Sense Key Specific

When the SKSV field is 1, the Sense Key Specific field indicates which field in the CDB or parameter list of a command caused the Check Condition status. Table 18-4 shows the format of this field.

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

Table 18-4 Sense Key Specific field

C/D

The Command/Data field indicates whether the Check Condition was caused by an illegal parameter in the parameter list or in the CDB, as follows:

0 – The Check Condition resulted from an illegal parameter in the parameter list sent with the command (Data).

1 – The Check Condition resulted from an illegal parameter in the CDB (Command).

BPV

The Bit Pointer Valid field indicates whether the Bit Pointer field is valid, as follows:

0 – The value contained in the Bit Pointer field is not valid.
1 – The value contained in the Bit Pointer field is valid.

Bit Pointer

The Bit Pointer specifies which bit is in error in the byte identified by the Field Pointer field. If the error is in a multiple-bit field, the Bit Pointer contains the value of the most significant bit of the field. (The most significant bit of a field is the one with the highest number.)

Field Pointer

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

18.3 Errors in Processing Request Sense

If one of the following errors occurs while it is processing a Request Sense command, the medium changer returns Check Condition status:

- An unrecoverable parity error occurs (parallel SCSI only)
- A malfunction prevents the return of sense data
- A reserved bit in the CDB is set to 1

If the Request Sense command terminates with Check Condition status, the medium changer does not return data. The resulting sense data replaces any previous sense data and is available to the next Request Sense command.

18.4 Preservation of Sense Data

As shown in the following example, sense data for a given LUN is preserved:

1. During configuration, the logical library is assigned LUN 0.

2. The medium changer receives a command with LUN 0, but the command terminates with a Check Condition status.

3. The medium changer receives a Request Sense command with LUN 1. The medium changer returns Good status to the Request Sense, but returns the sense data shown in Table 18-5, indicating that this LUN has not been defined.

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer Valid	Bit Pointer	Description
0h	05h	25h					Logical Unit Not Supported

Table 18-5 Sense data for wrong LUN

4. The medium changer receives a second Request Sense command with LUN 0. It now returns the original sense data that reflects the outcome of the command that resulted in the Check Condition status.

18.5 For More Information

For more information about the Request Sense command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*.

19 Request Volume Element Address - B5h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (B5h)							
1	Reserved (0)			VolTag	Element Type Code			
2-3	Element Address							
4-5	Number of Elements to Report							
6	Reserved (0)							
7-9	Allocation Length							
10	Reserved (0)							
11	Control (0)							

19.1 Command Description

The Request Volume Element Address command requests that the medium changer return information about either of the following:

- If the previous Send Volume Tag was Translate (Send Action Code 4h or 5h), the medium changer returns information about the elements that were matched.
- If the previous Send Volume Tag command was Assert, Replace, or Undefine (Send Action Code 8h, Ah, or Ch), the medium changer reports information about the element whose volume tag was changed.

Once it reports information for a given element address, the medium changer clears the match flag for that element and for all elements with smaller element addresses.

The medium changer returns the information in the form of Element Status pages containing element descriptors. The Element Status pages returned for this command have the same format as those returned by the Read Element Status command. Refer to **Section 14.2, "Element Status Data," on page 14-3**.

Note: The Request Volume Element CDB does not include a DVCID field, so the returned data does not include device identifiers.

If an initiator has reserved the logical unit or its elements, the medium changer returns Reservation Conflict status to any other initiator who issues the Request Volume Element Address command. For information about using this command in a multi-initiator environment, refer to "Considerations in a Multi-Initiator Environment" on page 23-3.

19.1.1 VolTag

The Volume Tag bit specifies whether the medium changer should return volume tag information, as follows:

0 – The medium changer should not report volume tag information.
1 – The medium changer should report volume tag information.

19.1.2 Element Type Code

The Element Type Code field specifies the type of element the medium changer should return element status data for. Table 19-1 lists the values of this field.

Element Type Code	Type	Description
0h	All element types	Return information for all element types in element address order, starting with the Element Address
1h	Medium Transport Element	Return information for the handler
2h	Storage Element	Return information for the cartridge slots
3h	Import/Export Element	Return information for the I/O port slots
4h	Data Transfer Element	Return information for the tape drives

Table 19-1 Values for the Element Type Code field

19.1.3 Element Address

The Element Address field specifies the element address to be reported by the medium changer, as follows:

- If the Send Action Code field in the last Send Volume Tag command was 4h or 5h (Translate), the Element Address field identifies the minimum element address (starting address) to be reported.

- If the Send Action Code in the last Send Volume Tag command was 8h, Ah, or Ch (Assert, Replace, or Undefine), this field specifies the element whose volume tag was changed.

  Note: If the Element Address specifies an element whose volume tag was not changed, the medium changer reports Good status, but it does not return an element descriptor.

