StorageTek StreamLine™ SL8500

modular library system

User's Guide

Part Number 96154
Revision K

StreamLine™ SL8500 Modular
Library System

User's Guide

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Summary of Changes

EC	Date	Revision	Description
111906	May 2004	First	Initial release
111920	July 2004	Second	Refer to this edition for the list of changes
111945	November 2004	Third	Refer to this edition for the list of changes
111959	February 2005	Fourth	Refer to this edition for the list of changes
111974	May 2005	Fifth	Refer to this edition for the list of changes
114119	September 2005	F	Refer to this edition for the list of changes
114146	May 2006	H	Refer to this edition for the list of changes
114164	August 2006	J	**Safety:** • Modified the safety information for Emergency Robotics Stop Switches and Smoke Detection. • Included a section on Fire Suppression. **Chapter 3:** Added information on host to library communication to include the dual TCP/IP feature. See **Appendix C:** • Updated the trap notification level to iclude the level 11. • Updated the trap severity code to iclude the group 11.
114189	March 2007	K	Updated for library partitioning feature. New information includes: • *"Library Partitioning" on page 22* • *"Configuring Library Partitions" on page 34* • *"Using CAPS in a Partitioned Library" on page 53*

Contents

Figures

Tables

Preface

This guide, while intended primarily for users of the library, also contains information that can be used by system administrators. Most of the information pertains to the library hardware and related operations. For specific drive information or for client-generated software commands and console messages, refer to your drive or software documentation.

Organization

The organization of this guide is:

Chapter 1	"Introduction" provides an overview of the SL8500 modular library system.
Chapter 2	"Configuration Information" describes how to activate your site user account, verify the library and drive configuration entries, and upgrade firmware.
Chapter 3	"Host to Library Communications" describes host and server support, the connections from the library to the server.
Chapter 4	"Library Operation" describes the tasks you can perform while the library is operating in automated and manual modes.
Chapter 5	"Cartridge Information" describes how to handle, inspect, and maintain cartridges.
Chapter 6	"Troubleshooting and Diagnostics" describes how to correct problems with the library and the attached devices (drives, CAP, robots, and elevators). It also describes some of the diagnostic utilities.
Chapter 7	"Obtaining Maintenance Support" describes how to contact Customer Support for assistance if problems occur with the tape library.
Appendix A	"Cartridge Slot Locations" explains the locations and numbering schemes of the cartridge slots in the library.
Appendix B	"Drive Bay Locations" explains the locations and numbering schemes of the drive bays in the library.
Appendix C	"SNMP" describes the Simple Network Management Protocol (SNMP) feature of the library.
Glossary	The Glossary defines new or special terms and abbreviations used in this manual.
Index	The Index helps you find information in this manual.

Alert Messages

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

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

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

Warning – Possible Physical Injury. **A warning alerts the reader to conditions that might result in injury or death. A warning always precedes the information to which it pertains.**

Conventions

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

Item	Example	Description of Convention
Buttons	MENU	Font and capitalization follows label on product
Commands	Mode Select	Initial cap
Document titles	*System Assurance Guide*	Italic font
Emphasis	*not* or *must*	Italic font
File names	fsc.txt	Monospace font
Hypertext links	Figure 2-1 on page 2-5	Blue (prints black in hardcopy publications)
Indicators	Open	Font and capitalization follows label on product
Jumper names	TERMPWR	All uppercase
Keyboard keys	<Y> <Enter> or <Ctrl+Alt+Delete>	Font and capitalization follows label on product; enclosed within angle brackets
Menu names	Configuration Menu	Capitalization follows label on product
Parameters and variables	Device = *xx*	Italic font
Path names	c:/mydirectory	Monospace font
Port or connector names	SER1	Font and capitalization follows label on product; otherwise, all uppercase
Positions for circuit breakers, jumpers, and switches	ON	Font and capitalization follows label on product; otherwise, all uppercase
Screen text (including screen captures, screen messages, and user input)	downloading	Monospace font
Switch names	Power	Font and capitalization follows label on product
URLs	http://www.sun.com	Blue (prints black in hardcopy publications)

Related Publications

The following publications that relate to the SL8500 Tape Library are listed below.

Tape Drive Documentation	Part Number
Hewlett Packard Ultrium Tape Drive Manual	CD included with drive
IBM Ultrium Tape Drive Manual	CD included with drive
Seagate Ultrium Tape Drive Product Manual	CD included with drive
Super DLT600 Product Manual	CD included with drive
T9840 Tape Drive User's Reference Manual	95739
T9940 Tape Drive Operator's Guide	95989

Software Publications	Part Number
Automated Cartridge System Library Software (ACSLS)	
ACSLS System Administrator's Guide	3134648
ACSLS Messages	3134649
ACSLS Quick Reference	3134650
Host Software Component (HSC) MVS Publications	
HSC Operator's Guide	312531101
HSC Messages and Codes Guide	312531301

Other Publications	Part Number
American National Standard Dictionary for Information Processing Systems	ANSI X3/TR-1-82
Fibre Optics User's Guide	9433

Additional Information

Sun Microsystems, Inc. (Sun) offers several methods for you to obtain additional information.

Sun's External Web Site

Sun's external Web site provides marketing, product, event, corporate, and service information. The external Web site is accessible to anyone with a Web browser and an Internet connection.

The URL for the Sun external Web site is: http://www.sun.com

Customer Resource Center

The Sun StorageTek product Customer Resource Center (CRC) is a Web site that enables members to resolve technical issues by searching code fixes and technical documentation. CRC membership entitles you to other proactive services, such as HIPER subscriptions, technical tips, answers to frequently asked questions, addenda to product documentation books, and online product support contact information. Customers who have a current warranty or a current maintenance service agreement may apply for membership by clicking on the Request Password button on the CRC home page.

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

e-Partners Site

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

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

Notices

Please read the following compliance and warning statements for this product.

Caution – *Potential equipment damage:* Cables that connect peripherals must be shielded and grounded; refer to descriptions in the cable instruction manuals. Operation of this equipment with cables that are not shielded and not correctly grounded might result in interference to radio and TV reception.

Changes or modifications to this equipment that are not expressly approved in advance by StorageTek will void the warranty. In addition, changes or modifications to this equipment might cause it to create harmful interference.

United States FCC Compliance Statement

The following compliance statement pertains to Federal Communications Commission Rules 47 CFR 15.105:

Note – 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 or her own expense.

CISPR 22 and EN55022 Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Japanese Compliance Statement

The following compliance statement in Japanese pertains to VCCI EMI regulations:

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

English translation: This is a Class A product based on the Technical Requirement of the Voluntary Control Council for Interference by Information Technology (VCCI). In a domestic environment, this product may cause radio interference, in which case the user may be required to take corrective actions.

Taiwan Warning Label Statement

The following warning label statement pertains to BSMI regulations in Taiwan, R.O.C.:

警告使用者：這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策

English translation: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

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NOTICE

INTERNAL CODE LICENSE

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   c. "Maintenance Code" is defined as Microcode and other software, including data files, which may reside or execute in or be used by or in connection with Equipment, and which detects, records, displays, and/or analyzes malfunctions in the Equipment.

   d. "Microcode" is defined as a set of instructions (software) that is either imbedded into or is to be loaded into the Equipment and executes below the external user interface of such Equipment. Microcode includes both Internal Code and Maintenance Code, and may be in magnetic or other storage media, integrated circuitry, or other media.

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Safety

The following pages describe common practices concerning electrostatic discharge, fiber optics, and library safety.

Electrostatic Discharge Damage Prevention

Before you touch any internal components in the library, including drives, you must take precautions against electrostatic discharge (ESD).

Caution – *Components are sensitive to static electricity:* Even a small electrostatic discharge can damage an electrical component that is inside the library. A damaged component might not fail immediately, but over time, it will become worse and might eventually cause an "intermittent" problem. Be sure that you touch an *unpainted* metal surface of the library before you reach inside the library or touch the drives or optional interface equipment.

Before you touch any internal components:

1. With your finger, touch an *unpainted* metal surface of the library. In some libraries, you can touch the library's frame. In other libraries, you might have to touch a bolt on the wall or on the door frame.

2. Keep your body movement to a minimum as you touch the drives or the library components.

Antistatic wrist straps that have clip-on ends are commercially available.

Fiber-optic Safety

Warning – Possible Physical Injury. *Đ ġ'ĵ c |ctf* . **Never look directly into a fiber-optic cable, a fiber-optic connector, or a laser transceiver module. Hazardous conditions might exist from laser power levels that are capable of causing injury to the eye.**

Be especially careful when using optical instruments with this equipment. Such instruments might increase the likelihood of eye injury.

The laser transceivers in fiber-optic equipment can pose dangers to personal safety. Ensure that anyone who works with this StorageTek equipment understands these dangers and follows safety procedures. Ensure that the optical ports of every laser transceiver module are terminated with an optical connector, a dust plug, or a cover.

Each fiber-optic interface in this StorageTek Fibre Channel equipment contains a laser transceiver that is a Class 1 Laser Product. Each laser transceiver has an output of less than 70 µW. StorageTek's Class 1 Laser Products comply with EN60825-1:1994+A1+A2 and with sections 21 CFR 1040.10 and 1040.11 of the Food and Drug Administration (FDA) regulations.

Caution – Use of controls or adjustment or performance of procedures other than those specified herein might result in hazardous radiation exposure.

The following translations are for users in Finland and Sweden who wish to identify laser safety and classification:

> CLASS 1 LASER
> LUOKAN 1 LASERLAITE
> KLASSE 1 LASER APPARAT

Laser Product Label

In accordance with safety regulations, a label on each StorageTek Fibre Channel product identifies the laser class of the product and the place and date of the manufacturer. The label appears on top of a Fibre Channel tape drive and near the Fibre Channel connectors on a Fibre Channel tape library. A copy of the label is shown here:

CLASS 1 LASER PRODUCT
LASER KLASSE 1
APPAREIL A LASER DE CLASSE 1
COMPLIES WITH 21 CFR 1040.10 AND 1040.11

EN60950-1:2001 Statement

The following statement pertains to products that require a ground connection at the wall outlet.

Norway:
Apparatet må tilkoples jordet stikkontakt

Finland:
Laite on liitettävä suojamaadoituskoskettimilla varustettuun pistorasiaan

Sweden:
Apparaten skall anslutas till jordat uttag

Denmark:
For tilsluting af de øvrige ledere, se medfølgende installationsvejledning

Library Safety

It is essential that safety procedures are followed. Be sure you are familiar with *all the* precautions in this section before you attempt to enter the library. Interlocks, robotics emergency robotics stop switches, and smoke detectors are provided to assure safety throughout the library.

Mechanical Access Door Mechanisms

On the rear of each door lock, a mechanism (painted yellow) is available to release the door lock from the inside of the library. This is a non-electrical safeguard against being locked inside the library.

Should an access door be shut and locked from the outside, someone inside the library need only push on the mechanism to unlock and open the door.

SL8500 Door Interlocks

The library features two types of safety interlocks:

- Door frames: Two redundant switches behind each front access door of the Customer Interface Module.
- Service safety door: Two sets of dual switches located on the upper section of the front frame for the service safety door.

When two libraries are connected by a pass-thru port (PTP), entering the interior of either library automatically suspends the pass-thru operations in the two libraries. Operations also stop within the library with the open door, while the other library's operation continues.

Door Switches

The library has four front door switches on the Customer Interface Module that monitor the state of the front access doors; should a door be opened without using service mode, these switches remove power from the robotics.

Emergency Robotics Stop Switches

Emergency robotic stop (ERS) is the removal of AC and DC power to the robotics, such as the HandBots, pass-thru ports, CAPs, and elevators; the library and tape drives are not affected. The emergency robotic stop ensures that no robotic motion occurs while someone is inside the library.

In case of a condition that requires an immediate power-off of the library, there are two ERS switches for the library:

- One interior, lighted switch on the left side of the drive area, as seen from the front of the machine
- One non-illuminated, covered switch on the front operator key panel

Pressing an ERS switch immediately removes AC and DC power to the robotics (not the entire library). After it is determined that it is safe to restore power, press the switch again to reset it.

Smoke Detection

A smoke detector is present within the library. The smoke detector is in the upper right section of the drive and electronics module, as seen from the rear of the machine.

If the detector senses smoke, the library performs an emergency power-off (EPO) procedure, removing all (AC and DC) power from the library. Call your service representative to diagnose the problem.

The replacement of the smoke detector is an annual preventative maintenance requirement.

Fire Suppression

The library does not ship with a Fire Suppression System installed, although features have been incorporated into the library to allow fire suppression systems to be installed. Professional Services can install a Fire Suppression System on site. Contact your service representative for more information.

Service Safety Door

The optional service safety door is a sliding door that is activated by the maintenance key. This maintenance key is controlled only by service representatives and is used when a failing component in the front of the library needs to be replaced.

The service safety door moves either to the left or right, depending upon which maintenance lock is opened. When the maintenance key is inserted into its lock and turned, the safety door separates the forward maintenance area from the library interior. This allows the service representative to safely replace a failing front frame component while the library remains fully operational.

The Service Safety Door is an optional feature for libraries with four HandBots. However, it is required for redundant (eight) HandBot operation.

The service safety door moves either to the left or right, depending upon which maintenance lock is opened. When the maintenance key is inserted into its lock and turned, the safety door separates the forward maintenance area from the library interior. This allows the service representative to safely replace a failing front frame component while the library remains fully operational.

Interior Lighting

The interior of the library is always illuminated with *white* LEDs on the ceiling. The ceiling of the Customer Interface Module has *yellow* (hazard) LEDs that flash when the library is in service mode and for approximately 10 seconds when the doors are closed to alert anyone who may still be inside the library.

SL8500 Servo Power Interrupt

An additional safety feature is the servo power interrupt (SPI). If a library motor is determined to be out-of-range, the processor generates an SPI to turn off drive voltage to the faulty motor. This prevents a servo runaway condition until the cause of the problem can be determined.

Introduction

This chapter introduces the major hardware components and provides the library specifications for the StreamLine^{TM} SL8500 modular library system, which is referred to as the SL8500 library or just the "library" throughout this manual. For software information and drive information, refer to the publications that pertain to these specific topics.

The library is a robotic system that mounts cartridges into storage slots or into drives for read/write operations. It also moves cartridges between the cartridge access port (CAP) to storage slots or between slots.

Library Overview

The SL8500 Library is a fully automated cartridge tape storage and retrieval system.

The base library stands 2.37 m (7.76 ft.) tall, 1.7 m (5.6 ft.) wide, and 2.76 m (9.1 ft.) deep. Depending on the model and features selected, *one* SL8500 library can store from 1,448 to 6,632 cartridge tapes and house from four to 64 tape drives.

A library complex, consists of two or more libraries that connect with pass-thru ports (PTPs) and contains *over* 320,000 customer usable cartridges and 2,048 tape drives.

The approximate speed of each robot (termed StreamLine HandBot™ high performance robotics) is from 2 m (75 in.) to 2.5 m (100 in.) per second.

Single Physical SL8500 Library—Base

The minimum SL8500 library configuration is composed of:

■ A Drive and Electronics Module, containing from four to 64 tape drives and the controlling circuit cards for the library

■ One Robotics Interface Module, containing up to 800 cartridge storage slots

■ Multiple HandBots (four – eight) that service four rails. They move horizontally along rails and vertically along their individual Z axes. They retrieve cartridges from both inner and outer walls (and the elevator and turntable assembly or CAPs) by pivoting 180 degrees

■ One Customer Interface Module that contains 648 data cartridges slots, 198 diagnostic and cleaning cartridges slots, 24 end slots (eight 3-slot arrays) for targeting and drop-off cells, and an LED display

■ A remote "operator panel" (StreamLine Library Console™ software that provides an operator panel display on the customer's personal computer [PC])

■ An elevator assembly located in the front (Customer Interface Module), that transfers cartridges vertically across rail boundaries (elevator) or from one side of the library to the other (by passing them to either HandBot using a turntable)

■ A standard cartridge access port (CAP) that allows up to 39 cartridges to be entered/ejected at one time

Single Physical SL8500 Library—Options

Options for each stand-alone SL8500 library are:

■ A maximum of five additional storage expansion modules, providing 1,728 cartridge storage slots each, to a maximum cartridge storage number of 10, 088 cartridges within one library

■ A touch-panel operator control in the middle of the Customer Interface Module, between the two access doors

■ An optional second CAP (CAP B) is also available

■ Redundant HandBots (maximum of four) that provide redundancy should one robot encounter a failure

■ One service safety door for maintenance activity

■ Library partitioning—a licensed feature that allows SL8500 rails (LSMs) to be partitioned for exclusive use by separate hosts. See "Library Partitioning" on page 22 for details.

A view of a library with one expansion frame is shown in FIGURE 1-1 on page 3.

FIGURE 1-1 Library Modules
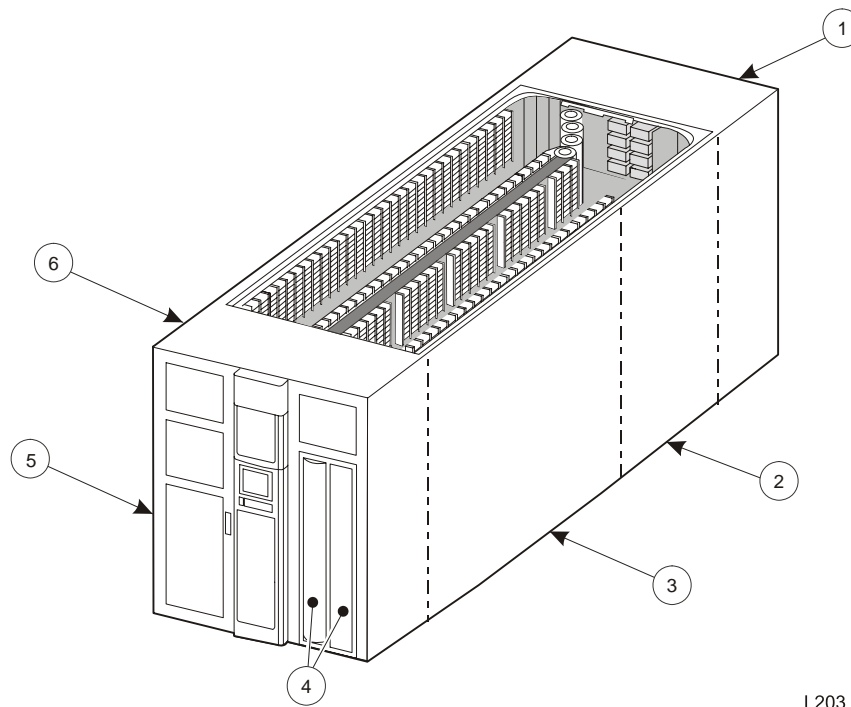
L203_009

1. Drive and electronics module	4. CAPs A and B (shown on front, right door)
2. Robotics interface module	5. Left front door
3. Storage expansion module	6. Customer Interface Module

Library Modules

The base library consists of three modules:

1. **Drive and Electronics Module**

2. **Robotics Interface Module**

3. **Customer Interface Module**

Besides the three modules, *up to three* **Storage Expansion Modules** may be added per library to increase capacity. These expansion modules are installed between the Robotics Interface Module and the Customer Interface Module.

With a PTP installed between two or more libraries, all libraries can share their cartridges and effectively act as a single system.

FIGURE 1-2   Base Library with One Storage Expansion Module
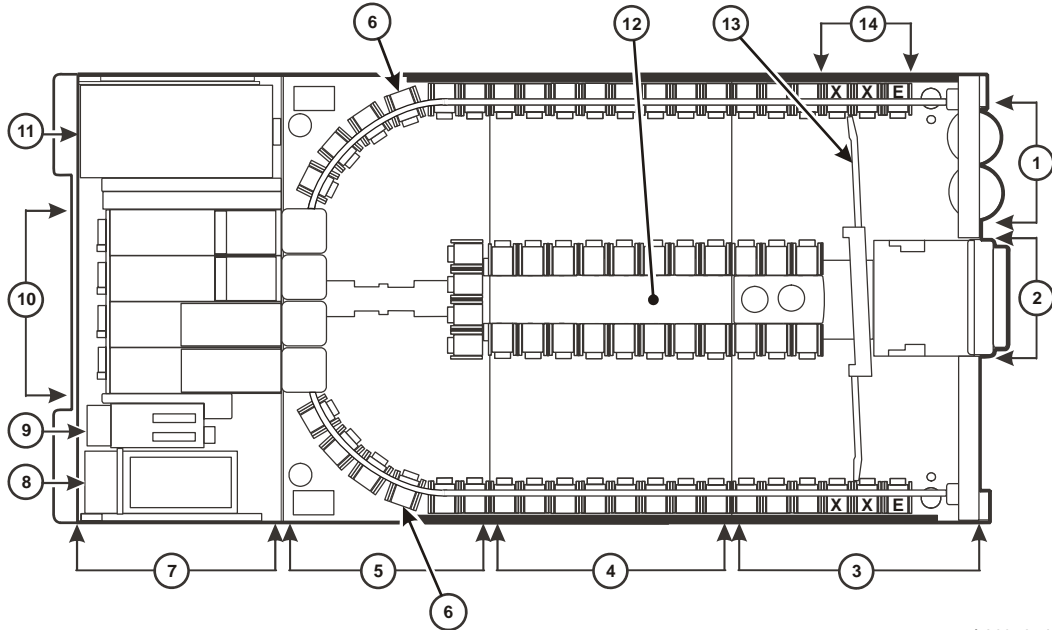
L203_054

1. Cartridge Access Ports (2) Caps
2. Facade Operator Panel (Optional) Icey Pad
3. Customer Interface Module
4. Storage Expansion Module
5. Robotics Interface Module
6. PTP (Pass Through Port)
7. Drive Electronics Module
8. AC Power Supplies Electronic Control Module
9. DC Power Supplies
10. Tape Drives
11. Accessory Racks
12. Inner Wall
13. Service Door
14. Reserved Columns
    E= End Stop
    X= Diagnostic & Cleaning Cartridge

Capacities

The following table shows the data cartridge capacities in a single library:.

TABLE 1-1   Data Cartridge Capacity

	Module Type	Cartridge Capacity
Basic Library	Drive and Electronics[1]	0
	Robotic Interface	800
	Customer Interface[2]	648
	Basic library	1,448

TABLE 1-1   Data Cartridge Capacity (Continued)

	Module Type	Cartridge Capacity
Expansion Modules	First storage expansion module	3,176
	Second storage expansion module	4,904
	Third storage expansion module	6,632
	Fourth storage expansion module	8,360
	Fifth storage expansion module	10,088

[1] There are no cartridge storage locations in the Drive and Electronics Module.
[2] The Customer Interface Module contains 198 storage slots for cleaning and diagnostic cartridges.

Note – This total number of cartridges does not include slots in the cartridge access port (CAP), pass-thru-port.

Drive and Electronics Module

The major components of this module include:

- AC power distribution units N+1 (standard) or 2N (*optional*) (see "Power" on page 17)
- Load sharing DC power supplies that provide power for the tape drives and HandBots
- Electronics control modules (ECM) and cards for library operation (see "Electronics Control Module" on page 7)
- Accessory racks to mount network devices and components, servers, and the service delivery platform
- Slots for 1 to 64 tape drives

Tape Drives

SL8500 library supports from 1 to 64 drives. The interface to these drives is fiber-optic based; meaning Fibre Channel, FICON[1], or ESCON[2] attachments.

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1. Short for *Fiber Connection*, or *Fiber Connectivity*—IBM's fiber optic channel technology that extends the capabilities ESCON. FICON supports full duplex data transfers over longer distances.

2. Short for *Enterprise Systems Connection*, or *Enterprise Systems Connectivity*—an IBM fiber optic channel technology that supports half duplex data transfers up to 200 Mb/s.

The following table lists the supported vendors, drives types, and interfaces.

TABLE 1-2 Supported Drives

Vendor	Drive Type	Host Interface Type
StorageTek	T9840A	Fibre Channel, ESCON
	T9840B	Fibre Channel, FICON, ESCON
	T9840C	Fibre Channel, FICON, ESCON
	T9940B	Fibre Channel, VSM ESCON
	T10000	Fibre Channel
HP	Linear Tape-Open (LTO 2, 3)	Fibre Channel
IBM	Linear Tape-Open (LTO 2, 3)	Fibre Channel
Quantum	Linear Tape-Open (LTO 3)	Fibre Channel
Quantum	Super DLT (SDLT600)	Fibre Channel

StorageTek T-Series Tape Drives

The StorageTek T-Series tape drives are small, modular, high-performance drives designed for both the enterprise and client-server environments.

T9x40

StorageTek's T9x40 tape drives are high-performance drives designed for enterprise and client-server environments. There are two models available:

T9840   The access-centric T9840 tape drive is ideal for applications that demand high data throughput and fast recall. These drives give you access to data at an average of 8 seconds, store up to 40 GB, with transfer rates of up to 30 MB/s.

The SL8500 supports all three models of the T9840 (A, B, and C).

T9940   The T9940 tape drives are designed for high-capacity storage applications. They use a single reel cartridge tape for higher capacities of up to 200 GB with transfer rates of up to 30 MB/s.

Note: The T9940*A* tape drive is *not* supported.

T10000

StorageTek's T10000 are high-capacity, high-performance tape drives. These drives use a single reel data cartridge with a native storage capacity of up to 500 GB (native) and transfer rates of up to 120 MB/s. These new tape drives are designed to take advantage of the new speeds in storage area networks (SANs)—4 Gb/s.

LTO Ultrium

Ultrium Linear Tape-Open (LTO) technology was developed jointly by Hewlett-Packard (HP), IBM, and Seagate to enable data interchange among different LTO Ultrium tape drive vendors. LTO is an "open format" technology, which means that users have multiple sources of product and media. The "open" nature of LTO technology enables compatibility between the three different vendors.

The SL8500 supports the Ultrium Generation 2 and 3 LTO drives available

from HP, IBM, and Quantum. These drives use a single reel data cartridge with native transfer rates and capacities of up to

- 35MB/s with capacities of 200 GB for LTO2 drives
- 80 MB/s with capacities of 300 GB for LTO3 drives

TABLE 1-3   LTO Drive Backward Readability

	LTO Gen 2 Drive	LTO Gen 3 Drive
LTO 1 media	Read and write	Read only
LTO 2 media	Read and write	Read and write
LTO 3 media	No action	Read and write

Super DLT

The Super DLT (SDLT) is a standard for mid-range UNIX and Windows platforms. The SDLT 600 incorporates an advanced tape recording technology for high capacity tapes, up to 300 GB, with transfer rates of 36 MB/s.

Electronics Control Module

Each library contains an electronics control module.

HBK Card

The HBK card contains flash memory and feature upgrade controls; it resides on a separate logic card within the control module. It contains the configuration, firmware versions, and features for the library.

Configuration

Library configuration is retained on the flash memory card. This saves significant time in cases where an HBC card must be replaced, because the new card fetches the configuration from flash memory instead of requiring manual re-configuration by a service representative.

Firmware Versions

Flash memory holds both the most recently activated firmware version and the previous firmware version. Therefore, if there is a requirement to return machine control to a previous version, a service representative merely re-activates the previous version and places the now-deactivated version into the "previous" state.

Features

When features are added to a library, they are tracked to the machine's serial number[3]. Any upgrade must be matched to the serial number before activation. The upgrade process is accomplished over the command line interface (CLI) by the service representative.

HBC Card

The HBC card is the library controller, responsible for coordinating all component operations within the library. It is the interface between the host and the library. One HBC card can control a library's operation, but a second HBC is available to assure redundancy. Operating voltage for HBC cards is +3.3 VDC.

In addition to the cards in the electronics control module, the HBC card interfaces with the following cards and components:

- Ethernet hubs (Library-to-library LANs, tape drive service LAN)
- TCP/IP/Web host interface
- HBS cards (robots)
- Power, smoke, and environmental monitoring circuits throughout the library
- Flash memory

HBT Card

The HBT card translates commands from the HBC controller card into unique drive commands, transferred across differential RS422 lines. The HBT card contain 66 Universal Asynchronous Receiver/Transmitters (UARTs); 64 are responsible for the parallel-to-serial conversion for the tape drives and the remaining two communicate with the tape environmental monitor card (HBD card).

Robotics Interface Module

The robots move cartridges between storage slots, between slots and tape drives, and between the CAP and slots.

There are four robotic rail assemblies in the library that provide both power and communications to the four or eight robots. Each robot can service up to 16 tape drives. Robots consists of:

- Rail, brush, and HandBot assemblies

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3. The machine serial number is on the rear, bottom of the Tape Drive and Electronic Module.

- A Z-mechanism for vertical motion of the hand
- A wrist-mechanism for lateral or horizontal motion
- A bar-code scanner for both targeting and reading cartridge labels
- A proximity sensor for detection of empty slots and unlabeled cartridges
- A belt-driven gripper mechanism for gripping the *sides* of the cartridges

Important:
Because of the four individual rails, each robotic assembly is considered a library storage module (LSM). So the architecture of the SL8500 provides four separate and unique LSMs within a single library.

To optimize system performance, the HandBots automatically implement the *Fast Load* capability. Once a HandBot successfully inserts a cartridge into a drive, it is immediately available for the next request and does not wait until the drive reports that the cartridge has been loaded. The SL8500 library control electronics waits to return the response to the mount request until it detects that the tape drive has successfully loaded the cartridge tape.

Two HandBots can service a single rail section within the library, providing redundancy. Each HandBot has two motors, if one fails, the other motor is powerful enough to move the defective HandBot into the forward service area. If both the motors fail for a HandBot, then the redundant HandBot moves the defective HandBot into the forward service area thus continuing HandBot operations.

One robotics interface module contains up to 800 cartridge storage slots.

FIGURE 1-3   HandBot (Detail)
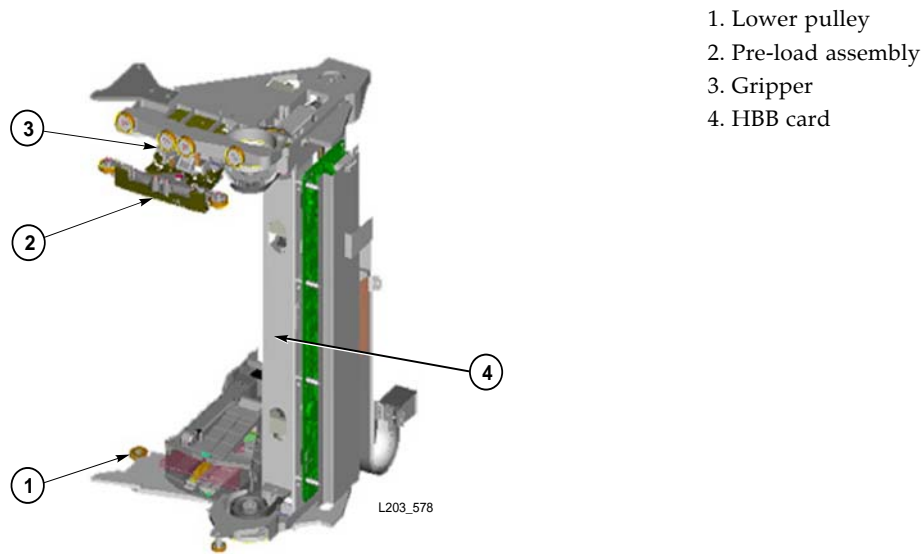
1. Lower pulley
2. Pre-load assembly
3. Gripper
4. HBB card

L203_578

FIGURE 1-4 HandBot on the Power Rail)
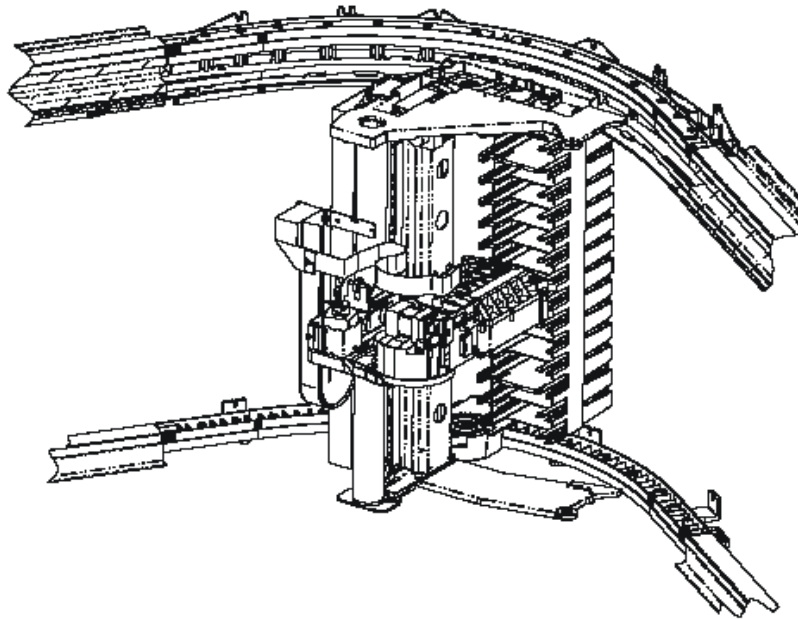
Redundant HandBots

Make sure that the service representative completes the following are prerequisite to the operation of the redundant HandBots (two HandBots per rail):

1. Install the Service Safety Door

2. Upgrade the HandBot assemblies

3. Upgrade the library firmware (FRS 2.50 or later)

4. Upgrade the HBS assemblies; these have an "X" on the upper left of the assembly

5. Upgrade the HBN card

6. HBQ rail terminator cards

7. ENDSTOP bar code inserts in the 3-cell arrays at the ends of all rails

8. Additional DC power supplies

Initialization

When power is applied to the library, each HandBot begins its initialization routine. The sequence for initialization is in the following order:

Note – If there are multiple HandBots, each HandBot attempts initialization through the following sequence. If a failure is encountered in one HandBot, that HandBot is flagged as defective. Initialization continues for the other HandBots and, after they are successfully initialized, the defective HandBot is pushed into the maintenance area for replacement.

1. Logic/controller cards initialize (HBC, HBB).

2. Rail communication is established with the HandBots: this is accomplished through the HandBot's electrically conductive brushes that contact the rail. HandBots are identified by number and hand address:

   a. Number: the HandBot that encounters the left stop (referenced from the front of the customer interface module) is HandBot number "1," the one encountering the right stop is HandBot number "2."

   b. Hand address: according to their rail location (numbered 1—4, from the top, down). See "HandBot Numbering" on page 12 for more information.

3. If a service safety door is installed, the HBC card checks that:

   a. Both maintenance keys are in the vertical (OFF) positions

   b. The door is in the center (disengaged) position. If the door is not in the correct position, the HBC card will issue the command to move it into its center position.

4. HandBots move vertically (this is the *only* HandBot motion that is controlled by the microcode within the HandBot's HBB card—all other motions are controlled by the HBC card)

5. The gripper sensors are checked.

6. The hand retracts – this protects:

   a. Hand components—if the hand's "reach safe" sensor cannot be detected, initialization stops.

   b. A customer cartridge that may have been left in the gripper during a power failure. If this is the case, the "cartridge present" sensor activates and the hand holds the cartridge in the retracted position.

7. Belt-driven wrist moves counterclockwise.

8. For libraries *without* redundant HandBots, each HandBot moves to both the left and right end stops.

9. For redundant HandBots:

   a. Both HandBots move to their respective end stops

   b. Both HandBots initialize.

   c. The right HandBot remains at its end stop.

   d. The left HandBot moves around the track to meet the right HandBot. This distance is calculated by the HBC card as the absolute track distance

   e. The left HandBot moves to the end of its track

10. HandBots move to an empty slot detection area (the slot under the bar code insert, in the 3-cell array at the front of the customer interface module) to verify proximity sensor accuracy. During normal operation, if an empty slot is detected, the "empty slot detector" sensor is activated; non-labeled cartridges are also detected.

11. Belt-driven reach mechanism initializes by a wrist motion, pointing the hand to an aisle position, and reach components are then verified.

12. Gripper, reach, and scanner initialization is accomplished at the three cell array section:

    a. If there is no cartridge in the gripper, the initialization continues.

    b. If a cartridge is in the hand, the hand moves to the drop-off slot, the cartridge is placed in the slot, and gripper initialization continues.

Note – Cartridge drop-off slots are the bottom slots in the 3-cell arrays and the top fixed array slots under the PTP locations leading to a total of 16.

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13. Hand points toward the rear of the library.

14. End status sent to HBC card.

Note – If any hand or robotic error cannot be resolved by error recovery routines, the *entire HandBot* must be replaced.

