Oracle® SL8500 StorageTek Modular Library System

Systems Assurance Guide

E24254-08

February 2013

ORACLE®

Oracle® StorageTek SL8500 Modular Library System, Systems Assurance Guide

E24254-08

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Preface

The system assurance process is the exchange of information among team members to ensure that no aspects of the sale, order, or installation of Oracle's StorageTek SL8500 Modular Library System are overlooked. This process promotes an error-free installation and contributes to the overall customer satisfaction.

This *Systems Assurance Guide* is intended for customers interested in purchasing an SL8500 library, account executives, marketing and sales representatives, system engineers, professional services, installation coordinators, service representatives, plus anyone interested in information about the SL8500 modular library system.

> **Note:** This guide is intended as an introduction and planning resource for the SL8500 Modular Library System. For detailed information about this product, refer to the SL8500 product documentation library on the Oracle Technical Network.

Terminology and Usage

The following terminology is used throughout this document and mean the same unless otherwise noted:

- SL8500 modular library system, SL8500 library, SL8500, or just "library"
- Media, cartridges, tape cartridges, volumes, tape volumes, or just "tapes"
- Tape drives, or just "drives"
- Rail (hardware) and library storage module or LSM (software)
- Slots (hardware) and cells (software)
- Library complex (hardware) and automated cartridge system ACS (software), an ACS can contain multiple libraries within a complex

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support.

For information, visit http://www.oracle.com/support/contact.html or http://www.oracle.com/accessibility/support.html if you are hearing impaired.

Obtaining Customer Documentation

The following procedure describes how you can obtain Oracle customer documentation relating to library and tape drive products from the Oracle Technical

Network (OTN). Documentation is separated into "Libraries" that are created for each product type.

To obtain documentation:

1. Point your Web browser to: http://www.oracle.com/technetwork/documentation/tape-storage-curr-187744.html
2. Bookmark this location. The page lists available document libraries by product family.
3. To view and download documents, scroll down to the section that lists the documents for the type of product that interests you.
4. Sections include Storage- and Library-Management Software, Tape Libraries, Tape Drives, Storage Encryption, Storage Virtualization, Archiving Systems, and Local Area Networking.
5. To view a list of documents contained within the table, click "View Library" in the "Link" column to the left of the "Product Description" column. Click any of the links on the library index to download the corresponding document.
6. To download a compressed archive file that contains the entire suite of documents, click the "Download" link.
7. The table below provides a summary of changes made to the document.

Summary of Changes

The table below provides a summary of changes made to the document.

Date	Revision	Description
May 2004	First (A)	Initial release
June 2004	Second (B)	Refer to this revision for the list of changes (artwork change)
July 2004	Third (C)	Refer to this revision for the list of changes (power updates)
October 2004	Fourth (D)	Refer to this revision for the list of changes (specifications)
May 2005	Fifth (E)	Refer to this revision for the list of changes (pass-thru port)
September 2005	Sixth (F)	Refer to this revision for the list of changes (handbots and drives)
March 2006	Seventh (G)	Refer to this revision for the list of changes (features)
September 2006	Eighth (H)	Refer to this revision for the list of changes (SPL, TCP/IP)
March 2007	Ninth (J)	Refer to this revision for the list of changes (SPL, Host connectivity)
January 2008	Tenth (K)	Refer to this revision for the list of changes.
January 2010	Eleventh (KA)	Refer to this revision for the list of changes.
May 2010	Twelfth (L)	Refer to this revision for the list of changes.
July 2011	01	Updated with engineering comments Updated marketing order numbers Assigned a new Oracle part number: E24254-XX
October 2011	02	Updated with engineering comments Updated information about Partitioning in an SL8500 library.
November 2011	03	Updated with engineering comments Updated information the Oracle Software Delivery Cloud. Where you can find downloads for all licensable Oracle products. Updated information about the One-Time Password (OTP).
March 2012	04	Updated with engineering and marketing comments. Updated to the Oracle template.
August 2012	05	Updated figures and outdated content with engineering and marketing comments. Major reorganization of content.
November 2012	06	Updated for new web camera. Updated with marketing comments.
December 2012	07	Updated with LTO6 support.

Date	Revision	Description
February 2013	08	Partial re-write for conversion to new template. Removed worksheets.

1
Introduction

Oracle's StorageTek SL8500 Modular Library System is a highly scalable, high-performance, high-density, high-availability enterprise storage solution that provides fully automated tape-cartridge storage and retrieval. It is ideal for long-term data retention, archive, backup, heterogeneous data consolidation, and mission-critical computing applications, particularly in high data growth environments and where multi-generational media support is essential.

This chapter provides an overview of the SL8500 library that outlines the major features, software options, and drive/media compatibility. Additionally, the overview lists the major components of each module type found in the library.

Note: This guide is intended as an introduction and planning resource. For detailed information, refer to the SL8500product documentation library on the Oracle Technical Network.

Features and Options

The SL8500 library features include:

- A modular design that provides flexibility in storage capacity from 1,448 to over 100,000 data cartridges
- The ability to grow in real time with Capacity on Demand
- Management of the library with standalone and web-launched versions of StorageTek Library Console (SL Console) software
- Support for multiple platforms and operating environments
- Optional host connectivity features
- Optional partitioning of the library
- Automatic handling of dynamic World Wide Name (dWWN) assignments through the operating firmware
- Activation of features through Hardware Activation Files

Software Options

There are several software components available depending on the platform, connection type, and operating system that support the SL8500 library for both mainframe and open system platforms.

The main options for library management software for the SL8500 library include:

- Enterprise Library Software (ELS)/Host Software Component (HSC) for mainframe
- Automated Cartridge System Library Software (ACSLS) for open systems

Additional software and storage system solutions include:

- Virtual Storage Manager (VSM)
- Library Content Manager (LCM) and Expert Library Reporter (ExPR)
- StorageTek Tape Analytics (STA)
- Independent Software Vendors (ISVs)

Tape Drive and Media Compatibility

The SL8500 library supports three types of media and tape drives:

- StorageTek T-Series (T9840 series, the T9940B, and T10000 series)
- Linear Tape-Open (LTO) generations 2, 3, 4, 5 and 6
- Super DLT (SDLT) drives (SDLT600, DLT-S4)

Library Overview

The figure below shows an example of the SL8500 library, which stands 2.37 m (7.76 ft) tall, 1.7 m (5.6 ft) wide, and from 2.76 m (9.1 ft) to 7.5 m (24.7 ft) deep.