19.1.4 Number of Elements

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

19.1.5 Allocation Length

The Allocation Length field specifies the number of bytes the initiator has allocated for returned Volume Element Address data. The medium changer transfers the amount of data specified by the Allocation Length or the total number of bytes available, whichever is less. If the Allocation Length is 0, the medium changer does not transfer any data.

19.2 Volume Element Address Data

The Volume Element Address data consists of an eight-byte header followed by zero or more status pages for each type of element. Table 19-2 shows the format of the Volume Element Address data.

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

Table 19-2 Volume Element Address data

19.2.1 First Element Address Reported

The First Element Address Reported field indicates the address of the first element for which the medium changer is returning an element descriptor.

19.2.2 Number of Elements Available

The Number of Elements Available field indicates the total number of element descriptors that meet the requirements of the CDB. If the Allocation Length is sufficient, the medium changer returns element descriptors for this number of elements.

19.2.3 Send Action Code

The Send Action Code field indicates the function performed by the last Send Volume Tag command. See Table 23-1, “Values for the Element Type Code field,” on page 23-3.

19.2.4 Byte Count of Report Available

The Byte Count of Report Available field indicates the number of bytes of element status data available to be returned. If the Allocation Length is sufficient, the medium changer returns this amount of data.

19.3 Element Status Page

The Element Status pages returned in the Volume Element Address data are the same ones returned by the Read Element Status command. For information, see **Section 14.2, "Element Status Data," on page 14-3**.

19.4 For More Information

For more information about the Request Volume Element Address command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*.

20 Reserve Element (6) - 16h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (16h)							
1	Reserved (0)			Obsolete (0)				Element
2	Reservation Identification							
3-4	Element List Length							
5	Control (0)							

20.1 Command Description

The Reserve Element command allows an initiator to reserve the entire logical library (*unit reservation*) or a portion of the logical library (*element reservation*) for its exclusive use.

Note: For information about making a reservation for another initiator (*third-party reservation*), refer to Chapter 21, "Reserve Element (10) - 56h."

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

- The initiator that reserved the unit or elements releases the unit or elements (see Chapter 15, "Release Element (6) - 17h" and Chapter 16, "Release Element (10) - 57h").
- A reservation is made that supersedes the existing reservation (see Section 21.5).
- A power-on or reset event occurs.

20.1.1 Element

The Element bit specifies whether to make a unit or element reservation, as follows:

0 – Make a unit reservation (reserve the entire logical library).

1 – Make an element reservation (reserve one or more elements, as specified in the Reserve Element parameter list).

If Element is 0, the Reservation Identification and Element List Length fields are ignored.

20.1.2 Reservation Identification

If Element is 1, the Reservation Identification field specifies a unique number used to identify this reservation. Include this number in a Release Element command (see Chapter 15, "Release Element (6) - 17h" and Chapter 16, "Release Element (10) - 57h") to release only those elements affected by this reservation.

The library supports up to 256 reservation IDs.

If Element is 0, the Reservation Identification field is ignored.

20.1.3 Element List Length

If Element is 1, the Element List Length field specifies the length of the Element List Descriptor that follows the CDB (see Section 20.2). Valid values are 0, 6, and multiples of 6. If this field is 0, no elements are reserved.

If Element is 0, the Element List Length field is ignored.

20.2 Element List Descriptor

The Element List Descriptor specifies how many elements to reserve and the starting element address. Table 20-1 shows the format of the Element List Descriptor.

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

Table 20-1 Element List Descriptor

You send the Element List Descriptor immediately after the CDB. You can send zero or more descriptors to reserve specific elements.

20.2.1 Number of Elements

The Number of Elements field specifies how many elements to reserve, as follows:

0 – Reserve all elements starting with the one specified in the Element Address field and ending with the last element address in the logical library.

n – Reserve *n* elements, starting with the one specified in the Element Address field.

20.2.2 Element Address

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

20.3 Reservation Conflict Status

The medium changer returns Reservation Conflict status if one of the following events occurs:

- An initiator issues one of the following commands when the unit is reserved for another initiator's use:
  - Initialize Element Status
  - Initialize Element Status with Range
  - Log Sense
  - Mode Select
  - Mode Sense
  - Move Medium
  - Position to Element
  - Prevent/Allow Medium Removal with the Prevent bit set to 0
  - Read Element Status with the CurData bit set to 0
  - Request Volume Element Address
  - Send Diagnostic
  - Send Volume Tag
  - Test Unit Ready
- An initiator issues a command to access an element when the element is reserved for another initiator's use
- An initiator attempts to make a unit or element reservation and the unit or element is already reserved by a different initiator
- An initiator attempts to release a unit or element that is reserved by a different initiator
- An initiator currently holding a unit or element reservation attempts to make a new reservation that overlaps the existing one, and the new reservation is not a valid case of superseding (see Section 21.5 on page 21-5)

Note: If a Reservation Conflict precludes any part of the command, none of the command is performed.