HandBot Numbering

Rails are numbered from 1 (top rail) to 4 (bottom rail). They are also designated as separate library storage modules (LSMs) within a library.

As examples:

■ Rails 1 and 2 can be designated LSMs for HSC, while rails number 3 and 4 can be designated LSMs for ACSLS.

■ If only one host exists, all rails become separate LSMs for that host.

See Appendix A, "Cartridge Slot Locations" for more details.

HandBots have the following numbering:

1. **Library number** (within a library complex)

2. **Rail number –** Rails are numbered 1 through 4, rail 1 is the top rail

3. **Column number –** Columns are "signed" numbers referenced from the customer interface module, where +1 is right of the center of the drive bays and -1 is to the left of the drive bays

4. **Side number –** Outer wall = 1, Inner wall = 2

Note – Side numbers for HandBots are numbered according to their end stops: 1 (left HandBot stop) and 2 (right HandBot stop).

5. **Row number –** Numbered consecutively, from the top down

Note – Because HandBot hands are not storage slots, their row numbering is 0.

As examples:

- Location 1, **1**, 0, **1**, 0 = the HandBot on rail 1 (top rail) that encounters the stop on the *left side* of the customer interface module

- Location 1, **1**, 0, **2,** 0 = the HandBot on rail 1 (top rail) that encounters the stop on the *right* side of the customer interface module

- Location 1, **2**, 0, **1**, 0 = the HandBot on rail 2 (next rail down) that encounters the stop on the *left side* of the customer interface module

shows how this notation appears on the StreamLine Library Console.

FIGURE 1-5   StreamLine Library Console – HandBot Display
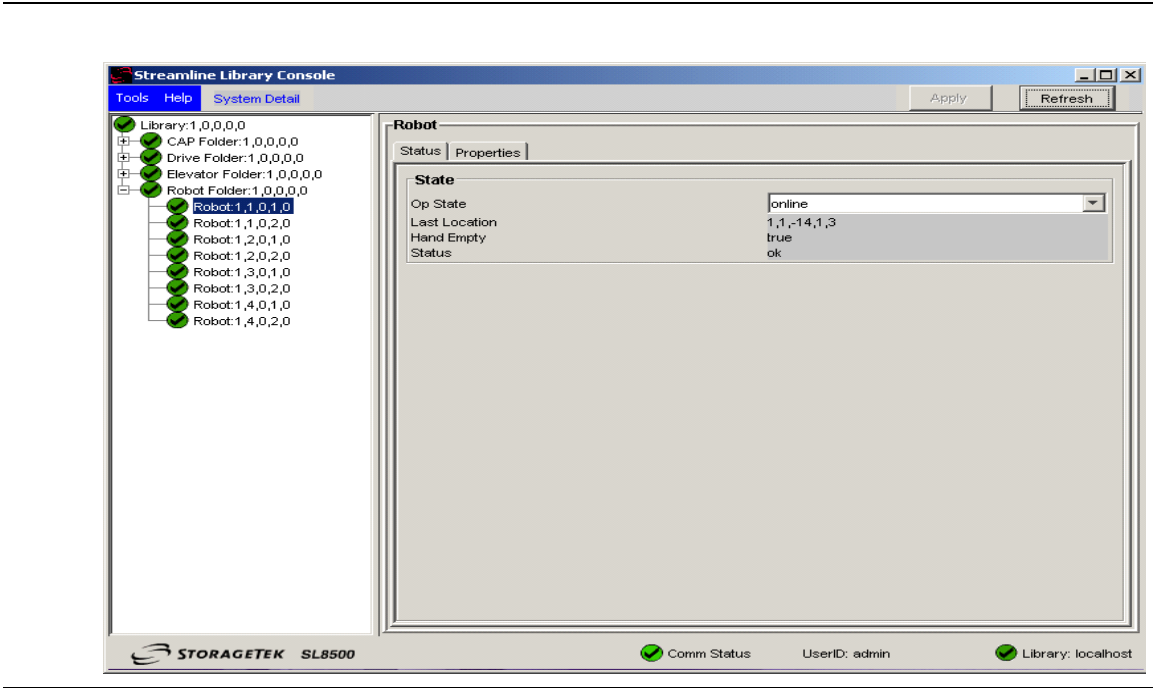
Library Cameras

An Ethernet-based library camera system (WebCam) with monitoring software are optional features of the SL8500 library. The cameras allows you to remotely see the inside of their SL8500 library. The WebCam attaches to a 10Base-T, 100Base-T Ethernet connection and provides remote, high-quality, audio and video. This feature contains two cameras that mount in the upper frame of the front access door-one on each side of the library.

Note – The WebCam feature uses a third party camera designed for the security surveillance market and is subject to change without notice.

Customer Interface Module

The customer interface module consists of the following components:

Keypad

FIGURE 1-6 Keypad
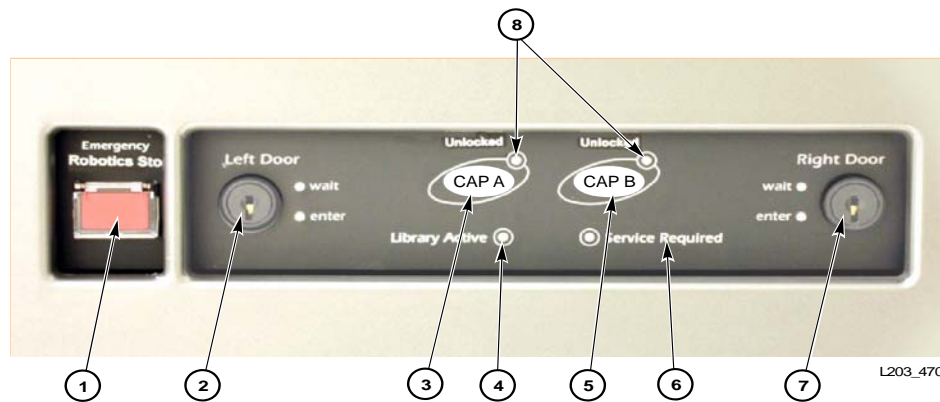
1. Emergency robotics stop switch
2. Left service safety door key
3. CAP A button
4. Library active indicator

5. CAP B button
6. Service required indicator
7. Right service safety door key
8. CAP unlocked indicators

The keypad has the following buttons, switches, and indicators:

TABLE 1-4 Keypad Switches, Buttons, and Indicators

Emergency robotics stop switch	Actuate the emergency robotics stop switch to disconnect DC power to the power rails. When it is safe to restore power, press the switch to restore power to the rails.
CAP A button	Press to open and close CAP A.
CAP B button	Press to open and close CAP B.
CAP unlocked indicators	The amber LED light is On when the CAP is unlocked, and Off when locked. When the light is On and blinking, manual intervention required. Open the CAP and make sure the cartridges in the CAP slots are properly seated.
Service required indicator	This red indicator is lit when operator intervention is required.
Service safety door keys (left and right doors)	Allows the service representatives to place the library in maintenance mode.

Operator Panel

In the SL8500, the StreamLine^{TM} Library Console^{TM} software is the operator panel software application capable of execution on both a local operator console (touch-screen panel resident within the SL8500 frame), as well as a remote operator console (network PC).

The Library Console runs a JAVA application that provides the graphical user interface (GUI) for the library. The Library Console communicates to the library controller (HBC) through an Ethernet connection. In compliance with section 508 of the Americans with Disabilities Act, the touch-panel is accessible from a sitting or standing position.

The keypad interface of the software for the touch-panel enables alphanumeric data entry to the operator panel application from the local operator panel. The local operator panel does not contain either a keyboard or a mouse.

Use the Library Console to:
■ View and modify status and properties of the library and the associated devices (drives, CAP, robots, and elevators)
■ Perform library audit, self test, and code load
■ Locate cartridges
■ Display standard reports
■ Display standard events

Local Operator Console

The local operator console is an optional feature on the front of the library. This panel consists of a flat screen display with a touch-screen interface. The local operator console has the following features:
■ 12.1 inch flat panel display
■ Touch screen interface (no keyboard/mouse option)
■ A pen and stylus are available for the touch screen interface
■ Resident within the library frame
■ Ethernet interface
■ JAVA application that provides the Graphical User Interface (GUI) for the library

Remote Operator Console

The remote operator console is a standard feature that displays the operator panel application on a personal computer (PC). A CD containing the Library Console software is supplied with each library that you can use to install the application.

Capacities

A basic library can store up to 1,448 data cartridges. This total does not include cartridges in the cartridge access port (CAP) or the reserved slots. A total of 198 slots are dedicated to diagnostic and cleaning cartridges. See Appendix A, "Cartridge Slot Locations" for information on slot locations.

There are also eight drop-off slots in the library, two for each robot. These slots are used in the event of a robotic failure when there is still a cartridge in the hand.

TABLE 1-5 lists the capacity variations for the SL8500 library.

TABLE 1-5   SL8500 Capacity Variations

Module Type	Cartridge Capacity
Drive and Electronics[1]	0
Robotic Interface	800
Customer Interface[2]	648
Basic library	1,448
First storage expansion module	3,176
Second storage expansion module	4,904
Third storage expansion module	6,632
Fourth storage expansion module	8,360
Fifth storage expansion module	10,088

[1] There are no cartridge storage locations in the Drive and Electronics Module.
[2] The Customer Interface Module contains 198 storage slots for cleaning and diagnostic cartridges.

Elevator

Elevators provide vertical pass-thru operations between rails within the *same* library. Both elevators are located in the front of the library between the front access doors and the Service Safety Door. Each of the four rails *share* the two elevators.

Cartridge Access Port (CAP)

CAPs allow operators to enter cartridges and eject cartridges from the library. A total of 39 cartridges can be imported or ejected at one time through each CAP. SL8500 library CAPs are installed on the right access door. FIGURE 1-7 on page 17 illustrates the CAPs. See Chapter 4, "Library Operation" for information on CAP operation.

Note – A CAP will not operate unless the library is in the automated mode.

FIGURE 1-7   CAP
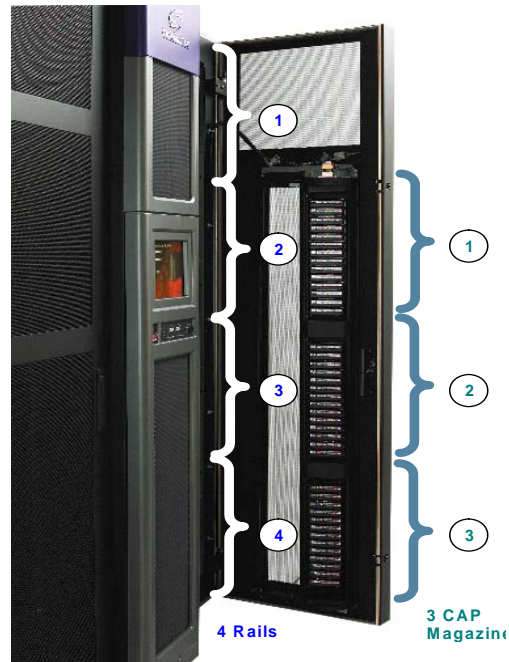
The CAP spans across three rails—2, 3, and 4 (LSMs 1, 2, and 3).

Storage Expansion Modules

Besides the basic configuration, up to five Storage Expansion Modules may be added per library to increase capacity. These expansion modules are installed between the Robotics Interface Module and the Customer Interface Module.

Each Storage Expansion Module can contain up to 1,728 data cartridge slots.

Power

There are five (5) power grids that distribute power throughout the library. Two of the power grids carry 220 VAC; the other three carry 48 VDC.

- The two AC power grids distribute 220 VAC to the different Load Sharing Power Supplies, Electronics Control Module (ECM), and accessory racks.
- The three DC power grids supply 48 VDC to the tape drives, robots, and front frame components.
  - The Drive Power Grid supports up to 64 tape drives (with the proper number of Load Sharing Power Supplies). A single tape drive power supply provides power for up to 8 tape drives, so at least 8 power supplies are required for 64 tape drives (in an N+1 configuration).
  - The Robot and Pass-thru Port (PTP) Power Grid supplies power to the robots and the four pass-thru ports (PTP). A single power supply can power up to four robots, so two power supplies are required for eight robots.
  - The Front Frame Power Grid is powered by a *single* Load Sharing Power Supply that supplies 48 VDC power to the two Cartridge Access Ports if present, one Turntable, two Elevators, and the Service Safety Door.

Note – The power supply for the Front Frame Power Grid is in the Customer Interface Module. All the other Load Sharing Power Supplies are located in the Drive and Electronics Module.

Power Consumption

Power consumption for the library is as follows:

- Single phase configurations
  - 24 Amps per phase (minimum) – 13.0kW, 44,382 Btu/hr
  - 768 Amps per phase (maximum) – 416 kW, 1.4 M Btu/hr
- Three phase configurations
  - 40 Amps per phase (minimum) – 13.0 kW, 44,382 Btu/hr
  - 280 Amps per phase (maximum) – 416 kW, 1.4 M Btu/hr

Note – *Power cabling must be done by a licensed electrician.*

Power Configurations

Two power configurations are available for the SL8500 library:

1. N+1 base power configuration

2. 2N power configuration

N+1 Base Power Configuration

The base power configuration contains one system power distribution unit (PDU) and one N+1 PDU.

- The system PDU, connected directly to the branch circuit, provides AC power to three DC power grids and the electronics control module.
- The N+1 PDU supplies added +48 VDC load sharing power to each of the three DC power grids and an extra AC-to-DC power supply for the electronics control module.

The base power configuration provides power to the:

- Tape drive power supplies
- Robotic rail power supplies
- Customer Interface Module power supplies
- Touch screen operator control panel
- Electronics control module power supplies

Note – The base power configuration does not offer redundant AC power.

2N Power Configuration

The 2N power configuration contains the base power configuration (PDU 1) and a second PDU, PDU number 2.

This configuration provides power to the same components as N+1, plus power for:

- Optional, redundant load sharing power supplies
- Two additional accessory racks for customer components
- Redundant controller cards

Note – The 2N PDU is required for the 2N drive power, 2N robotic power, and also for the additional rack installed.

Library Complex

A library complex is created by connecting two or more SL8500 libraries together with Pass-thru Ports (PTPs).

The maximum size library complex possible consists of either:

- 32 libraries for Host Software Component (HSC) systems, connected through PTPs, containing over 320,000 cartridge slots and 2,048 tape drives.
- 31 libraries for Automated Cartridge System Library Software (ACSLS) connection, connected through PTPs, containing over 320,000 cartridge slots and 1,984 tape drives.

Note – A library complex with functional pass-thru ports (PTPs) cannot be partitioned. All PTPs must be disabled before partitioning can be enabled. See for details.

Pass-thru Ports

A PTP is an electro-mechanical device that allows one Library Storage Module (LSM) to pass a cartridge to another library storage module within the same complex.

For example: If an operating system issues a mount request, and all the tape drives are busy in that LSM and library, the PTP can pass the cartridge to another library where an idle tape drive can satisfy the mount request.

There are eight PTP locations in an SL8500 library, two locations per rail (or LSM). These locations are on the curved portions of the Robotic Interface Module near the tape drives. Therefore, they provide quick access to the drives.

The SL8500 PTPs consist of a separate frame (FIGURE 1-8) that is installed between the Drive and Electronics Module and the Robotics Interface Module. Each frame has four separate PTP mechanisms that can pass up to *two* cartridges each between LSMs (one cartridge mechanism) for a total of eight cartridges.

The maximum size of a library complex connected through PTPs is 7 libraries.

FIGURE 1-8   Pass-thru Port

Note – Because elevators transfer cartridges from one LSM to another, these transfers are also pass-through operations. The elevators are thus internal PTPs, considered by host software to be on Panel 0.

The following terms and definitions apply to SL8500 PTP operations:

Home library	Provides power, signal, and control lines to the PTP mechanisms. This is the library on the right as viewed from the front.
Away library	Always located on the left side of a Home library, as viewed from the front.
Source	Contains the home slot location for the cartridge that will be passed through to an adjacent library.
Destination	Contains the tape drive or slot location in the adjacent library where the cartridge will be mounted or stored.

All SL8500 libraries come equipped and ready for the addition of the PTP frame▬no additional walls are needed on existing libraries.

The software applications▬ACSLS and HSCsupport PTP operations.

Physical characteristics for the PTP assembly are listed in TABLE 1-6.

TABLE 1-6   PTP Assembly – Physical Characteristics

Height	231 cm (91 in.)
Width	17.2 cm (6.76 in.)
Depth	150.8 cm (59.4 in.)
Weight	121 kg (266 lb)
Power	+48 VDC, supplied from the home side (left side of the library, as viewed from the front) by the corresponding HBF card for each rail.

Embedded Firmware

Operating firmware is resident on the HBC card from the factory. The features of the firmware are explained in the following sections.

Security

Access to the Library Console is secured by a fixed set of user accounts at the site. The site user accounts include the customer administrator, StorageTek customer service engineer (CSE), and third party field service technician.

The Library Console security system requires activation of the site user accounts with an activation password (see "Activating Password" on page 28).

Operating Firmware

Some key features of the SL8500 firmware are:

1. Two firmware versions may be held on the HBC card. When firmware is upgraded, the earlier image of firmware remains in memory and may be restored if required.

2. Auto Discovery of additional tape drives

3. Auto Discovery of new cartridge slots and added libraries

Automatic handling of dynamic World Wide Name (dWWN) assignments (See "Dynamic World Wide Name" on page 29).

Library Management Software

The library management software controls the library hardware to mount and dismount cartridges on drives and move the robot. When the library is in automated mode, these operations occur without manual intervention. The software determines the location of the cartridge by accessing the audit data uploaded from the library. The software then allocates the drive to receive the cartridge.

These application maintain a database that tracks volume serial numbers (VOLID) of cartridges and their current locations in the library.

Host Software Component

When an SL8500 library is in a configuration with a Multiple Virtual Storage (MVS) host, the host must run a version of the StorageTek Host Software Component (HSC) along with the Storage Management Component (SMC). HSC resides in the MVS host, but is invisible to the actual operating system. *HSC 6.0* or higher is required for host control. However, for new drives, higher levels of HSC may be required.

ACSLS

ACSLS is a software package that manages library contents and controls library hardware for the mounting and dismounting of cartridges. ACSLS 7.1 or higher is required. This application provides library management services such as cartridge tracking, pooling, reports, and library control.

Library Partitioning

Note – Library partitioning is a licensed feature which must be enabled by your Sun service representative. This feature is available starting with SL8500 firmware version 3.7x and StreamLine Library Console version 3.25. See "System Requirements for Library Partitioning" on page 24 for complete details.

Library partitioning allows SL8500 rails (LSMs) to be partitioned for exclusive use by separate hosts. For example, you can configure some rails to be used only by an HSC host and others to be used only by an ACSLS host. This allows you to configure an SL8500 library for applications running on multiple operating systems.

Following are important features and restrictions of library partitioning.

Partition Configuration Requirements

Only a single library can be partitioned. All pass-thru ports (PTPs) must be disabled before partitioning can be enabled. A library complex with functional PTPs cannot be partitioned (see "Library Complex" on page 19 for details about library complexes).

The smallest unit of measure for a partition is a rail, and a partition can consist of one to four rails. Rails in the partition must be adjacent—for example, a partition can consist of rails 1, 2, and 3, or rails 2 and 3, but not rails 1 and 3 only.

Each rail can be assigned to only one partition.

Hosts and Partitions

Each partition is assigned exclusively to one of the following:

■ A single ACSLS host

■ A single HSC host

■ A group of up to 16 HSC hosts sharing a common control dataset (CDS)

Each partition appears to the host as a separate ACS. An ACSLS server can control one or more partitions in a library, whereas an HSC system can control only one partition in a library.

Rails assigned to one partition are reported to all other partition owners as "unallocated." Partition owners cannot access or display information about any of the drives, storage slots, or cartridges within partitions assigned to other hosts.

Library Resources and Partitions

All drives, storage slots, and cartridges within a partition are owned exclusively by the assigned host. For example, if rails 1 and 2 are configured for an HSC host, only HSC-designated drives and cartridges can be installed at those rail positions.

All HandBots and CAPs in the library are shared resources which cannot be assigned exclusively to one partition.

Each host must reserve a CAP to use it, and when done, must release the reservation to make the CAP available to other hosts. No other host can access the CAP until the first host has terminated the operation and released the reservation.

If for some reason a host cannot release its CAP reservation, a library operator can use the SLConsole to override (unreserve) the reservation. You should use caution with this procedure, however. See "Overriding a CAP Reservation" on page 54 for the detailed procedure.

Since CAPs are shared resources, they cannot be set to run in auto mode. The commands to enable CAP auto mode are disabled to ACSLS and HSC for a partitioned library.

System Requirements for Library Partitioning

Note – Library partitioning is a licensed feature which must be enabled by your Sun service representative.

Following are minimum system requirements for library partitioning:

- SL8500 firmware version 3.7x
- StreamLine Library Console version 3.25
- ACSLS version 7.1/7.1.1 with PUT 0701 (Solaris on SPARC)
- ACSLS HA 2.0 with PTF6514766
- HSC 6.1 with current PTFs
- NCS, ExPR, VTCS versions 6.1
- ExLM version 6.0
- VSM version 4 and 5

Capacities for Partitions

Table 1-7 shows the data cartridge capacities per rail in a partitioned library.

TABLE 1-7   Partition Data Cartridge Capacities

	Module Type	Total Cartridge Capacity Per Rail
Basic Library	**Drive and Electronics**[1]	0
	Robotic Interface	200
	Customer Interface	162
	Basic library total	362
Expansion Modules	Each rail in an expansion module provides 432 additional data cartridge slots.	
	First storage expansion module	794
	Second storage expansion module	1226
	Third storage expansion module	1658
	Fourth storage expansion module	2090
	Fifth storage expansion module	2522

[1] There are no cartridge storage locations in the Drive and Electronics Module.

Library Specifications

TABLE 1-8   Library Specifications

Physical

• Hmeight	2.37 m (236.6 cm) or 7.76 ft (93.15 in.)
• Width	1.7 m (170.8 cm) or 5.6 ft (67.25 in.)
• Depth (Base Library)	2.8 m (276.9 cm) or 9.1 ft (109 in.)
■ With 1 expansion module	3.7 m (372.1 cm) or 12.2 ft (146.5 in.)
■ With 2 expansion modules	4.7 m (467.4 cm) or 15.3 ft (184 in.)
■ With 3 expansion modules	5.6 m (562.6 cm) or 18.5 ft (221.5 in.)
• Weights	*Library only:*
■ Base Library	1954 kg (4,309 lb)
■ With 1 expansion module	2392 kg (5,274 lb)
■ With 2 expansion modules	2830 kg (6,239 lb)
■ With 3 expansion modules	3396 kg (7,487 lb)
• Weight distribution per pad	454 kg (1,000 lb)
• Pass-thru Port	
■ Height	231 cm (91 in.)
■ Width	17.2 cm (6.76 in.)
■ Depth	150.8 cm (59.4 in.)
■ Weight	121 kg (266 lb) including the mechanisms
• Service Clearances	
■ Customer Interface Module	66 cm (26 in.)
■ Drive & Electronics Module	85 cm (33.5 in.)
■ Pass-thru port (between)	15.24 cm (6 in.)
• Temperature	
■ Operating	+16 to +32°C (+60 to +90°F)
■ Shipping	-30.5 to +49°C (-23 to +120°F)
■ Storing	+4.4 to +32°C (+40 to +90°F)
	+25.6°C (+78°F) maximum, non-condensing
• Wet bulb (operating)	
■ Humidity	20% to 80%
■ Operating	5% to 90%
■ Shipping	20% to 80%
■ Storing	
• Operating Heat Output	44,380 Btu/hr (maximum loading**)
	Calculation for this is: 3.41214 **x** Watts = Btu/hr
• Power Consumption	13.0 kW (maximum loading**)
Single phase configuration and three phase configurations	13.7 kVA
	kVA = kWatts ÷ Power factor
	The power factor for the SL8500 = 0.95

**Maximum loading includes 64 tape drives, 4 fully loaded racks, 8 HandBots, all the front frame components (CAPs, service door, and elevators), plus redundant control modules.

TABLE 1-8   Library Specifications (Continued)

Physical	
Tape Drive Weights *without* **Tray**	**Tape Drive Weights** *with* **Drive Tray**
• T9840 = 3.9 kg (8.5 lb) • T9940 = 6.8 kg (15.0 lb) • IBM LTO = 2.5 kg (5.5 lb) • HP LTO = 2.5 kg (5.5 lb) • **Drive Tray** = 4.3 kg (9.5 lb)	T9840 = 8.2 kg (18.0 lb) T9940 = 11 kg (24.3 lb) IBM LTO = 6.9 kg (15 lb) HP LTO = 6.9 kg (15 lb)
• **Cartridge Tape Weights** are approximately 227 g (8.0 oz) or 0.227 kg (0.5 lb)	

Configuration Information

This chapter describes how to verify the library and drives configuration entries for operation.

Some configuration values, such as drive locations, capacity, and drive types are set through an automatic configuration process that occurs during an IPL. However, before the library is fully operational, some of the configuration values must be verified and entered manually.

Typically, your service representative will configure your library during installation, during firmware upgrade, or after drives are added. If you must change the library's configuration, you may enter the values through the Library Console. Library configuration also includes setting up cleaning options using the library management software.

Installing StreamLine Library Console

StreamLine Library Console is a software application that provides all of the functions to test, monitor, and operate the library. You should activate the site user accounts before accessing this application (see "Activating Password" on page 28).

StreamLine Library Console is contained on a compact disk (PN 3139995xx). The code level of this application is also available on the Customer Resource Center web site at http://www.support.storagetek.com.

▼ To install the StreamLine Library Console on your PC

1. **Run the Library Console installer from the CD or download the appropriate Library Console code installer file from the customer resource center (CRC) at** http://www.support.storagetek.com **to a folder on your PC.**

   Microsoft Windows installer file: SLConsoleWindowsSTK.exe
   Sun Solaris installer file: SLConsoleSolarisSTK.bin

2. **Follow the guided instructions to complete the installation.**

Activating Password

If you are logging on to the Library Console for the first time you must activate your user account (admin) with an activation password.

The Library Console security system requires activation of your site user account with an activation password. This activation password is valid for one time use only. After the initial login with the activation password, the system prompts you to setup a new password for the user account. You can then share the new password with other users requiring access to the Library Console using the same user account.

Your service representative will retrieve the Activation Password for the customer administrator account.

▼ To Activate Your User Account

1. **Logon to the Library Console by entering your site user ID (service, admin, or oem), activation password, and the library name.**

   Note – The activation password is case sensitive. You must type this password exactly as it was issued by the Activation Password Request application. If you there is a mismatch, you have to obtain another password from the Activation Password Request application.

2. **The system authenticates the user ID and the activation password for the library.**

3. **If the authentication is not successful, the system displays the following error message:**

   ```
   "account is not activated. Contact customer Support for an activation
   password."
   ```

4. **If the logon process is successful, the system directs you to the change password screen to do the following:**

   a. **Type a new password.**

   b. **Retype the new password to confirm.**

   Note – It is mandatory to assign a new password to your user ID for future access to the StreamLine Library Console.

Verifying Configuration Entries

To verify or enter configuration details using the Library Console, select **System Details**, and then select the ? button for the online help.

Complete or verify the following fields to make the library and the drives operational:

TABLE 2-1   Library Configuration Entries

Fields	Valid Values	Description
Transition State	Online Offline Forced offline	Online indicates that the library is available for operation. Offline completes all outstanding jobs for the drive before taking it offline. Forced offline (not recommended) immediately varies the drive offline; all outstanding jobs receive a device failure error.

TABLE 2-2   Drive Configuration Entries

Fields	Valid Values	Description
Port X Enabled	True False	Setting this value will turn on or off the physical port (A or B) on the drive. If you select False then the communication channel between the host software and the drive is disabled. The network software automatically configures the Port (A or B) address. This is called soft mode addressing. *The arbitrated loop topology (hard ALPAs [Arbitrated Loop Physical Addresses]) can not be enabled for the SL8500 library or drives.*
Transition State	Online Offline Forced offline	Online indicates that the drive is available for operation. Offline completes all outstanding jobs for the drive before taking it offline. Forced offline (not recommended) immediately varies the drive offline; all outstanding jobs receive a device failure error.

Dynamic World Wide Name

Each connection (port) in a Fibre Channel environment must have a unique ID called the World Wide Name (WWN). The WWN is a 64-bit address that identifies each individual device, company, with vendor information.When enabled, dWWN assigns names to library drive *slots* rather than devices. When a drive is replaced, the new drive receives the same name as the one it replaced, thereby eliminating the need for system re-configuration There are three World wide Names reserved for each drive bay: Node, Port A, and Port B.

Changing the WWN feature must be coordinated with the system administrator and is usually enabled during installation.

Note – Both library and tape drives must have microcode or firmware that supports the dynamic World Wide Naming feature.

⚠️ **Caution –** Changing the dWWN feature must be coordinated with the system administrator. The feature is usually enabled at installation time.
A record of the configuration should be kept; this is not only something that should always be done, but it absolutely essential with the dWWN feature to eliminate system issues in the case of an failure.

⚠️ **Caution –** *System problems:* When enabling dWWN, all drives must be at the proper firmware level. If a drive has down level firmware, it will remain in the "configuring" state and is unavailable for host use.

Important:
Tape drives that are migrated from other libraries *will be assigned a different WWN* when installed in an SL8500 library. The existing storage area network will not associate this new WWN with the originally assigned name. A best practice is to configure all drive bay slots in the library and verify that the tape drive data path is bound correctly over the network.

Upgrading Firmware

The initial library code is factory-installed on all new libraries and resides within the flash memory on the HBC card.

Use the Library Console to download new firmware to the library.

There are two types of firmware packages (image files) for the library:
- SL8500 code for the library controllers and the associated devices
- StreamLine Library Console application code for the local operator console

Note – You can download code using only the remote operator console and not the local optional touch screen operator control panel. So, if the library has the optional touch screen panel, you can load updates to the Library Console application using the remote operator console.

The SL8500 code does not contain the code for the different drive types.

Before launching the code load utility, download the firmware upgrade package from the customer resource center (CRC) at http://www.support.storagetek.com to a folder on your PC.

Note – The firmware package is a .jar file. The firmware package for the SL8500 library firmware is SL8500.jar and for the local operator console is SLConsoleLocalDist.jar.

Upgrading firmware is a three-step process:

1. Download the firmware package

2. Activate the downloaded firmware currently residing in the library complex

3. Reboot the library to make the firmware operational

Note – The library has two versions of the image file residing in the flash memory. After the library completes the reboot process, the latest image becomes active and the earlier version that serves as a backup may be restored if required.

For instructions on loading new code, refer to the online help documentation accessible through the application.

Upgrading the Remote Library Console

▼ To upgrade the Remote Library Console application installed on your PC

1. **Download the appropriate Library Console code installer file from the customer resource center (CRC) at** http://www.support.storagetek.com **to a folder on your PC.**

   Microsoft Windows installer file: SLConsoleWindowsSTK.exe
   Sun Solaris installer file: SLConsoleSolarisSTK.bin

   Note – You may want to uninstall the previous version of the application before launching the installer program.

2. **Run the Library Console installer to install the application on your PC.**

3. **Follow the guided instructions to complete the installation.**

PTP Configuration

The *preferred* method of adding a PTP is by installing the PTP and second library to the *left side* (as viewed from the front of the existing library). This will makes the existing library a *home* library. This method does not require system reconfiguration.

If a PTP and second library are added to the right side (as viewed from the front of the existing library), this would make the existing library an *away* library and reconfiguration is required.

FIGURE 2-1 on page 33 illustrates the concept of home and away libraries.

Nondisruptive Installation

Installing PTPs from right to left has several advantages:

■ Existing libraries can remain operational while the PTP frame is attached to them during the installation of the adjacent library.

■ No rebooting of HSC or ACSLS is required.

■ Mount requests continue as normal in the first library (or existing library complex).

■ If cartridges are placed into the new SL8500, an ACSLS or HSC audit must be run to add these cartridges to the database. The pre-existing LSMs can remain online during the audit.

The numbering process proceeds sequentially from right-to-left as shown in TABLE 2-3.

TABLE 2-3   Adding a Library to the Left

New Library	Existing Libraries	
Library C	**Library B**	**Library A**
LSMs 8-11	LSMs 4-7	LSMs 0-3

Disruptive PTP Installation

Growing the library complex from left to the right requires:

■ Varying the libraries offline
■ Renumbering the LSMs
■ Auditing the new and existing libraries to update volume locations

This type of installation is therefore is highly disruptive to the library operations.

▼ To perform a disruptive PTP installation—for ACSLS or HSC

1. **Vary the LSMs offline.**

2. **Dynamically update the HSC or ACSLS configurations.**

3. **Because the LSMs are being renumbered, run an audit of the existing libraries and the new one added to update the cartridge locations. Vary the LSMs in the complex online.**

Refer to your library management software publication for more information.

Failure to reconfigure and audit of the libraries in the new complex will result in:

■ Mount failures because cartridges cannot be found in their new, correct locations.

■ Cartridge collisions because enters of new cartridges could collide with existing cartridges currently occupying the slots.

Perform audits in a specific sequence to avoid loss or mismatch of VOLIDs. first audit the library with the *highest numbered LSMs*. The audit process must proceed sequentially from left-to-right, as shown in TABLE 2-4. Audit the newly added library (lowest numbered LSM) last.

TABLE 2-4 Adding a Library to the Right

Exiting Libraries		New Library
First Audit Library A	Second Audit Library B	Last Audit Library C
Renumbers LSMs 4-7 to **8-11**	Renumbers LSMs 0-3 to **4-7**	Assigns LSM numbers **0-3**

FIGURE 2-1 shows how the libraries are configured when adding a PTP to an exiting library complex.

FIGURE 2-1 Adding a PTP to an Existing Library Complex

An existing Library complex has two libraries (A and B), connected with a PTP.
A = The home library contains LSMs 0—3.
B = The away library contains LSMs 4—7

New library C added to the *left* of libraries A and B with a Pass-thru Port

Pass-thru Port connecting existing libraries A and B

Existing libraries A and B connected with a Pass-thru Port

New library C added to the *right* of libraries A and B with a Pass-thru Port

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L203 876
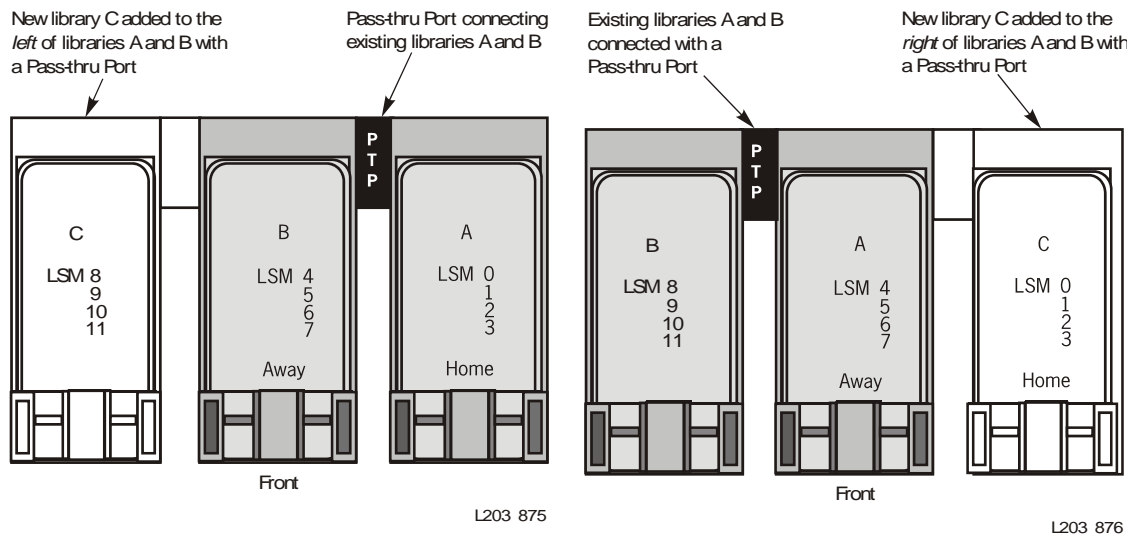
In this example, adding another library (C) to the *left* of the library complex increases the LSM numbering sequentially. *This is the preferred method.*

In this example, adding another library (C) to the *right* of the library complex requires a reconfiguration of LSM numbering.