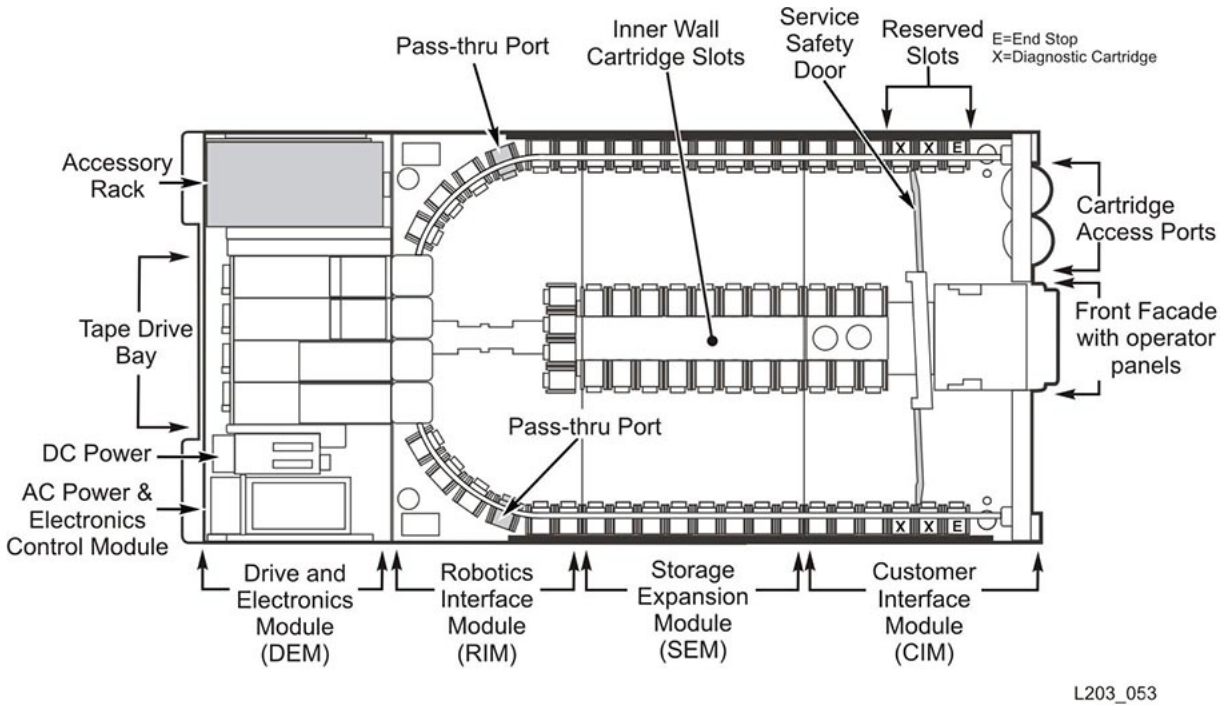
Figure 1–1 SL8500 Modular Library System

L205_212

The base library has slots for 1,448 cartridges. Depending on the model and features selected, one SL8500 library can store up to 10,088 tape cartridges with 64 tape drives. For additional capacity, multiple SL8500 libraries can be connected together to form a library complex. Currently, a library complex can consist of a maximum of ten SL8500 libraries. The libraries in a complex are connected together using pass-thru ports (PTPs) and can store over 100,000 customer usable data tape cartridges with up to 640 tape drives.

The figure below shows the modules and major components of an SL8500 library.

Figure 1–2 Library Modules



Customer Interface Module

The customer interface module is at the front of the library:

- Measures 95.25 cm (37.5 in.) deep

This module contains:

- 648 data cartridge slots, 198 slots for diagnostic and cleaning cartridges
- 24 end slots (eight 3-slot arrays) for targeting and drop-off cells
- One LED display and keypad
- Touch screen operator control panel
- Two load sharing DC power supplies
- One service safety door for maintenance activity
- One standard cartridge access port (CAP), the second CAP is optional
- Two elevator assemblies that transfer up to four cartridges between rails

Storage Expansion Modules (SEM)

There can be up to *five* storage expansion modules in a library. Each module:

- Measures 95.25 cm (37.5 in.) deep
- Contains 1,728 customer usable data cartridge slots

Robotics Interface Module (RIM)

The robotics interface module is between the DEM and CIM in a basic library or the DEM and a SEM in a library with additional storage.

- Measures 76.2 cm (30 in.) deep

This module contains:

- 800 data cartridge slots
- Pass-thru ports

Drive and Electronics Module (DEM)

The drive and electronics module is at the back the library:

- Measures 76.2 cm (30 in.) deep

This module contains:

- AC power distribution units
- Load Sharing DC Power Supplies
- Accessory Racks
- Electronics Control module
- Slots for 1 to 64 tape drives

2

Features, Software, and Connectivity

This chapter provides a description of the main features of the SL8500 library. It also provides a description of software and connectivity options. For more information on any of these topics, please refer to the product specific documentation library on the Oracle Technical Network.

For information about software version requirements, refer to Appendix A, "Software Requirements".

Hardware Activation Files

Certain SL8500 features are activated through an Oracle hardware activation file. This activation file is a digitally signed Java Archive (.jar) file containing a feature activation key.

Each feature purchased requires the installation of one hardware activation file. Installation of a new hardware activation file, adds the purchased feature to the features already activated on the library.

Capacities

The capacity for the SL8500 library uses Capacity on Demand and RealTime Growth to allow customers to instantly increase and activate capacity without disruption.

Slot upgrades provide the capability to increase the amount of activated capacity in the library (Capacity on Demand). RealTime Growth allows physical capacity to be pre-installed and then activated as needed.