20.4 Reserve Element (6) Errors

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	1Ah	00h	1	0003h		Parameter List Length Error.
5	26h	00h	0	x		Invalid Field In Parameter List. Reserved field set.
5	26h	02h	0	x		Parameter Value Invalid. Invalid element address. The Element Address is either invalid for the library or it has already been specified in another Element List Descriptor for this command.

Table 20-2 Reserve Element (6) Errors

20.5 For More Information

For more information about the Reserve Element (6) command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC).*

21 Reserve Element (10) - 56h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (56h)							
1	Reserved (0)			3rdPty	Reserved (0)		LongID	Element
2	Reservation Identification							
3	Third Party Device ID							
4-6	Reserved (0)							
7-8	Parameter List Length							
9	Control (0)							

21.1 Command Description

The Reserve Element (10) command allows an initiator to reserve the entire logical library (*unit reservation*) or a portion of the logical library (*element reservation*) for its exclusive use. Unlike the Reserve Element (6) command (see **Chapter 20, "Reserve Element (6) - 16h"**), the Reserve Element (10) command also allows reservations to be made for another initiator. These are called *third-party reservations*.

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

- The initiator that reserved the unit or elements releases the unit or elements (see **Chapter 15, "Release Element (6) - 17h"** and **Chapter 16, "Release Element (10) - 57h"**).
- A reservation is made that supersedes the existing reservation (see **Section 21.5**).
- A power-on or reset event occurs.

21.1.1 3rdPty

The Third Party bit specifies whether to make a reservation for another initiator, as follows:

0 – Do not make a third-party reservation.

1 – Make a unit or element reservation for another initiator.

21.1.2 LongID

The LongID bit specifies whether the Third Party Device ID is larger than 255, as follows:

0 – The Third Party Device ID associated with this reservation is equal to or smaller than 255 (FFh). Its value is specified in byte 3 of the CDB.

1 – The Third Party Device ID associated with this reservation is greater than 255. Its value is included in a Reserve Element parameter list.

21.1.3 Element

The Element bit specifies whether to make a unit or element reservation, as follows:

0 – Make a unit reservation (reserve the entire logical library).

1 – Make an element reservation (reserve one or more elements, as specified in the Reserve Element parameter list).

21.1.4 Reservation Identification

If Element is 1, the Reservation Identification field specifies a unique number used to identify this reservation. Include this number in a Release Element command (see **Chapter 15, "Release Element (6) - 17h"** and **Chapter 16, "Release Element (10) - 57h"**) to release only those elements affected by this reservation.

If Element is 0, the Reservation Identification field is ignored.

21.1.5 Third Party Device ID

The Third Party Device ID specifies the ID of the device for which the third-party reservation is being made. If the Third Party Device ID is greater than 255, set LongID to 1 and specify the value in the Reserve Element parameter list.

If LongID is 1, the medium changer ignores this byte.

21.1.6 Parameter List Length

The Parameter List Length field specifies the length of the Reserve Element parameter list. Valid values depend on the settings of the 3rdPty, LongID, and Element fields, as shown in Table 21-1.

3rdPty	LongID	Element	Parameter List Length	Description
0	0	0	0	Reserve the unit for yourself.
	0	1	6n	Reserve one or more elements for yourself. *n* is the number of Element List Descriptors you are sending.
1	0	0	0	Reserve the unit for a third party and specify the Third-Party Device ID in byte 3.
	0	1	6*n*	Reserve one or more elements for a third-party and specify the Third-Party Device ID in byte 3. *n* is the number of Element List Descriptors you are sending.
	1	0	8	Reserve the unit for a third party and specify the Third-Party Device ID in a parameter list.
	1	1	8 + 6*n*	Reserve one or more elements for a third-party and specify the Third-Party Device ID in a parameter list. *n* is the number of Element List Descriptors you are sending.

Table 21-1 Parameter List Length for Reserve Element (10)

21.2 Reserve Element Parameter List

Table 21-2 shows the format of the Reserve Element parameter list.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-7	Third Party Device ID (omitted if LongID is 0)							
(6n bytes)	Element Descriptors							

Table 21-2 Reserve Element (10) parameter list

21.3 Element Descriptor

An Element Descriptor specifies how many elements to reserve and the starting element address. Table 21-3 shows the general format of an Element Descriptor.

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

Table 21-3 Element Descriptor

You send an Element Descriptor in the parameter list. You can send zero or more descriptors to reserve specific elements.

21.3.1 Number of Elements

The Number of Elements field specifies how many elements of a single type to reserve, as follows:

0 – Reserve all elements starting with the one specified in the Element Address field and ending with the last element address of the logical library.

n – Reserve *n* elements, starting with the one specified in the Element Address field.