PTP Addressing Scheme

The following terms and definitions apply to PTP operations:

Home Library: For two libraries connected by PTPs, the home library is the library supplying power and signals to the PTP through the left side of the Drive and Electronics Module, as viewed from the front of both libraries.

Away Library: For two libraries connected by PTPs, the away library is the library on the left side of the home library as viewed from the front of both libraries.

The PTP addressing scheme is the same five-digit value as the other SL8500 devices and locations (see "Internal Address" on page 110).

PTP numbering for the *home* library is:

- Library number
- Rail number (1-4 [internal firmware] or 0-3 [host])
- **-6** (Column number)
- 1 (Side number)
- 0 (Row number)

PTP numbering for the *away* library would be:

- Library number
- Rail (LSM) number (1-4 [hardware] or 0-3 [host])
- **+6** (Column number)
- 1 (Side number)
- 0 (Row number)

Note – Columns +6 and -6 are the PTP areas for a library. Column +6 in a library firmware address refers to libraries connected to the right, -6 indicates libraries connected to the left.

However, the host software (ACSLS and HSC) consider Panel 1 as the PTP area, whereas elevators are Panel 0. The first library installed in the complex is 1 and each additional library added to the complex increments by 1.

Home and away designations are always referenced from a PTP perspective of the library it is connected to. When more than two libraries are connected in a complex, every library that has two neighbors is both a home and away library, depending on the perspective of the PTP devices. For example, the middle library in a set of three is the home library for the PTP's on its left and the away library for the PTPs on its right.

Configuring Library Partitions

Note – Library partitioning is a licensed feature which must be enabled by your Sun service representative. This feature is available starting with SL8500 firmware version 3.7x and StreamLine Library Console version 3.25. See "System Requirements for Library Partitioning" on page 24 for complete details.

Planning Library Partition Configurations

Library partitioning requires careful planning, a thorough knowledge of library wall and slot mapping, and expertise in configuring and administering ACSLS and HSC host software applications. There must be clear communication among all parties involved, including system programmers and administrators, library operators, and your Sun service representative.

See "Library Partitioning" on page 22 for details about library partitioning features and requirements.

Before creating partitions, you must verify that all tape drives and cartridges have been moved to the proper location, according to the planned host/rail assignments. For example, if rails 1 and 2 will be owned by an ACSLS host, only ACSLS-compatible drives can be installed at those rail positions, and all cartridges containing data for the ACSLS host must be migrated to those rails.

See the *SL8500 Modular Library System Best Practices Guide* for complete information about partition planning.

Following are examples of valid library partition configurations.

Example 1: one-partition library

Rail	Library A
1	
2	Partition 1, Host A (HSC)
3	
4	

■ Partition 1 is owned by an HSC host.

Example 2: two-partition library

Rail	Library B
1	
2	Partition 1, Host A (HSC)
3	Partition 2, Host B (ACSLS)
4	

■ Partition 1 is controlled by an HSC host.

■ Partition 2 is controlled by an ACSLS host.

■ Rail 4 is unassigned and therefore not available for use.

Example 3: two-partition library

Rail	Library C
1	
2	Partition 2, Host A (HSC)
3	
4	Partition 3, Host B (HSC)

- Partition 2 is controlled by an HSC host.
- Partition 3 is controlled by a second HSC host.
- Rails 1 and 3 are unassigned and therefore not available for use.

Example 4: three-partition library

Rail	Library D
1	Partition 2, Host A (ACSLS)
2	
3	Partition 3, Host A (ACSLS)
4	Partition 4, Host B (ACSLS)

- Partitions 2 and 3 are owned by the same ACSLS host. Each partition appears to the ACSLS host as a separate ACS.
- Partition 4 is owned by a second ACSLS host.

Example 5: three-partition library

Rail	Library E
1	Partition 1, Host A (ACSLS)
2	Partition 2, Host B (HSC)
3	Partition 3, Host C (HSC)
4	

- Partition 1 is controlled by an ACSLS host.
- Partition 2 is controlled by an HSC host.
- Partition 3 is controlled by a second HSC host.

Example 6: four-partition library

Rail	Library E
1	Partition 1, Host A (ACSLS)
2	Partition 2, Host B (HSC)
3	Partition 3, Host C (HSC)
4	Partition 4, Host D (ACSLS)

- Partition 1 is controlled by an ACSLS host.
- Partition 2 is controlled by an HSC host.
- Partition 3 is controlled by a second HSC host.
- Partition 4 is controlled by a second ASCLS host.

Defining Library Partitions

▼ To Create Partitions

Note – It is recommended that you quiesce the library to all hosts before beginning this procedure. See the ACSLS and HSC documentation for details.

1. **Select Tools > Partitions.**

2. **In the Partition ID column of the partition you want to create, select the rails that you want to include. For example, to include rails 1 and 2 in Partition 2 select Rail 1 and Rail 2 under the Partition ID 2 column.**

Note – Partition IDs do not need to be contiguous. For example, you can create Partition 2 and Partition 4, with no Partition 1 or 3.

Note – Rails within a partition must be adjacent to one another. For example, you can create a partition that includes rails 3 and 4, or rails 2, 3, and 4, but not rails 2 and 4 only.

Note – Each rail corresponds to an LSM, with the ID of each offset by one. Rail 1 = LSM 0, Rail 2 = LSM 1, etc.

- Select **Apply** to apply the updates and continue to Step 3.
- Select **Refresh** to cancel the updates and restore the original screen settings.

3. **A dialog displays, "This operation will take the library offline temporarily. Do you wish to continue?"**
   - Select **OK** to make the updates. The library goes offline and all host connections are dropped while the updates are made.

■ Select **Cancel** to cancel the updates and return to Step 2.

4. **All library hosts must now be configured to activate these updates. See the ACSLS and HSC documentation for details.**

▼ To Remove Partitions

Note – It is recommended that you quiesce the library to all hosts before beginning this procedure. See the ACSLS and HSC documentation for details.

---

1. **Select Tools > Partitions.**

2. **Select Unassigned for each rail you want to remove from a partition, or select Disable ALL Partitions to remove all rails from all partitions.**

   ■ Select **Apply** to apply the updates and continue to Step 3.

   ■ Select **Refresh** to cancel the updates and restore the original screen settings.

3. **A dialog displays, "This operation will take the library offline temporarily. Do you wish to continue?"**

   ■ Select **OK** to make the updates. The library goes offline and all host connections are dropped while the updates are made.

   ■ Select **Cancel** to cancel the updates and return to Step 2.

4. **All library hosts must now be configured to activate these updates. See the ACSLS and HSC documentation for details.**

Host to Library Communications

This chapter describes host and server support, the connections from the library to the server.

Host Interfaces

Host interface connections to the library are done with one of two methods:

- **TCP/IP** protocol over an **Ethernet** 10/100-baseT physical interface.
- **Fibre Channel** physical interface using SCSI commands and protocol.

TCP/IP

The SL8500 library uses TCP/IP protocol over an Ethernet physical interface to manage and communicate with the library. This interface enables *both* enterprise-level (HSC) and open system platforms (ACSLS) to connect to and communicate with the SL8500.

Note – A private network connection to an Ethernet hub or switch is *recommended* for maximum throughput and minimum resource contention.

The HBC card is the library controller responsible for coordinating all component operations within the library and providing the interface connection with the host.

There are two separate Ethernet connections on the HBC card for host to library communications—Ports 2A and 2B.

- Port **2A** provides the Dual TCP/IP host connection—this is an *optional feature* for SL8500 libraries..
- Port **2B** provides the primary connection for host communications—this is the standard connection for SL8500 libraries.

Figure 1. TCP/IP Connections
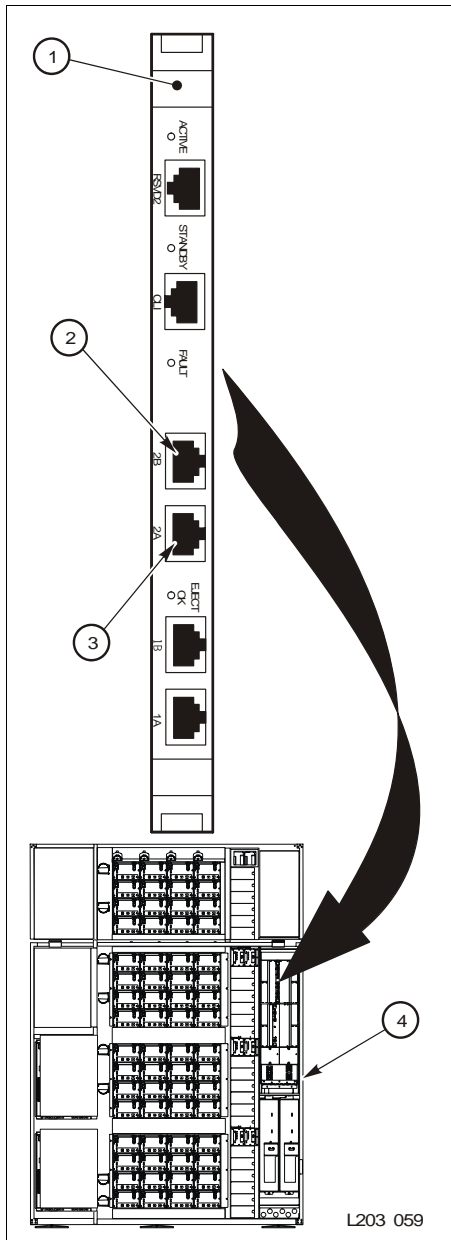
1. HBC card (library controller)
2. Port 2B—primary TCP/IP host connection
3. Port 2A—secondary dual TCP/IP host connection
4. Electronics control module (ECM)

Note: The other two Ethernet connections—Ports 1A and 1B—are reserved and for library-to-library communications for the pass-thru ports.

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Note – A private network connection to an Ethernet hub or switch is recommended for maximum throughput and minimum resource contention.

Consult with your Service Representative to identify the appropriate network topology for your site an to configure your SL8500 library to support Dual TCP/IP.

An example of how dual TCP/IP information appears on the operator panel is shown in FIGURE 3-1.

FIGURE 3-1 StreamLine Library Console – Dual TCP/IP Properties
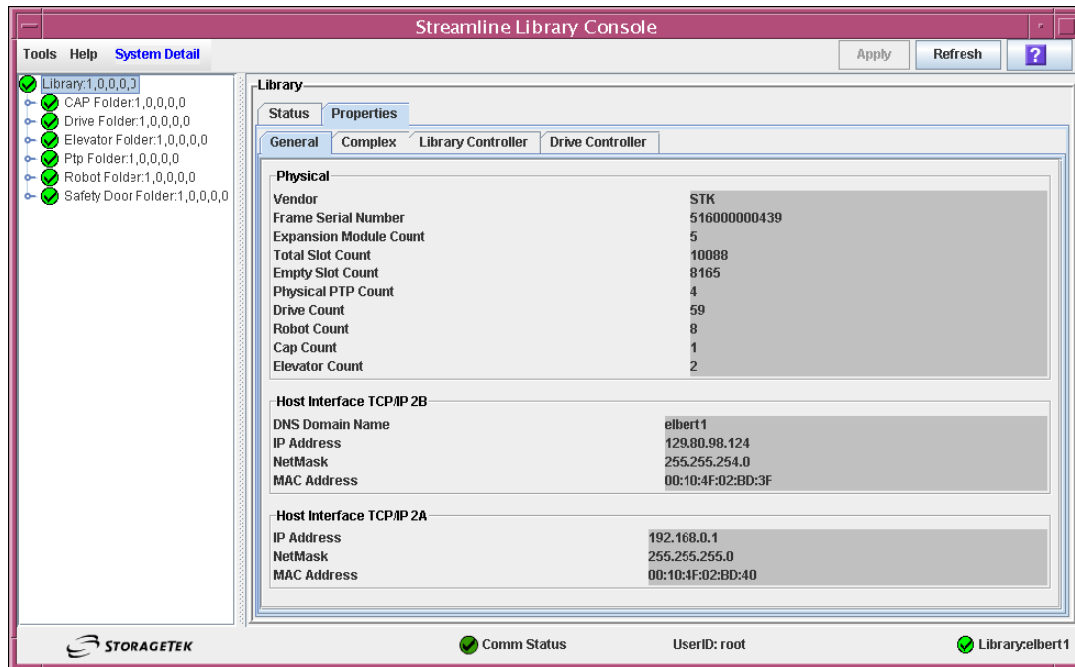
Definitions and Terminology

The SL8500 has Dual TCP/IP—two public network interfaces: the one previously used for TCP/IP—Port 2B on the HBC card—and a second one on Port 2A of the HBC card. This feature requires FRS_3.08 or higher library microcode.

Terminology associated with TCP/IP and dual TCP/IP are:

■ **Dual path**—Two distinct physical paths within a network architecture that interconnect two host systems. Note that these paths are *between host systems*, not between a host and an SL8500 library.

■ **Dual TCP/IP**—Provides *two separate* host connections between the host software (ACSLS or HSC) and the library controller. When both communication paths are available, ACSLS and HSC use both of them to communicate with the SL8500.

■ **Ethernet**—a local-area network (LAN) architecture that serves as the basis for the IEEE 802.3 standard. Ethernet is one of the most widely implemented LAN standards.

  ■ 10Base-T: 10 Mbps baseband Ethernet over twisted pair cables with a maximum length of 100 meters.

  ■ 100Base-T: 100 Mbps baseband Ethernet over twisted pair cable.

- **Mbps**—megabits per second, a unit of measure for data transfer speed (a megabit is equal to one million bits). Newer versions of Ethernet, called Gig-E or 1000Base-T support data transfers of 1 gigabit (1,000 Mbps).

- **Multi-homed**—the host system contains more than one network interface—this does *not* imply redundancy.

- **Netmask:**—also known as network mask or subnet mask. This entry makes the library accessible through a subnet on a larger network, using a number from 0 to 32; for example, 126.80.70.121/23.

- **Redundant TCP/IP**—relates to dynamic routing or switching from a primary interface to a secondary interface in the event of a network failure on one interface.

- **Static Routing**—routing information in the host system is manually configured by the system administrator. This is the only routing method supported by SL8500.

- **TCP/IP**—Transmission Control Protocol/Internet Protocol

  TCP is one of the main protocols in networks that enable two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and also guarantees that packets are delivered in the order they were sent.

  IP specifies the format of packets and the addressing scheme.

Fibre Channel

Topologies include:

- Switched Fabric

Note – This topology is the only one supported for library-attached drives.

A switched fabric provides dynamic interconnections between nodes and multiple, simultaneous Fibre Channel connections for the network.

If the library is connected to a Fibre Channel switch or fabric-capable host, it configures itself as a switched topology. A switched fabric topology can support up to 16 million ports logged into the fabric.

- Arbitrated Loop

Note – The library does not support forcing Arbitrated Loop connection by setting a Hard ALPA (Arbitrated Loop Physical Address).

Library Management Software

Library management software components control the library and manage the library database. They also retain volume location and attribute information, plus perform activities such as mounts and dismounts, enters and ejects.

Sun offers several software components depending on the platform, connection type, and operating system.

Note – The same Sun StorageTek library management software currently used by the customer today can be upgraded to support the SL8500 library.

Nearline Control Solutions

Some of the Sun suite of Nearline Control Solutions (NCS) software products are described in the sections below.

Client System Component

MVS/CSC provides client functions and communications between an MVS host and the Library Control System (LCS) or server on a non-MVS host. MVS/CSC allows the MVS client to perform automatic tape handling on a Sun library in addition to sharing multiple host systems (both IBM and non-IBM).

The MVS/CSC can communicate with LibraryStation in an MVS-only environment, or the SMC and the Sun StorageTek HTTP server can provide communication between MVS hosts.

Storage Management Component

Storage Management Component (SMC) is the interface between IBM's OS/390 and z/OS operating systems and a Sun library. SMC performs the allocation processing, message handling, and SMS processing for the NCS solution. SMC resides on the MVS host system with HSC and/or MVS/CSC, or on a remote system using the Sun StorageTek HTTP server to communicate with the HSC. SMC communicates with HSC or MVS/CSC to determine policies, volume locations, and drive ownership.

Note – SMC is a required NCS component.

Sun StorageTek HTTP Server

Sun StorageTek's HTTP Server for OS/390 and z/OS optionally provides the middleware to allow communication between the SMC (client) and a remote HSC subsystem (server). The HTTP server executes as a separate subsystem on the MVS host where the remote HSC subsystem resides.

Host Software Component

When an SL8500 library is in a stand-alone configuration with an MVS host, the host must run a version of Sun's Host Software Component (HSC) along with the Storage Management Component (SMC).

Sun's HSC and SMC:
- Influence allocations

- Intercept mount and dismount messages
- Receive requests from the interface and translates them into commands

HSC resides *within* the MVS host, but is invisible to the actual operating system. Versions of HSC that support library complex operation are:

- *HSC 6.0* (with additional PTFs) or higher
- *HSC 6.1 with Near Continuous Operation (NCO)*

Caution – *For customers using HSC 6.1 with NCO:* Upgrading the library complex configuration without performing a LIBGEN, MERGEcds, or stopping/restarting HSC is possible, but this requires assistance from Sun.

LibraryStation

LibraryStation provides a communications interface between HSC and a client system running an open systems host (either MVS or open systems), allowing network clients to access the library services of a Sun Automated Cartridge System (ACS) through the MVS host system. LibraryStation can communicate with the MVS/CSC in an MVS-only environment, or the SMC and the Sun StorageTek HTTP server can provide communication between MVS hosts. LibraryStation executes in the HSC address space on MVS.

Automated Cartridge System Library Software (ACSLS)

ACSLS is a software package that manages library contents and controls library hardware for the mounting and dismounting of cartridges.

Note – ACSLS 7.1 (with PUT0601, for Near Continuous Operation) or higher is required to support PTP and T10000 tape drive operation.

This application maintains a database that tracks tape volume names and their current locations in the tape libraries. In CSC configurations, ACSLS manages the library control software that runs in the UNIX-based Library Control System.

Note – The ACSLS application is sold to support a defined number of cartridge slots.

Library Operation

The library has three modes of operation, automated, manual, and maintenance. These modes are defined and explained in the following sections.

Automated Mode of Operation

The automated mode of operation is active when a library system or library complex is automatically mounting/dismounting cartridges without physical intervention by a person.

General automated library operations consist of the following activities:

- *"Mounting and Dismounting of Cartridges" on page 45*
- *"Performing CAP Activities" on page 46*
- *"Using CAPS in a Partitioned Library" on page 53*
- *"Monitoring Library Events" on page 57*
- *"Monitoring PTPs" on page 58*
- *"Cleaning of Drives" on page 58*

Mounting and Dismounting of Cartridges

The central function of the library or library complex is the automated mounting and dismounting of cartridges. Host mount/dismount commands are accepted by the library's central processor and translated into robotic commands that are performed by the robots.

Mount Sequence

A simplified mount sequence involves the following steps:

1. A host requests that a specific volume serial number (VOLID) for a cartridge be mounted in a drive.

2. The library transmits to the host that the VOLID is located within the library and a drive is available to satisfy the mount request.

3. The library assumes responsibility for the mount.

4. The host command is translated by the library controller into motion commands for the robot.

5. The cartridge is taken from its slot and placed in the drive.

6. The library returns status to the host that the mount operation is completed.

7. The drive then performs the read/write activity directed by the host.

Dismount Sequence

A simplified dismount sequence involves the following steps:

1. A host requests that a specific VOLID be dismounted from a drive.

2. The library transmits to the host that the VOLID is located in the drive and the library is available to satisfy the dismount request.

3. The library assumes responsibility for the dismount.

4. The host command is translated by the library controller into mechanical commands for the robot.

5. The cartridge is taken from the drive and placed into its home slot.

6. The library returns status to the host that the dismount operation is completed.

The library then awaits another activity directed by the host or continues those activities waiting in the library's queue of commands.

Performing CAP Activities

Note – This section describes general CAP activities applying to all libraries. For specific information on CAP activities in partitioned libraries, see "Using CAPS in a Partitioned Library" on page 53.

The CAP door contains a standard CAP A (on the left, as viewed from the front); an additional CAP (CAP B, on the right) is also available. CAPs allow you to import (enter) cartridges and export (eject) cartridges from the library.

A single CAP contains three magazines; each magazine contains 13 cells, allowing import/export of up to 39 cartridges at a time. The magazines can be removed from the CAP to import cartridges in a batch mode. Rotation of the CAP is accomplished through a motor. CAP operations are controlled by the HBZ logic card.

The CAP magazines span the lower three rails and on the *right side* of the library only. To import or export a cartridge from the top rail on the *right side*, a HandBot places the cartridge in an elevator slot to accomplish the move.

FIGURE 4-1 CAP A Unlocked

L203_473
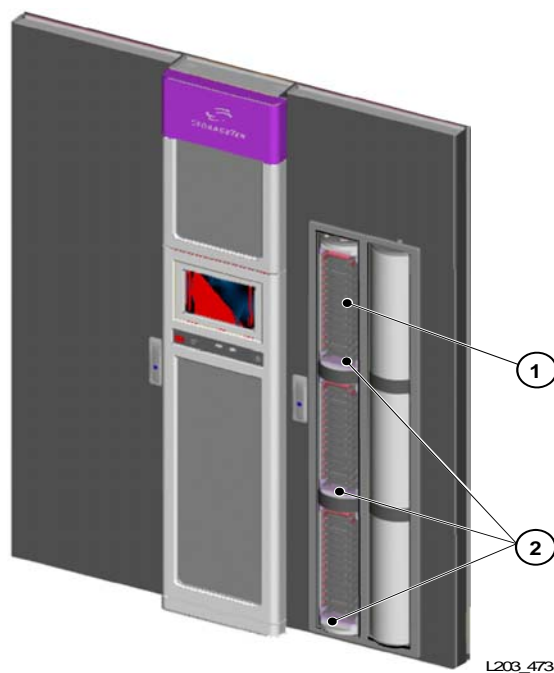
1. CAP slot   2. Three magazines with 13 slots each

▼ To open the CAP

1. **Logon to the StreamLine Library Console and select Tools > Utilities.**

2. **Select the CAP and then change the Locked status to False, and then select Apply. See the online help documentation accessible through the Library Console application.**

   Note – The LED light is on when you unlock the CAP and the CAP status changes to "unlocked" in the host library management software.

3. **Press the appropriate CAP Unlocked button (CAP A or CAP B) on the operator keypad (FIGURE 1-6 on page 14).**

   Note – This action causes the CAP to rotate outward and present the magazines to load or unload cartridges.

▼ To close the CAP

1. **Press the appropriate CAP Unlocked button (CAP A or CAP B) on the operator keypad.**

> **Note –** The above action causes the CAP to rotate inward for robotic access.

> **Caution –** *Possible Equipment Damage*. DO NOT manually force the CAP to open or close.

2. **From the StreamLine Library Console, select Tools > Utilities.**

3. **Select the CAP and then change the Locked status to False, and then select Apply. See the online help documentation accessible through the Library Console application.**

Cartridge Slot Locations

Slot locations within the CAPs have the following addressing:

1. **Library number** (within a library complex)

2. **Rail number –** Rails are numbered 1 through 4, rail 1 is the topmost rail.

> **Note –** CAP slots begin numbering at rail 2.

3. **Column number –** Columns are "signed" numbers as seen from the front of the library, where +1 is right of the drive bays and -1 is to the left of the drive bays.

4. **Side number –** Outer wall = 1, Inner wall = 2

> **Note –** For CAPs, side number -1 = CAP A and side number +1 = CAP B.

5. **Row number –** Numbered consecutively, from the top down

> **Note –** CAP slots begin with row number 0, which is the magazine handle. CAP slots are not considered as storage slots.

An example of how this notation appears on the operator panel is shown in FIGURE 4-2.

FIGURE 4-2   StreamLine Library Console – CAP
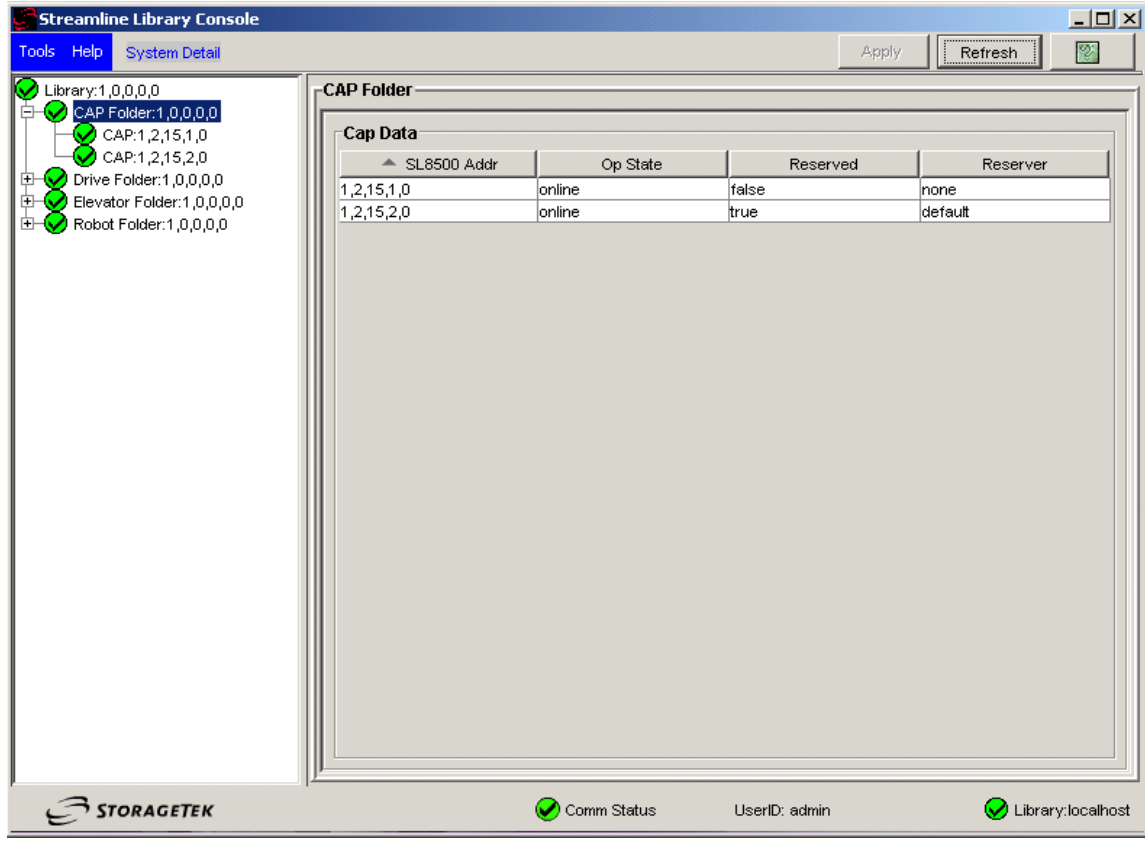
Importing Cartridges

When a cartridge is imported, the VOLID is read by the HandBot hand's bar-code line scanner and the cartridge is assigned a home slot by the library controller or mounted on a drive, depending upon the purpose for which it was imported. The location of a stored cartridge is recorded in library memory, designated in the form of library number, rail, column, side, and row numbers (see Appendix A, "Cartridge Slot Locations"). The location is also transmitted to the host and stored in its cartridge database.

Cartridges must be properly labeled (see "LTO Ultrium Generation 2 (Gen2) Fibre Channel Drives" on page 84) and correctly placed in the CAP slots. Insert the cartridges so that the customer label (if present) is facing up, the hub gear is facing down, and the VOLID label is facing you. Cartridges may be placed in any CAP slot, in any order; the HandBot audits all CAP slots upon closure of the CAP door. See "Ordering Cartridges and Labels" on page 75 for proper labeling and placement information.

FIGURE 4-3 Placement of Cartridges with the Magazine Inside the CAP

L203_449
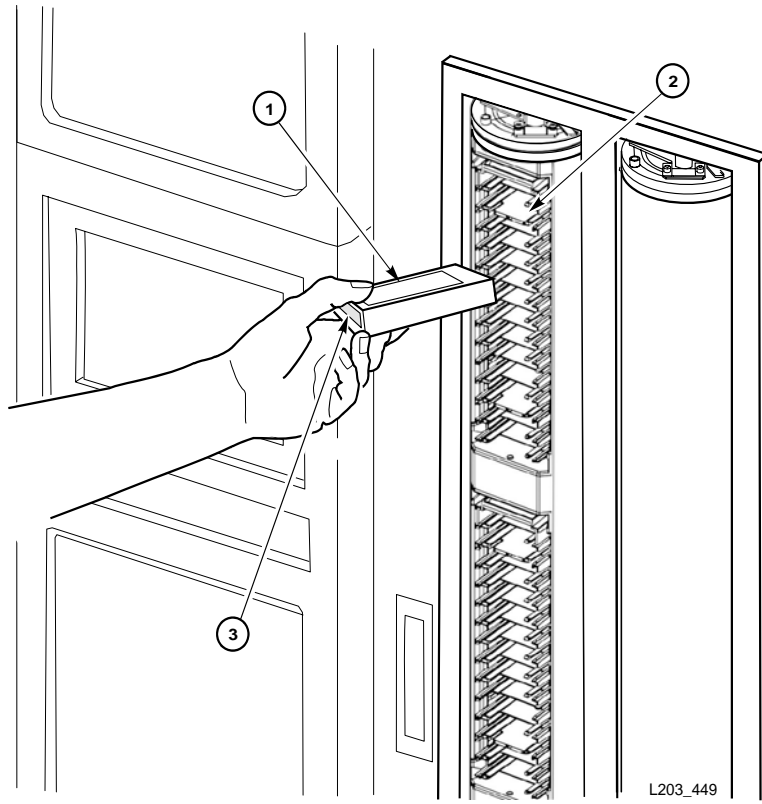
1. Customer label (9x40 only)   3. Volume serial number label
2. Magazine slots

FIGURE 4-4   Placement of Cartridges with the Magazine Outside the CAP

L203_474
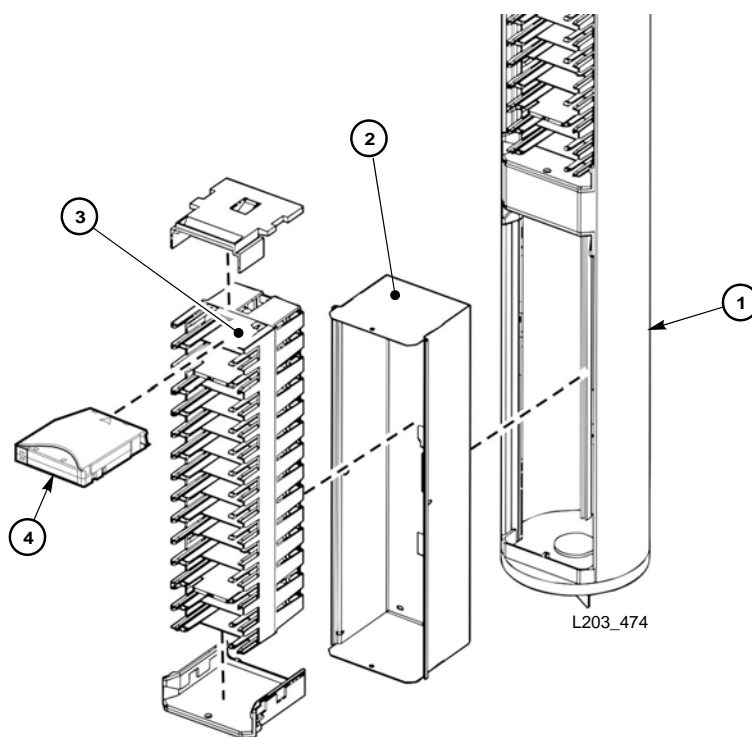
1. CAP	3. Magazine slots
2. CAP magazine removed	4. Inserting cartridge with hub down

When a CAP is in automated mode, it is unlocked unless it is currently being used to import cartridges.

▼ To import cartridges using the CAP

1. **Make sure that the CAP is unlocked (see** TABLE 1-4 on page 15 **for a description of CAP indicators).**

2. **Press the appropriate CAP Unlocked button (CAP A or CAP B) on the operator key pad.**

   Note – This action causes the CAP to rotate outward and present the magazines to load cartridges.

3. **With the CAP open, you may enter the cartridges into the magazines while the magazines are in the CAP; or you may remove the magazines from the CAP, insert cartridges into the magazines, and then replace the cartridge-filled magazines into the CAP.**

Note – Cartridges may be placed in any CAP slot, in any order; the library audits all CAP slots when the CAP door closes.

Caution – *Possible Media Damage*. While cartridges that do not contain external labels or are placed upside-down can be entered, this is not advisable. It presents problems when an audit is performed. Likewise, cartridges that contain unreadable or damaged labels should not be entered.

---

4. **Press the appropriate CAP Unlocked button (CAP A or CAP B) on the operator key pad.**

Note – This above action causes the CAP to rotate inward for robotic access.

---

5. **Make sure that the CAP is locked (see** TABLE 1-4 on page 15 **for a description of CAP indicators).**

Caution – *Possible Equipment Damage*. DO NOT manually force the CAP to open or close.

Exporting Cartridges

When a cartridge is exported, you must specify the VOLIDs of the cartridge you wish to remove from the library. The VOLID location is then retrieved from the library's memory, the HandBot moves to the cartridge, removes it from its slot, and the cartridge is placed into the CAP slot. A total of 39 cartridges may be exported at one time through each CAP.

After the CAP is opened, the location of the cartridge is erased from the librarys' memory and the host database. This is especially important when exporting *cleaning* cartridges from a library; if the cleaning cartridge is not removed from the CAP and the CAP is closed, the library treats the cartridge as "new" and the expired cleaning cartridge is used again.

▼ To export cartridges using the CAP

1. **Type the eject command at the console. Refer to your library management software publication for the command syntax.**

2. **The robot places cartridges into the CAP slots until all the specified cartridges are in the CAP. Refer to your library management software publication for the console messages.**

3. **Press the appropriate CAP Unlocked button (CAP A or CAP B) on the operator key pad.**

Note – This action causes the CAP to rotate outward and present the magazines with the exported cartridges.

---

4. **With the CAP open, remove the exported cartridge either by removing the cartridges from the magazine inside the CAP, or by removing the magazine from the CAP and then taking the cartridges from the magazine outside the CAP.**

   If you remove the magazine, replace the empty magazine inside the appropriate CAP (CAP A or B).

5. **Press the appropriate CAP Unlocked button (CAP A or CAP B) on the operator key pad.**

Caution – *Possible Equipment Damage*. DO NOT manually force the CAP to open or close.

---

6. **If more cartridges need to be exported, the robot continues filling the CAP. Wait until the CAP door is unlocked and repeat** Step 3 **through** Step 5**.**

Note – The export operation ends automatically when all specified cartridges have been exported.

Using CAPS in a Partitioned Library

Note – This topic applies to partitioned libraries only. See "Configuring Library Partitions" on page 34 for details about defining library partitions.

A CAP is a shared library resource—that is, it can be used by all partitions in the library.

A CAP can be used by only one partition at a time. While a partition is using a CAP for enters or ejects, the CAP is reserved to that partition and unavailable to all others.

In order for a partition to reserve a CAP, all of the following conditions must be met:

■ The CAP must be available—that is, not reserved by any other partition.

■ The CAP must be empty.

■ The CAP must be closed and locked.

When a partition reserves a CAP, the library sends "CAP opened" and "CAP closed" messages only to the host holding the reservation.

When a host attempts to reserve a CAP already reserved by another partition, the library sends a message to the requesting host identifying the partition ID and host ID holding the reservation.

Automatic CAPs—that is, the ability for a library operator to open a CAP without first issuing an explicit enter request—are not supported in partitioned libraries.

How CAP Reservations Work in a Partitioned Library

In a partitioned library, CAPs are shared by all partitions. When entering or ejecting cartridges, a partition reserves the CAP for its exclusive use. Before the CAP can be made available to other partitions, the host must complete the enter or eject operation and leave the CAP empty and in an unreserved state.

In normal operations, the CAP reservation is released in the following ways:

■ Enter operations—After all cartridges have been successfully entered into the library, the requestor must explicitly terminate the enter command. The library releases the CAP after verifying that the CAP is closed and empty.

■ Eject operations—After all cartridges have been successfully ejected, the ACSLS or HSC host automatically terminates the eject operation. The library releases the CAP after verifying that the CAP is closed and empty.