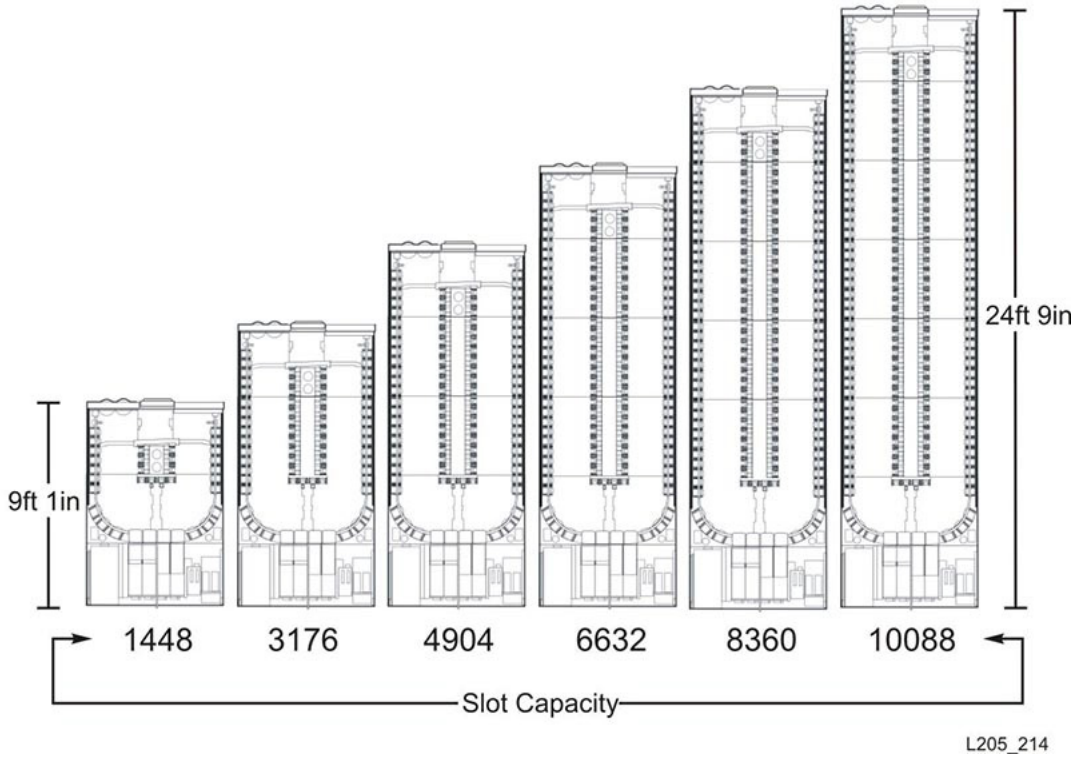
The SL8500 library delivers exceptional value in these ways:

- Scales non-disruptively at the customers pace, which allows the customer to pay only for current capacity needs with RealTime Growth capability and Capacity on Demand.
- Includes flexibility with the "Any Cartridge, Any Slot" capability, which allows customers to select any physical slots in the library as licensed slots.

Expansion Modules and Library Capacities

The figure below shows the physical capacity of the library as storage expansion modules (SEMs) are added. The libraries in the figure below range from no storage expansion modules on the left, to five storage expansion modules on the right. Each expansion module increases library physical capacity by 1,728 slots.

Figure 2–1 Expansion Modules and Physical Capacities



The table below lists the physical capacity of the library when SEMs are added.

Table 2–1 Physical Data Cartridge Capacity

Library Configuration	Cartridge Capacity
Base configuration	1,448
One SEM	3,176
Two SEMs	4,904
Three SEMs	6,632
Four SEMs	8,360
Five SEMs (maximum)	10,088

Reserved Slot Capacities

Reserved slots *cannot* be used for data cartridges. These slots are reserved for cleaning and diagnostic cartridges. The reserved slots are located in the customer interface module (CIM).

Table 2–2 Reserved Slots

Slots	Usage
198	Diagnostic cartridges
24	Eight 3-cell arrays intended for targeting, proximity sensing, and drop-off
8	Drop-off slot for the second HandBot

RealTime Growth

RealTime Growth offers:

- Advance installation of expansion modules
  - Install extra physical capacity during the initial install.
  - Pay to activate slots (capacity) when additional capacity become necessary, the physical capacity is already installed.
- Quick and easy growth
  - Non-disruptive growth in capacity
  - No physical library components required for growth
  - Eliminates many internal procedures

RealTime Growth also includes the capability to add pass-thru ports dynamically while the library is operating.

Capacity on Demand

Capacity on Demand is non-disruptive, allowing the customer to increase capacity within the library by activating previously installed, yet inactive slots. The SL8500 library offers capacity on demand with slot upgrades in 100, 250, 500, and 1000 slot increments.

Non-disruptive Capacity Changes

Changes to active capacity result in minimal disruptions to library operations. With HLI libraries, such as the SL8500 library, an increase in active capacity doesn't stop host jobs or cause host connections to go offline. When the capacity changes, the library is offline only momentarily and automatically comes back online.

Note: Although changes to active capacity are non-disruptive to current library hosts, it is recommended that you make the library unavailable to other user requests before committing the active storage region changes.

Partitioning

Library partitioning reserves specified library resources for the exclusive use of specified hosts. Up to 8 hosts can share a single SL8500library. For example, the customer can reserve one side of the library for an HSC mainframe host and the other for an ACSLS open-systems host. Alternatively, the customer may reserve the uppermost rail in the library for backing up their resource and development environment, the middle two rails for backing up financial transactions, and the remaining rails for backing up IT resources.

Important partitioning guidelines include:

- Library partitioning is an optional feature that is enabled through the hardware activation process.
- Partition boundaries can be as small as a single array of storage cells and one tape drive.

- Partitions support non-contiguous resource assignments. Partitions are set up using the StorageTek Library Console. CAPs and robotics are a shared library resource and are not assigned to specific partitions.
- Only a single library may be partitioned—pass-thru port (PTP) operations are not allowed.
- Hosts with a common database, such as HSC hosts using a common Control Data Set (CDS), can share a partition. These hosts are called a "host group."
- A single ACSLS server can manage multiple partitions in the same library. Each partition is configured as a separate automated cartridge system (ACS).

For more details about the partitioning feature, refer to the *SL8500 User's Guide*.

Networking and Communication

The SL8500 has several connectivity and network topology options.

Connectivity Options

There are several host connectivity options for the SL8500 library that offer flexibility and redundancy to support a variety of customer requirements. These connectivity options include:

- *Dual TCP/IP* provides two connections between a library or a library complex and an ACSLS or ELS/HSC host(s). Dual TCIP/IP avoids the single point of failure when there is only one connection between the library and the host
- *Multi TCP/IP* provides multiple connections between a library complex and an ACSLS or ELS/HSC host(s). In addition to redundancy in connectivity, this feature also helps reduce contention and improve performance of the library and tape drives.
- *Redundant Electronics (RE)* provides redundant library control and communications, and protects against failure should the active HBC/HBCR card fail or if communication to the card is lost.

For more information, see the *SL8500 Host Connectivity Guide*.

Communicating with Hosts

Host systems and tape libraries exchange two distinct kinds of information:

- Library command-and-control information: A library control application (StorageTek ACSLS or HSC) runs on the host and sends instructions that position robotics, mount and unmount volumes, clean drives, and query the status of components. The library returns the results of commands and queries to the software.
- User/application data: A data backup, archiving, or management application (NetBackup, Tivoli, SAM-QFS, etc.) runs on the host and transfers user and application data to and from file systems and tape media mounted on tape drives in the library.