21.3.2 Element Address

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

21.4 Reservation Conflict Status

The medium changer returns Reservation Conflict status if one of the following events occurs:

- An initiator issues one of the following commands when the unit is reserved for another initiator's use:
  - Initialize Element Status
  - Initialize Element Status with Range
  - Log Sense
  - Mode Select
  - Mode Sense
  - Move Medium
  - Position to Element
  - Prevent/Allow Medium Removal with the Prevent bit set to 0
  - Read Element Status with the CurData bit set to 0
  - Request Volume Element Address
  - Send Diagnostic
  - Send Volume Tag
  - Test Unit Ready
- An initiator issues a command to access an element when the element is reserved for another initiator's use
- An initiator attempts to make a unit or element reservation and the unit or element is already reserved by a different initiator
- An initiator attempts to release a unit or element reservation made by a different initiator
- An initiator currently holding a unit or element reservation attempts to make a new reservation that overlaps the existing one, and the new reservation is not a valid case of superseding (see Section 21.5).

Note: If a Reservation Conflict precludes any part of the command, none of the command is performed.

21.5 Superseding Reservations

A *superseding reservation* occurs when an initiator currently holding a reservation makes a new reservation that in some way overlaps the existing one. If the overlap is a valid case of superseding (see the examples below), the medium changer makes the new reservation after releasing the existing one.

Note: You cannot supersede a third-party reservation with a non-third-party reservation or vice versa. The medium changer returns Reservation Conflict status to any attempted overlaps between third-party and non-third-party reservations.

Valid examples of superseding reservations include those reservations made for the unit that overlap reservations made for individual elements, as follows:

- An initiator attempts to make a unit reservation, and the unit is already reserved by the same initiator.
- An initiator attempts to make a unit reservation, and all existing element reservations were made by the same initiator.
- An initiator attempts to make a unit reservation for a third party, and the unit is already reserved by the same initiator for the same third party.
- An initiator attempts to make a unit reservation for a third party, and all existing element reservations were made by the same initiator for the same third party.
- An initiator uses a Reservation ID to reserve a range of elements, and elements within the range have already been reserved by the same initiator using the same Reservation ID.
- An initiator uses a Reservation ID to reserve a range of elements for a third party, and elements within the range have already been reserved by the same initiator for the same third party using the same Reservation ID.

When a valid superseding reservation is made, the superseded reservation is released. For example, if the superseding reservation is for a range of elements, all elements with that Reservation ID for that initiator are released, not just the overlapped elements.

21.6 Reserve Element (10) Errors

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	1Ah	00h	1	0003h		Parameter List Length Error.
5	26h	00h	0	x		Invalid Field In Parameter List. Reserved field set.
5	26h	02h	0	x		Parameter Value Invalid. Invalid element address. The Element Address is either invalid for the library or it has already been specified in another Element List Descriptor for this command.

Table 21-4 Reserve Element (10) Errors

21.7 For More Information

For more information about the Reserve Element (10) command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC).*

Notes:

22 Send Diagnostic - 1Dh

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (1Dh)							
1	Reserved (0)			PF (0)	RSVD (0)	SelfTest (1)	DevOffL (0)	UnitOffL (0)
2	Reserved (0)							
3-4	Parameter List Length (0)							
5	Control (0)							

22.1 Command Description

The Send Diagnostic command requests that the medium changer perform its self-test function. If the self-test completes successfully, the medium changer returns Good status; otherwise, it returns Check Condition status. The sense key is set to Hardware Error.

22.1.1 PF

The Page Format bit must be 0.

22.1.2 SelfTest

The SelfTest bit must be 1 (perform a self-test).

22.1.3 DevOffL and UnitOffL

The Device Offline and Unit Offline bits must be 0.

22.1.4 Parameter List Length

The Parameter List Length field must be 0.

22.2 For More Information

For more information about the Send Diagnostic command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC).*

Notes:

23 Send Volume Tag - B6h

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (B6h)							
1	Reserved (0)				Element Type Code			
2-3	Element Address							
4	Reserved (0)							
5	Reserved (0)			Send Action Code				
6-7	Reserved (0)							
8-9	Parameter List Length							
10	Reserved (0)							
11	Control (0)							

23.1 Command Description

The Send Volume Tag command allows you to perform either of the following actions:

- **Translate function.** You can search library elements for volume tags (typically, barcode labels) that contain specific information. You send a template containing the desired search criteria. When the medium changer receives the template, it:

  a. Searches all volume tags

  b. Sets a match flag for each element that fits the template

  c. Returns information about the flagged elements in response to a Request Volume Element Address command (see Chapter 19, "Request Volume Element Address - B5h," for more information)

- **Assert, Replace, and Undefine functions.** You can write, overwrite, or clear an element's volume tag. These functions are supported for Primary Volume Tags only. For information about volume tags, refer to Section 14.4, "Primary Volume Tag Information," on page 14-20.

Before setting new match flags, a Send Volume Tag command clears any existing match flags. For this reason, if you want to find element addresses that meet more than one set of criteria, send multiple Send Volume Tag commands, with each command followed by a Request Volume Element Address command.