If for some reason a CAP reservation is not released as described above, the CAP will be unavailable to other all partitions, and cartridges belonging to the first partition may remain in the CAP. In this case, it is recommended that you identify the partition holding the CAP reservation and then terminate the enter or eject from that host. This ensures a normal release of the CAP reservation.

Note – See the ACSLS or HSC documentation for details about terminating enters and ejects.

In some cases, however, you may not be able to access the host holding the reservation and therefore cannot perform a normal release of the CAP. This may be because the host has terminated or because you lack physical access or security authorization to issue commands to the host. In these cases, you can use the SLConsole to override the CAP reservation (unreserve). See for the detailed procedure.

Note – Use extreme care when using the SLConsole to override a CAP reservation. If you do not complete the procedure, the CAP could be left unavailable to all partitions, and/or cartridges assigned to one partition could be entered into another partition.

Note – You can use the SLConsole to override a CAP reservation only in a partitioned library. If a library is not partitioned, CAP reservations must always be released through ACSLS or HSC.

Overriding a CAP Reservation

Note – This topic applies to partitioned libraries only. If a library is not partitioned, CAP reservations must always be released through ACSLS or HSC. See the ACSLS and HSC documentation for details.

Use this procedure when a partition has reserved a CAP, but the reservation cannot be released through the ACSLS or HSC host.

▼ To Override a CAP Reservation

Note – You must follow all steps in this procedure. If you do not complete the procedure, the CAP could be left unavailable to all partitions, and/or cartridges assigned to one partition could be entered into another partition.

1. **At the SLConsole, select Tools > Diagnostics.**

2. **On the device tree, expand the CAP Folder.**

3. **Select the CAP whose reservation you want to override (unreserve).**

   The screen displays a message identifying the partition (hli1, hli2, hli3, hli4, or default) that has reserved the CAP.

4. **Select the Unreserve tab.**

5. **Select Apply to override the reservation.**

6. **The screen displays the dialog, "This will remove the reservation from the designated host..."**
   - Select **OK** to continue with the override operation. The library removes the CAP reservation and sets the CAP user to "default," which makes the CAP unavailable to all partitions.
   - Select **Cancel** to cancel the override operation and return to Step 5.

7. **If the CAP is locked, unlock it at the SLConsole.**

8. **Open the CAP.**
   - If it is empty, proceed to Step 10.
   - If it contains cartridges, remove them all.

9. **Label the cartridges with the partition ID displayed in Step 3.**

10. **Close the CAP. It locks automatically.**

    The library locks and audits the CAP to verify that it is empty. It then sets the CAP status to "unreserved," which makes the CAP available to all partitions.

    Note – You might need to refresh the CAP display to see the new CAP status.

11. **Contact a person responsible for managing the removed cartridges to determine their disposition. If they are to be re-entered into the library, they must be entered to the correct partition.**

CAP Release and Override Scenarios

The following scenarios describe in detail the interactions between the SLConsole, the library, and the attached hosts when a CAP in a partitioned library is used to enter or eject cartridges.

Scenario 1—CAP reservation released by the ACSLS host

Note – This illustrates how a CAP reservation is released by the host in normal operations.

1. **Partition 1, Host 1 (ACSLS) is ejecting cartridges through CAP A.**
   - CAP A is reserved to Partition 1, Host 1.
   - Cartridges belonging to Partition 1, Host 1 are contained in CAP A.

2. **Partition 2, Host 2 requests to enter cartridges. The library rejects the request with a message indicating that the CAP is reserved by Partition 1, Host 1.**

3. **All cartridges are successfully ejected. The ACSLS host automatically terminates the eject request.**

4. **The library operator verifies that the CAP is empty, and then closes the CAP.**
   - The library locks the CAP and audits it to verify that it is empty.
   - The library releases the CAP reservation. The CAP is available to all partitions.

5. **Host B must resubmit the enter request.**
   - CAP A is reserved to Partition 2, Host 2.

Scenario 2—CAP reservation overridden successfully

Note – This illustrates an exceptional situation, where a CAP reservation must be overridden (unreserved) by the library operator.

1. **Partition 1, Host 1 (ACSLS) is entering cartridges through CAP A.**
   - CAP A is reserved to Partition 1, Host 1.
   - Cartridges belonging to Partition 1, Host 1 are contained in CAP A.

2. **Partition 2, Host 2 requests to enter cartridges through CAP A. The library rejects the request with a message indicating that the CAP is reserved by Partition 1, Host 1.**

3. **All cartridges are successfully entered, but the requestor does not explicitly terminate the enter request through the ACSLS host.**
   - CAP A remains unlocked and reserved to Partition 1, Host 1.

Note – The enter operation must always be explicitly terminated from the host.

4. **The library operator is unable to access the ACSLS console to terminate the enter. The operator uses the SLConsole to override the reservation on CAP A. (See** "Overriding a CAP Reservation" on page 54 **for the detailed procedure.)**
   - The library removes the CAP reservation and sets the CAP user to "default." The CAP is unavailable to all partitions.
   - The library sends a message to Partition 1, Host 1, indicating that the reservation on CAP A has been overridden.

5. **The library operator uses the SLConsole to unlock the CAP.**

6. **The library operator opens the CAP, verifies that it is empty, and then closes the CAP.**

   ■ The library locks the CAP and audits it to verify that it is empty.

   ■ The library releases the CAP reservation. The CAP is available to all partitions.

7. **Partition 2, Host 2 must resubmit the enter request.**

   ■ CAP A is reserved to Partition 2, Host 2.

Monitoring Library Events

Library operations are continually monitored by the HBC controller. All events associated with these operations are logged by the HBC card and can be retrieved by operators and service representative for examination.

Library events are accessible from the StreamLine Library Console (see "Event Monitors" on page 103). Events are represented by the following codes:

■ Action codes (what command was issued, such as "load drive")
■ Result codes (what was the result of the action requested)
■ Known service plan (KSP) diagnosis (what mechanism or component is responsible for the task or fault)

See "Working with the Search Utility" on page 106 to lookup on a result code.

Events are stored under three headings:

■ Communication events (host-to-library, library-to-library, and library-to-drive). Data for these events include:

   ■ Date/time stamp
   ■ Library identifier
   ■ Drive identifier
   ■ Requestor
   ■ Interface protocol
   ■ Communication type

■ Error events, which include:

   ■ Date/time stamp
   ■ Drive identifier
   ■ Operation type
   ■ Four-digit (hexadecimal) Action Code
   ■ Interrupt level (generated by the hardware or software)
   ■ VOLID for media-related events

■ Warning events, which indicate a loss of performance or events that may be indicative of future, fatal errors. The data for these are the same as in error events.

Note – Using the Library Console you an spool event data being monitored to a file.

Monitoring PTPs

You can monitor the libraries in a complex using the StreamLine Library Console. To use the Library Console in a library complex, you must open a separate session for each library in the complex.

Note – You can have up to five Library Console sessions running for a library.

After you log on to a Library Console session, the application automatically detects a PTP device if the library is in a complex. If a PTP is detected, the device tree displays the PTP folder (FIGURE 4-5)

FIGURE 4-5   Sample System Detail Screen with the PTP Folder
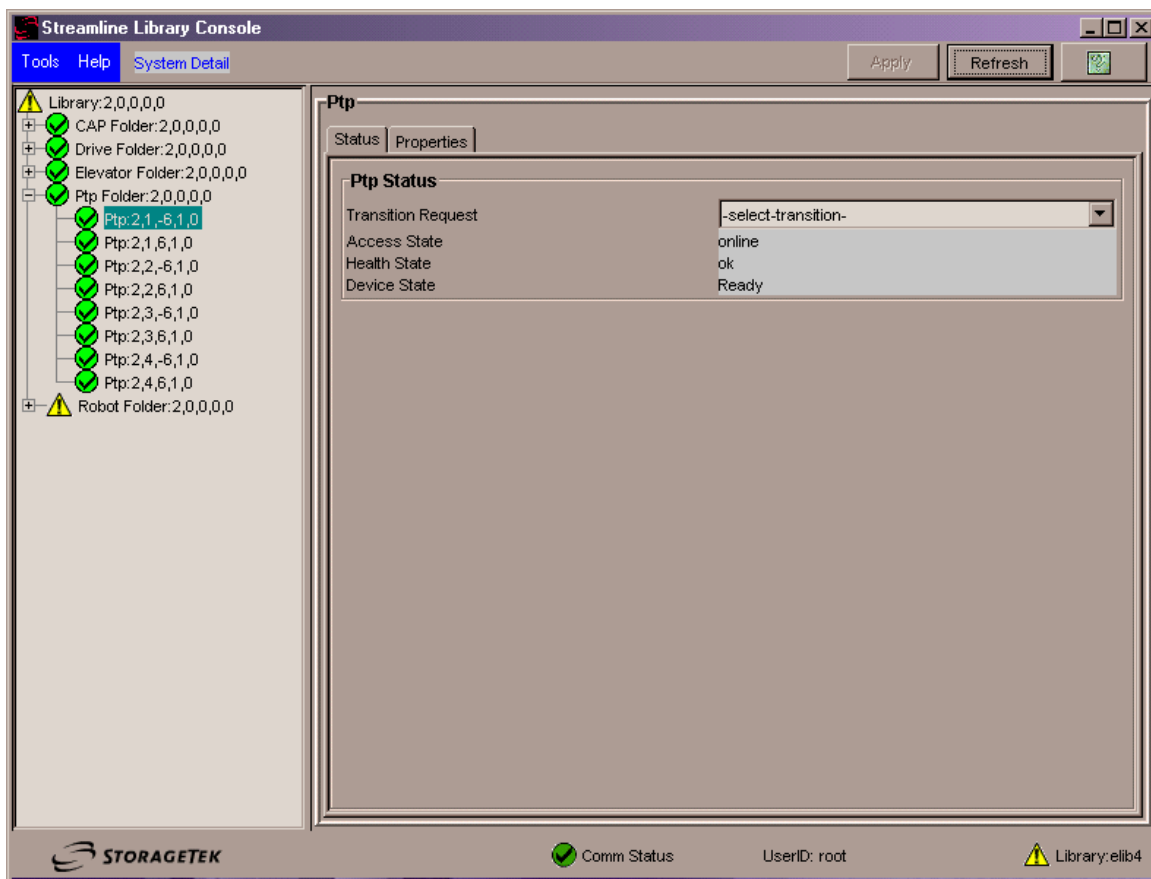
Cleaning of Drives

The drives require periodic cleaning to prevent read and write errors. The drives can be setup for automatic or manual and automatic cleaning.

> **Note –** You *MUST* use cleaning cartridges whose media types are compatible with the drive types in the library. See TABLE 5-6 on page 87 for cartridge codes.

Manual Cleaning:

Use the library management software to perform a manual clean. Refer to the software publication for command syntax.

Cleaning cartridges have a limited life span. Refer to your tape drive's publication for the recommended use and life of the drive's cleaning cartridge. When a cleaning cartridge expires, use the CAP to eject the expired cleaning cartridge and replace the cleaning cartridge by perform an enter (see "Importing Cartridges" on page 49 and "Exporting Cartridges" on page 52).

Automatic Cleaning:

When a drive requires cleaning, the library management software automatically mounts a cleaning cartridge on the drive when required. When the cartridge dismounts, the robot returns the cleaning cartridge to its slot location within the library.

Advanced configuration includes setting up the auto clean option for the drives. Refer to your library management software publication for the command syntax.

Important: ACSLS and HSC cannot access the reserved slots in the Customer Interface Module. So, for any ACSLS or HSC managed cleaning, the cartridges must be placed in the customer usable slots and not in the reserved slots.

Manual Mode of Operation

Manual mode of operation is used when the library (or library complex) is unavailable for system use or human intervention is required. An example of this situation would be when a library experiences an unrecoverable error, making automated mounts/dismounts impossible.

In the case of a failure of a non-redundant component (for example, a single HBC controller card for the entire library), the library is said to be "unavailable" to the system. In this case, the entire library must be placed offline until the repair is accomplished.

A library's inability to automatically perform cartridge mounts/dismounts does not, however, stop cartridge tape activity—mount and dismount requests by the host continue to be generated.

To perform the cartridge activities, someone might be required to physically enter the library and manually perform the mount/dismount activities previously done by the robot. The location of the cartridge to be mounted is supplied by the software and the slot location must be determined by the coordinates shown in Appendix A, "Cartridge Slot Locations".

Manual operations include:

- "Placing the Library Offline"
- "Determining the Library is Not in Automatic Mode"

- "Entering the Library"
- "Locating a Cartridge and Drive"
- "Moving the Robot"
- "Mounting a Cartridge"
- "Dismounting a Cartridge"
- "Exiting the Library"
- "Placing the Drives to Online"

Precautions

When you enter a library to manually mount and dismount cartridges, you must strictly observe safety precautions and pay attention to the physical space restrictions.

Safety Precautions

In manual mode, you must observe the following safety precautions. Be sure to *always*:

- Ensure the library is offline.
- Leave both the front access doors open whenever you work inside the library. There are switches on each door frame that disconnect DC power and signal lines to the library's robotic motors when either access door is opened.

Physical Restrictions

The library design is optimized for high density, so there is not much free room for movement. Be careful not to:

- Snag your clothing on the arrays that house the cartridges (only 0.4 m [18 in.] of aisle clearance).

- Bump your head or body against the arrays

You might also have to move a robot to gain access to a cartridge, in which case, you must avoid damaging the robot's mechanical or electronic components. See "Moving the Robot" on page 63).

If you are manually loading or unloading a cartridge, your hands must remain clear of the drive's mechanical and electronic load components.

Placing the Library Offline

Place the library offline using your library management software. Refer to you library management software publication for the command syntax and console messages.

Notes:

1. Wait for the message confirming the library is offline. If the library does not come offline, enter the command to display the status of the library.

2. Wait for the outstanding processes to complete or type the command to force the library offline to all hosts.

The library remains offline until you issue a command to place the library online.

Determining the Library is Not in Automatic Mode

The following conditions indicate that the library is not functioning in automatic mode:

- One or both the library access doors are open.
- The robot does not automatically mount and dismount cartridges.
- The device tree in the StreamLine Library Console indicates that there is a problem with the library.

Entering the Library

Warning – Possible Physical Injury. *Rj{ ukecn'Kplut{* **. You can be injured if you do not follow the correct procedure to enter the library.**

▼ **To prevent personal injury, follow these precautions:**

1. Make sure that the library is offline (see "Placing the Library Offline" on page 60).

2. Do not attempt to override any of the electrical or mechanical safety devices in the library.

3. Do not enter the library without informing someone in the immediate area.

4. Make sure both the front access doors are open.

FIGURE 4-6   Library Front View (Access Doors Open)

L203_563
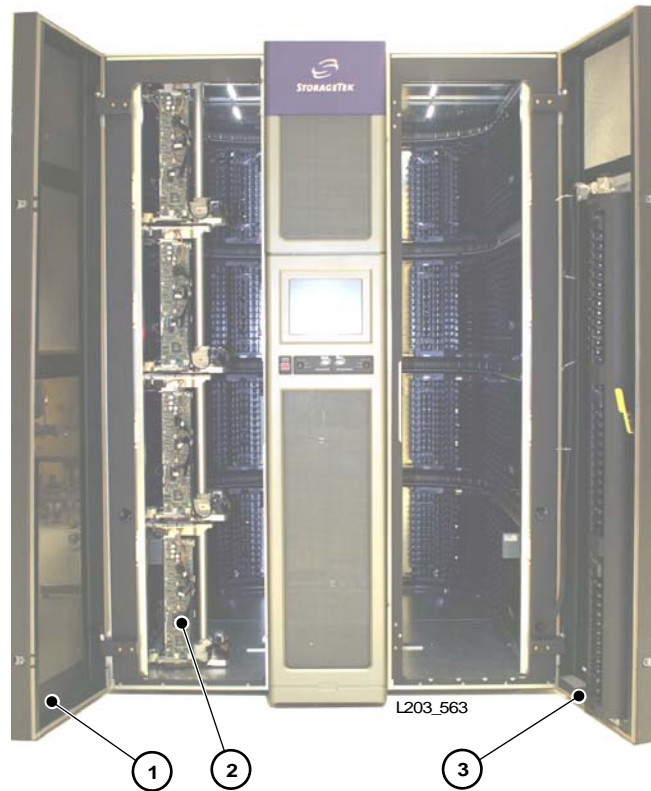
1. Left access door
2. Robots
3. Right access door

▼ To open the door

1. **Insert the key and unlock the access door.**

2. **Pull the paddle handle to activate the opening mechanism and open the access door. Opening the access door activates a switch, which automatically causes a software interrupt and stops the robot. Take the key with you so that no one can close the door while you are inside, and then enter the library.**

Locating a Cartridge and Drive

The library management software provides the location and the VOLID of the cartridge and also the drive bay address available for the manual mount. Before you enter the library, write down the VOLID, cartridge location, and the drive bay location.

▼ To locate a cartridge

1. **Logon to the StreamLine Library Console.**

2. **Select Tools > Utilities and then select the Search tab.**

3. **From the pull-down menu select Cartridge Location as the Search Type.**

4. **Enter the VOLID of the cartridge you are trying to locate.**

5. **Select the Requester (see notes below) as the default from the pull-down menu.**

6. **Select the Cartridge Type (data, clean, unreadable label, duplicate label).**

7. **Select Search button from the top right corner.**

See FIGURE A-1 on page 111 through FIGURE 0-1 on page 118 for pictorial maps of the cartridge locations.

Notes:

■ You can lookup a cartridge location either in the internal library firmware format or the HLI-PRC format based on the library management software (see "Internal Address" on page 110 and "HLI-PRC Address" on page 122).

■ If the library is in a complex, make sure you enter the correct library number (for the internal firmware address search) or the LSM number (for the HLI-PRC address search). For more information see "PTP Addressing Scheme" on page 34.

▼ To locate a drive

See "Manually Locating a Drive Bay" on page 128.

Moving the Robot

You might have to move the robot to:

■ Locate the cartridge from the slots.

■ Access the drive panel and identify the drive to perform a manual mount/dismount.

⚠ **Warning – Possible Physical Injury.** To prevent physical injury and damage to components, follow the instructions carefully.

▼ To move the robot, follow these precautions:

1. Do not enter the library or move any of the HandBot mechanisms if you have any reason to suspect they are enabled.

2. Do not touch any shiny polished surfaces. Body oils can destroy the lubrication on these surfaces.

⚠️ **Warning – Possible Physical Injury.** **If all four HandBots are parked near each other, before you enter the library, move the HandBots out of your way one at a time starting at the lowest rail. You could trip over the HandBots on the lower rails or injure your head with the HandBots on the upper rails.**

3. Do not touch any lubricated parts.

4. Hold the HandBot carriage handle to push or pull as shown in FIGURE 4-7 on page 64.

5. The HandBot should move freely. Do not force the HandBot if movement is restricted. Before you close the library access doors, look inside the library and ask in a loud voice if anyone is inside the library.

FIGURE 4-7   Moving the HandBot
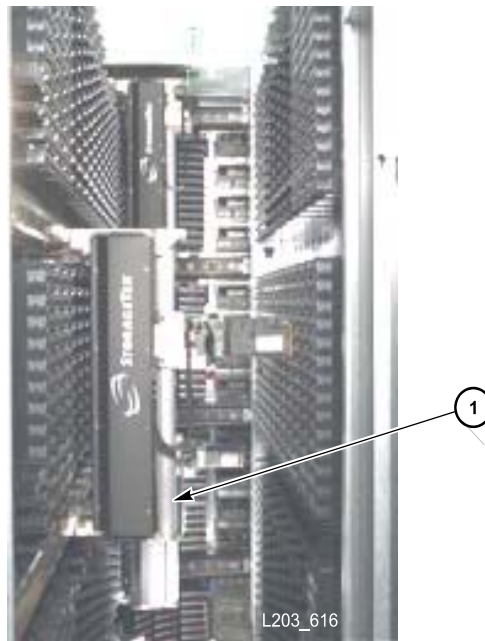
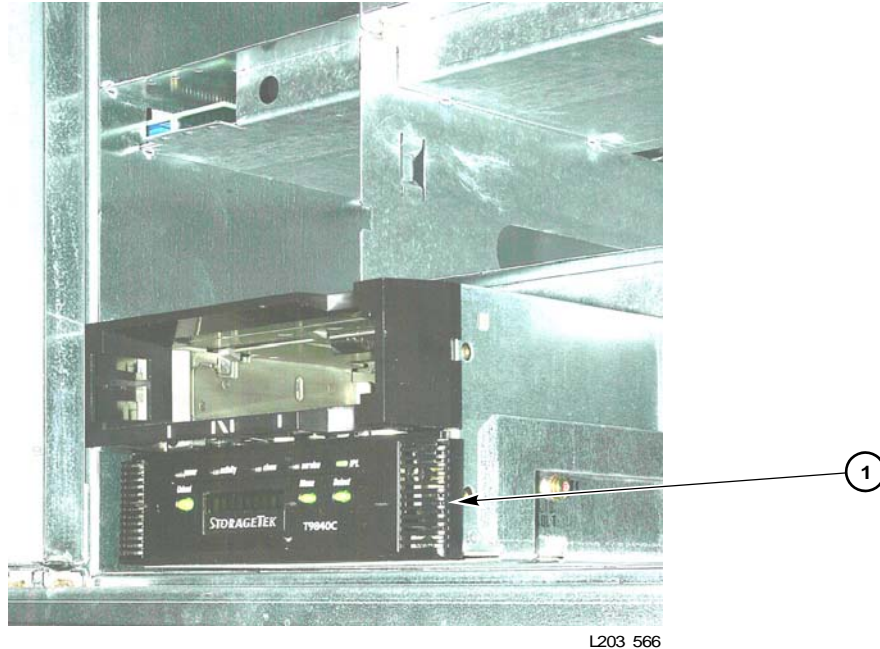1. HandBot handle (hold the handle to move the HandBot)

6. Leave the library only when you are certain that the HandBots can move freely in all directions.

⚠️ **Caution –** *Damage to Robot*. Make sure no extra material (manuals, eyeglasses, tools) are left inside. These objects would cause the robot to stop and could damage it.

Mounting a Cartridge

FIGURE 4-8 Drive Panel

L203 566

1. Drive bay

▼ To manually mount a cartridge

1. **Whether you manually insert a T9x40 cartridge or an LTO Ultrium cartridge, the VOLID label must be facing you, with the numeric characters *c dqxg* the bar code.**

2. **Do not force the cartridge into the tape drive. If you feel some resistance as you insert the cartridge, make sure you are installing the cartridge into the appropriate tape drive.**

3. **T9840 and T9940 tape drives look very similar, but you cannot put 9840 cartridges in a T9940 tape drive, nor put 9940 cartridges in T9840 tape drive.**

   Never attempt to insert an LTO Ultrium cartridge in a T9x40 tape drive. However, you can insert an LTO Ultrium cartridges in either an IBM or HP Ultrium tape drive.

   FIGURE 4-9 shows manual insertion of a T9840 cartridge.

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FIGURE 4-9   Manually Inserting a Cartridge
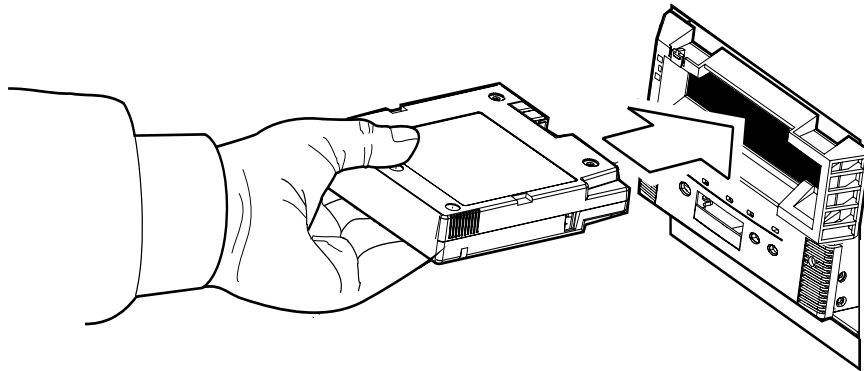
L203_472

For more information on manually mounting a cartridge into a drive, refer to the relevant tape drive publication.

Dismounting a Cartridge

All T9x40 and LTO Ultrium tape drives have a unload button on the operator panel.

1. **Make sure that the tape drive is not in use by the system.**

2. **Press the UNLOAD switch. One of the following conditions occurs:**

   ■ After the tape rewinds, the cartridge is ejected from the drive. Remove the cartridge from the drive.

   ■ The cartridge is not ejected after the tape rewinds. Refer to your drive documentation for more information.

For more information on manually dismounting a cartridge from a drive, refer to the relevant tape drive publication.

Exiting the Library

Before you leave the library, make sure that no tools or foreign objects are left, and no cartridges are outside the cartridge slots. Then:

1. **Return the cartridges that your removed to do a manual mount/dismount to their slots.**

2. **Step outside the library.**

Warning – Possible Physical Injury. **Before you close the library access door, look inside the library and ask in a loud voice if anyone is inside the library.**

3. **Close the front access door.**

Caution – *Equipment/Media Damage*. Do not slam the door. You could damage the door or cause cartridges to fall onto the floor. The robot cannot recover cartridges that fall onto the floor.

4. **Insert the key and lock the access door. Keep the key in a safe place.**

In the unlikely event that someone becomes locked inside and the system begins to start up, lights flash for 30 seconds before the robot starts to move. This provides enough time to push the emergency robotic stop switch on the CAP door (FIGURE 4-10). This actions stops any further robotic movement.

FIGURE 4-10 Emergency Robotic Stop Switch

L203_471

1. Emergency robotics stop switch

Placing the Drives to Online

The following pages describe how to varying the drives online:

T9840/T9940 Drive Display

To verify that the T9840/T9940 drives are ready and online, press the MENU switch—the display should now read Online.

If the drive displays Offline, press the SELECT switch once to place it online.

- If the drive message indicates Online, the transition to online completed.
- If the Onl Pend message appears, the online state is pending due to completion of diagnostic tests.
- If other messages appear, refer to either the *T9840/T9840 Tape Drive User's Reference Manual,* PN 95739, or *T9940 Tape Drive Operator's Guide,* PN 95989.

LTO Ultrium Drives

LTO Ultrium drives are automatically placed online when you place the library online.

Placing the Library Online

You can vary the library online using your library management software. Refer to library management software publication for the command syntax and console messages.

Powering-off the Library

Caution – If you power-off the library without performing the following procedure, you risk possible equipment or cartridge damage or loss of data.

▼ To power-off the library

1. **Make sure that all jobs have completed processing.**

2. **Quiesce the library to make sure the library and tape drives are not in use.**

3. **Vary the library and the drives offline.**

Note – Refer to your library management software publication for commands and syntax for Step 2 and Step 3.

4. **Make sure that the drives are empty by verifying the drive state using the StreamLine Library Console.**

Note – Refer to the online help documentation accessible through the Library Console application.

---

5. **Open the rear doors of the library.**

6. **Locate the power distribution unit (PDU) and move the system power-off/on switch to the OFF position (0).**

Note – If the library has a 2N power configuration, you must switch off the system power on both the PDUs.

An AC PDU is shown in FIGURE 4-11.

FIGURE 4-11 AC PDU

1. Retainer
2. LEDs
3. System Power Off/On Switch
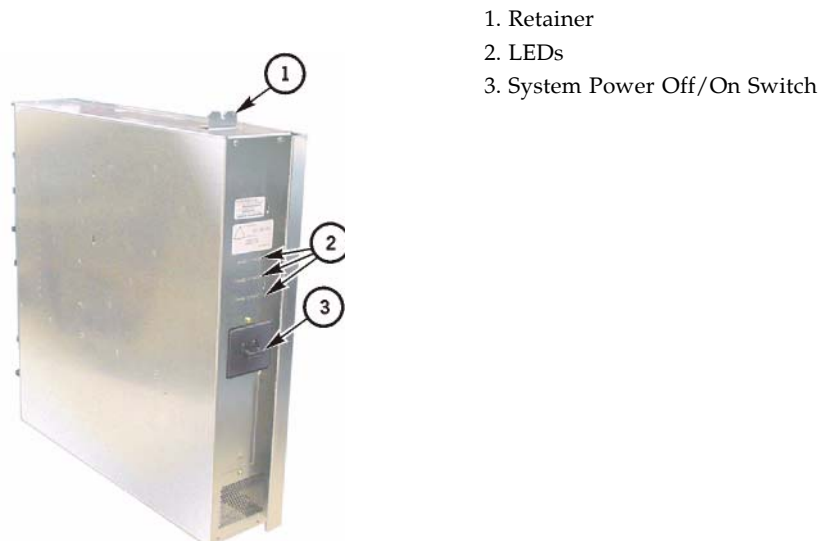
Figure 20 illustrates the locations of all power supplies (except for the Customer Interface Module's front frame area).

FIGURE 4-12 AC PDU and DC Power Supply Locations

From left to right:

1. Optional switches or hubs (1 – 4)

2. Drive locations/numbering (1 – 64)

3. DC power supplies (1 – 24)

4. Rail Power enable breakers (numbered 1 and 2, above DC supplies)

5. Far right: AC PDUs (bottom) and the logic gate sections they supply (top)

Powering-on the Library

▼ To power-on the library

1. **Close and lock the front access door if the doors are open.**

   Note – If you DO NOT want to power-on the robots, CAPs, and the elevators, leave the doors open.

2. **Move the system power-off/on switch to ON (1) position.**

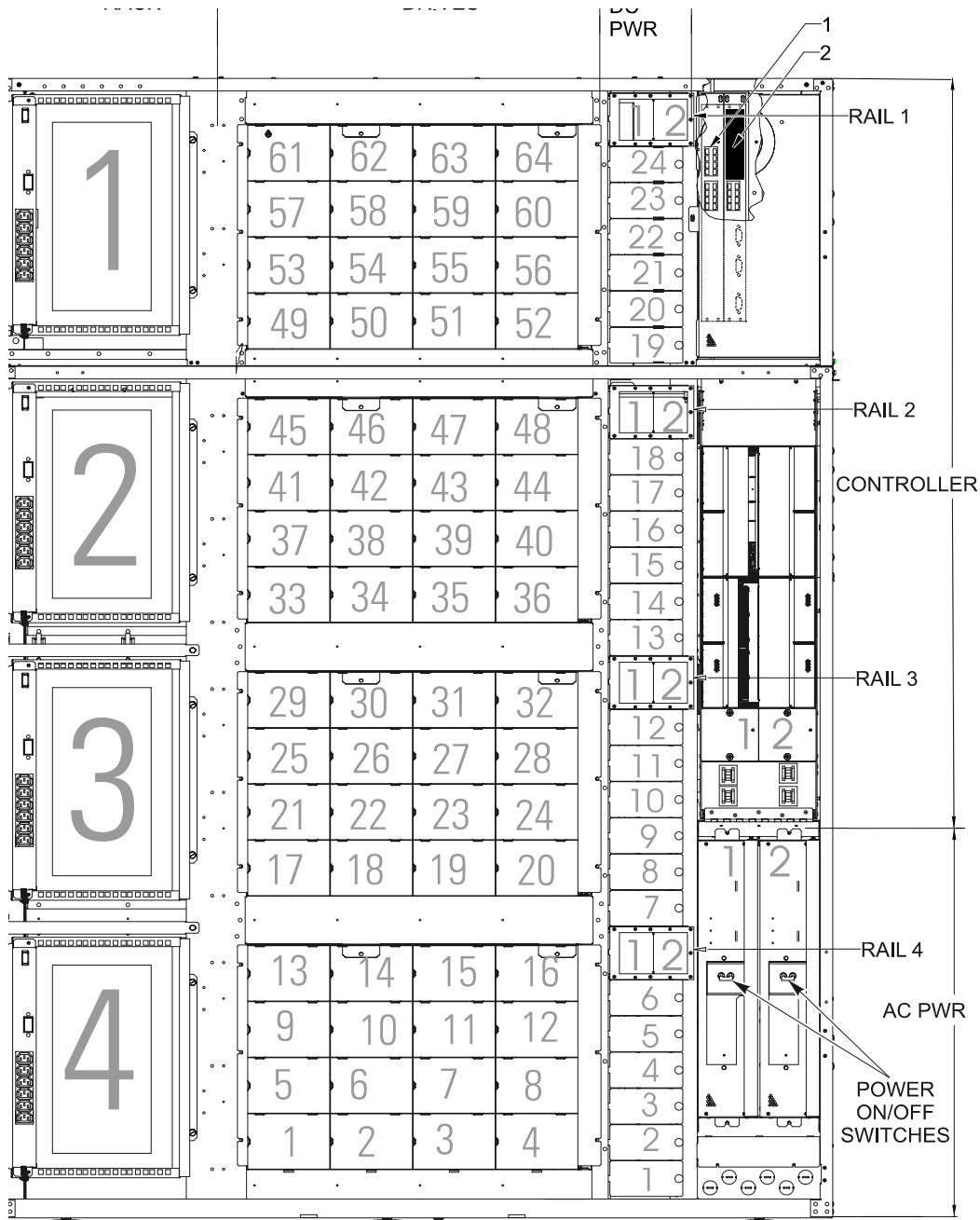   **Note –** If the library has a 2N power configuration, you must switch on the system power on both the PDUs.

   See FIGURE 4-11 on page 69 and FIGURE 4-12 on page 70 for detailed illustrations.

Maintenance Mode of Operation

Maintenance mode is active when a service representative enters the access door to perform maintenance or to replace a component.

An example of this would be the replacement of a defective HandBot when a redundant or operational HandBot is available. Each HandBot has two motors, if one fails, the other motor is powerful enough to move the defective HandBot into the forward service area. If both the motors fail for a HandBot, then the redundant HandBot moves the defective HandBot into the forward service area thus continuing HandBot operations. The service representative then requests that the library be made available for maintenance entry on the side where the HandBot is positioned. The maintenance key (available only to a service representative) is inserted, a service safety door moves to the side selected (partitioning the service area from operational library activity) and the HandBot is replaced.

Note – The service safety door is not parallel to the front of the library; its right side is angled toward the rear of the library (see FIGURE 1-2 on page 4).

Service Safety Door Operation

During the replacement, the library continues to function. Because there are cartridge arrays in the forward portion of the Customer Interface Module, these slots are reserved for diagnostic and cleaning cartridges only. A mount request for a cartridge in the slot closer to the side (left or right) where the service safety door is engaged may be

inhibited until the maintenance activity is completed. The reserved slots on the other side of the service area may still be accessed if the service safety door is not engaged on that side as well.

After the maintenance activity is completed, the access door is closed and locked and the service safety door moves to the center, clearing the area for HandBot operations. The HandBots then resume their full service.

Left Maintenance Area

During normal operation, vary the left elevator offline to the library management software using the StreamLine Library Console *before* the service representative activates the service safety door. After the maintenance activity is complete vary the left elevator online through StreamLine Library Console.

Right Maintenance Area

During normal operation, vary the CAPs offline to the to the library management software *and also* vary the right elevator offline using StreamLine Library Console before the service representative activates the service safety door to the right side of the library.

After the maintenance activity is complete vary the CAPs and the right elevator online to the system through StreamLine Library Console.

The following sample screen is an example of the Library Console displaying the service safety door feature.