In the SL8500library, commands and data travel over separate host interfaces, via a library control path and a data path.

Switched Fabric (FC-SW) Topology

In a switched fabric topology, all nodes on the storage area network connect to Fibre Channel switches that provide optimized, dynamic interconnections between nodes. When an SL8500library is connected to a Fibre Channel switch or fabric-capable host, it automatically configures itself for switched topology. This configuration can support up to 16 million ports on the fabric.

To configure library-attached drives on an SL8500library, you must use switched fabric topology.

Note: The SL8500 library *does not support* tape drives configured in arbitrated loops.

TCP/IP Network

The SL8500 library has a library controller card, the HBC/HBCR. This card is responsible for coordinating all component operations within the library and provides the interface between the host and the library. The HBC/HBCR card has two ethernet management ports: 2B (the primary) and 2A that connect to the customer network. Depending on the network configuration and the host connectivity features selected, one or both of these ports may be used.

Simple Network Management Protocol (SNMP)

The SL8500library can be managed remotely over a TCP/IP local area network through SNMP by:

- System administrators
- Standards-compliant management applications
- Customers using StorageTek Tape Analytics

For full information on configuring and using SNMP with the SL8500library, see the document *SL8500 Library: Simple Network Management Protocol*, available in the SL8500product documentation library on the Oracle Technical Network.

Host Library Management Software

Library management software controls the library hardware and manages the library database. When the library is operating in automated mode, cartridge mount and dismount operations occur without manual intervention. Using audit data uploaded from the library, the software:

- Tracks volume identifiers (vol-ids), attributes, and locations of cartridges
- Allocates drives and requests library operations, such as entering, mounting, dismounting, and ejecting cartridges

Oracle offers several library management software components for various combinations of platform, connection type, and operating system.

Mainframe: Enterprise Library Software (ELS)

Oracle's Enterprise Library Software (ELS) is a suite of software components that manage both tape libraries and virtual tape storage in a mainframe environment. The suite of software includes the following components:

Host Software Component (HSC) and Storage Management Component (SMC)

The Host Software Component (HSC) manages volume pools and communication with the SL8500 library. HSC resides on the host, but is transparent to the operating system. A separate component, the Storage Management Component (SMC), provides the interface between z/OS operating systems and HSC. SMC resides on all MVS hosts that perform tape processing with HSC.

HSC and SMC work together to:

- Influence allocations and determine policies, volume locations, and drive ownership
- Translate user requests into library commands
- Provide message handling

Virtual Tape Control System (VTCS)

Virtual Tape Control System is the host software that enables centralized management of StorageTek virtual tape libraries, such as VSM and VLE. VTCS manages:

- Virtual tape volumes and drives
- Migration and recall of virtual volumes
- Use of real tape cartridges and drives

Concurrent Disaster Recovery Test (CDRT)

The Concurrent Disaster REcovery Test (CDRT) is a feature integrated into the ELS suite. CDRT enables disaster recovery testing while the library or virtual storage is in use.

Open Systems: ACSLS

In open systems environments, the Automated Cartridge System Library Software (ACSLS) software package provides library management services such as cartridge tracking, pooling, reports, and library control.

ACSLS 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.

ACSLS functions as the standard in automated library management software for Open Systems environments and efficiently shares library resources with just about any application on almost any platform. ACSLS offers many advantages when managing a tape library environment:

- Processes multiple requests in parallel and optimizes use of large library complexes
- Avoids delays caused by pass-thru between robots
- Automatically recovers and retries requests that fail
- Allows multiple clients to share a library
- Simplifies support of new libraries and library features
- Presents logical libraries through ASCAPI or SCSI media changer interface over fibre
- Provides choice of interfaces

- Changes library configurations while libraries remain online
- Manages all libraries at a customer site from ACSLS
- Provides a high availability option

A major feature of ACSLS is the ability to manage any combination of Oracle's StorageTek libraries, including combinations of the SL8500, SL3000, SL500 and legacy libraries such as 9310. This provides access to the latest ACS technology and to applications across libraries.

Detailed information about ACSLS can be obtained in the ACSLS documentation library on the Oracle Technical Network.

Other Storage System Solutions

The SL8500 is compatible with several other Oracle products to provide a multifaceted storage solution. This list is not all inclusive, for more information visit the tape storage area of the Oracle corporate website.

Virtual Storage Manager (VSM)

Virtual Storage Manager (VSM) is a virtual tape system that optimizes the tape storage systems for mainframe platforms. VSM stores virtual tape volumes on a disk buffer called the Virtual Tape Storage Subsystem (VTSS). VSM then migrates (and stacks) the virtual tape volumes on the VTSS to real automated tape volumes that are mounted on real tape drives. The VTSS and virtual tape volumes allow VSM to optimize access time, throughput, and physical media and tape drive use.

The primary host software for VSM is the Virtual Tape Control System (VTCS). VTCS manages:

- Virtual tape volumes and drives
- Migration and recall of virtual volumes
- Use of real tape cartridges and drives

Overall, the VSM-type solutions consist of a server, disk storage, and front-end software, that complement the physical tape and library products. The server, disk, and software provide a buffer or cache between the operating systems and the tape drives for storage in a library.

Virtual Library Extension (VLE)

Virtual Library Extension (VLE) can be added to a VSM for additional capacity. VLE provides an economical second tier of disk storage that can be utilized to boost the overall VSM storage capacity or to use VSM as a tapeless virtual library.

Library Content Manager (LCM)

Library Content Manager (LCM) [formerly Expert Library Manager (ExLM)] manages Nearline and VSM resources. LCM optimizes overall performance by assuring there are adequate resources available for a scheduled job. LCM also includes LCM Explorer, a graphical user interface that allows a user to configure LCM by creating configuration files instead of parameter files.

Expert Performance Reporter

Expert Performance Reporter (ExPR) software collects performance data and generates reports about status and performance. It provides information on manual tape systems, as well as Nearline and VSM tape systems. ExPR has both an MVS component and a PC component.

Client System Component (CSC)

The client system component (MVS/CSC) allows SMC on MVS to use ACSLS as its library server.

LibraryStation

LibraryStation allows an open systems client to use HSC on MVS as its library server.

Extended High Performance Data Mover

Extended High Performance Data Mover (ExHPDM) is utility software that performs high-speed backup and restore of data sets by interleaving very large block sizes on high-speed, high-capacity tape devices.

ExHPDM achieves its speed by treating all data equally regardless of the type. Its only function is to move data from disk to very fast tape and back again.