For example, to find the locations of cartridges whose barcode labels start with 1 or 2, follow these steps:

1. Issue a Send Volume Tag command to find barcode labels starting with 1.
2. Issue a Request Volume Element Address command to determine the locations of these cartridges.
3. Issue a second Send Volume Tag command to find barcode labels starting with 2.
4. Issue a second Request Volume Element Address command to determine the locations of these cartridges.

Preservation of Send Volume Tag Results

The medium changer preserves the results of a Send Volume Tag command for as long as possible. It does not clear or change the match flags until one of the following occurs:

- A power-on or reset event occurs. The medium changer clears all match flags.
- It receives a new Send Volume Tag command from any initiator. The medium changer clears all match flags, then resets them according to the new search criteria.

  Note: If the library is reserved for one initiator, a Send Volume Tag command sent by another initiator does not clear the match flags.

- An inventory violation occurs (for example, someone opens the door and reaches into the cabinet). The medium changer clears all match flags.
- It returns information about the flagged elements in response to a Request Volume Element Address command. After it reports the data, the medium changer clears the match flag for the elements it reported.
- It receives a Move Medium command to move a cartridge. It moves the cartridge and updates the match flags of the source and destination elements.
- The user physically opens the I/O port. The medium changer clears the match flags of all import/export elements.

Considerations in a Multi-Initiator Environment

To avoid unexpected results in a multi-initiator environment, be sure to reserve the entire logical library (unit reservation) before issuing Send Volume Tag and Request Volume Element Address commands. Follow these steps:

1. Issue a Reserve Element command to reserve the entire logical library (set Element to 0).

2. Issue a Send Volume Tag command. Set the Send Action Code field to 4h or 5h and specify the search criteria in the parameter list. The medium changer sets match flags for all elements that meet the specified criteria.

   Note: Because the library is reserved, a second initiator cannot send a Send Volume Tag command that would reset the match flags.

3. Issue one or more Request Volume Element Address commands as required to retrieve the results of the search.

4. When you have retrieved all the information you need, issue a Release Element command to release the unit reservation (set Element to 0).

23.1.1 Element Type Code

If the Send Action Code is 4h or 5h (Translate), the Element Type Code identifies the type of element to be searched. Table 23-1 lists the values of this field.

Element Type Code	Type	Description
0h	All element types	Search all element types in element address order, starting with the Element Address
1h	Medium Transport Element	Search the handler
2h	Storage Element	Search the cartridge slots
3h	Import/Export Element	Search the I/O port slots
4h	Data Transfer Element	Search the tape drives

Table 23-1 Values for the Element Type Code field

Note: If the Send Action Code is Assert, Replace or Undefine, the Element Type Code field must be 0.

23.1.2 Element Address

The Element Address field identifies an element address, as follows:

- If the Send Action Code is 4h or 5h (Translate), the Element Address field specifies the first element to be compared to the search criteria.
- If the Send Action Code is 8h, Ah, or Ch (Assert, Replace or Undefine), the Element Address field specifies the address of a single element whose volume tag information you want to modify.

23.1.3 Send Action Code

The Send Action Code field specifies the type of operation to perform. Table 23-2 lists the supported values.

Send Action Code	Action	Description
4h	Translate – All Tags	Search all defined tags and ignore sequence numbers. The Volume Identification Template field in the parameter list specifies the search template. (This is equivalent to 5h since the medium changer does not support alternate tags.)
5h	Translate – Primary Tags	Search all primary tags and ignore sequence numbers. The Volume Identification Template field in the parameter list specifies the search template.
8h	Assert – Primary Tag	Specify Primary Volume Tag information for a single element that does not already have volume tag information. The Volume Identification Template field in the parameter list specifies the new information.
Ah	Replace – Primary Tag	Overwrite the Primary Volume Tag information for a single element. The Volume Identification Template field in the parameter list specifies the new information. It is not an error if a Primary Volume Tag was not previously defined.
Ch	Undefine – Primary Tag	Clear the Primary Volume Tag information for a single element. The Parameter List Length must be 0. It is not an error if a Primary Volume Tag was not previously defined.

Table 23-2 Values for the Send Action Code field

Note: Any volume tag information you assert, replace, or undefine (Send Action Codes 8h, Ah, or Ch) is cleared when the library is powered off or reset.

23.1.4 Parameter List Length

The Parameter List Length field specifies the number of bytes included in the Send Volume Tag parameter list. The minimum length is 32 bytes and the maximum length is 40.

Note: If the Send Action Code is Ch (Undefine), the Parameter List Length must be 0.

23.2 Send Volume Tag Parameter List

Table 23-3 shows the format of the Send Volume Tag parameter list.

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

Table 23-3 Send Volume Tag parameter list

Volume Identification Template

The Volume Identification Template field allows you to specify a search template or a specific volume tag, as follows:

- If the Send Action Code is 4h or 5h (Translate), the Volume Identification Template field specifies a search template. The search template can contain wildcard characters, as follows:

  ? – A question mark (3Fh) matches any single character.