FIGURE 4-13 StreamLine Library Console – Service Safety Door
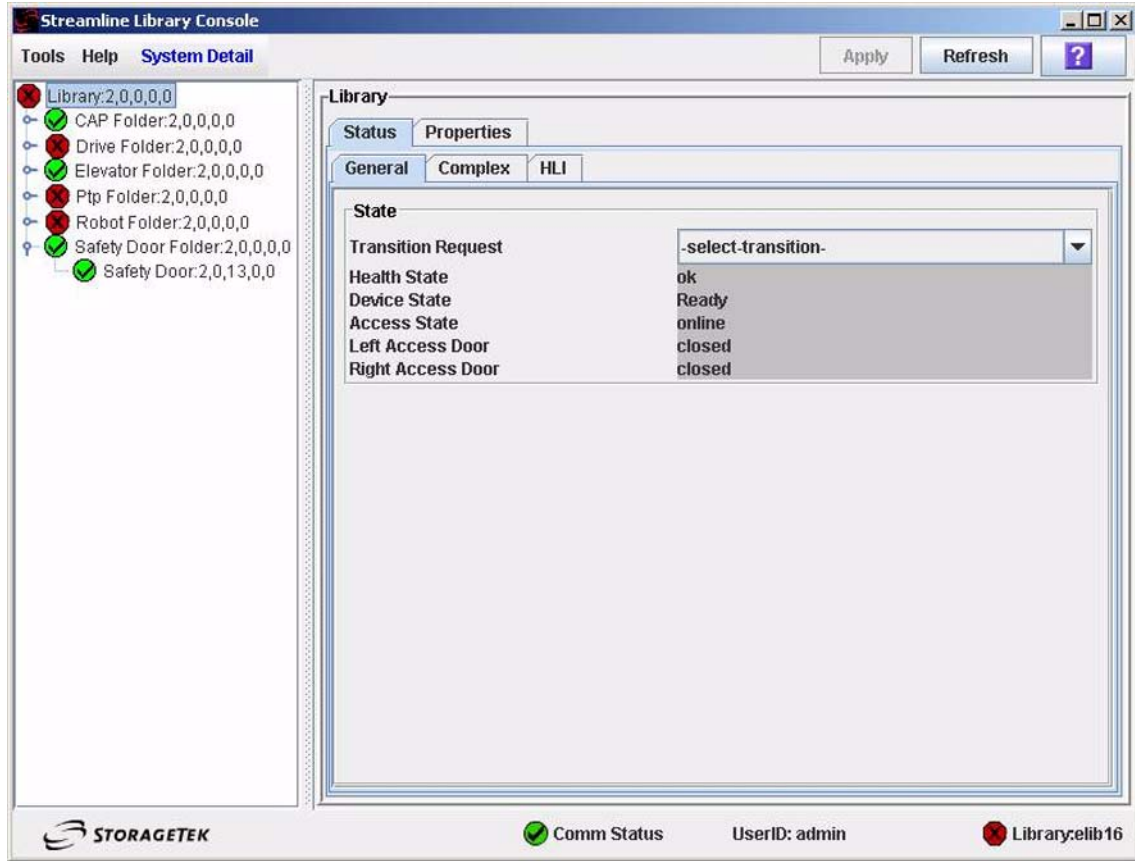
Cartridge Information

This chapter describes how to handle, inspect, and maintain cartridges.

Cartridge Requirements

Cartridges must meet specifications defined in *American National Standard Magnetic Tape and Cartridge for Information Interchange*.

Refer to your drive vendor's publication and Web site for specific cartridge requirements and specifications.

Colored cartridges are approved only if the measured reflection density is greater than 0.1 as measured by an X-rite 404G color reflection densitometer. For more information about colored cartridges, contact your Sun StorageTek representative.

Colored measurements are:

Bandwidth	ANSI Status T Wide band (380 to 780 nm)
Measuring range	Density (0.00 to 2.50) D
Accuracy	±0.02 D
Repeatability	±0.01 D
Aperture diameter	3.4 mm (0.13in.)

For more information about colored cartridges, contact your Sun StorageTek representative.

Ordering Cartridges and Labels

Contact your authorized Sun StorageTek Selling Agent for *labeled cartridges*.

For cartridge *labels*, contact EDP/Colorflex at:

- Phone: 1.888.438.8362 (domestic and international)
- Web site: http://www.colorflex.com

For technical questions, contact Sun StorageTek Sales Support at:

■ Phone: 1.800.275.4785

■ E-mail: sales_support@storagetek.co

Handling a Cartridge

Improper handling of cartridges can result in a loss of data or damage to a library component.

Improper handling of cartridges can result in a loss of data or damage to a machine component.

To handle a cartridge correctly:

■ Do not carry several cartridges loosely in a container. The leader blocks can snag on other cartridges and become unlatched.

Note – T9940 and LTO Ultrium cartridges have leader blocks. T9840 cartridges do not.

■ Make sure that the leader block is latched every time you pick up a cartridge.

■ Keep cartridges *clean*.

■ Inspect a cartridge before each use and *never* put a damaged cartridge into a drive or library.

■ Never release a leader block and pull tape from a cartridge.

■ Never open a cartridge.

■ Do not handle tape that is outside the cartridge; the tape edge might be damaged.

■ Do not expose the tape or cartridge to direct sunlight or moisture.

■ Do not expose a recorded cartridge to magnetic fields; this might destroy data on the tape.

Inspecting and Identifying a Cartridge

A defective or dirty cartridge can damage a drive. Always inspect a cartridge before you insert it into a drive or into a tape library. See FIGURE 5-1 on page 78 through FIGURE 5-4 on page 84. Look for:

■ Cracked or broken cartridge
■ Broken leader
■ Broken tape access door
■ Damaged file-protect selector or write-protect switch
■ Liquid in the cartridge
■ Labels not firmly attached or extending over the cartridge edge
■ Any other obvious damage

All the cartridges you use in a SL8500 library are similar, but they have significant differences.

StorageTek Cartridges

The T9840 and T9940 Tape Drives use a cartridge tape that is the same physical size; however, they are *not* interchangeable.

The T10000 data cartridge can be used only in a T10000 tape drive, and the T10000 tape drive accepts no other type of cartridge.

T9840 Cartridge

The T9840 data cartridge has two reels between which the tape travels (FIGURE 5-1). It does not have a leader block. It cannot be used in a T9940 or LTO Ultrium tape drive.

The StorageTek 9840 cartridge tape was designed to provide fast access to data and storage of up to 20 gigabytes of uncompressed data with an average access time of just 12 seconds.

TABLE 5-1 lists the specifications of the 9840 cartridge with the T9840x Tape Drives.
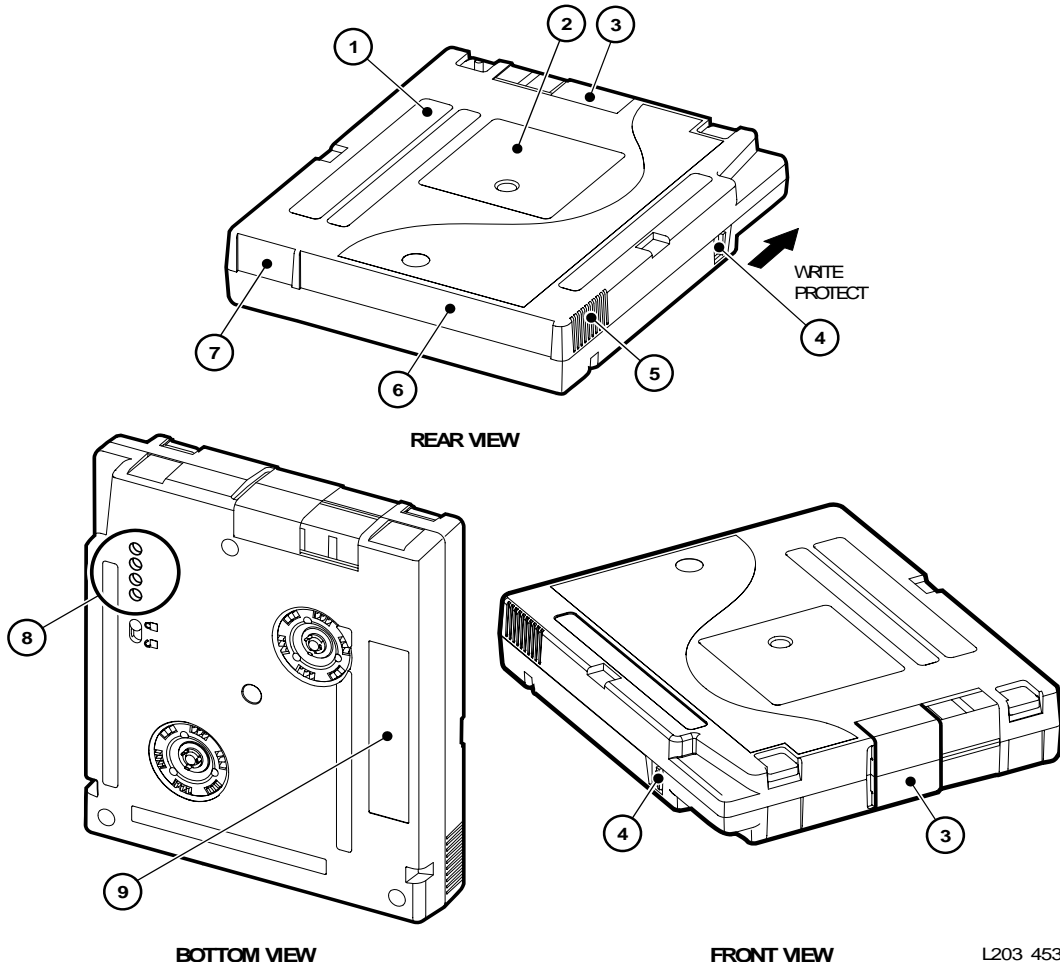
TABLE 5-1   T9840 Cartridge Tape Specifications

Specification	T9840A	T9840B	T9840C
Capacity, native (uncompressed)	20 GB	20 GB	40 GB
Performance:			
Read/Write speed	2.0 m/s (79 ips)	4.0 m/s (158 ips)	3.4 m/s (134 ips)
Search/Rewind speed		11.0 m/s (440 ips)	
Format:			
Formulation		Advanced metal particle (AMP)	
Coercivity		1625+/-75 Oersteds (130+/16.0 KA/m)	
Substrate		Polyethylene naphthalate (PEN)	
Uncorrected bit error rate		$1 \times 10^{(-18)}$	
Permanent errors		0	
Form factor	Half inch, 3480/3490E		
Number of tracks	288	288	
Availability:			
Archival life		15–30 years	
Compatibility		T9840A, T9840B, T9840C	
Dimensions:			
Height	25.4 mm (1.0 in.)		
Width	109.0 mm (4.29 in.)		
Weight	262.0 g (9.17 oz)		
Drop strength	1.0 m (38.4 in.)		
Temperature (non-condensing):			
Operating	+15° to +32°C (+60° to +90°F)		

TABLE 5-1 T9840 Cartridge Tape Specifications

Storage (archive)	+15° to +25°C (+59° to +77°F)
Shipping	-23° to +49°C (-10° to +120°F)
Wet bulb maximum	26°C (78°F)

FIGURE 5-1 A T9840 Cartridge

1. Manufacturer's label
2. Customer's label
3. Tape access door
4. Write-protect switch
5. Finger grips

6. VOLID label
7. Media ID label (R=data, U=cleaning, yellow for VolSafe)
8. Media ID (machine identifiable)
9. Manufacturer Part ID

Note – The manufacturer and media identification labels are yellow (9840A/B), green (9840C). The write-protect switch is yellow (9840A/B), green (9840C).

T9940 Cartridge

The T9940 cartridge has a single reel and a leader block that the T9940 tape drive uses to move the tape across the tape drive head (FIGURE 5-2). A T9940 cartridge cannot be used in a T9840 or LTO Ultrium tape drive.

The StorageTek 9940 data cartridge was designed to store up to 200 gigabytes of uncompressed data, or up to 400 gigabytes with 2:1 data compression, on a single cartridge. TABLE 5-2 lists the specifications of the 9940 cartridge with the T9940x Tape Drives.

TABLE 5-2   T9940 Cartridge Tape Specifications

Specification	T9940A	T9940B
Capacity, native (uncompressed)	60 GB	200 GB
Performance:		
Read/Write speed	2.0 m/s (79 ips)	2.4 m/s (95 ips)
Search/Rewind speed	11.0 m/s (440 ips)	
Formulation	Advanced metal particle (AMP)	
Coercivity	1625+/-75 Oersteds (130+/16.0 KA/m)	
Substrate	Polyethylene naphthalate (PEN)	
Number of tracks	288	576
Availability:		
Archival life	15–30 years	
Compatibility	T9940A, T9940B	
Dimensions:		
Width	109.0 mm (4.29 in.)	
Length	125.0 mm (4.92 in.)	
Height	25.4 mm (1.0 in.)	
Weight:	262.0 g (9.17 oz)	
Drop strength	1.0 m (39.3 in.)	
Temperature (non-condensing):		
Operating	+15° to +32°C +60° to +90°F	
Storage (archive)	+15° to +25°C +59° to +77°F	
Shipping	-23° to +49°C -10° to +120°F	
Wet bulb maximum	26°C (78°F)	

FIGURE 5-2 A T9940 Cartridge

REAR VIEW

BOTTOM VIEW

FRONT VIEW
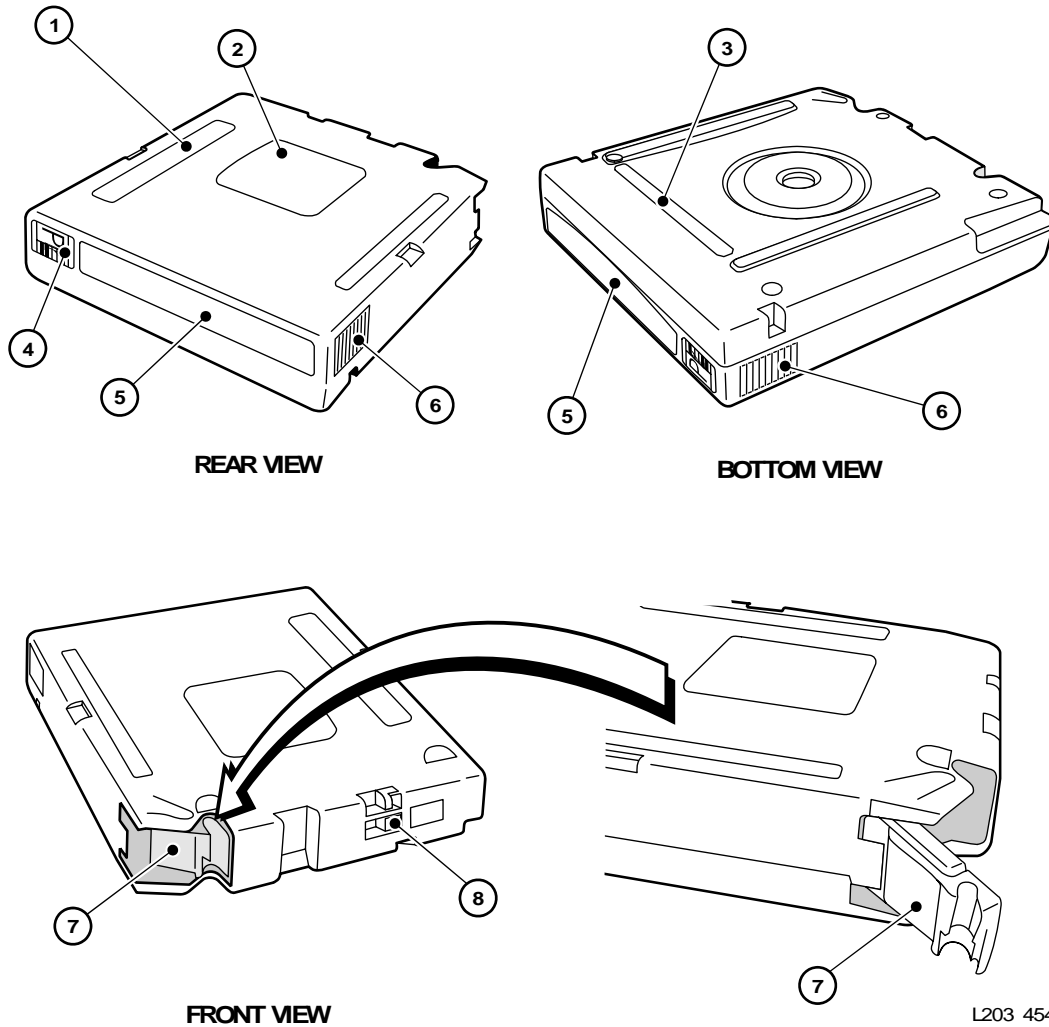
L203 454

1. Manufacturer's label (yellow for VolSafe)	5. VOLID label
2. Customer's label	6. Finger grips
3. Manufacturer's part ID	7. Tape leader block
4. Media ID label (P=data, W=cleaning)	8. Write-protect switch (yellow for VolSafe)

T10000 Data Cartridges

Optimized for high capacity, the T10000 data cartridges use a single reel hub to maximize performance. There are four types of cartridges:

- Standard

- Sport

- Diagnostic

- Cleaning

There are two types of data cartridges (see FIGURE 5-3 to identify these cartridges); standard (500 GB) and sport (120 GB). These cartridges are under warranty for 10,000 (ten-thousand) mounts.

Cleaning cartridges clean the tape path and read/write head up to 100 times, after which, the tape drive rejects the cartridge.

Important: After 15,000 mounts, a tape drive *y kɯ′pqv″*accept the cartridge.

The tape is under warranty for 200 full file writes to the media. *The tape drive issues a warning message when that number is exceeded* giving you time to transfer the data.
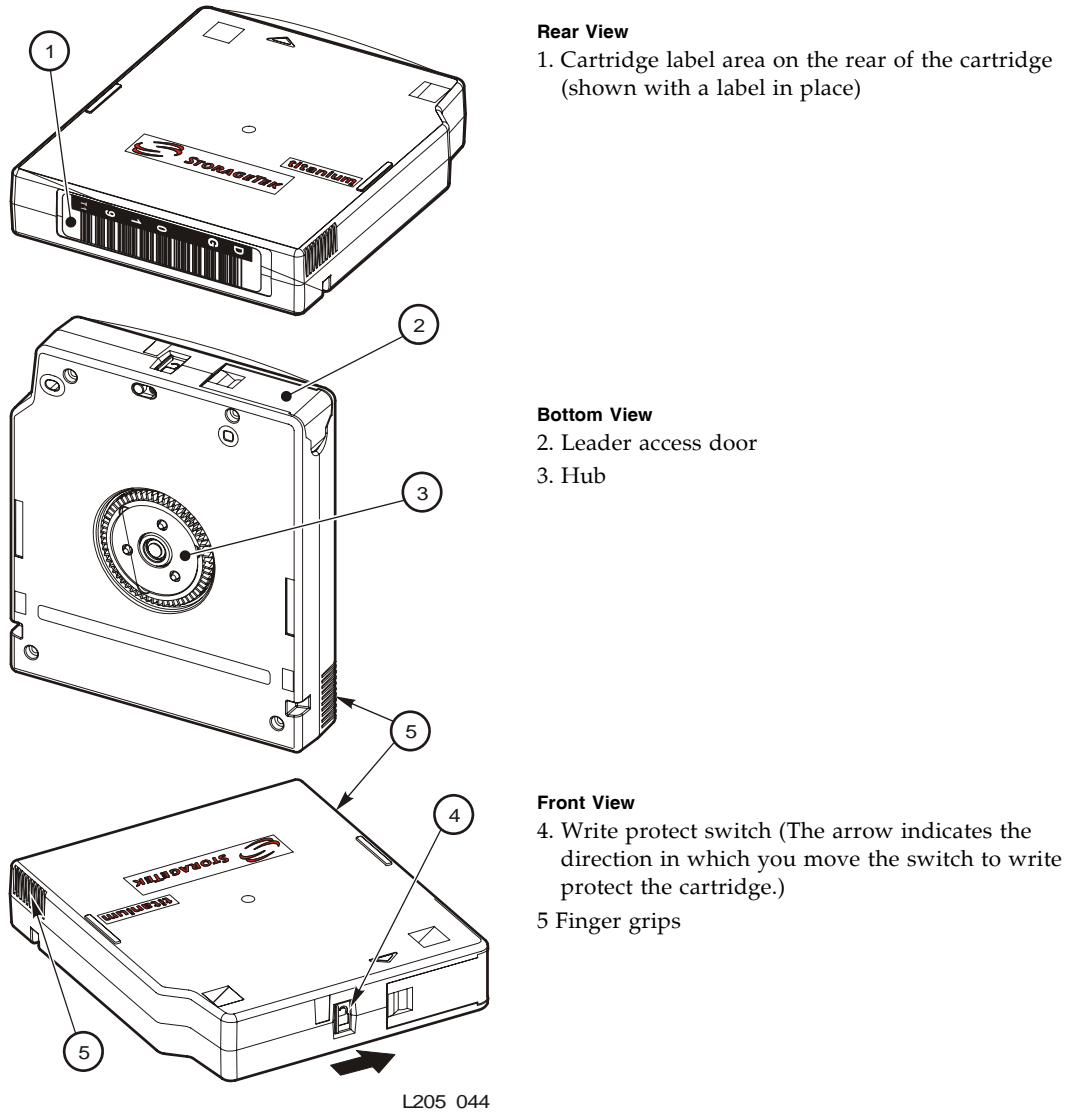
Note – The T10000 cartridge can be used only in a T10000 tape drive, and the T10000 tape drive accepts no other type of cartridge.

TABLE 5-3 lists the specifications of the T10000 cartridge.

TABLE 5-3   T10000 Cartridge Specifications

Specifications		Performance	
Capacity, native		Read/Write speed	
T10000A	500 GB	T10000A	2.0 to 4.95 m/s
Format		**Search/Rewind speed**	—
9. Number of tracks	10.768	**Mechanical**	
Physical length	917 m (3,009 ft)	Height	2.54 cm (1.00 in.)
Recordable length	855 m (2,805 ft)	Width	10.9 cm (4.29 in.)
Form factor	Half-inch	Length	12.5 cm (4.92 in.)
Formulation	Advanced metal	Weight	264 g (9.31 oz)
Track-following servo	particle	Drop strength	1.00 m (39.4 in.)
	Pre-recorded		

FIGURE 5-3   A T10000 Cartridge

Rear View

1. Cartridge label area on the rear of the cartridge (shown with a label in place)

Bottom View

2. Leader access door

3. Hub

Front View

4. Write protect switch (The arrow indicates the direction in which you move the switch to write protect the cartridge.)

5 Finger grips

L205 044

LTO Ultrium Cartridge

An LTO Ultrium cartridge has a single reel and a leader block (FIGURE 5-4), which makes it similar to a T9940 cartridge, but it cannot be used in place of a T9940 cartridge. Ultrium cartridges follow the linear tape open (LTO) format that allows them to be used in Ultrium tape drives made by any manufacturer, such as Hewlett-Packard, IBM, or Certance. In the past, cartridges could be used only in tape drives from the same manufacturer as the tape.

LTO Ultrium tapes use a single reel cartridge to maximize capacity that makes them ideal for backup, restore, and archive applications.

Note – There is a universal cleaning cartridge that can be used to clean LTO tape drives.

LTO Generation 2 technology stores up to 200 gigabytes of uncompressed data on a single cartridge, or up to 400 gigabytes with 2:1 data compression. TABLE 5-4 lists the specifications of the LTO Ultrium cartridges.

TABLE 5-4 LTO Cartridge Specifications

Specifications	LTO1	LTO2	LTO3
Capacity, native	100 GB	200 GB	400 GB
Performance			
Read/Write speed	4.0 m/s	6.22 m/s	5.46 m/s
Search/Rewind speed	7 m/s	7 m/s	7 m/s
Dimensions			
Width	107 mm (4.2 in.)	107 mm (4.2 in.)	107 mm (4.2 in.)
Length	22.9 mm (0.9 in.)	22.9 mm (0.9 in.)	22.9 mm (0.9 in.)
Depth	102 mm (4.0 in.)	102 mm (4.0 in.)	102 mm (4.0 in.)
Weight	210.0 g (0.46 lb)	210.0 g (0.46 lb)	210.0 g (0.46 lb)
Format			
Recording density (kilobits per inch)	124 kb/in	188 kb/in	245 kb/in
Number of tracks	384	512	704
Availability			
Archival life	15–30 yrs	15–30 yrs	15–30 yrs
Durability	Average 1,000,000+ head passes in an office/computer environment		
Compatibility			
Read Write	LTO1 LTO1	LTO1, LTO2 LTO1, LTO2	LTO1, LTO2, LTO3 LTO2, LTO3
Supported tape drives	LTO1	LTO1, LTO2	LTO3

FIGURE 5-4   An LTO Ultrium Cartridge
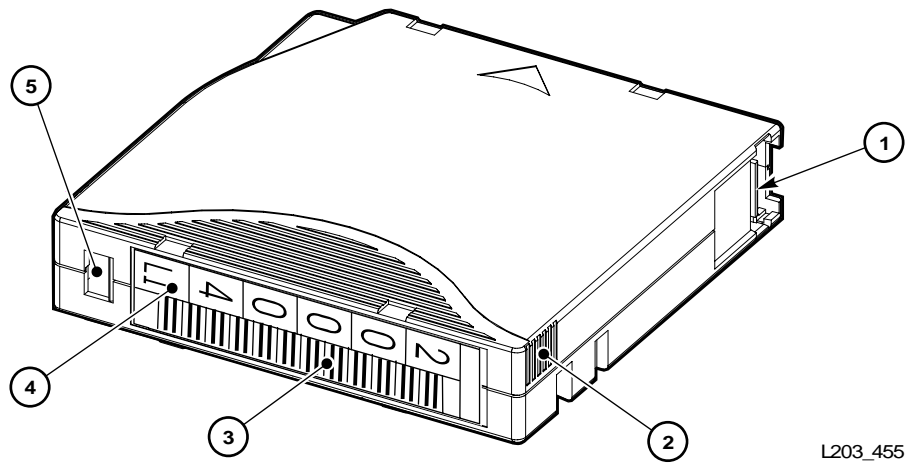
L203_455

1. Tape access door
2. Finger grips
3. VOLID label
4. Media ID label
5. Write protect switch

LTO Ultrium Generation 2 (Gen2) Fibre Channel Drives

The Gen2 cartridge specifics include:

1. Use of standard Ultrium cartridges

2. Ability to read/write to Gen1 tape media

3. A new model code for Gen2 drives—LTO2001 and new feature code—IBFC

4. Cartridge Media ID for Gen2 drives is "L2" (200 GB)

The major improvements seen with the Gen2 drives are:

■ Increased native capacity of 200 GB or up to 400 GB compressed

■ Data transfer rate of 40–80 MB/sec

The LTO Ultrium Generation 3 technology enables storage of upto 400 gigabytes of uncompressed data on a single cartridge.

Super DLTtape II

The Super DLTtape II cartridge like other high capacity cartridges has only the supply reel inside the cartridge. The take-up reel is inside the tape drive.

The Super DLTtape I and DLTtape VS1 are both readable on the SDLT 600 Tape Drive.

The Super DLTtape II cartridge like other high capacity cartridges has only the supply reel inside the cartridge. The take-up reel is inside the tape drive. Designed for use with the SDLT600, the Super DLTtape II cartridge delivers a 300 GB native capacity. StorageTek offers SDLT cartridges in a partnership with Quantum Corporation.

TABLE 5-5 lists the specifications of the SDLT cartridges.

Note – The Super DLTtape I and DLTtape VS1 are both readable on the SDLT600 Tape Drive.

TABLE 5-5   SDLT Cartridge Specifications

Specifications	SDLTtape I	SDLTtape II
Capacity, native	110 GB (SDLT 220) 160 GB (SDLT320)	300 GB
Performance		
Read/Write speed	3.1 m/s	3.56 m/s
Search/Rewind speed	4.1 m/s	4.83 m/s
Format		
Recording density (kilobits per inch)	193 kb/in (SDLT320)	233 kb/in
Number of tracks	448	640
Tape length (total) Usable	854 m (2800 ft) 538 m (1765 ft)	630 m (2066 ft) 596 m (1957 ft)
Availability		
Archival life	15–30 yrs	15–30 yrs
Durability	Average 1,000,000+ head passes in an office/computer environment	
Long-length durability (maximum)	260 full media passes	
Uncorrected bit error rate	1×10^{-17}	1×10^{-17}
Permanent errors	Zero	Zero
Compatibility		
Read Write	DLT IV, SDLTtape I SDLTtape I	SDLTtape I, II SDLTtape II
Supported tape drives	SDLT 220/320	SDLT 320/600

VolSafe Cartridges

VolSafe (volume safe) and WORM-enabled tape drives provides write once, read many (WORM) technology to VolSafe designated cartridges. VolSafe permits new data to only append the tape media, while it prevents erasure or overwrite of previously written data.

All StorageTek T-Series tape drives are VolSafe-technology-capable and you can identify the VolSafe cartridge by the colored areas on the cartridge.

VolSafe and WORM cartridges can often be identified by the color of the media identification labels (See FIGURE 5-1 on page 78 and FIGURE 5-2 on page 80):

■ T9840 cartridges use the color green

■ T10000 and T9940 cartridges use the color yellow

■ LTO3 technology uses two-tone cartridges to identify WORM cartridges

SDLT drives can convert *standard data cartridges* into WORM cartridges

Media Domain and Media ID

The media domain and media ID labels are the way a particular type of cartridge is identified by a library. The use of media domain and media ID labels allows you to mix tape drive types and media types in a single library or library complex.

The SL8500 library supports three types of barcode labels:

■ For T9x40 drives, 1/2-inch labels supplied by Trioptic (Engineered Data Products/Colorflex) or Tricode (American Eagle/Writeline). Both versions require a separate Media ID Type, which is one character.

■ For T10000 drives, labels with eight characters, the last two of which are the required Media ID Domain and the Media ID Type characters.

■ For LTO drives, labels with eight characters, the last two of which are the required Media ID Domain and the Media ID Type characters.

■ For SDLT drives, labels with seven characters, the last of which is the required Media ID character.

Notes:

1. Pre-labeled cartridges are available from Sun StorageTek. For information on ordering these cartridges, see "Ordering Cartridges and Labels" on page 75.

2. Sun StorageTek does *not* supply cartridge labels. For a supplier of labels only, see "Ordering Cartridges and Labels" on page 75.

3. Cleaning and diagnostic kits have one labeled cleaning cartridge and one labeled diagnostic cartridge with a volume serial number of 0 (zero) for each. Extra cleaning and diagnostic labels are sent with each library.

Cartridge Codes

Cartridge codes reflect the cartridge media and usage. Cleaning cartridges have CLN in the VOLID; diagnostic cartridges have DG in the VOLID. The media ID label correlates to the tape drive or transport capable of using the cartridge:

TABLE 5-6   Cartridge Codes

Drive Type	Media ID	Usage
T9840	R	Data
	U	Cleaning
T9940	P	Data
	W	Cleaning
T10000	T1	Data
	CT	Cleaning
HP GEN2 LTO Ultrium	C_1 plus CLN	Cleaning
IBM GEN2 LTO Ultrium	C_2 plus CLN	Cleaning
HP and IBM GEN2 and GEN3 LTO Ultrium	C_u	Universal cleaning cartridge
HP and IBM GEN2 LTO Ultrium	L_2	Data
HP GEN3 LTO Ultrium	L_3	Data
HP GEN3 LTO Ultrium	C_1 plus CLN	Cleaning

TABLE 5-7   Ultrium Cartridge Models

Description	Model Number
Ultrium media cartridge	MEDLTOM
Universal cleaning cartridge	MEDCLNT
Required feature code:	
20-count 100 GB data cartridges	1C20
Universal cleaning cartridge	UNCL
EDP Vivid Color Labels	EVLA
Horizontal labels	HLBL
Vertical labels	VLBL

Data Cartridge Label Examples

through show examples of the various cartridge labels used by the drives in the library. Be sure to use the proper labels for each drive type.

FIGURE 5-5   Data Cartridges Label Examples
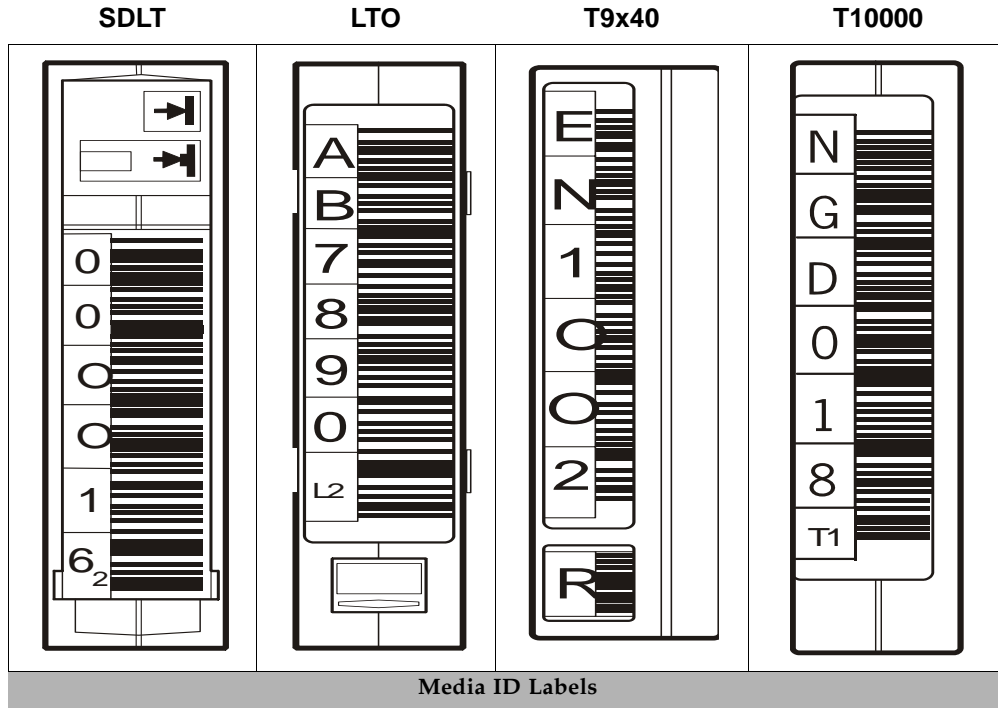
SDLT	LTO	T9x40	T10000

Media ID Labels

The SDLT Media ID is incorporated into the tape label:

S = Super DLT tape I and II

The LTO Media ID is incorporated at the end of the tape labels:

L*z* = Data cartridge:
    L3 = 400GB
    L2 = 200GB
    L1 = 100 GB
    LA = 50 GB
    LB = 30 GB
    LC = 10 GB

The Media ID label for the T9x40 is at the end of the tape label:

P = T9940 Data
R = T 9840 Data

The Media ID label for the T10000 is at the end of the tape label:

T1 = Data

Cleaning Cartridges Label Examples

Cleaning cartridges clean the read/write heads of the drives and the tape paths. Cleaning Cartridge Label Examples

The cleaning cartridges have the label format **CLNvxx**. The first three alphabets **CLN** identifies the cartridge as cleaning, the **v** determines the drive type, and the **xx** is a number value from 00 to 99 to identify the individual cleaning cartridge. The SDLT, LTO, and T10000 cartridges also have a media ID in the cartridge label. For example, CLNT19CT identifies the cartridges as a T10000 cleaning cartridge.

> **Note –** The SDLT and T9x40 cartridges do not have the drive type identifier.

FIGURE 5-6   Cleaning Cartridges Label Examples
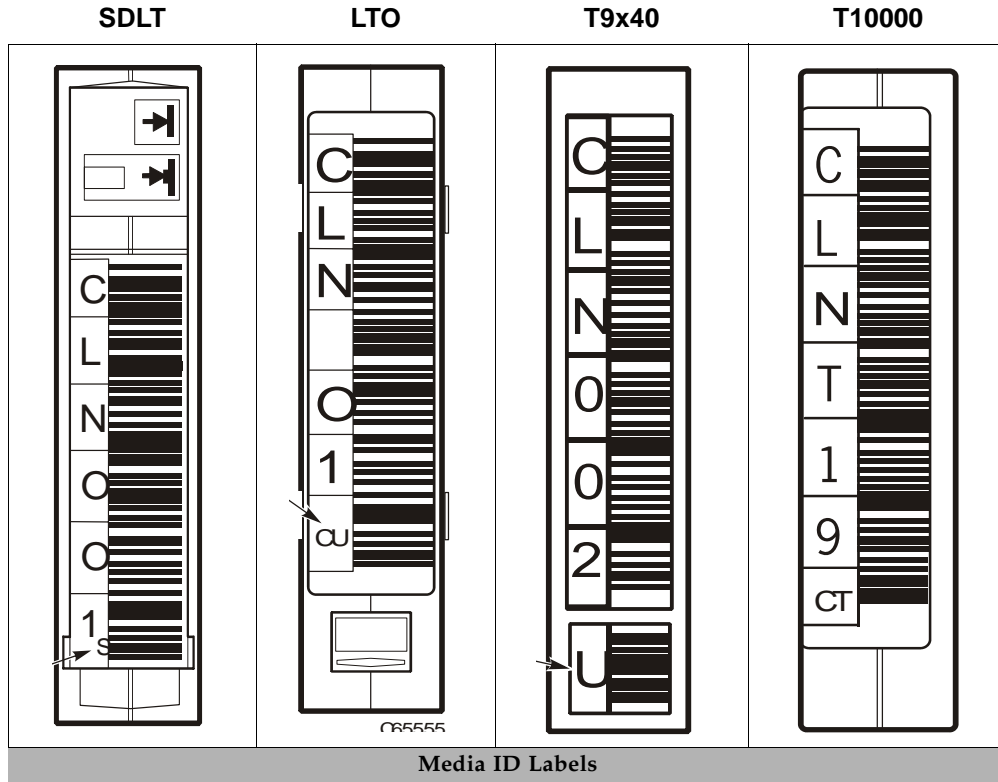
SDLT	LTO	T9x40	T10000

Media ID Labels

The SDLT Media ID is incorporated into the tape label:

S = Super DLT tape I and II

The LTO Media ID is incorporated at the end of the tape label:

C1 = HP cleaning
C2 = IBM cleaning
CU = Universal

The Media ID label for the T9x40 is at the end of the tape label:

W = T9940 Cleaning
U = T9840 Cleaning

The Media ID label for the T10000 is at the end of the tape label:

CT = Cleaning

Diagnostic Cartridges Label Examples

Diagnostic cartridges are data cartridges with a DG label. Service representatives use the diagnostic cartridges to perform run read and write tests on the drives.