ExHPDM's version of the best method to move data is to enable tape devices to move data at their maximum available speed:

- Using 256 Kilobyte (KB) blocks or chunks of data
- Interleaving the 256 KB blocks onto single or multiple tape volumes.

The ExHPDM software moves blocks of data in parallel from several concurrently executing MVS application programs. The data from the application programs is buffered into 256 KB tape block sizes in the application program's address space and the 256 KB blocks are interleaved onto single or multiple tape volumes.

StorageTek Tape Analytics

Oracle's StorageTek Tape Analytics (STA) is an intelligent monitoring application, available exclusively for StorageTek Modular Tape Libraries. It simplifies tape storage management and allows the customer to make informed decisions about future tape storage investments based on the current health of the tape storage environment.

STA allows the customer to monitor globally dispersed libraries from a single, browser-based user interface. The customer can manage open systems and mainframe, mixed-media, and mixed-drive environments across multiple library platforms.

STA allows the customer to increase the utilization and performance tape investments by performing detailed performance trending analyses. These analyses are based on a regularly updated database of library operations.

Independent Software Vendors

There are a variety of Independent Software Vendors (ISVs) that have tested their applications and support connection to the SL8500. For the most current versions and compatibility refer to the independent software vendor website and documentation.

Some independent software applications include:

- Quest NetVault 7.4+

- CA ArcServe 16+
- CA BrightStor 11.5
- HP Data Protector 5.5/6.0+
- Legato NetWorker 7.3/7.4/7.5+
- SAM FS 5.2
- Tivoli Storage Manager 5.5.+/6.+
- Symantec BackupExec 2012 and Netbackup 6.0/6.5/7+

On different platforms, such as:

- HP, HP-UX
- IBM AIX
- Linux, both Red Hat and Suse
- Microsoft Windows
- Solaris

Note: Not every application is tested on every platform or platform version.

StorageTek Library Console

The StorageTek Library Console (SL Console) is a standalone, Java-based or hosted, browser-based software application used to administer and monitor the SL8500 library. The SL Console can be accessed from the local operator panel, a stand-alone version on a PC or workstation, or through the Web-based SL Console to be installed on a centralized Web server and accessed through a browser. The table below lists the requirements for the stand alone version of SL Console.

Table 2–3 Stand Alone SL Console Requirements

Platform	Solaris 10.9 SPARC, Solaris 10.9 x86
	Windows Server 2003, Windows Server 2008 SP2: 64bit, Windows XP SP3: 32 bit or 64bit
	Windows Enterprise 7 SP1: 64 bit
	Oracle Unbrakable Linux 5
	SUSE Enterprise Linux 10.2
Other	Ethernet connection to the library

The table below lists the requirements for the web-based version of SL Console.

Table 2–4 Web-based SL Console Requirements

Platform	Windows XP: 32 or 64 (IE 7, Firefox 3.x), Windows7: 64 bit (IE 7, Firefox 3.x)
Other	Java 1.5 Plug-in (the browser will install this automatically if it is not present already).
	Ethernet connection to the Web-launched SL Console server.

The Web-launched SL Console is delivered to clients as a Java Web Start process, which executes outside the browser. The standalone SLC software is available for

download at the Oracle Software Delivery Cloud, found under Oracle StoageTek products and Generic Platform at: http://edelivery.oracle.com/

Note: Initializing StorageTek Library Console requires a one-time Administration password. A service representative must obtain this password for the customer.

The SL Console allows a customer or operator to:

- View and modify status and properties of the library and associated devices.
- Manage and configure library partitions (optional feature).
- Download new library firmware while the library is in operation.
- Locate a cartridge or move a cartridge from one location to another.
- Display library logs, error explanations, and context-sensitive help.
- Perform an audit on all or part of the library
- Perform a self-test on the library or an associated device
- Perform a diagnostic move (exercise a robot)

Command Line Interface (CLI)

Through the command line interface (CLI), Oracle support representatives can service the library using a serial connection to the CLI port on the HBC/HBCR library controller card. The **CLI** interface is reserved for authorized service personnel only, except for customers who use the StorageTek Tape Analytics (STA) server. For CLI commands related to the STA server, see the *StorageTek Tape Analytics Installation and Administration Guide*.

Firmware

SL8500 firmware resides on the HBC library controller card. The HBC/HBCR card can hold up to two firmware versions. When firmware is upgraded, the earlier image of remains in memory and may be restored if required.

The firmware supports automatic discovery of tape drives, automatic discovery of new cartridge slots and added libraries, and automatic handling of dynamic World Wide Name (dWWN) assignments.

Dynamic World Wide Name

The SL8500 library includes the dynamic World Wide Name (dWWN) feature, that, when enabled, assigns world wide names to the library drive slots rather than the drives themselves. When a dWWN-named device is replaced, it is assigned the same WWN as the one it replaced, preventing reconfiguration of the network.

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

With the dWWN feature enabled, tape drives do not appear to keep their original WWNs when they are migrated between libraries. A drive that was previously known

to the SAN under its own, drive-specific WWN will no longer be recognized. For this reason, the 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 SAN.

3

Hardware and Safety

This chapter outlines the major hardware components of the SL8500 library. Additionally, the library safety features are explained, along with the key safety regulatory agencies that the SL8500 library complies to.

Hardware and Components

This section covers the major hardware components of the SL8500 library.

Electronics Control Module

The electronics control module consist of two main controller cards:

- HBC/HBCR card—the library controller
- HBT card—the tape drive controller

An optional Redundant Electronics (RE) feature is available for failover protection should an SL8500 HBC/HBCR controller card fail. With the RE feature, each library uses two HBC/HBCR controller cards instead of one. If the library controller experiences errors, operations switch automatically to the stand-by library controller, with minimal disruption to library and host operations. The Redundant Electronics feature also provides minimal disruption of library operations during firmware upgrades. For more information about the RE feature, see the *SL8500 Host Connectivity Guide*.

HBC Card

The HBC card is the library controller, responsible for coordinating all component operations within the library.

This card provides the interface between the host and the library plus:

- Library-to-library LANs
- Tape drive service LAN
- Rail signal interfaces for HandBots
- Environmental monitoring circuits throughout the library

HBT Card

The HBT card is the tape drive controller, responsible for translating commands from the library controller (HBC card) into unique drive commands that are transferred across differential RS-422 cables to the tape drives (the TTI interface).