  * – An asterisk (2Ah) matches any string of characters. When it appears in a template, the remainder of the template at higher offsets in the field is not used.

- If the Send Action Code is 8h or Ah (Assert or Replace), the Volume Identification Template field specifies the exact value of the new volume tag. Wildcard characters—asterisks (2Ah) and question marks (3Fh)—are not allowed.

  Note: For more information about volume tags, refer to Section 14.4, "Primary Volume Tag Information," on page 14-20.

Minimum and Maximum Volume Sequence Numbers

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

23.3 Send Volume Tag Errors

Sense Key	ASC	ASCQ	C/D Bit	Field Pointer	Bit Pointer	Description
5	1Ah	00h	1	0008h		Parameter List Length error.
5	21h	01h	1	0002h		Invalid Element Address. Volume tag information is already defined so the Assert request fails.
5	21h	01h	1	0002h		Invalid Element Address.
5	24h	0h	1	5h	04h	Invalid Send Action Code.
5	3Ah	00h	1	0002h		Medium Not Present. An Assert, Replace or Undefine action was attempted on an empty element.

Table 23-4 Send Volume Tag errors

23.4 For More Information

For more information about the Send Volume Tag command, refer to ANSI NCITS 314:1998, *SCSI-3 Medium Changer Commands (SMC)*.

24 Test Unit Ready - 00h

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

24.1 Command Description

The Test Unit Ready command returns the current status of the medium changer to the initiator. If the medium changer is ready to receive a motion command, it returns Good status to the Test Unit Ready command. If it is not ready, it returns Check Condition status with the sense key set to Not Ready.

24.2 For More Information

For more information about the Test Unit Ready command, refer to ANSI INCITS 301:1997, *SCSI-3 Primary Commands (SPC)*.

Notes:

Appendix A Using the I/O Port

This appendix provides information about using the I/O port and the Move Medium and Prevent/Allow Medium Removal commands to import and export cartridges from the library. See Chapter 11, "Move Medium - A5h," and Chapter 13, "Prevent/Allow Medium Removal - 1Eh," for complete information.

A.1 I/O Port Terminology

While reading this appendix, keep the following definitions in mind:

Physical I/O ports: As shown in Figure A-1, the XLS base unit includes up to four *physical I/O ports* that allow cartridges to be imported or exported from the XLS. Each physical I/O port holds 10 cartridges in a removable magazine.

Figure A-1 *(left)* One of up to four physical I/O ports *(right)* Removable 10-slot magazine

Logical I/O port: The *logical I/O port* consists of all physical I/O ports assigned to the logical library. A logical library can control zero, one, or more physical I/O ports. It cannot share physical I/O ports with any other logical library partition.

Once they are assigned to a logical library partition, the physical I/O ports function as a single logical entity. That is, if a logical library controls four physical I/O ports, all I/O ports are extended when the initiator sends a Move Medium command with the I/O Port Code set to 01b. Similarly, if a user issues the Open I/O Port command from the XLS Management Interface, all physical I/O ports assigned to the logical library come open at once.

Import/export element: Each I/O port magazine has 10 cartridge slots; each I/O port slot is referred to as an *import/export element*.

I/O port extended: An I/O port is *extended* when the initiator issues a Move Medium command with the I/O Port Code field set to "extend" (01b). When an I/O port is extended, the I/O port slots (that is, the import/export elements) become inaccessible to the initiator, but the I/O port remains closed.

I/O port opened: An I/O port is *opened* when a user has physically opened it using options available on the XLS Management Interface.

I/O port scan An *I/O port scan* occurs when a user closes an open I/O port by pushing it shut. During an I/O port scan, the medium changer moves the handler to each import/export element to determine whether a cartridge is present and to scan any barcode labels.

A.2 About I/O Port Behavior

As soon as the I/O port is extended by a Move Medium command or physically opened from the XLS Management Interface, the following motion and inventory commands receive Check Condition status with the sense key set to Not Ready:

- Initialize Element Status
- Initialize Element Status with Range
- Move Medium
- Position to Element
- Read Element Status
- Request Volume Element Address
- Send Diagnostic (Good status is returned if no motion or inventory access is required)
- Send Volume Tag
- Test Unit Ready

As shown in Table A-1, the ASC and ASCQ values indicate whether the I/O port is extended, physically open, or being scanned.

Sense Key	ASC	ASCQ	Description
2h (Not Ready)	04h	01h	Logical unit is in process of becoming ready. The I/O port is being scanned.
	04h	82h	Logical unit not ready. The I/O port is extended or physically open.

Table A-1 Errors reported when the I/O port is in use

After the I/O port is extended or physically opened, the medium changer continues to report Not Ready to these commands until all physical I/O ports for the logical library partition have been closed and scanned. When the I/O port scan is complete, the medium changer returns Check Condition status with the sense key set to Unit Attention. The ASC and ASCQ are set to 28h 01h (Import or export element accessed).

A.3 Managing Import and Export Operations

This section describes how to import and export cartridges using the I/O port.