The diagnostic cartridges have the label format DG *xxx*. The first two alpha characters, DG, identify the cartridge as diagnostic, followed by a space, and *xxx* is a number value from 000 to 999 to identify the individual diagnostic cartridge. For example DG 001L2 is an LTO data cartridge with a diagnostic label.

FIGURE 5-7   Diagnostic Cartridges Label Examples
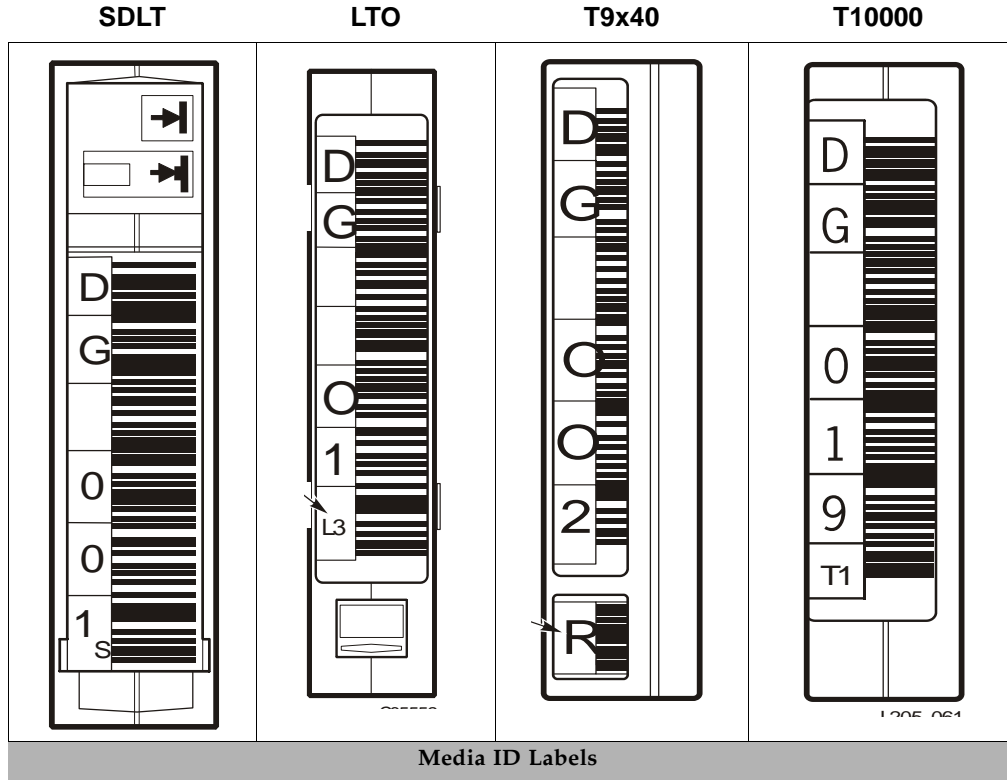
SDLT	LTO	T9x40	T10000

Media ID Labels			

The SDLT Media ID is incorporated into the tape label:
 	
S = Super DLT tape I and II
	The LTO Media ID is incorporated at the end of the tape labels:
	
	L*z* = Data cartridge:
	  L3 = 400GB
	  L2 = 200GB
	  L1 = 100 GB
	  LA = 50 GB
	  LB = 30 GB
	  LC = 10 GB
		The Media ID label for the T9x40 is at the end of the tape label:
		
		P = T9940 Data
		R = T 9840 Data
			The Media ID label for the T10000 is at the end of the tape label:
			
			T1 = Data

Non-labeled Cartridges

The SL8500 library does not support non-labeled cartridges. If non-labeled cartridges are left inside the library and a software audit (such as HSC) is initiated and the cartridges are exported through the CAP.

Upside Down Cartridges

Inserting a *cartridge upside down can cause damage to the HandBot and to the cartridge.*

Caution – The SL8500 scans upside-down LTO or SDLT cartridges and inserts them into slots. However, mounts of these upside-down cartridges will fail. Currently, the library returns these cartridges back to the slot and does not eject them through the CAP.

The behavior for upside down cartridges is explained in the following sections.

LTO Cartridges

For upside down LTO cartridges, the label can be recognized and may be placed into a cartridge slot.

When the library tries to load the cartridge into a drive:

- the drive will not allow the upside down cartridge to be inserted,
- the cartridge is returned to its original slot, and
- the drive posts a load error message on the host console.

Verify if there is an upside down condition by ejecting the cartridge through the CAP.

T9x40 Drives

Caution – *Equipment and cartridge damage:* An upside down 9x40 cartridge can cause damage to both the HandBot and the cartridge.

CAP Entry:
If you insert a 9x40 cartridge upside down into a CAP slot, the cartridge will not seat correctly within the slot and the CAP can not close.

Manual Array Slot Entry:
If you insert a 9x40 cartridge upside down into a storage slot, *the cartridge will extend from the slot and damage can occur to both the HandBot and the cartridge.*

Applying Labels to Cartridges

▼ To apply the label on a cartridge

1. Make sure that the cartridge has been at room temperature for at least 24 hours.

2. Clean the surface where the label will be placed using a cleaning solution made for this purpose. See "Cleaning the Cartridge Exterior" on page 97.

3. Peel the backing from the VOLID label.

4. Lay the cartridge flat, in the position you would use to insert the cartridge in a tape drive.

5. Position the VOLID label with the bar-code characters *below* the alphanumeric characters. Press it into place.

Note – On LTO Ultrium VOLID labels, the alphanumeric characters can be either vertical or horizontal.

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6. If the cartridge has a customer label, place the label in the area and press it into place.

7. Repeat Steps 2 through 5 for the media ID label.

8. The label must be within the indented area of the cartridge so that the edges of the label are parallel to the edges of the cartridge. The label should be close to the inside edge of the indented area but must *never* overlap the edge of this area. FIGURE 5-8 on page 92 through FIGURE 5-10 on page 93 illustrate labeling and the locations of the SDLT, the T9840 and T9940 cartridges. See FIGURE 5-4 on page 84 for the LTO Ultrium FIGURE 5-3 on page 82 for the T10000 cartridge label area.

Notes:

1. Make sure that the label is not placed elsewhere on the cartridge surface.

2. Make sure that the edges of the label do not curl up; curling causes the cartridge to stick in the drive loader.

3. Use labels that do not leave a residue when they are removed.

4. Make sure that the label contains a VOLID.

FIGURE 5-8   Applying Cartridge Label to SDLT Cartridge

1. SDLT cartridge
2. VOLID label
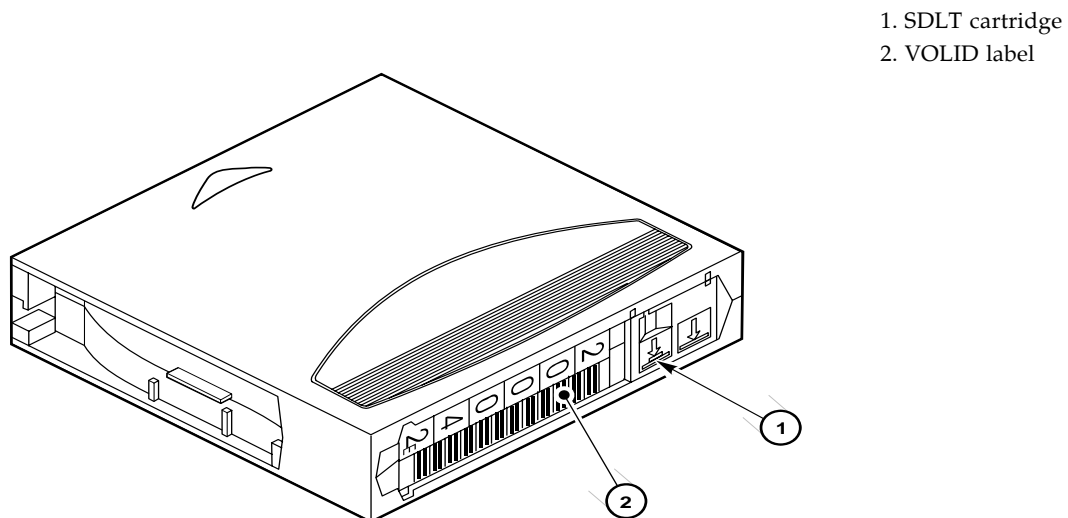
FIGURE 5-9   Applying Cartridge Label to T9840 Cartridge
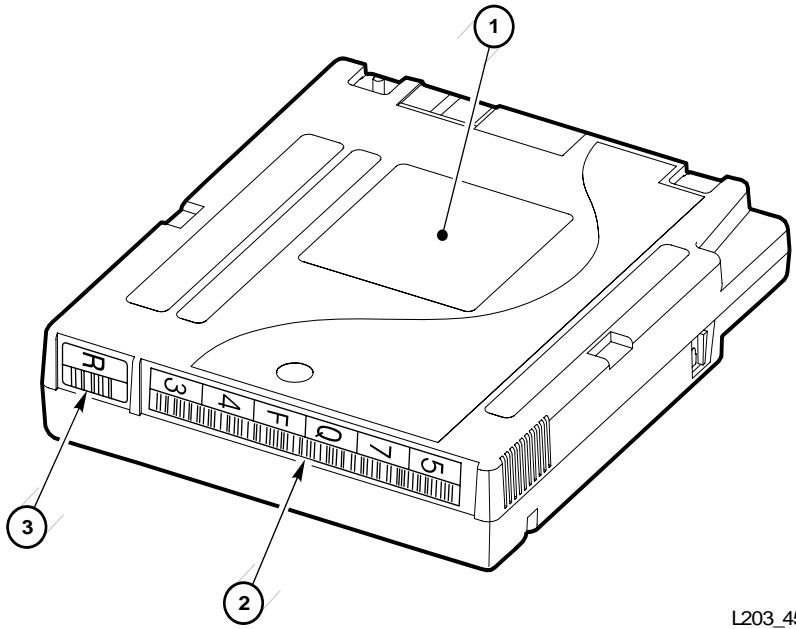
1. Customer Label
2. VOLID label
3. Media ID label ("R" = data, "U" = cleaning)

L203_45

FIGURE 5-10 Applying Cartridge Label to T9940 Cartridge
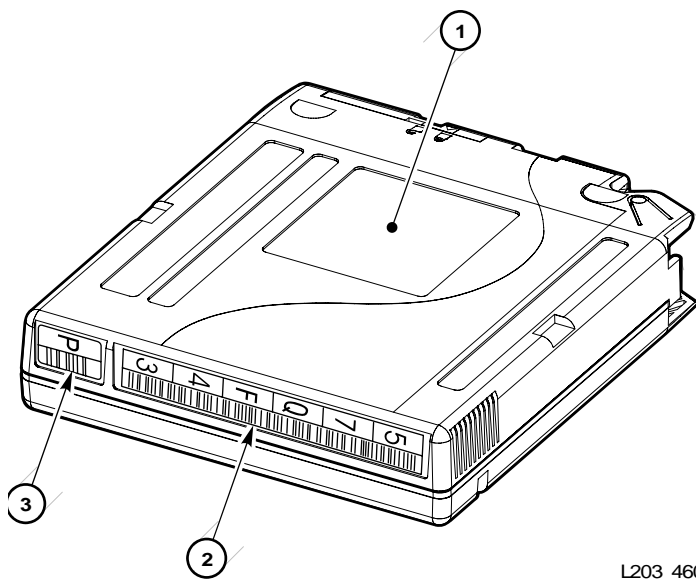
1. Customer label
2. VOLID label
3. Media ID label ("R" = data, "U" = cleaning)

L203_460

Setting the Write Protect Switch

The following sections provide information about setting the write protect switch on the cartridges. The switch location and design varies slightly between cartridge types.

Setting the T9840 Write Protect Switch to Read-Only

You can set the T9840 write protect switch so that the cartridge is read-only (nothing can be written on the tape). Slide the switch (FIGURE 5-11 on page 94) to the front of the cartridge. In this position, the drive can only read data from the tape and cannot write data.

Setting the T9840 Write Protect Switch to Read/Write

You can set the T9840 write protect switch so that the cartridge is write-enabled. Slide the switch (FIGURE 5-11) to the rear of the cartridge. In this position, the drive can write as well as read data. This setting is recommended when you enter cartridges into the library.

Note – Some software has a feature called virtual thumb wheel, allowing read-only access to a cartridge that is not physically write-protected.

FIGURE 5-11 Setting the T9840 Cartridge Write Protect Switch
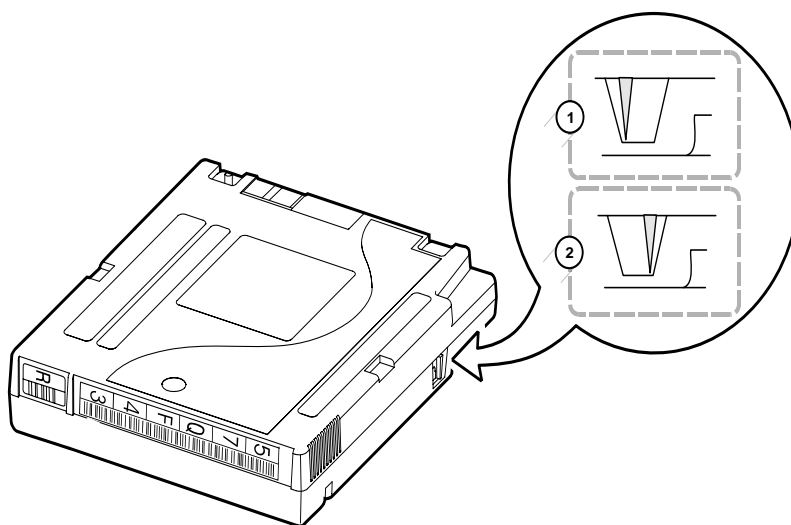
1. Write enable position
2. Write protect position

L203_462

Setting the T9940 Write Protect Switch to Read-Only

You can set the T9940 write protect switch so that the cartridge is read-only (nothing can be written on the tape). Slide the switch (FIGURE 5-12) to the write protect position. In this position, the drive can only read data from the tape and can not write data.

Setting the T9940 Write Protect Switch to Read/Write

You can set the T9940 write protect switch so that the cartridge is write-enabled. Slide the switch (FIGURE 5-12) to the write enabled position. In this position, the drive can write as well as read data. This setting is recommended when you enter cartridges into the library.

Note – Some software has a feature called virtual thumb wheel, allowing read-only access to a cartridge that is not physically write-protected.

FIGURE 5-12 Setting the T9940 Cartridge Write Protect Switch

1. Write enable position
2. Write protect position
3. Write protect switch

L203_463
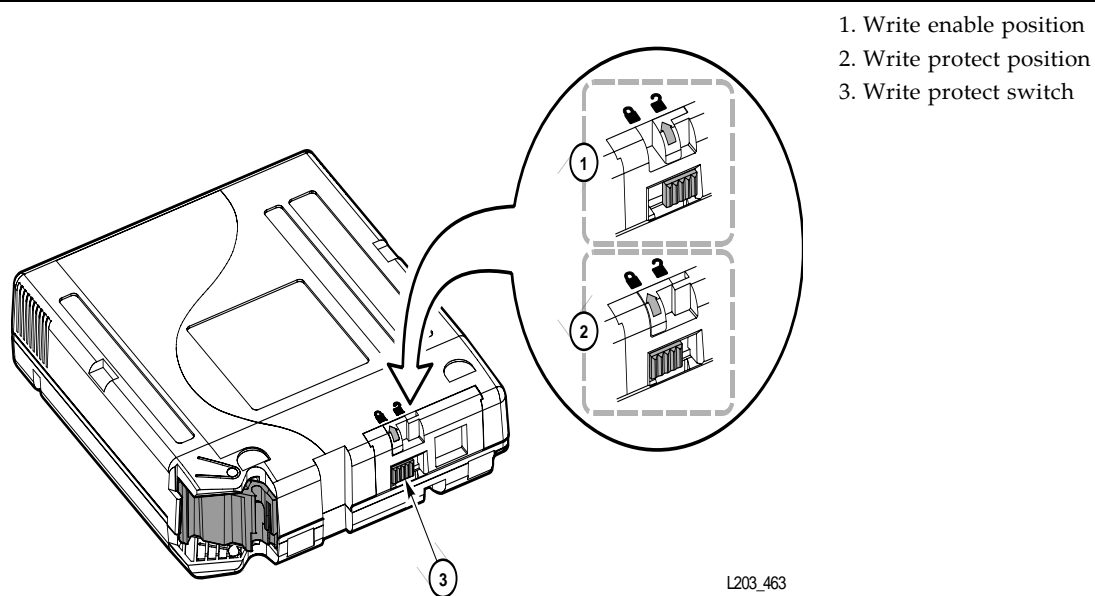
Setting the T10000 Write Protect Switch to Read/Write

You can set the T10000 write protect switch so that the cartridge is read-only (nothing can be written on the tape). Slide the switch (FIGURE 5-13) to the write protect position. In this position, the drive can only read data from the tape and can not write data.

FIGURE 5-13 Setting the T10000 Cartridge Write Protect Switch
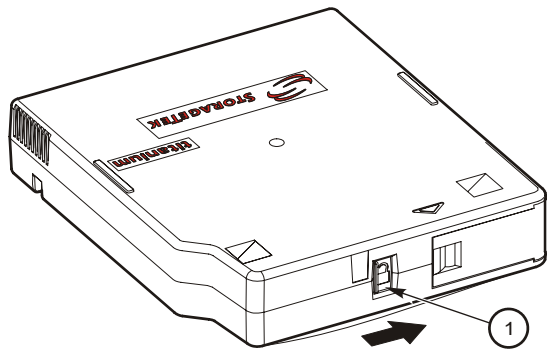
1. Write protect switch (The arrow indicates the direction in which you move the switch to write protect the cartridge.)

L205 058

Setting the LTO Ultrium Write Protect Switch to Read-Only

You can set the LTO Ultrium write protect switch so that the cartridge is read-only (nothing can be written on the tape). Slide the switch (FIGURE 5-14) so that the "closed lock" is revealed. In this position, the drive can only read data from the tape and can not write data to it.

Setting the LTO Ultrium Write Protect Switch to Read/Write

You can set the LTO Ultrium write protect switch so that the cartridge is write-enabled. Slide the switch (FIGURE 5-14) so that the "open lock" is revealed. In this position, the drive can write as well as read data. This setting is recommended when you enter cartridges into the library.

FIGURE 5-14 Setting the LTO Ultrium Cartridge Write-Protect Switch

1. Write protect switch (data=red, cleaning= gray)

L203 464
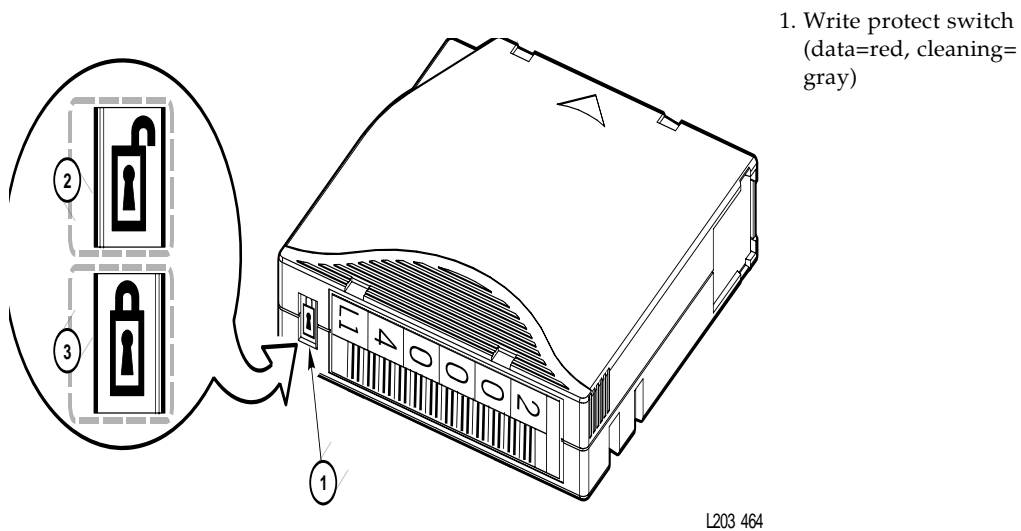
Maintaining Cartridges

The following section describe how to clean cartridges and repair a detached leader block.

Cleaning the Cartridge Exterior

Caution – CARTRIDGE DAMAGE: Certain solvents can damage the cartridges. DO NOT USE ACETONE, TRICHLOROETHANE, TOLUENE, XYLENE, BENZENE, KETONE, METHYL ETHYL KETONE, METHYLENE CHLORIDE, ETHYLDICHLORIDE, ESTERS, ETHYL ACETATE, OR SIMILAR CHEMICALS TO REMOVE LABELS OR TO CLEAN CARTRIDGES.

Wipe all dust, dirt, and moisture from the cartridge with a lint-free cloth.

Use StorageTek Tape Cleaner Wipes, PN 4046289-01 to clean the cartridges. These wipes are saturated with isopropyl alcohol. Do not let any solution touch the tape or get inside the cartridge.

Using Cleaning Cartridges

Cleaning cartridges have a media ID label that identifies the type of tape drive in which it can be used (see TABLE 5-6 on page 87).

These cartridges can not be used as scratch cartridges or initialized by software utilities.

Caution – PROCEDURE ERROR: When you enter a cleaning cartridge, the software considers it to be new, and sets the usage counter to zero. DO NOT RE-ENTER A CLEANING CARTRIDGE THAT LIBRARY EJECTS THROUGH THE CAP.

Repairing a Detached Leader Block

When a T9940 or LTO Ultrium cartridge tape is damaged, use a backup tape if possible. If a cartridge leader block is detached, there is no backup tape, and the cartridge or tape has no obvious damage, you may repair the leader block using a repair kit provided by the tape supplier. You can use the tape one time to copy the data onto another tape.

Storing of Cartridges

When you store a cartridge:

■ Do not take a cartridge out of its protective wrapping until you are ready to use it. Use the tear string, not a sharp instrument, to remove the wrapping.

■ Store cartridges in a clean environment that duplicates the conditions of the room in which they are used.

■ Before using a cartridge, make sure that it has been in its operating environment for at least 24 hours.

■ Archival storage is 1 to 10 years for 9x40 cartridge tapes and 15 to 30 years for LTO Ultrium cartridge tapes.

Troubleshooting and Diagnostics

This chapter describes how to correct problems with the library and the attached devices (drives, CAP, robots, and elevators). It also includes some of the diagnostic procedures you can perform using the StreamLine Library Console.

If you encounter any problems with the library, you should take several steps before you contact the Technical Excellence Center (TEC).

If you must contact the TEC, see Chapter 7 for more information.

Troubleshooting the Library

The following table describes a few of the troubleshooting tips:

TABLE 6-1   Troubleshooting Table

Problem	What to do
Service Required (red) LED is constantly lit.	**Perform the following procedure:** Use the StreamLine Library Console to check the health of the library and the attached devices (drives, CAP, robots, and elevators). To perform a health check: 1. Launch the Library Console application. 2. Access the System Detail module (Tools > System Detail). 3. Check the device tree for the following indicators: Device Healthy Device Error **Note –** The device tree is on the left panel that provides a list of devices attached to the library (drives, CAP, robots, elevator). The Status (for example, online/offline) tab provides more information on the health of the library and devices. For more information, see the online help documentation accessible through the Library Console application. Other checks: • Make sure that all cartridges are fully seated and properly oriented in their slots. • Inspect the library floor for any foreign objects or debris; remove any objects you find.
CAP unlocked LED is lit and blinking.	Open the CAP and make sure the cartridges in the CAP slots are properly seated. See "To open the CAP" on page 47.
The client computer cannot communicate with the library or drives.	Make sure that all cables are securely attached to their connectors on the rear of the library, the drives, and the client computer.

TABLE 6-1 Troubleshooting Table (Continued)

Problem	What to do
The StreamLine Library Console does not display modified data or information remains static.	• Select the **Refresh** button to update the screen. • Check the heartbeat monitor icon of the Library Console. The heartbeat monitor icon is on the status line of the Library Console screens that flashes periodically indicating that the library and server are communicating: If the heartbeat monitor stops blinking heartbeat monitor icon on status line changes to the warning icon. The warning icon indicates that the Library Console has lost communication with the library. When the library looses communication with the server, after about 30 to 60 seconds, the warning icon is replaced by an error icon and the system displays the following error message: `"Heartbeat message not received from the server."` Select Problem Details to obtain possible causes and suggested actions about the error message. **Note –** When there is a communication failure, you MUST log off from the Library Console and then log on again to restore communication between the library and server. For more information, see the online help documentation accessible through the Library Console application.
The StreamLine Console cannot communicate with the library.	The version of the Library Console is not compatible with the library controller code. 1. Download a different version of the application. See "Upgrading Firmware" on page 30 and "Upgrading the Remote Library Console" on page 31. 2. Restart the Library Console and logon again.
Drive is unable to eject a cartridge.	See "Dismounting a Cartridge" on page 66.
Cannot detect a HandBot.	Select the Robots folder from the device tree and check for the following indicators for all HandBots: Device Healthy Device Error Device error indicates that the defective HandBot has been pushed to the service area for maintenance.
Unable to find a cartridge VOLID.	Perform a library audit using the Library Console. See "Performing Audits" on page 104.

TABLE 6-1   Troubleshooting Table (Continued)

Problem	What to do
The StreamLine Console cannot locate a cartridge based on the HLI address	• If the library is in a complex, make sure you have entered the correct LSM number. See "Working with the Search Utility" on page 106. • Perform a library audit using the Library Console. See"Performing Audits" on page 104.

Diagnostic Utilities

The StreamLine Library Console provides utilities, reports, and monitors to help diagnose a problem with the library and the attached devices (drives, CAPs, robots, and elevators).

Reports

The reports from the Library Console provide static information on the library and the associated devices (for example, drives, robots, elevators, and CAPs), events, and cartridges.

Permanent reports are predefined and built into the Library Console application. These reports are useful when you need to access the report utility and quickly select an existing report template to generate relevant data to view, e-mail, print, or save to a file. This can help the service representative diagnose a problem remotely. For example, the service representative might want a summary report of all the cartridges after an audit.

You can quickly access the Reports module and select the Cartridge Summary report from the Permanent reports folder and display it on screen. FIGURE 6-1 is a sample report providing a summary of all the cartridges in the library.

FIGURE 6-1 Sample Permanent Report
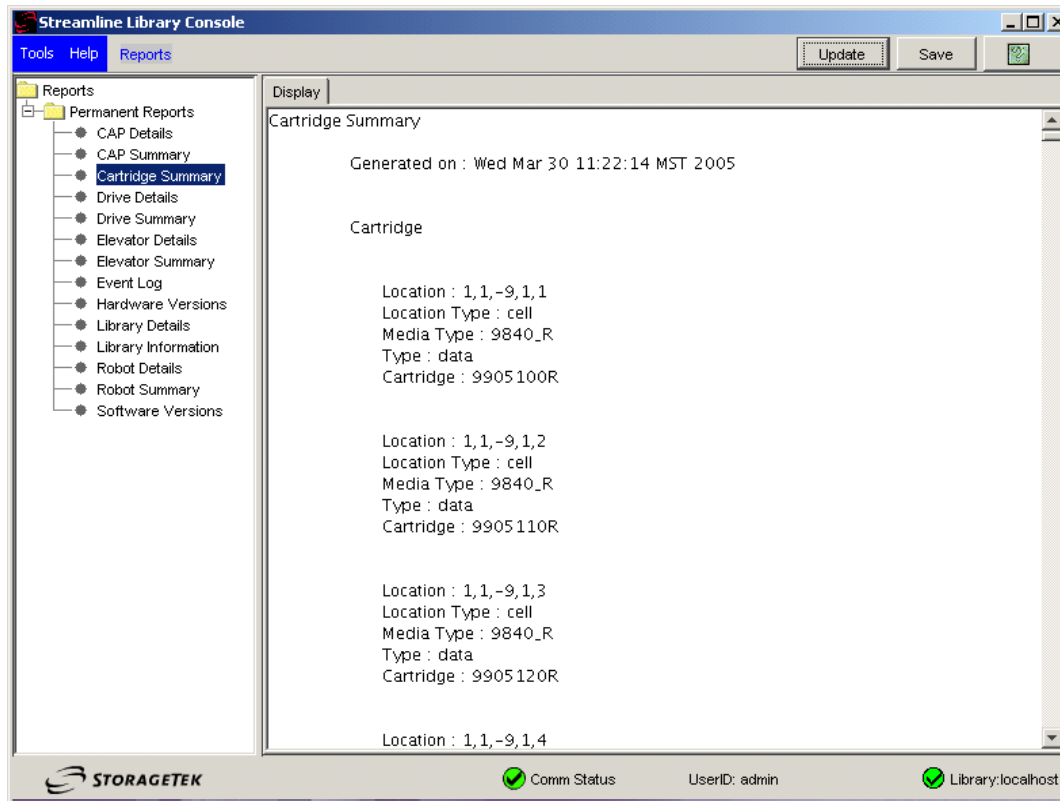
Event Monitors

Event monitors are setup to collect information about the library and the associated devices when specific events occur. For example, mounting a cartridge on a drive can be an event that causes an event monitor to track the number of reads on the drive.

Event monitors help service representatives to easily identify and resolve problems to minimize unscheduled machine downtime.

Permanent monitors are predefined and built into the Library Console application. These monitors are useful to quickly select an existing event monitor template to capture the data associated with the event. For example, a service representative has to resolve a problem with the tape drive in physical location (1,2,1,1,1) that has been logging read errors. Diagnosis of this problem requires monitoring the different events associated with the drive starting with the drive mount. The service representative selects the permanent monitor designed to collect this information as soon as the event occurs. The system starts displaying the different activities related to the event monitor.

Note – Using the Library Console, you an spool event data being monitored to a file.

Utilities

The StreamLine Library Console provides the following utilities to:

- Load code
- Perform audits
- Perform a library self test
- Move cartridges within a library
- Search for a cartridge, result code, or device status
- Modify the CAP locked status
- Copying the MIB text file

For detailed instructions on using the these utilities, access the online help documentation available through the StreamLine Library Console application.

Loading Code

See for information on loading code.

Performing Audits

An SL8500 library is capable of storing all cartridge locations within its memory.

The term *audit* refers to the process of reading and cataloging all cartridges within a library, verifying the locations of specified cartridges, or validating a range of slot locations.

During an initialization, the library audits the location and VOLID of all cartridges in the storage and reserve slots. The library also performs an audit when you:

- Open and close the library access doors
- Make a request from the Library Console
- Make a request at the host console to audit the tape library

The SL8500 maintains a cartridge database in the HBC card. The cartridge database contains the following information for all the cartridges in the library:

- Volume Serial Numbers (VOLID)
- SL8500 address location
- Verified status (true or false)

The Library Console offers the following types of audits:

1. **Physical audit**. The library controller *reads and catalogs every* cartridge by its VOLID slot location. This information is stored in HBC memory. Audit times vary according to the size of the library, the number of HandBots, and the speed of the scan engine for the bar code scanner.

   The library performs a physical audit:

   a. At power-up or when one or both access doors are opened and closed - the HandBot visits all cartridge slots, catalogs the VOLIDs and locations, and updates the HBC cartridge database.

   b. When initiated from the Library Console. The application offers two types of physical audits:

■ *Entire library audit*. The robot visits all cartridge slots (including the CAPs and drives), catalogs the VOLIDs and locations, and updates the HBC cartridge database. This audit is a background process and so does not interrupt online library operations. View the Cartridge Summary Report for the latest cartridge locations and VOLIDs.

Note – The estimated time for a physical audit of an entire library is from less than 10 minutes for a 1,448 cartridge library to 45 minutes for 6,632 cartridge library.

■ *Specific range audit*. the robot visits only a specific range of cartridge slots (including caps and drives) and updates the HBC database. The audit information is displayed on the console while the audit is being performed.

2. **Verified audit**. Available through the StreamLine Library Console, this audit validates the status of a specific cartridge slot (or range of slots). If a cartridge in a slot has a status of "false," the VOLID is audited and the database is updated. The audit information is displayed on the console while the audit is being performed.

3. **Virtual audit**. Available through the StreamLine Library Console, this audit displays the cartridge database.

Performing Library Self-test

The self-test is minimal functional test performed after the library is installed and also at periodic intervals during library operations to help diagnose basic problems with library and the associated devices (drives, robots, elevators, and CAPs).

The self-test checks the communication paths between the main library controller (HBC) and all drives, robots, elevators, and CAPs. The utility also performs several motion tests to check the health of the robots, elevators, and CAPs. Finally, a full audit of the library is performed, followed by drive mounts and dismounts.

Moving Cartridges

Using the move utility, you can move a cartridge from one location (source) to another (destination) within a library. Examples: (1) you might decide to group cartridges by data type or to move them closer to their assigned drive. (2) to replace a cleaning cartridge that has expired──move the cartridge to a CAP slot and then perform an eject; enter the new cleaning cartridges into a CAP slot and move the cartridge from the CAP slot to a reserved slot.

Before moving any cartridge, it might be helpful to generate a cartridge summary report that shows the contents of slots in the library. This report will help you determine which slots are available for use and which cartridges might have to be moved to obtain their slot.

Working with the Search Utility

The search utility provides a convenient way to look up information on:

- Cartridge locations (based on the "Internal Address", "HLI-PRC Address", and VOLID)
- Result codes (the result of the action requested)
- Device Status codes (the status of communications errors between the devices [drives, CAPs, elevators, robots] and the library controller)

For more information on the search utility, see "Locating a Cartridge and Drive" on page 62.

Modifying the CAP Locked Status

Before attempting to enter or eject cartridges using a CAP, you must unlock the CAP and then open it. See "Precautions" on page 60. The StreamLine Library Console provides the functionality to lock and unlock the CAPs.

Copying the MIB Text File

The MIB text resides within the library's controller card (HBC). Use the Library Console (2.26.00) or higher to copy the MIB text file to your PC.

Obtaining Maintenance Support

This chapter describes what to do if problems occur with the tape library. In some cases, you might be able to correct the problem. In other cases, you must contact your service representative, as described in this chapter.

When the problem is caused by cartridge tapes, see Chapter 5, "Cartridge Information". When the problem is caused by cartridge tape drives, refer to your tape drive operator's guide.

Remote Support

StorageTek Customer Service Representatives are available to assist you and the customer with hardware and software problem resolution. During the initial order and installation planning, make sure that you inform the customer about StorageTek's local and remote support.

Service Delivery Platform

The Service Delivery Platform (SDP) is the preferred remote support solution for the SL8500 library. SDP is a software application for providing sophisticated remote support of storage hardware devices. The software resides on an intelligent appliance at your site, providing a secure connection between your StorageTek products and a server located within the StorageTek IT data center. The SDP software monitors your devices and automatically alerts StorageTek when it finds a problem. It also enables remote resolution for problems that do not require physical intervention at the site.

Through a secure, Internet/VPN-based communication link that is enabled by a StorageTek-supplied VPN router and your Internet access and connectivity, the SDP is designed to collect device events on a 24 x 7 x 365 basis. In the event of a device failure, the SDP intelligent appliance and the software application capture device logs and other pertinent diagnostic data that can help determine the reason for device failure.

The robust SDP security architecture is designed for strict data privacy. The software uses 128-bit encrypted Secure Sockets Layer (SSL) protocol for data transmission and additional secure data gathering procedures for specific technical issues.

To obtain the SDP Analyst client application contact your service representative.

Customer Initiated Maintenance

Customer initiated maintenance begins with a telephone call from you to the Customer Service Support Center (CSSC). You receive immediate attention from qualified StorageTek personnel, who record problem information and respond with the appropriate level of support.