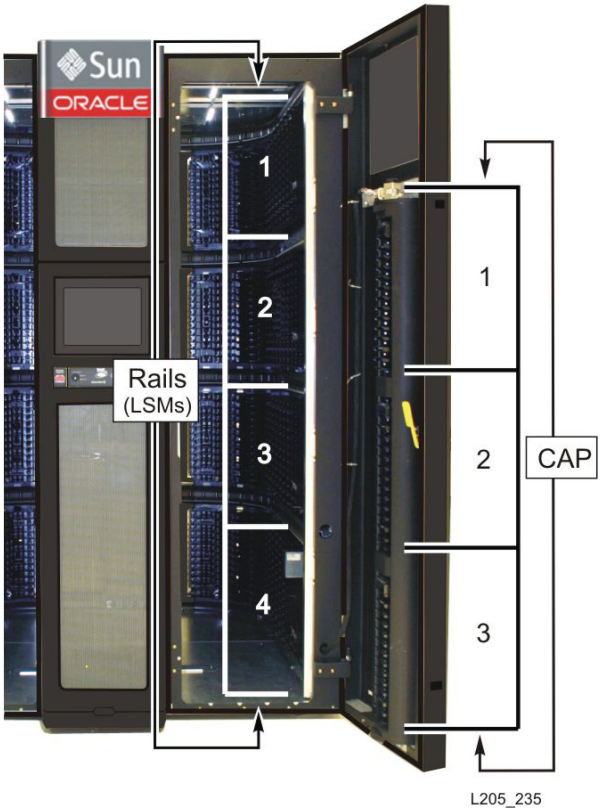
HBK Card

The HBK card contains a flash memory that stores information about the library configuration, passwords, and world wide name. Only one HBK card is required for the controllers. This card serves both control modules if the redundant electronics feature is installed. In the event that you need to replace the HBC controller card, having the information available on the HBK card prevents the need of a reconfiguration to restore the information to the control card.

Cartridge Access Ports

The library comes with one standard, 39-slot, cartridge access port (CAP A), and an option for an additional 39-slot cartridge access port (CAP B). Both CAPs are located on the right front access door to the library.

Figure 3–1 Internal View - Cartridge Access Ports (CAPs)



A CAP consists of 39 slots—three magazines with 13 slots each. A single CAP spans across three rails—2, 3, and 4. There is no adjacent CAP section for the top rail. Entering or ejecting cartridges from the top rail requires an elevator operation. There can be two CAPs, A and B.

- **CAP A** is on the left-side.
  - Comes standard with the library
  - Controls are on the left side of the keypad
- **CAP B** is on the right-side (*optional* feature).
  - Controls are on the right side of the keypad

CAP usage considerations include:

- When a CAP is in use for enter or eject operations, all 39 slots are reserved for that operation, the CAP cannot be subdivided.
- When loading cartridges in the CAP, slots can be skipped.
- Currently, the middle magazine cannot be missing if both the upper and lower or magazines are installed.
- If the HandBot adjacent to the CAP is inoperative, that portion of the CAP is inaccessible.

Slot Arrays and Cartridge Magazines

Cartridges within the library are held in slot arrays that line the inner and outer walls of the library. The library has two types of walls with slot arrays that hold cartridges:

- Inner walls—consist of 14-slot arrays
- Outer walls—consist of 13-slot arrays with space for the robotic rails

Additionally, each CAP in the library can hold three 13-slot magazines.

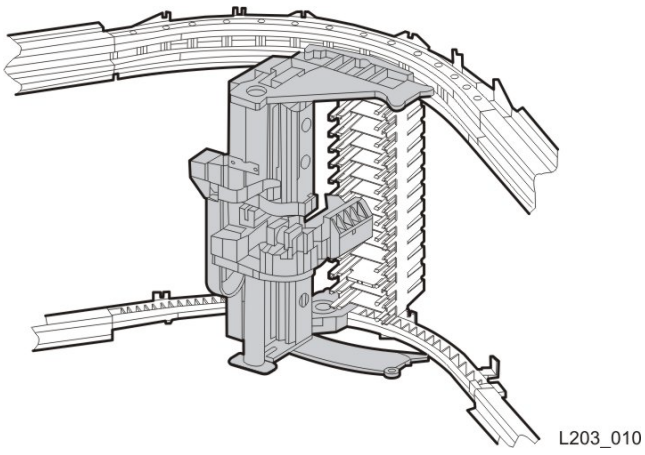
Each slot array has *two targets* centered vertically with allowances that accommodate the different sizes and depths of the tape cartridges. Cartridges are placed in slots and lie flat, hub-side down, parallel to the floor. To prevent slippage, cartridges are held within their slots by retainer clips.

Robotic Rail Assemblies

The figure below shows an example of the HandBot and rail assembly in the SL8500.

- Each SL8500 library has four separate robotic rail assemblies. The rail assemblies provide both power and communication signals the robotics system residing on the rail.
- The robotic systems in the SL8500 library are called HandBots. Each HandBot can service up to 16 tape drives and all of the tape cartridges on a rail (LSM).
- The four rail assemblies can pass tape cartridges to another rail using the two elevators within the library. These elevators perform an internal pass-thru port operation that allows any tape cartridge to have access to any tape drive in the SL8500 library and within an SL8500 library complex.

Figure 3–2 HandBot and Rail Assembly



There are two HandBot configurations: four HandBots (one per rail) or eight HandBots (two per rail).

A HandBot assembly consists of:

- Rail and brush assemblies
- Z-mechanism for vertical motion of the hand
- Wrist-mechanism for horizontal motion
- Digital vision system for targeting
- Barcode scanner for reading volume IDs (VOLID) cartridge labels
- Proximity sensor for detecting empty cells
- Worm-drive gripper mechanism for gripping the *sides* of the cartridges

To optimize system performance, the HandBots automatically implement the *Fast Load* capability. Once a HandBot successfully inserts a tape 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.

Elevators

An elevator moves cartridges *vertically* between rails. The library comes with two 4-slot elevators in the front of the library, one elevator on each side of the facade.

Elevators provide vertical cartridge movement between rails within the same library. Each of the four rails share the resources of the two elevators. Both elevators are located in the front of the library between the front access doors and the Service Safety Door.