A.3.1 Importing Cartridges

To import one or more cartridges using the I/O port, follow these steps:

1. Issue a Move Medium command to extend the I/O port (that is, make it inaccessible to the initiator). Set the I/O Port Code field to 01b.

2. Instruct the user to open the I/O port from the XLS Management Interface and to insert new cartridges.

3. Wait for the user to open the I/O port, insert cartridges, and push the I/O port shut and for the medium changer to scan the import/export elements. Periodically issue Test Unit Ready commands to determine the medium changer's status, as shown in Table A-2:

Command Status	Sense Key	ASC	ASCQ	Meaning
Check Condition	2h	04h	82h	Logical unit not ready. The I/O port is extended or physically open.
Check Condition	2h	04h	01h	Logical unit becoming ready. The medium changer is scanning the slots.
Unit Attention	6h	28h	01h	Import or export element accessed. The medium changer has scanned all import/export elements.

Table A-2 Responses to Test Unit Ready command during import

4. Upon receiving the Unit Attention, issue a Read Element Status command to update the inventory.

5. Issue one or more Move Medium commands to move any new cartridges from the I/O port.

A.3.2 Exporting Cartridges

To export one or more cartridges using the I/O port, follow these steps:

1. Issue one or more Move Medium commands to move cartridges to the I/O port. Set the I/O Port Code field to 0.

2. Issue a Move Medium command to extend the I/O port (that is, make it inaccessible to the initiator). Set the I/O Port Code field to 01b.

3. Instruct the user to open the I/O port from the XLS Management Interface and to remove the cartridges.

4. Wait for the user to open the I/O port, remove cartridges, and push the I/O port shut and for the medium changer to scan the import/export elements. Periodically issue Test Unit Ready commands to determine the medium changer's status, as shown in Table A-3:

Command Status	Sense Key	ASC	ASCQ	Meaning
Check Condition	2h	04h	82h	Logical unit not ready. The I/O port is extended or physically open.
Check Condition	2h	04h	01h	Logical unit becoming ready. The medium changer is scanning the slots.
Unit Attention	6h	28h	01h	Import or export element accessed. The medium changer has scanned all import/export elements.

Table A-3 Responses to Test Unit Ready command during export

5. Upon receiving the Unit Attention, issue a Read Element Status command to update the inventory.

A.4 Effect of Prevent/Allow Medium Removal Command

The Prevent/Allow Medium Removal command allows an initiator to prevent the I/O port from being physically opened from the XLS Management Interface while the logical library is online.

CAUTION

If the logical library is offline, an operator can open the I/O ports for the physical library regardless of whether a Prevent Medium Removal command has been issued.

As shown in Table A-4, the effect of the Prevent/Allow Medium Removal command depends on the state of the I/O port when the command is issued.

If the I/O port has been...		It can be extended by the initiator?	It can be opened from the XLS Management Interface?
Extended[1]	Prevented[2]		
No	No	Yes	Yes
No	Yes	Yes	No
Yes	No	No[3]	Yes
Yes	Yes	No[3]	Yes

1. An I/O port is extended when the initiator sends a Move Medium command with the I/O Port Code field set to 01b.
2. An I/O port is prevented when the initiator sends a Prevent/Allow Medium Removal command with the Prevent field set to 01b.
3. Attempting to extend an already-extended I/O port returns Check Condition status. The sense key is set to Not Ready.

Table A-4 Effect of Prevent/Allow Medium Removal command on I/O port operation

Notes:

Glossary

alert	A notification sent to specified users when an event occurs in the library.
barcode reader	The device on the library's robotic handler that scans and reads barcode labels on the cartridges.
calibration cartridge	A special cartridge containing a triangular target (*fiducial*) that is inserted into each tape drive during the calibration process.
carousel	The rotating mechanism in a Media Expansion Module (MEM) that holds the cartridges.
cartridge bay	The removable hardware that contains slots for 30 cartridges and is interchangeable with a drive bay.
cartridge inventory	The internal data base of cartridge locations that is maintained by the system controller.
cartridge slot	Any of the locations in the library that can store a cartridge. A cartridge slot is referred to as a storage element in the SCSI standard.
door slot	Any of the cartridge slots that can be installed on the inside of the library's doors.
drive bay	The removable hardware in the library that can contain up to four tape drives and that is interchangeable with a cartridge bay.
drive carrier	The hardware that encloses the tape drives and provides power, SCSI or Fibre Channel connectors, communications with the system controller, status LEDs, and cooling fans.
controller/power bay	The library assembly that contains the system controller, two cooling fans, the power supplies, the AC power switch, and the AC power connector.
elements	The addressable locations in the library, including the tape drives, the cartridge slots, the handler, and the I/O ports slots.