▼ To contact the CSSC about a problem

1. Use the telephone to call the StorageTek customer service at:

   800.525.0369 (within the United States)

   303.673.4056 (outside the United States)

2. Describe the problem to the call taker. The call taker will ask several questions and will either route your call to or dispatch a service representative.

If you have the following information when you place a service call, the process will be much easier:

Account name	
Site location number	
Contact name	
Telephone number	
Equipment model number	
Device address	
Device serial number (if known)	
Urgency of problem	
Problem description	

StorageTek's Worldwide Offices

You may contact any of StorageTek's worldwide offices to discuss complete storage, service, and support solutions for your organization. You can find address and telephone number information on StorageTek's external Web site at:

http://www.storagetek.com

Cartridge Slot Locations

Library Walls

The SL8500 library has two walls:

The *Inner walls* has 14 slot arrays.

The *Outer walls* use various sizes of arrays consisting of:
- 13 cartridge slots (allowing space for the robotic rails)
- 8-slot arrays placed within the future PTP areas and underneath the stop brackets for the service safety door
- 4-slot arrays used on sections that are cutout for each future PTP
- 3-slot arrays at the ends of all rails; these slots are reserved for robotic end stop labels (top slot), proximity calibration (middle slot), and drop-off slot (bottom slot)

There are also 4-slot arrays for each elevator and turntable assembly.

Service areas are located on each, front side of the customer interface module; these areas are reserved for non-functioning HandBots and do not interfere with cartridge GET or PUT operations by the functioning HandBots. Currently, arrays installed within the service areas (198 slots) are reserved for diagnostic and cleaning cartridges only.

Cartridges placed in arrays lie flat, hub down, and parallel to the floor. To prevent slippage, cartridges are held in their slot by internal retainer clips. Each array has *two targets* centered vertically to accommodate the different sizes and depths of cartridges.

Aisle space between arrays is limited to 0.5 m (18 in.). Due to the built-in redundancy of components, entry into the library beyond the maintenance area should be infrequent.

Reserved Slots

There are a total of 230 slots within the library that are reserved (that is, not to be used for data cartridge storage); these are listed in TABLE A-1.

TABLE A-1   Reserved Slots

Number of Slots	Use for	Location
198	Diagnostic or Cleaning Cartridges	Front section of Customer Interface Module (separated from data cartridge cells by the Service Safety Door area)
24	3-cell arrays: endstop label (top) proximity sensing (middle) drop-off slot for single HandBot (bottom)	Front section of Customer Interface Module
8	Drop-off slot for second HandBot	Top cell under the PTP area
Total = 230		

Cartridge Address

You have to understand two types of addressing scheme to manually locate a cartridge:

- Internal firmware address
- HLI-PRC (Host LMU Interface - Panel, Row, Column) address

Internal Address

The internal library firmware designates cartridge locations with a five-digit number as viewed from the front of the library, Library, Rail, Column, Side, and Row represented as L,R,C,S,W.

Library number: The number within a library or library complex

Rail number: Rails are numbered 1 through 4; Rail 1 is the top rail

Column number: Columns are "signed" numbers referenced from the customer interface module, where +1 is right of the center of the drive bays and -1 is to the left of the drive bays

Side number: Outer walls = 1, inner walls = 2

Row number: Numbered consecutively, from the top (1) down

See "Locating a Cartridge and Drive" on page 62 to locate a cartridge using the Library Console.

FIGURE A-1 Cartridge and Drive Locations – Internal Firmware (1 of 8) (L203_090)

Outer and Inner Wall Cell Layout Map
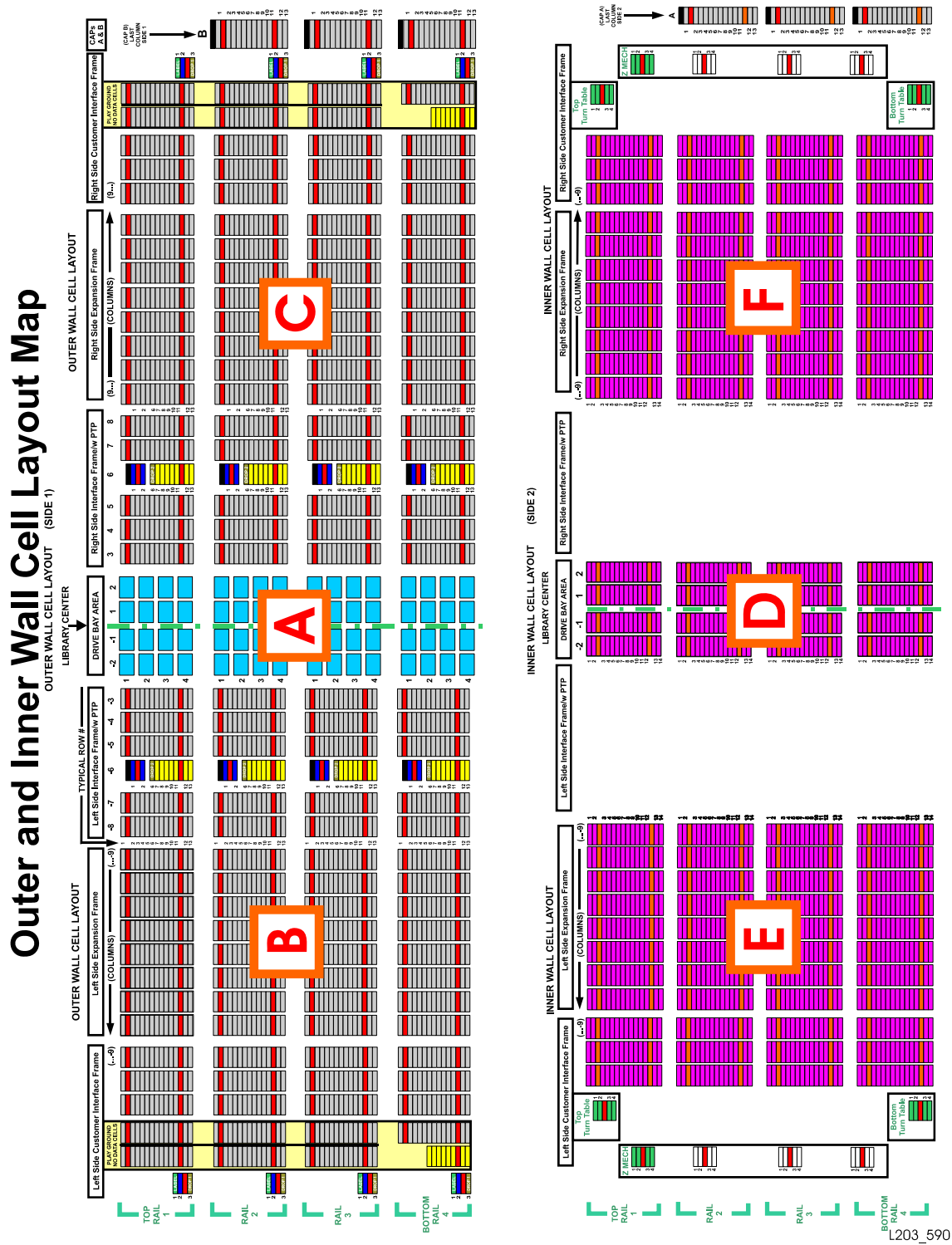
L203_590

FIGURE A-2 Cartridge and Drive Locations – Internal Firmware (2 of 8)(L203_591)
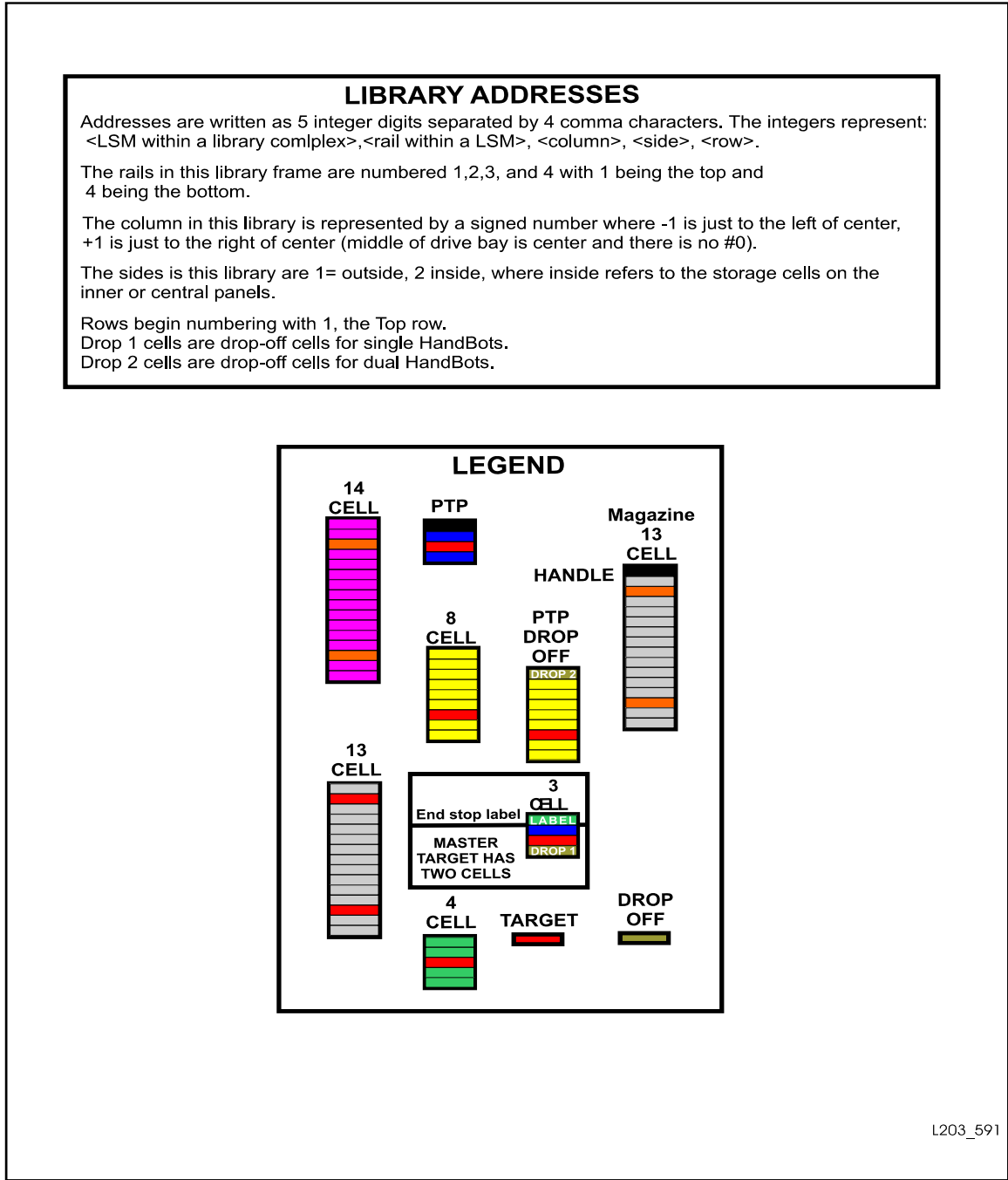
FIGURE A-3 Cartridge and Drive Locations – Internal Firmware (3 of 8)(L203_592)

L203_592

FIGURE A-4 Cartridge and Drive Locations – Internal Firmware (4 of 8)(L203_593)
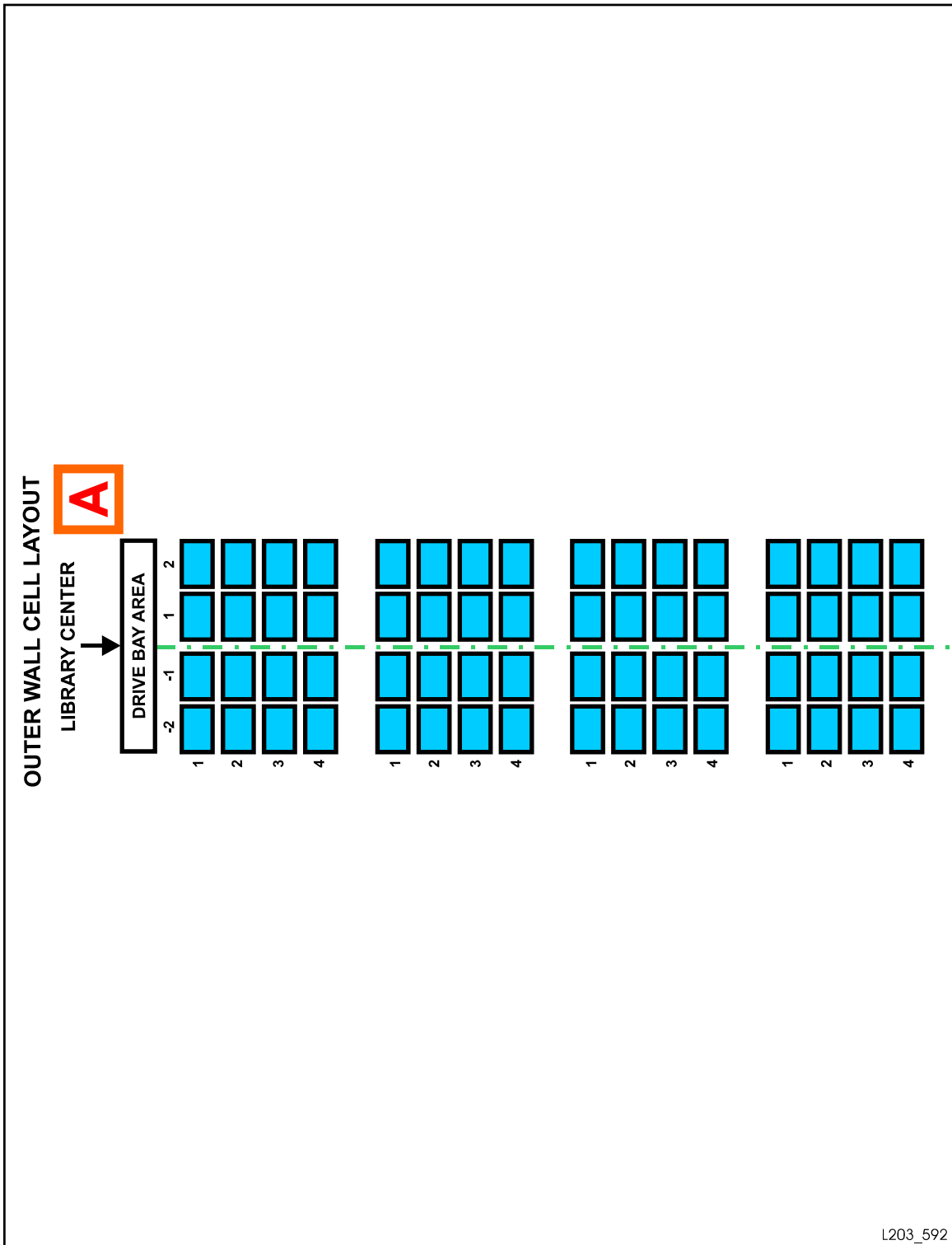
FIGURE A-5 Cartridge and Drive Locations – Internal Firmware (5 of 8)(L203_594)
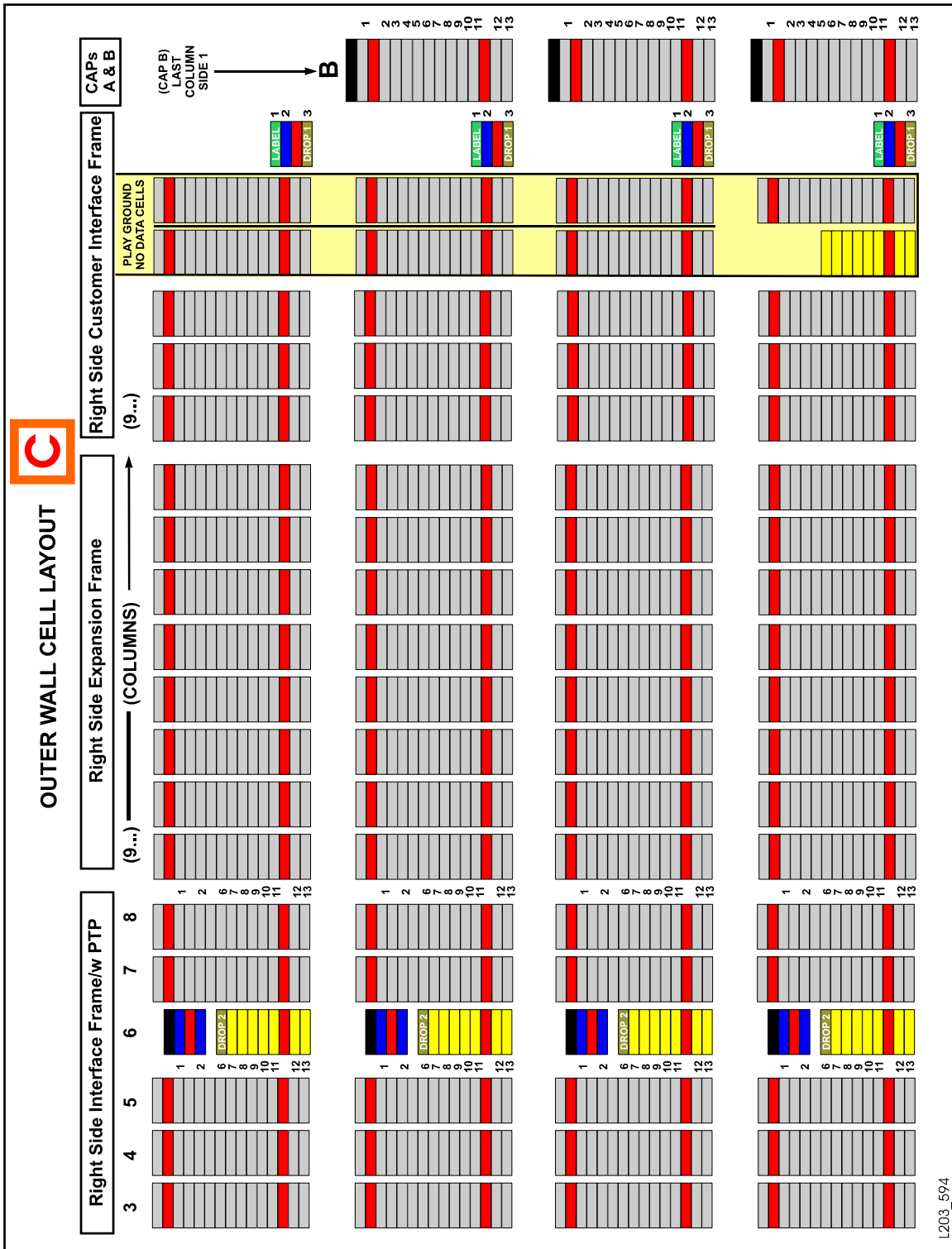
FIGURE A-6 Cartridge and Drive Locations – Internal Firmware (6 of 8)(L203_595)
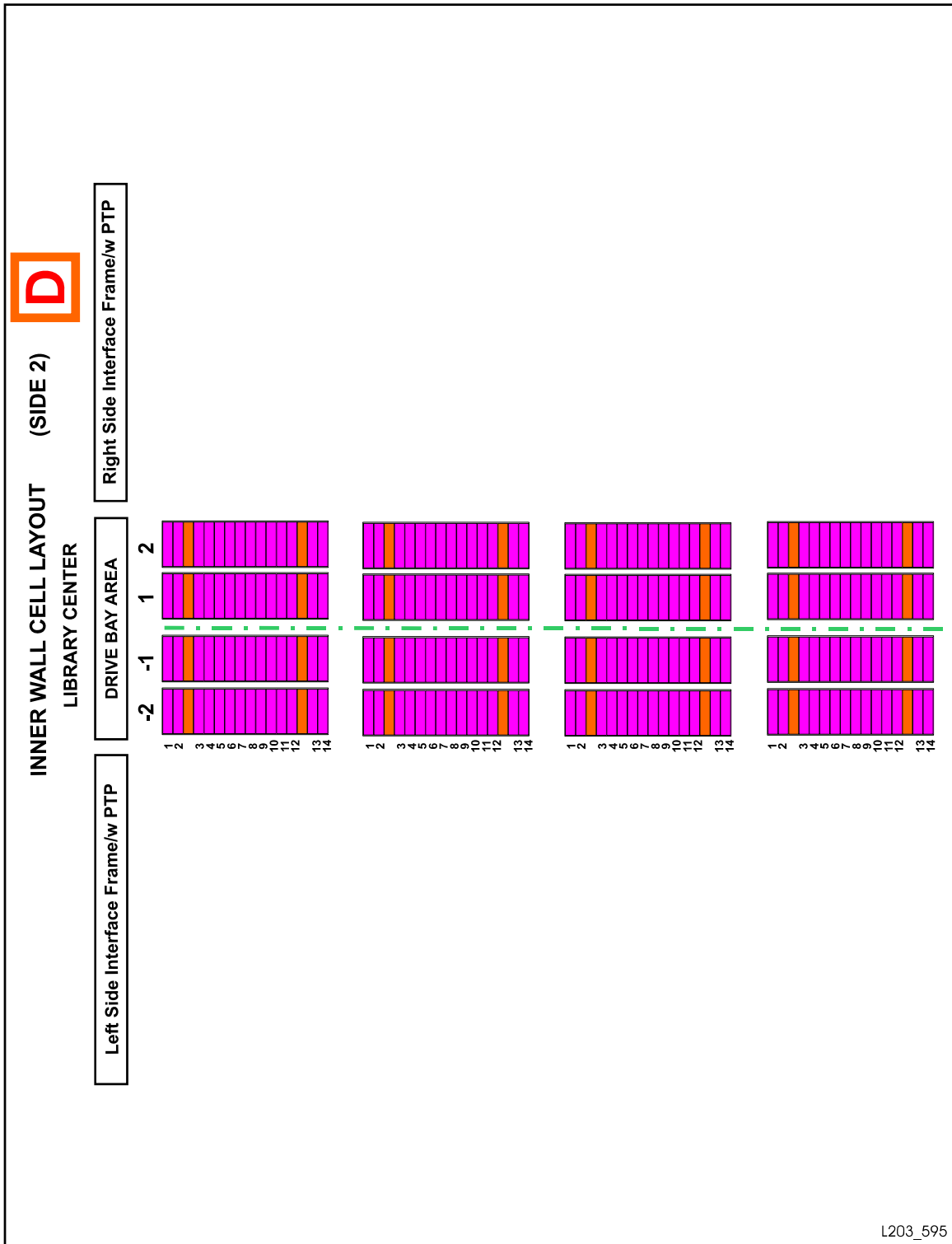
FIGURE A-7 Cartridge and Drive Locations – Internal Firmware (7 of 8)(L203_596)

L203_596

FIGURE 0-1 Cartridge and Drive Locations – Internal Firmware (8 of 8)(L203_597)

L203_597
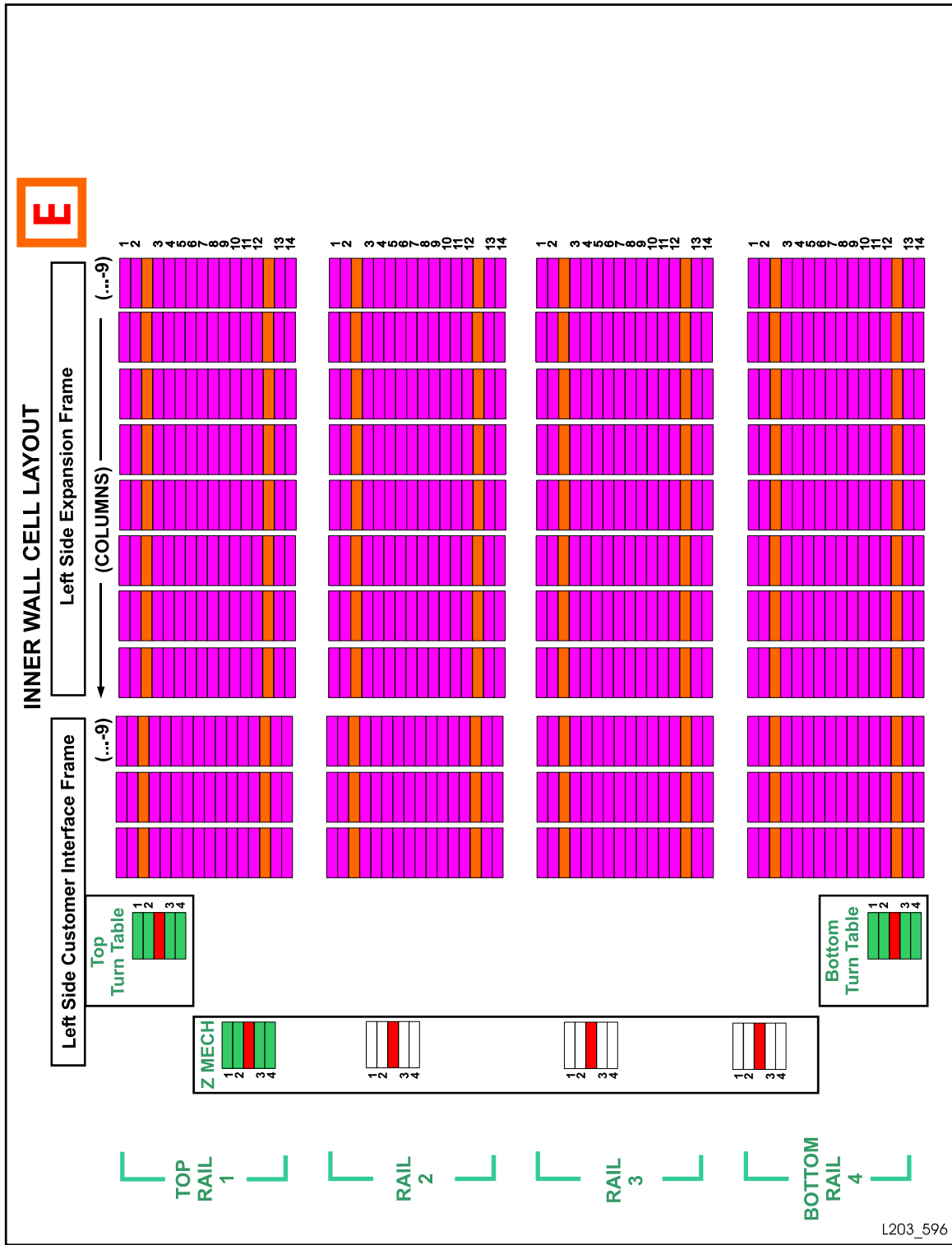
TABLE A-2   Cartridge Locations (1 of 3)

Left Outer Wall (1)											
Rail	**Row**	**Customer Module**			**Robotics Module**						**Left Drive Module**	
Columns												
		-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
Rail 1	Rows	1	1	1	1	1	6	1	1	1	1	1
		13	13	13	13	13	13	13	13	13	4	4
Rail 2	Rows	1	1	1	1	1	6	1	1	1	1	1
		13	13	13	13	13	13	13	13	13	4	4
Rail 3	Rows	1	1	1	1	1	6	1	1	1	1	1
		13	13	13	13	13	13	13	13	13	4	4
Rail 4	Rows	1	1	1	1	1	6	1	1	1	1	1
		13	13	13	13	13	13	13	13	13	4	4
Notes:												

Notes:

Negative numbering starts from the left, center column of drives within the drive module. If an expansion module is added, numbering will be consecutive, starting with column -9 for the expansion module.

Column -6 is a PTP area and therefore contains 8-cell arrays, numbered 6 – 13. Slot 6 is designated a drop-off slot.

If an storage expansion module is added, column numbering will be consecutive, starting from column -9.

TABLE A-3 Cartridge Locations (2 of 3)

Rail	Row	Right Drive Module		Robotics Module						Customer Module		
Right Outer Wall (1)												
		Columns										
		+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11
Rail 1	Rows	1 4	1 4	1 13	1 13	6 13	1 13	1 13	1 13	1 13	1 13	1 13
Rail 2	Rows	1 4	1 4	1 13	1 13	1 13	6 13	1 13	1 13	1 13	1 13	1 13
Rail 3	Rows	1 4	1 4	1 13	1 13	1 13	6 13	1 13	1 13	1 13	1 13	1 13
Rail 4	Rows	1 4	1 4	1 13	1 13	1 13	6 13	1 13	1 13	1 13	1 13	1 13

Notes:

The positive numbering starts from the right, center column of drives within the drive module. If an expansion module is added, numbering will be consecutive, starting from Column +9 for the next expansion module.

Column +6 is a PTP area and therefore contains 8-cell arrays, numbered 6 – 13. Slot 6 is designated a drop-off slot.

If an storage expansion module is added, column numbering will be consecutive, starting from Column +9.

TABLE A-4 Cartridge Locations (3 of 3)

		Inner Walls (2)									
Rail	**Row**	**Left Side (Customer Module)**			**Wall Opposite Drive Module**				**Right Side (Customer Module)**		
		Columns									
		-11	-10	-9	-2	-1	+1	+2	+9	+10	+11
Rail 1	Rows	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14
Rail 2	Rows	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14
Rail 3	Rows	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14
Rail 4	Rows	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14	1 14

Notes:

Inner walls begin their numbering from -9 on the left, and +9 on the right.

If a storage expansion module is added, column numbering will be consecutive, starting from column -3 on the left and +3 on the right.

Example One:

As viewed from the front of the library, cartridge location 1, 4, -3, 1, 13 would be the slot next to drive number one (lower left drive). Listing this location breaks down as follows:

1 = **L**ibrary number
4 = Bottom **r**ail
-3 = The first cartridge **c**olumn to the left of the drive bay area
1 = **S**ide number (*outer* wall)
13 = Bottom **r**ow, next to the bottom, left drive

Example Two:

Cartridge location 1, 1, 3, 1, 1 would be the slot next to drive number 61 (top, left drive):

1 = **L**ibrary number
1 = Top **r**ail
3 = The first cartridge **c**olumn to the right of the drive bay area
1 = **S**ide number (*outer* wall)
1 = Top **r**ow, opposite the top, right drive

HLI-PRC Address

HLI-PRC (Host LMU Interface - Panel, Row, Column) address is a four digit comma-separated value (L,P,R,C) representing LSM, Panel, Row, Column. This addressing scheme is used by HLI (Host LMU Interface) clients, including ACSLS and HSC, to represent library components accessible to those HLI clients.

The slot location appears in the following format:

	l	l	p	p	r	r	c	c	

where:

ll: LSM number (0-3)
pp: Panel
rr: Row in the panel
cc: Column in the row

See "Locating a Cartridge and Drive" on page 50 to locate a cartridge using the Library Console.

Although the library management software follows a five digit numbering scheme as that of the SL8500 address there are significant differences in slot designations, CAP behavior, and other operational considerations as described below (see also "PTP Addressing Scheme" on page 34).

Library Storage Module (LSM)

The SL8500 library has four rails on which robots travel. The host software considers each SL8500 rail as a separate LSM. From top to bottom, SL8500 rails are numbered from 1 - 4 while the host LSMs are numbered from 0 - 3. For example, SL8500 rail 1 is Host LSM 0.

TABLE A-5   Rail Numbering

Host	Internal Firmware
LSM 0	Rail 1
LSM 1	Rail 2
LSM 2	Rail 3
LSM 3	Rail 4

Panel Designations

- Panel 0 = cartridge access port (CAP)
- Panel 1 = drive panel
- The data cartridge slots start their numbering after the drive bay (Panel 1) forward.

Row

Within each LSM (rail) rows are numbered consecutively from the top down. These start with 1 for the SL8500 and 0 for host.

Column

SL8500 column numbers are referenced from the customer interface module, where +1 is right of the center of the drive bays and -1 is to the left of the drive bays. The host software reports two columns for each cell storage panel (column 0 and 1)

CAP

The CAP behavior controlled by host software is as follows:

- The CAPs service all the LSMs in the library.

- CAPs span across three LSMs (1-3).

- Each CAP has three magazines with 13 slots each. Each magazine is adjacent to a separate rail, and can only be accessed by robots on that rail. There is no adjacent section in the CAP for the top LSM (0), which requires pass-thru operations with the elevator.

- When loading cartridges in the CAP, slots can be skipped or magazines missing.

- There is no adjacent magazine section in the CAP for rail 1 (LSM 0), which requires pass-thru operations with the elevator.

- The CAP is treated as an independent component, and does not belong to any one rail.

Examples of CAP Behavior:

- A CAP can be online and operational even though the LSM (rail) identified in the CAP ID is offline or not operational.

- If an LSM is offline, the associated CAPs are not automatically offline.

- If an LSM is online, the associated CAP is not automatically placed online.

- Even if LSMs 1 through 3 are offline, CAPs can be used to enter/eject cartridges for LSM 0.

Elevators

Elevators are considered a type of pass-thru port. Each elevator has three logical pass-thru connections per rail. Each rail can pass-thru to the other three rails.

Operational Considerations

To optimize HandBot operations:

- Mount scratch tapes- selects cartridges based on the LSM (rail)
- Enter cartridges from the CAP to the closest LSM with free slots
- The software tries to enter the cartridge to an LSM (rail) adjacent to the CAP.
- The software also tries to eject the cartridge to the CAP adjacent to the LSM.

Note – When HandBot optimization is not possible by the host, the library controller manages the moving of cartridges using a pass-thru operation (elevator).

Drive Bay Locations

The SL8500 library features automatic detection of drives that are added or replaced.

There are four types of addressing schemes for drives:

- Bay address (the physical location)
- Internal address (assigned by the library firmware)
- HLI-PRC (Host LMU Interface - panel, row, column address assigned by the host software)
- System addresses (assigned by the operating system)

Bay Address

The drive bay address is a two-digit number (01-64) representing the physical locations into which drive tray assemblies are inserted. The bay number of a drive is strictly internal to the library, defined by a drive's position within a drive array. A drive is automatically assigned a number from 1– 64 by the library controller after the drive is installed and the library is re-initialized.

A decal on the rear of the Drive and Electronics Module depicts the bay numbers, as shown in TABLE B-1 on page 125. The bay numbers indicate the physical location of drives. You have to be familiar with the bay numbers to locate a drive to perform a manual mount (see "Manual Mode of Operation" on page 59).

TABLE B-1   Drive Bay Address

Rail Number	Drive Bay Assembly Number 4			
1	Drive 61	Drive 62	Drive 63	Drive 64
	Drive 57	Drive 58	Drive 59	Drive 60
	Drive 53	Drive 54	Drive 55	Drive 56
	Drive 49	Drive 50	Drive 51	Drive 52
Rail Number	Drive Bay Assembly Number 3			

TABLE B-1   Drive Bay Address (Continued)

2	Drive 45	Drive 46	Drive 47	Drive 48
	Drive 41	Drive 42	Drive 43	Drive 44
	Drive 37	Drive 38	Drive 39	Drive 40
	Drive 33	Drive 34	Drive 35	Drive 36
Rail Number	**Drive Bay Assembly Number 2**			
3	Drive 29	Drive 30	Drive 31	Drive 32
	Drive 25	Drive 26	Drive 27	Drive 28
	Drive 21	Drive 22	Drive 23	Drive 24
	Drive 17	Drive 18	Drive 19	Drive 20
Rail Number	**Drive Bay Assembly Number 1**			
4	Drive 13	Drive 14	Drive 15	Drive 16
	Drive 9	Drive 10	Drive 11	Drive 12
	Drive 5	Drive 6	Drive 7	Drive 8
	Drive 1	Drive 2	Drive 3	Drive 4

Note – sNumbers shown are referenced from the rear of the tape drive and electronics module.

Internal Address

The internal address is a five-digit comma-separated value (L,R,C,S,W) representing Library, Rail, Column, Side, Row, *viewed from inside the library facing the drive bays.* This addressing scheme is used by the firmware and internal communications to represent all devices and locations within the library.

Library number (within a library complex)

Rail number: Rails are numbered 1 through 4, rail 1 is the top rail

Column number: Columns, where +1 is right of the center of the drive bays and -1 is left of the center of the drive bays

Side number: Outer walls = 1, inner walls = 2 (all drives are side 1, the outer walls)

Row number: Numbered consecutively, from the top (1) down

Firmware numbering is listed in TABLE B-2.