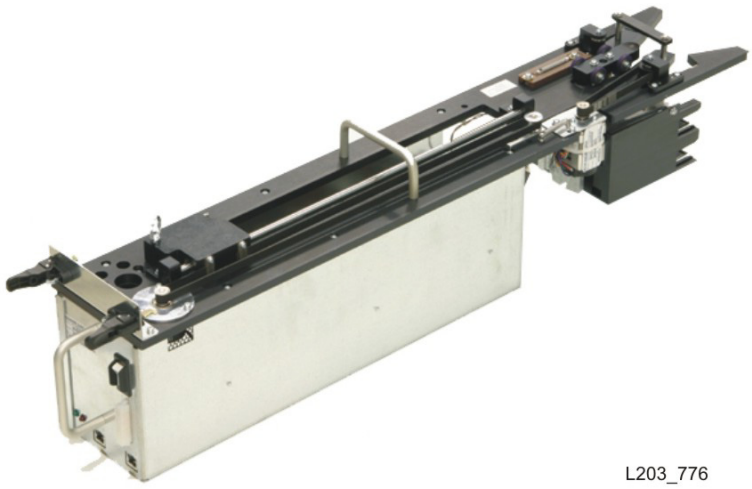
Figure 3–3 Elevator

Pass-thru Ports

A pass-thru port moves cartridges *horizontally* between libraries. A pass-thru port (PTP) is an electro-mechanical device that allows one library storage module (LSM) to pass a cartridge to another LSM in the same SL8500 Library Complex.

The figure below is an example of a pass-thru port mechanism.

Figure 3–4 Pass-thru Port Mechanism



The SL8500 pass-thru port feature consists of a separate frame that is installed at the rear of the library between two adjacent libraries.

Each PTP frame has four separate PTP mechanisms that can pass up to two cartridges per LSM/rail between the libraries. The PTP frames can be placed on both sides of the library, resulting in up to eight PTP locations, two per rail (or LSM). These locations are on the curved portions of the Robotics Interface Module near the tape drives.

The need to plan ahead for the addition of pass-thru ports is *extremely important*. The library complex can "grow" in either direction, left or right. The preferred method of installing PTPs to an existing library is to add the new library to the left (when viewed from the CAP-side). See "Pass-thru Port Planning" on page 6-13 for more information.

All SL8500 libraries come equipped and ready for the addition of the PTP frame and feature—no additional walls are needed. Both ACSLS and HSC support pass-thru port operations—no additional software is needed. Existing libraries can remain operational while attaching the PTP frame during the installation of an adjacent library.

Power for the PTPs comes from the same +48 VDC power bus as the robotic rails. Both the N+1 and 2N power configurations currently support the PTP hardware, no additional power supplies are needed.

If service is required, the pass-thru port mechanism slides out of the frame from the rear of the library—not affecting library operations.

Library Cameras

Oracle's StorageTek SL8500 library has a camera system (WebCam) with monitoring software. This feature allows a customer to remotely see the inside of the SL8500 library, which is especially important for those customers who have remote and

lights-out data centers. There are two cameras that mount in the upper frame of the front access door, one on each side of the library. The library camera uses third party monitoring software.

The WebCam feature attaches to a 10Base-T, 100Base-TX Ethernet connection and provides remote, high-quality, audio and video.

Figure 3–5 Library Camera

The following table lists details about the library camera:

OS Compatibility	Windows 7, Vista, XP SP3
Minimum Browser Requirements	Windows Explorer 6.0 SP3
Dimensions	Depth: 74mm (2.9 in.); Width: 100mm (3.9 in.); Height: 100mm (3.9 in.) Weight: 345 g (12.2 oz or 0.76 lb)
Connectivity	Ethernet 10Base-T/100Base-TX
Camera	¼ MOS color sensor, 1.3 megapixels Min illumination: 0.6 lx color, 0.5 lx black/white
Video	Max resolution: 1280x960 at 30fps; 8x Digital Zoom H.264 digital video format; NTSC video format
Audio	Built-in microphone, two way audio capable

Accessory Racks

The SL8500 library provides space where up to four standard RETMA (Radio Electronics Television Manufacturers Association) 19 inch racks can be installed. These racks are oriented so the components mount vertically instead of horizontally and can hold up to 6U (one U =4.4 cm (1.75 in.)) of equipment, such as switches, hubs, and servers.

There is a six connector PDU that provides 4 amps of AC power for each rack. Two cooling fans provide additional air flow for the installed equipment.

Because of the numerous types of equipment, Oracle cannot mandate what the customer installs in these racks. Therefore, certain guidelines should be followed to

prevent voiding the warranty. The table below lists the guidelines that should be followed when installing equipment in the accessory racks.

Table 3–1 Accessory Rack Installation Guidelines

Guideline	Details
Equipment weight	The accessory rack itself is mounted on slides rated for 80 kg (175 lb). The recommended safe load is 64 kg (140 lb).
Rack mounting	Components must be able to function in a vertical orientation. Heavy components (such as Fibre Channel switches) must have threaded holes in the sides to attach rack slides. Light weight components (such as Ethernet switches) may be mounted with a bracket.
Thermal requirements	Maximum power dissipation is 880 watts (3,000 Btu/hr) per rack module.
Air flow	Generally from non-port end to port end of component. Side to side air flow is acceptable. Maximum Volume per 6u rack module is 241 scfm (standard cubic feet per minute) at 0 inches of water static pressure to a minimum of 0 scfm at 0.60 inches of water static pressure depending upon the devices and equipment installed blocking the fan air flow.
Power cord	Power plug to connect to the rack PDU is: IEC320 C13 shrouded male plug. Minimum cord length is component length plus 46 cm (18 in.) for a service loop.
Regulatory agency compliance	Minimum requirements are: Safety –UL or CSA certification and Electromagnetic –Class A certification from agencies such as the FCC or BSMI.
Dimensional restrictions	Rack module depth is 72 cm (28 in.) Recommended safe length is 66 cm (26 in.)
Maximum power consumption	Per rack module is 4 Amps (maximum) Per outlet strip is 200–240 VAC, 50 to 60 Hz

The accessory rack has the following power characteristics:

- Two of the racks (2 and 4) receive power from the primary AC power grid.
- The other two racks (1 and 3) require the 2N power configuration.
- When you lose power to a PDU, you also lose power to the associated racks.