EMI	Electro magnetic interference.
Ethernet	A local area networking technology. Ethernet can transport any of several upper layer protocols, the most popular of which is TCP/IP.
event	A change of condition to a library component or a change of state that can be recorded in the event log. When an event occurs, an e-mail or pager alert can be sent to specified users.
facet	One of the columns of cartridge slots in a Media Expansion Module (MEM).The carousel in a MEM contains 18 facets, with 60 slots (rows) per facet.
Fibre Channel	One of the communication protocols supported by the library. Fibre Channel is a set of standards for a serial I/O bus.
front panel slot	Any the cartridge slots that can be installed on the inside of the library's front panel instead of an I/O port.
handler	The library assembly that includes the picker mechanism and the barcode reader. The handler moves side to side on the x-axis, up and down on the y-axis, and in and out on the z-axis. It rotates on the theta-axis. The handler is referred to as a medium transport element in the SCSI standard.
HBA	Host bus adapter card.
host bus adapter card (HBA)	A circuit board installed in one of the system controller's four expansion slots that allows the library to attach to and communicate with a SCSI bus or Fibre Channel network. The HBAs supported by the library have two ports, which means you can connect two networks or SCSI buses to each card.
hot swappable	A library component, such as tape drive assemblies, fans, and power supplies, that can be replaced without removing system power.
I/O port	An opening on the front of the library through which cartridges can be inserted or removed without exposing internal library components.
Inventory Sentry	The pairs of LED emitters and detectors in the front of the library that detect whether a cartridge is protruding from a slot or whether someone has reached into the library. Also referred to as the *light curtain*.
LED	Light emitting diode. The library contains five LEDs on its front panel to indicate its operating status. Additional LEDs are used on each power supply and tape drive assembly.

library	A robotic media handler that is capable of storing multiple pieces of removable media and loading and unloading them from one or more tape drives in arbitrary order.
Library Resource Module (LRM)	The main library module that contains the system controller, touch screen, status LEDs, controller/power bay, handler, tape drives, I/O ports, cartridge slots, and optional equipment rack.
light curtain	See *Inventory Sentry*.
logical library	One of up to eight partitions of the physical library. Logical libraries ensure that each software application has dedicated and secure access to specific tape drives, cartridge slots, and I/O ports. The handler is shared among all logical libraries.
LRM	Library Resource Module. The XLS base unit.
LTO	Linear Tape Open. An industry standard 1/2-inch tape format also known as Ultrium.
LUN	Logical unit number. A number between 0 and 7 assigned to each logical library.
Management Information Base (MIB)	The specification and formal description of a set of objects and variables that can be read and possibly written using the SNMP protocol.
Media Expansion Module (MEM)	The auxiliary library module that contains a motor-driven carousel with storage for 1,080 cartridges. You can connect one or two MEMs to each LRM, or you can place an LRM between two MEMs.
medium changer	The library's SCSI controller. The medium changer responds to SCSI commands sent by initiators (or host applications) and sends instructions to the system controller to move cartridges between tape drives, cartridge slots, and I/O ports.
MEM	Media Expansion Module. The XLS expansion unit that contains a carousel.
MIB	Management Information Base.
nexus setting	A unique combination of port ID, target (or SCSI) ID, and logical unit number (LUN) that describes each logical library connection.
parallel SCSI	One of the communication protocols supported by the library. The parallel SCSI protocol defines the rules and processes for transmitting and receiving data over a parallel (multi-signal) I/O bus.

physical library	The entire library, including all tape drives, cartridge slots, the robotics, and the I/O ports.
portlet	One of the following sections on the Home page: Configuration, Events, Logical Libraries, Physical Library, Settings & Policies, Users & Groups, and Service. The portlets on the Home page can be rearranged or closed to suit the needs of each user.
robotics	Any part of the library that moves automatically, including the carousel, the gripper, the I/O ports, and the handler.
SCSI	Small Computer System Interface.
Simple Mail Transfer Protocol (SMTP)	A protocol for sending e-mail messages between servers and between a mail client and a mail server.
Simple Network Management Protocol (SNMP)	A protocol for monitoring and managing systems and devices in a network. The data being monitored and managed is defined by a MIB. The functions supported by the protocol are the request and retrieval of data, the setting or writing of data, and traps that signal the occurrence of events.
SMTP	Simple Mail Transfer Protocol.
SNMP	Simple Network Management Protocol.
SNMP trap	A message sent by the XLS to an SNMP host indicating that a certain type of event has occurred.
system controller	The PC within the library that manages and controls all library activities.
tape drive	The devices used to write and read data. Tape drives are mounted in drive carriers. Tape drives are referred to as data transfer elements in the SCSI standard.
tape drive assembly	The tape drive plus the drive carrier. Tape drive assemblies are installed into the drive bays.
touch screen	The 15-inch color page on the library's front panel used to display X-Link.
user group	A collection of library users that has been assigned a common set of permissions.
virtual keyboard	A feature of the library's touch-screen display that allows you to enter text without needing a real keyboard.
XMI	The X-Link interface.

Index

D

E

F

H

I

L

M

N

O

P

Q

R

S

T

U

V

W

X