TABLE B-2 Firmware Drive Address

Rail Number	Row Number	Drive Column -2 Drive Number	Drive Column -1 Drive Number	Drive Column 1 Drive Number	Drive Column 2 Drive Number
1	1	x, 1, -2, 1, 1	x, 1, -1, 1, 1	x, 1, 1, 1, 1	x, 1, 2, 1, 1
	2	x, 1, -2, 1, 2	x, 1, -1, 1, 2	x, 1, 1, 1, 2	x, 1, 2, 1, 2
	3	x, 1, -2, 1, 3	x, 1, -1, 1, 3	x, 1, 1, 1, 3	x, 1, 2, 1, 3
	4	x, 1, -2, 1, 4	x, 1, -1, 1, 4	x, 1, 1, 1, 4	x, 1, 2, 1, 4
2	1	x, 2, -2, 1,1	x, 2, -1, 1, 1	x, 2, 1, 1, 1	x, 2, 2, 1, 1
	2	x, 2, -2, 1, 2	x, 2, -1, 1, 2	x, 2, 1, 1, 2	x, 2, 2, 1, 2
	3	x, 2, -2, 1, 3	x, 2, -1, 1, 3	x, 2, 1, 1, 3	x, 2, 2, 1, 3
	4	x, 2, -2, 1, 4	x, 2, -1, 1, 4	x, 2, 1, 1, 4	x, 2, 2, 1, 4
3	1	x, 3, -2, 1, 1	x, 3, -1, 1, 1	x, 3, 1, 1, 1	x, 3, 2, 1, 1
	2	x, 3, -2, 1, 2	x, 3, -1, 1, 2	x, 3, 1, 1, 2	x, 3, 2, 1, 2
	3	x, 3, -2, 1, 3	x, 3, -1, 1, 3	x, 3, 1, 1, 3	x, 3, 2, 1, 3
	4	x, 3, -2, 1, 4	x, 3, -1, 1, 4	x, 3, 1, 1, 4	x, 3, 2, 1, 4
4	1	x, 4, -2, 1, 1	x, 4, -1, 1, 1	x, 4, 1, 1, 1	x, 4, 2, 1, 1
	2	x, 4, -2, 1, 2	x, 4, -1, 1, 2	x, 4, 1, 1, 2	x, 4, 2, 1, 2
	3	x, 4, -2, 1, 3	x, 4, -1, 1, 3	x, 4, 1, 1, 3	x, 4, 2, 1, 3
	4	x, 4, -2, 1, 4	x, 4, -1, 1, 4	x, 4, 1, 1, 4	x, 4, 2, 1, 4

Note – Perspective is from the *front* of the Customer Interface Module. "x" = library #

As examples:

■ Drive firmware number 1, 4, -2, 1, 4 is the bottom, left drive in rail 1, as viewed from inside *the library looking at the drive bays.*

■ Drive firmware number 1, 1, 2, 1, 1 is the top, right drive in rail 1, as viewed from inside *the library looking at the drive bays.*

HLI-PRC Address

The HLI-PRC addressing is a four-digit comma-separated value (L,P,R,C) representing Library, Panel, Row, and Column. The HLI (Host LMU Interface) clients (ACSLS, HSC) use this addressing scheme to represent library components accessible to the host.

The tape drives are associated with and belong to each LSM (numbered 0-3). Each LSM is assigned 16 drives (0-15). Panel 1 is designated as the drive panel. To mount a cartridge tape in a different LSM, the cartridge must go through an internal pass-thru port (the elevator) to the drive.

TABLE B-3 Host Software Drive Address

LSM Number	Host Software Number			
0	Drive 0	Drive 4	Drive 8	Drive 12
	Drive 1	Drive 5	Drive 9	Drive 13
	Drive 2	Drive 6	Drive 10	Drive 14
	Drive 3	Drive 7	Drive 11	Drive 15
1	Drive 0	Drive 4	Drive 8	Drive 12
	Drive 1	Drive 5	Drive 9	Drive 13
	Drive 2	Drive 6	Drive 10	Drive 14
	Drive 3	Drive 7	Drive 11	Drive 15
2	Drive 0	Drive 4	Drive 8	Drive 12
	Drive 1	Drive 5	Drive 9	Drive 13
	Drive 2	Drive 6	Drive 10	Drive 14
	Drive 3	Drive 7	Drive 11	Drive 15
3	Drive 0	Drive 4	Drive 8	Drive 12
	Drive 1	Drive 5	Drive 9	Drive 13
	Drive 2	Drive 6	Drive 10	Drive 14
	Drive 3	Drive 7	Drive 11	Drive 15

System Address

The operating system also assigns system addresses to drives. Because Fibre Channel is the operating mode for drives within a SL8500 library, you can minimize a network re-configuration resulting from the replacement of a defective drive by enabling dynamic World Wide Name (dWWN) through the library configuration process. See "Dynamic World Wide Name" on page 29. A system address, once assigned, is automatically re-assigned when a drive is replaced.

Manually Locating a Drive Bay

If you need to perform a manual mount to a drive, the Library Console provides mapping of the hardware, firmware, and software mapping for all the drives attached to a library.

▼ To locate a drive

1. **Logon to the Library Console.**

2. **Select Tools > System Detail.**

3. **From the device tree, select the Drive folder.**

Note – The device tree is the left panel that provides a list of devices attached to the library (drives, CAP, robots, elevator)

The status screen displays the SL8500 address, the corresponding drive bay, and the HLI-PRC addresses. For more information on the System Details module, see the online help documentation accessible through the Library Console application.

FIGURE B-1 Library Console (Drives Data)

SNMP

Simple Network Management Protocol (SNMP) is an application layer protocol that performs network management operations over an Ethernet connection using a User Datagram Protocol (UDP/IP).

The Simple Network Management Protocol allows:

■ Libraries to inform the systems administrator of potential problems.

Systems administrators to query the library for configuration, operation, and statistical information.

Systems administrators and network managers use SNMP to monitor and receive status from the library, such as:

■ Operational state of the library)

■ Plus many other variables defined in the database

Note – The SL8500 Library firmware must be version 3.00 or later to support SNMP. StreamLine Library Console software must be version 2.26.00 or higher to use the Transfer File feature that copies the Management Information Base (MIB) file to your PC.

FIGURE C-1 illustrates a simple network block diagram that identifies the locations of the SNMP software application. This figure also identifies the IP addresses, Ethernet connections, location of the Management Information Base (MIB) and the library controller (HBC card).

The SL8500 libraries support:

■ SNMPv2c of the simple network management protocol for machine status queries.

Note – Note: with this version, any information transmitted is not secure.

■ SNMPv3 of the simple network management protocol is reserved for proprietary information. Because this version supports encryption and stronger user identification it is the preferred protocol for proprietary data.

FIGURE C-1 SNMP Block Diagram Example
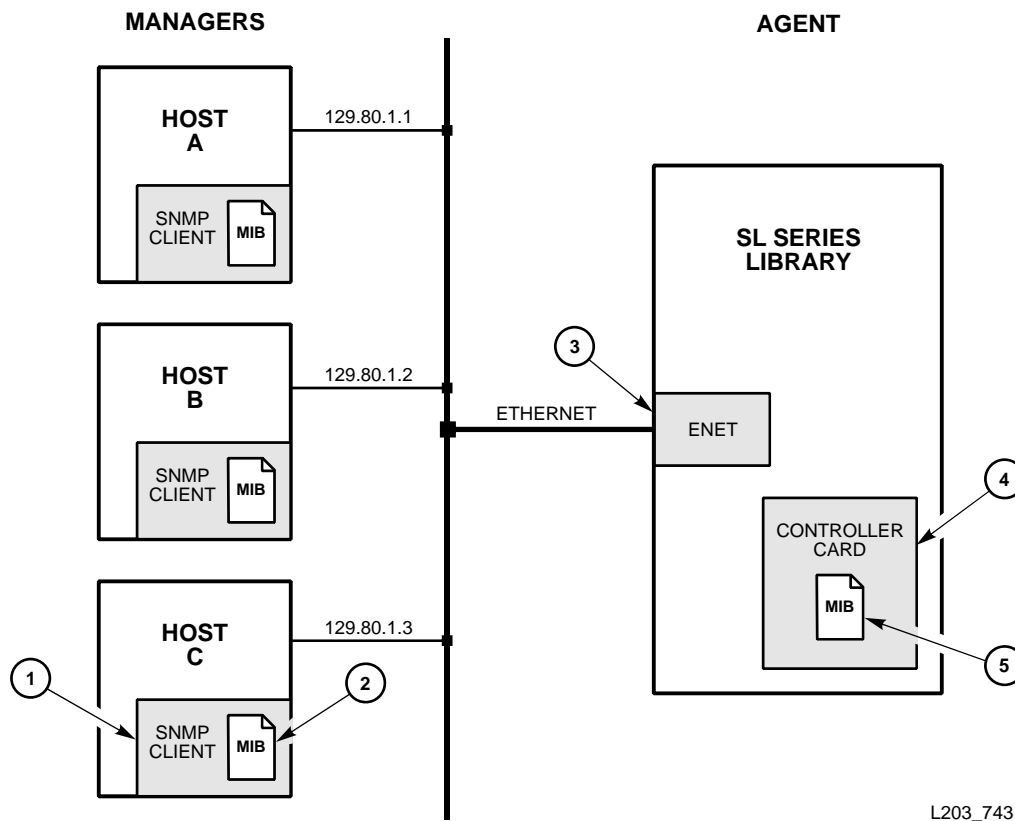
1. SNMP software application that implements the role of manager. Examples are Sun Microsystems SunNet Manager, HP OpenView and IBM NetView.
2. The Management Information Base (MIB), copied from the library controller card.
3. Ethernet connection (ENET) for the library (HBC card, port 2B—public port).
4. The SNMP agent is a process running on the library's controller card.
5. MIB data can be read by v2c users; read/*write* access is only available to v3 users (see "Access Control" on page 134). MIB data is read by the customer through the StreamLine Library Console (see "Copying the MIB Text File" on page 136).

> **Note –** By default, the SNMP agent is turned off and must be activated by a service representative through the Command Line Interface (CLI) port.

SNMP Terms

SNMP uses a manager/agent structure, a database, and a small set of commands to exchange information. SNMP terms include:

- **Advanced Encryption Standard (AES)—**An NIST-standard cryptographic cipher that uses a block length of 128 bits and key lengths of 128, 192, or 256 bits. AES uses the Rijndael algorithm, officially replacing the Triple DES Method. AES encryption can be done in one pass instead of three and its key size is greater than Triple Desís 168 bits. One of two privacy encryption protocols, AES is a stronger form of encryption than DES (see also "Data Encryption Standard"). (Source: The Internet Society, RFC 3664)

- **Agent—**A module that resides in a managed device. The agent is responsible for responding to requests from the manager and for sending *traps* to a recipient that inform the systems administrator of potential problems.

- **Community String—**Applications use community strings for access control. The manager includes the community string in its SNMP messages to an agent. The agent consequently can accept or reject the operation.

- **Data Encryption Standard (DES)—**An NIST-standard cryptographic cipher that uses a 56-bit key. DES has been replaced by AES as an official standard. DES is a symmetric block cipher that processes 64-bit blocks in four different modes of operation (electronic code book [ECB] being the most popular). Triple DES added security by providing several, multiplepass techniques. As an example, Triple DES encrypts with one key, decrypts the results with a different key, and then encrypts with a third. These extra passes add considerable time, DES, however, is still used for applications that do not require the strongest security. One of two privacy encryption protocols (see also ìAdvanced Encryption Standardî). (Source: The Internet Society, RFC 1829)

- **EngineID—**An administratively unique identifier of an SNMP v3 engine used for identification, not for addressing (Source: The Internet Society, RFC 3411). SNMP v3 authentication and encryption keys are generated based upon the associated passwords and the engine ID.

- **Host keyword—**Currently, the host keyword is limited to the machine's IP address (DNS is not available at this time). The maximum keyword length is 31 alphanumeric characters.

- **Managed device—**A device that hosts the services of an SNMP agent that provides monitored information and controlled operations using SNMP. SL8500 libraries are managed devices.

- **Management Information Base (MIB)—**A collection of information stored in a database that contains configuration and statistical information for a managed device. For SL8500 libraries, a copy of the MIB is loaded with microcode and stored on the processor card. See "Management Information Base" on page 135 for more information about the MIB.

- **Manager—**Provides the communication link between the systems administrator and the managed devices on the network. A manager station or server allows the systems administrator to get information about the device through the MIB and to receive traps from an agent.

- **Message Digest 5 (MD5)—**A popular one-hash function that is used to create a message digest for digital signatures. MD5 is faster than SHA, but is considered less secure (see also "Secure Hash Algorithm"). (Source: The Internet Society, RFC 1321)

- **Recipient—**A location on a manager where the SNMP agent sends traps. This location is defined by the combination of either the IP address or DNS name and the port number. The default recipient port number is 162.

- **Secure Hash Algorithm (SHA-1/SHA)—**A popular one-hash algorithm used to create digital signatures; it is more secure, but slightly slower than MD5 (see also "Message Digest 5"). (Source: The Internet Society, RFC 3174)

- **Trap/Notification—**A message that reports a problem, error, or significant event that occurred within the device.

- **Trap Level String—**The list of trap levels that will be filtered (see). The maximum length is 31 alphanumeric characters.

SNMP Commands

SNMP offers commands that follow a simple request/response exchange to communicate between the manager and the agent.

The *manager* issues request such as:

- **Get:** A request for information of a specific variable.

- **GetNext:** A request for the *next* specific variable.

- **Set:** A request to change the value of a specific variable.

- The *agent* responds with:

- **Get-Response:** A response to the manager's Get and GetNext commands.

- The *agent* sends out asynchronous events:

- **Trap:** An asynchronous message to the recipients about an event.

SNMP "walks" are also functional. Refer to the SNMP software documentation for additional information.

Access Control

Because community strings provide a form of access control in SNMP, StorageTek's embedded agent will not rely on the so-called "private" community string in order to accept changes to the library's configuration. The MIB can be viewed with v3/v2 get/getnext. The library properties can only be changed with the v3 set command.

Using an administrative password provides access control and authorization for Set operations. Consequently StorageTek's embedded agent uses only one community string for both Get and Set operations.

Traps however, can be sent to recipients using v2c/v3-based PDUs. Different community strings can be specified while adding entries to the Trap Recipient List.

Management Information Base

The MIB is a viewable document that contains descriptions about the characteristics for a managed device. These characteristics are the functional elements for that device which can be monitored using SNMP software.

Note – SL8500 libraries implement only MIB extensions defined in the SLSERIES-TAPE-LIBRARY-MIB under the **private (4)** section as shown in FIGURE C-2.

FIGURE C-2   Management Information Base Hierarchy

MIB Tree Root
Object Name = StreamLine-Tape-Library-MIB::streamlineTapeLibrary == 1.3.6.1.4.1.1.1211.1.15
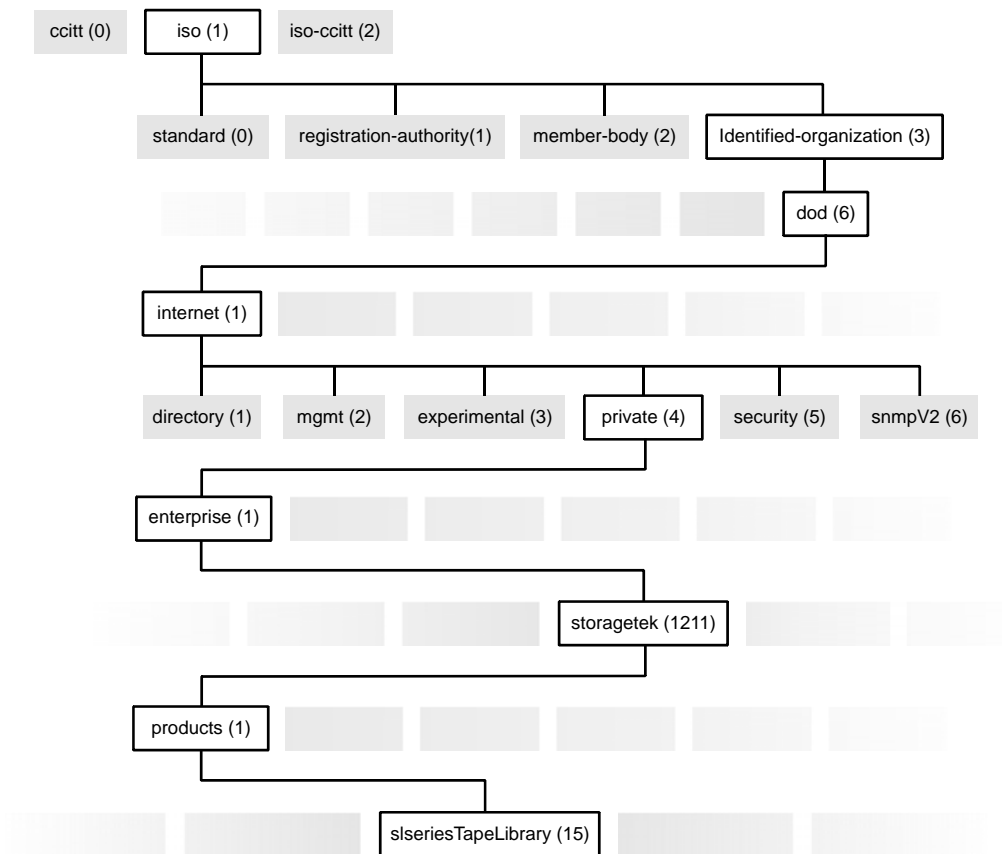
L203_742

Copying the MIB Text File

The MIB text resides within the library's controller card (HBC). Use the Library Console (2.26.00) or higher to copy the MIB text file to your PC.

▼ To copy the MIB file

1. Log on to the library using StreamLine Library Console.

2. Select **Tools** ⇒ Diagnostics.

3. Click the **TransferFile** tab.

4. Click the **Transfer** button next to "STREAMLINE_TAPE_LIBRARY_MIB_TEXT.text file."

5. In the Save dialog box, select a "Save in" folder.

6. Type in a file name.

7. Click **Save.**

SNMP Traps/Notifications

Your Service Representative will add users to the recipients list and configure the traps required to give them access to the information. Currently, this can be only be done through the CLI port, using the "service" logon.

Trap/Notification Levels

Trap or notification levels available at this time are listed in TABLE C-1. Trap levels are generally filtered to include only those traps that you wish to monitor. These levels are specified when entering the trap information.

TABLE C-1   Trap/Notification Levels

Trap Level	Number	Description
Error	1	Error/System Log entries
Warning	2	Warning Log entries
11	11	SNMP Agent Start Up

Trap Data

SNMP traps provide data that are derivations of SL8500 log entries, such as:

- Severity (such as error, warning, information; see TABLE C-2)
- Result codes (such as "0000 = success," "5010 = robot excessive posn error")

■ Activity string (such as "HLI move" or "CLI version print")

■ A descriptive text string

Other information may include:

■ Date and time

■ Device address associated with the event

■ User name associated with the activity (such as "HLI host," "advsrv")

■ The interface-specific request identifier (such as "HLI000001")

Severity Codes

SMNP Traps are grouped into three categories. These categories are listed in TABLE C-2. Other categories may be added in the future.

TABLE C-2   Trap Severity Codes

Group	Type	Summary	Description
1	Error	Errors critical to library operation. Provide all machine analysis information.	*Device inoperable:* refers to the entire system. Failure of a sub-unit or redundant component is not a Category "1."
2	Warning	Conditions that may require attention.	*Device degraded:* refers to recoverable failures that may allow the system to remain in use, but only in a degraded mode.
11	—	SNMP Agent Start Up	The SNMP Agent has started

Glossary

Numerics

2NA power configuration that gives the Product Name librsway full AC and DC power redundancy. This configuration allows AC line cords on two separate circuits, either of which can power the entire system. *See also* N+1.

A

access doorA door on either side of the front facade through which service personnel can enter the library. Optional CAPs are attached to the right access door.

accessory rack An area of the drive and electronics module that is used for Product Name library electronic and power equipment and for other standard 19-inch rack-mount electronic equipment. Up to four racks are permitted in the electronics/drive assembly. Rack-mount equipment must be on the approved equipment list.

ACSLS*See* Automated Cartridge System Library Software.

addressing schemes*See* the following:

- SL8500 address
- SL8500 drive bay
- HLI-PRC address

Any Cartridge Any Slot™ technology The StorageTek technology that allows seamless sharing of different media types and drives without hard partitions.

arrayA partitioned unit that holds multiple objects, such as cartridges or tape drive tray assemblies.

asynchronous (ASYNC) Not synchronized; not occurring at regular, predetermined intervals. Asynchronous transmissions send one data character at a time, at irregular intervals, rather than in one steady stream; a start bit and a stop bit notify the receiver when the transmission begins and ends. Contrast with synchronous.

audit*See* host audit and security audit.

**Automated Cartridge
System Library Software**
(ACSLS) Software that manages ACS library contents and controls ACS library hardware to mount and dismount cartridges on ACS drives.

automation bezelA tape drive attachment with a locator target for positioning gets and puts to the tape drive.

away library In a library complex of two or more libraries connected by PTPs, the library on the left side of home library (from the front of the libraries).

B

backplaneThe main circuit board inside electronic equipment that contains the central processing unit, the bus, memory sockets, expansion slots, and other components.

**bar-code line scan
camera**A component of the robot that is used for cartridge identification and position calibration.

blind mate connectorA connector that allows hot plugging instead of manually placing a cable between two fixed connectors.

bulk load Manually loading cartridges into the library, for example, during library installation.

C

cameraIn a StreamLine library, one of two types:

- The bar-code line scanner that is part of the robot hand assembly.
- The two LibCam monitoring cameras that display activity inside the library on the touch screen operator control panel.

CAP_See_ cartridge access port.

card_Synonymous with_ printed wire assembly (PWA).

cartridgeA container holding magnetic tape that can be processed without separating the tape from the container.

The library uses data, diagnostic, and cleaning cartridges. These cartridges are not interchangeable.

**cartridge access port
(CAP)**A device in the library that allows an operator to insert or remove cartridges during library operations.

Synonymous with import/export mail slot in SCSI and open system libraries.

See also unlocked.

cartridge array An array that holds multiple cartridges.

Product Name arrays contain 8, 13, or 14 slots, depending on their location.

cartridge bias Left or right justification of a cartridge within a storage slot, CAP, or tape drive.

cartridge mover *See* robot.

cartridge proximity detector A component that determines if a slot is empty or contains an unlabeled cartridge during a label reading error recovery procedure. *Synonymous with* empty slot detector.

CIM controller The module that houses the controls for the elevators, CAPs, turntables, and service safety door.

cleaning cartridge A cartridge that contains special material to clean the tape path in a tape drive.

CLI Command line interface.

cold swap Removal and replacement of a system component (typically one such as a logic board that has no redundant backup) after system operations have been stopped and system power has been disabled. *Contrast with* hot swap.

CompactPCI (cPCI®) Industry standard bus used for card-to-card bus expansion.

cPCI® *See* CompactPCI.

customer interface module The front module of the SL8500 library at which the customer has access to the touch screen operator panel and CAPs, and service personnel have access to the library and service bay.

D

data cartridge A term used to distinguish a cartridge onto which a tape drive may write data from a cartridge used for cleaning or diagnostic purposes.

diagnostic cartridge A data cartridge with a "DG" label that is used for diagnostic routines.

DLE Data link escape.

drive and electronics module The module in an Product Name library that contains the electronics control module, power distribution units (PDUs), power supplies, accessory racks and equipment, and tape drives for the library.

drive array assembly An array that is installed in the drive and electronics module for mounting tape drive tray assemblies. The drive and electronics module holds up to four array assemblies, and each array holds up to 16 tape drive tray assemblies.

drive bay A partitioned section of the drive array assembly that holds one tape drive tray assembly.

drop-off slots Slots used to hold a cartridge in the event of a robot failure that occurs while a cartridge is in the robot hand.

E

ECM *See* electronics control module.

electronics control module The assembly that:

- Processes commands from a host system
- Coordinates the activities of robots, elevators, pass-thru ports, and tape drives
- Monitors status inputs from sensors and switches

elevator The device that transports cartridges vertically, across rail boundaries.

emergency power-off (EPO) (1) A safety scheme that allows a "power down" of a subsystem or a system as a whole instead of powering it down component-by-component.

(2) A safety switch on a machine or in a data center that allows a user to immediately power down a machine or a data center power supply by cutting off the external source power.

See also Emergency Robotics Stop.

Emergency Robotics Stop A button on the customer interface module keypad that removes power to the robotics power grid, leaving the remaining library power on.

Enterprise Systems Connection (ESCON) A set of fiber-optic based products and services developed by IBM that allows devices within a storage environment to be dynamically configured. A channel-to-control unit I/O interface that uses optical cables as a transmission medium.

environmental monitors A collective term for the sensors that track temperatures, fan speeds, and the status of various other mechanism within a library.

EPO *See* emergency power-off.

ESCON *See* Enterprise Systems Connection.

Ethernet A local-area, packet-switched network technology. Originally designed for coaxial cable, it is now found running over shielded, twisted-pair cable. Ethernet is a 10- or 100-megabytes-per-second LAN.

export The action in which the library places a cartridge into the cartridge access port so that the operator can remove the cartridge from the library. *Synonymous with* eject.

F

failover The act of moving to a secondary or redundant path when the primary path fails.

FFC Flat flexible cable.

Fibre ChannelA bidirectional, full-duplex, point-to-point, serial data channel structured for high performance capacity. The Fibre Channel is an interconnection of multiple communication ports, called N_Ports. These N_Ports are interconnected by a switching network, called a fabric, to a point-to-point link, or an arbitrated loop. Fibre Channel is a generalized transport mechanism with no protocol of its own. A Fibre Channel does not have a native input/output command set, but can transport existing Upper Level Protocols (ULP) such as SCSI and IPI. Fibre Channel operates at speeds of up to 200 MB per second over distances of up to 100 m over copper media or up to 10 km over optical links.

fibre connection (FICON) An IBM S/390-based channel architecture that provides up to 256 channels in a single connection, each having a capacity of 100 MB per second.

FICON*See* fibre connection.

front facade The external portion of the customer interface module, between the access doors, that holds the:

- Membrane keypad
- Product logos
- Optional touch screen operator control panel

G

getAn activity in which a robot obtains a cartridge from a slot or tape drive.

gripper(1) The portion of the hand assembly that grasps the cartridge.

(2) The part of the hand assembly that grasps and holds a cartridge during transport.

H

hand assemblyA part of the library robot whose function is to grasp cartridges and move them between storage slots and drives. A bar-code line scan camera on the hand assembly reads cartridge volume labels.

HandBot™A high-performance small robot. Four or eight HandBots are used in an SL8500 library. *Contrast with* TallBot™.

The full name is StreamLine™ HandBot™ high-performance robotics.

HBZ module*See* CIM Controller.

HLI-PRC addressA four-digit, comma-separated value (L,P,R,C) that represents LSM, Panel, Row, and Column. This addressing scheme is used by host LMU interface (HLI) clients, including ACSLS and HSC, to represent library components accessible to those HLI clients.

home library In a library complex of two or more SL8500 libraries connected by PTPs, the library that supplies power and signals to the pass-thru port on its left side (as viewed from the front of the libraries). *See also* away library.

host audit The process of updating the cartridge VOLIDs and locations (collected by a security audit) in a host CDS. This audit is initiated by a host command.

Host Software Component (HSC)A host-resident software package that controls an automated cartridge system (ACS). After synchronizing with the target library (or libraries), HSC records cell status, allocates devices, and automates mount and dismount requests from the host.

hot swap Removal and replacement of a system component while system power remains on and system operations continue. *Contrast with* cold swap. *Contrast with* hot-pluggable.

Synonymous with online servicing.

hot-pluggable The capability that allows a service representative to replace FRUs while power to the FRU is maintained. This feature allows hardware maintenance actions and hardware upgrades to proceed without disrupting subsystem availability. *Contrast with* hot swap.

HSC*See* Host Software Component.

I

importThe process of placing a cartridge into the cartridge access port so that the library can insert it into a storage slot.

Synonymous with enter.

initial program load (IPL)(1) A process that activates a machine reset and loads system programs to prepare a computer system for operation. Processors having diagnostic programs activate these programs at initial program load execution. Devices running firmware usually reload the functional firmware from a diskette or disk drive at initial program load execution. *Synonymous with* initial microprogram load (IML). (from the GLS Glossary)

(2) The initialization procedure that activates a machine reset, initiates wake-up diagnostics (from EPROMs) and loads functional code. (from the GLS Glossary)

interlock switchA switch that disconnects power to library mechanisms, excluding tape drives, when the front door is opened.

IPL*See* initial program load.

J

JREJava runtime environment.

K

keypad interface *See* membrane keypad.

L

LibCam Monitoring A feature that provides two cameras, one for each aisle of the library, for viewing activity inside the library.

library camera *See* LibCam Monitoring.

library complex (1) Two or more Product Name libraries attached to each other with PTPs.

(2) Two Product Name libraries attached to each other with a pass-thru port assembly in which the library on the right (as viewed from the front of the libraries) is the home library and the library on the left is the away library for pass-through purposes.

library console *See* Streamline™ Library Console™.

library controller (LC) The HBC card within the Product Name library that controls operations and communicates with the operator panel.

library operator panel *See* touch screen operator control panel.

library partition A licensed features that allows SL8500 rails (LSMs) to be partitioned for exclusive use by separate hosts.

library storage module (LSM) A term used to identify each level of the SL8500, including the rail assembly, robotics, tape drives, power supplies, electronics modules, and accessory rack. The LSMs are numbered top-to-bottom, 0–3.

logical library A virtual representation of a physical library. *Synonymous with* virtual library partition.

M

magazine A removable array that holds cartridges and is placed into the cartridge access port (CAP).

Each SL8500 CAP holds up to three magazines, each of which holds up to 13 cartridges.

master (pass-thru port) The side of a pass-thru port (PTP) that contains the electronics that control the actions of the PTP. *See also* standby (pass-thru port).

membrane keypad A keypad mounted on the front facade used to monitor the status of the SL8500 library and to operate the CAPs.

N

N+1A power configuration that provides AC power and redundant DC power by adding a second DC power supply to each DC bus. *See also* 2N.

O

online replacement Replacement or service of a module while the library remains operational. The service person might be required to power off the module before removing or replacing it. *Synonymous with* hot swap.

operator panel*See* touch screen operator control panel.

P

pass-thru port (PTP)(1) A mechanism that enables a cartridge to pass through from one library to another in a multiple modular library complex.

(2) An assembly that connects two SL8500 libraries in which four pass-thru mechanisms (one for each LSM of the two libraries) can pass cartridges from one library to the other. Each PTP mechanism holds up to two cartridges.

PCIPeripheral component interconnect.

PDU*See* power distribution unit.

physical libraryA single Product Name library consisting of a customer interface module, a robotics interface module, and a drive and electronics module, with one to three storage expansion modules optional. *See also* logical library.

PLCPower line communications.

PLI*See* primary library interface.

power distribution unit (PDU)A device for the distribution of AC line power from one inlet to multiple outlets. Multiple PDUs provide higher availability because the power continues if one PDU (or its alternating current [AC] source if the PDUs use separate AC sources) loses power.

power gridA power circuit that minimizes power failures that cause the library to cease operations.

An Product Name library has five power grids, two for AC power and three for DC power.

power/communication bus railA rail that sits on the robot track to provide 48 VDC power and communication to the robot.

primary library interface
> **(PLI)** The communication path between the operator panel and the library controller (the HBC card). This consists of Ethernet with TCP/IP and XML.

> **PTP** *See* pass-thru port.

> **put** An activity in which a robot places a cartridge into a slot or drive.

> **PWA** Printed wiring assembly.

R

RaceTrack™ architecture The design and implementation of the SL8500 library's multiple high-performance robotics.

> **rail** That portion of the upper robot track assembly that provides power and communication to the robot.

> **rail assembly** The mechanism on which the robot travels between cartridge arrays and tape drives.

> **reach mechanism** A component of the robot that moves the gripper to get or put a cartridge at a designated location.

RealTime Growth™
> **capability** The capability to add pass-thru ports dynamically while the library is operating.

remote operator console The customer's operator panel that interfaces with the PLI. *See also* security software layer.

> **reserved slots** Cartridge slots that are used only for cleaning and diagnostic cartridges and as drop-off slots.

> **robot** A mechanism that moves horizontally along a track in the Product Name to transport cartridges to and from other locations in the library. *Also called* a HandBot or TallBot.

robotics interface
> **module** The module containing the curved rails and pass-through port (PTP) assemblies. *See also* StreamLine™ RaceTrack™.

S

security audit The process of reading and storing in Product Name library memory the VOLIDs and locations of all cartridges in the library. *See also* host audit.

security software layer
> **(SSL)** The communication path between the PLI and the remote operator console.

> **service area** An area between the access doors of the customer interface module and the service safety door in which an inoperable robot is stored for service and other mechanisms can be repaired or replaced.

service safety doorA motor-driven barrier that separates the service areas of the customer interface module from the rest of the library so that service personnel can safely repair or replace failed library mechanisms while the library continues normal operations. *Synonymous with* safety barrier.

servo power interrupt

A signal that removes voltage to a motor if overtravel is detected in the motor or a safety condition exists (for example, the main access door to the library storage module is open). When the sensor or switch is made, the drive current to the motor disables and an error posts. The SPI prevents a servo runaway condition for an out-of-range motor; it also prevents motors from starting up while the access door is open.

SL8500 See StreamLine™ SL8500 modular library system.

SL8500 addressA five-digit, comma-separated value (L,C,R,S,W) that represents Library, Rail, Column, Side, and Row. This addressing scheme is used by SL8500 firmware and internal communications to represent all devices and locations within the library.

SL8500 drive bayA two-digit integer
(01–64) that represents the physical locations into which drive tray assemblies are inserted.

slotThe location in the library in which a cartridge is stored. *Synonymous with* cell.

SMCSee Storage Management Component.

SPISee servo power interrupt.

SSiSystem server infrastructure.

standby (pass-thru port) The side of a pass-thru port (PTP) that operates in response to actions initiated by the master side of the PTP. *See also* master (pass-thru port).

storage cell See slot.

storage expansion

moduleAn optional module for the Product Name library that provides up to 1728 additional cartridge storage slots. Up to three modules can be attached to each SL8500 library.

Storage Management

Component (SMC) The software interface between IBM's OS/390 and z/OS operating systems and StorageTek real and virtual hardware. SMC performs the allocation processing, message handling, and SMS processing for the NCS solution. It resides on the MVS host system with HSC and/or MVS/CSC, and communicates with these products to determine policies, volume locations, and drive ownership. **SMC is a required NCS component.**

StreamLine™ Library

Console™The operator panel software application used for the StreamLine libraries.

StreamLine™

RaceTrack™The design and implementation of the SL8500 library's multiple high-performance robotics.

StreamLine™ RealTime

Growth™The capability to add pass-thru ports dynamically while the library is operating.

StreamLine™ SL8500

modular library system An automated tape library comprised of:

- Customer interface module
- Robotics interface module
- Drive and electronics module
- Storage expansion module (optional)

T

TallBot™A high-capacity tall robot. One or two TallBots are used in an SL8500 library. *Contrast with* HandBot™.

The full name is StreamLine™ TallBot™ high-capacity robotics.

tape drive An electromechanical device that moves magnetic tape and includes mechanisms for writing and reading data to and from the tape.

tape drive tray assembly The mechanical structure that houses a tape drive, fan assembly, power and logic cards, cables, and connectors for data and logic cables. *Synonymous with* drive tray assembly.

tape storage area The area in the Product Name library where cartridges are stored.

tape transport interface (TTI) An interface to control/monitor tape drive operation.

touch screen operator control panel An optional feature consisting of a flat-panel display with a touch screen interface and a panel mount computer. This feature is attached to the front facade.

trackThe horizontal path upon which a robot travels.

track drive mechanism The component that moves the robot along the track between the storage arrays, CAPs, and tape drives.

TTI*See* tape transport interface.

turntableA mechanism that transfers cartridges between the aisles within a single library.

U

UA standard unit of measurement of vertical space inside a rack-mount cabinet. One u equals 44.5 mm (1.75 in.).

UARTUniversal asynchronous receiver/transmitter.

unlockedIn the SL8500, status indicating that software has made a CAP available for operator use. An LED is lit when a CAP is unlocked.

V

vacancy plateA plate that covers an unused bay, such as a drive bay or power supply bay.

W

wrist(1) A mechanism in the robot assembly that allows the robot to access the outer and inner storage walls.

(2) A component of the hand assembly that rotates the hand horizontally.

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