Operator Panels

The SL8500 library has three options operators can use to access the library:

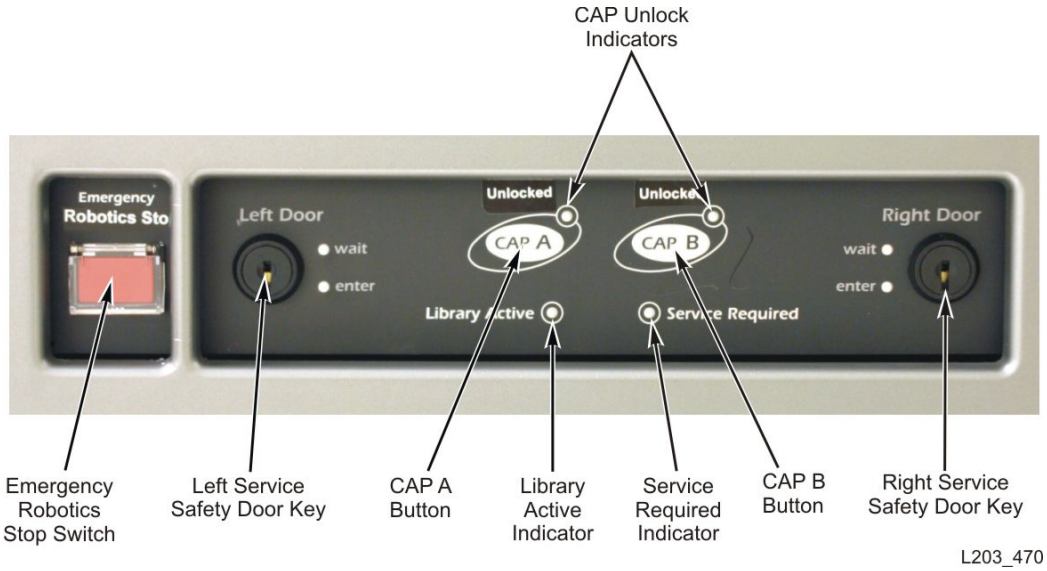
- Keypad
- Remote operator panel
- Touch screen operator panel

Keypad

The library includes a keypad that has two buttons, eight LEDs, two locks, and a safety stop button.

- The two buttons open and close the CAPs.
- The eight LEDs indicate library activity and status.
- The two safety locks allow the service representatives to place the library in maintenance mode.
- The red safety button cuts power to the robots in the library.

Figure 3–6 Keypad



Remote Operator Panel

A remote operator panel is a standard feature that displays operator functions on a personal computer (PC) that is running the Library Console. Library console is a software application that the customer can use to monitor and operate the library.

Software requirements are described in "StorageTek Library Console" on page 31.

Touch Screen Operator Control Panel

The touch screen operator control panel mounts on the front of the library. The panel consists of a flat screen display, with a touch-screen interface, and a panel-mounted personal computer. Through this panel, all of the library instructions, diagnostics, library status, library and drive monitoring and functional information can be accessed.

The operator panel consists of:

- Library Console software
- 12-inch flat screen display (diagonal measurement)
- Touch screen interface (no mouse or keypad necessary)
- 20 GB hard drive
- 512 MB memory and 32 MB RAM
- Java applet as the graphical user interface (GUI).

Figure 3–7 Touch Screen Operator Panel

L205_254

Service Safety Door

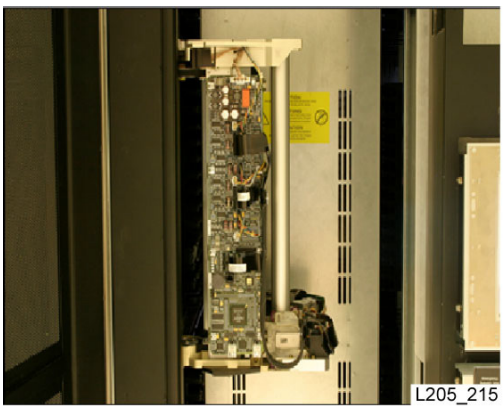
The service safety door is a sliding door that moves either to the left or right, depending upon which maintenance lock is opened. The safety door allows maintenance to be performed at the front of the library without shutting down power to the entire library.

The service safety door has a service mode, used by a service representative while performing library maintenance. When the maintenance key is inserted into its lock and turned, the safety door separates the forward maintenance area from the library interior.

This feature allows the service representative to safely replace a failing front frame component, such as a HandBot, CAP, or elevator, while the library remains fully operational.

Note: Service mode is not permitted by an operator. Only qualified service representatives with a service mode key can initiate service.

Figure 3–8 Service Safety Door



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Safety Features

The SL8500 library has a combination of safety features to ensure safe operation of the library.

Emergency Robotics Stop

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.

The library has two ERS switches:

- One interior lighted switch on the left side of the drive bay area
- One non-illuminated, covered switch, on the front panel

> **Note:** 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.

Figure 3–9 Emergency Robotics Stop Button

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.

Smoke Detection

In the event of smoke in or around the library, a photo-electric smoke detector mounted in the upper right section of the Drive and Electronics Module, removes all power from the library. Power is restored to the library by resetting the AC circuit breakers.

Service Mode

Service mode is a method that qualified service representatives can use to access the front service area of the library while the library remains operational. This allows the service representative to perform such operations as HandBot replacement, elevator or turntable motor replacement, or CAP replacement.

Note: This mode is not permitted by an operator. Only qualified service representative with a service mode key can initiate service.

Interlocks

The library features two types of safety interlocks:

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

Mechanical Access Door Mechanism

On the rear section of each door lock, a mechanism is available to mechanically release the door lock from the inside. This is a non-electrical safeguard against someone being locked inside the library. Should an access door be shut and locked from the outside, someone inside the library can push on the mechanism to unlock and open the door.

Service Safety Door

The 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.

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.

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 offers fire suppression systems which are installed on site. See "Fire Suppression Planning" on page 6-16 for more information.

Regulatory Agencies

The following regulatory agencies have tested and certified the SL8500 library.

Safety

The safety regulatory agencies include:

- Underwriters Laboratories Inc. (UL) - in compliance with UL 60950-1; First Edition, Standard for Information Technology Equipment - Safety; Part 1: General Requirements.
- Canadian Standards Association (CSA) - in compliance with CAN/CSA-C22.2 No. 60950-1-03 First Edition, Standard for Information Technology Equipment - Safety - Part 1: General Requirements.
- TUV Rheinland (TUV) - in compliance with EN 60950-1 (IEC 60950-1:2001, modified), Standard for Information Technology Equipment - Safety - Part 1: General Requirements.
- CB Scheme - in compliance to international Certified Body Scheme requirements with all national deviations by TUV Rheinland.

Electromagnetic

Configuration used for verification and compliance is an SL8500 Modular Library with a TCP/IP connection and 4 to 64 tape drives:

- Federal Communications Commission (FCC) –in compliance to the requirements of FCC 47, Part15, Subpart B and Unintentional Radiators Class A.
- Voluntary Control Council for Interference (VCCI) (Japan) –in compliance to VCCI Class A (Cispr22).
- Australia/New Zealand (C-Tick Mark) –in compliance to requirements of the Australia/New Zealand EMC Framework AS/NZS 3548: 1995 Class A.
- European Community (CE Mark) –in compliance to the requirements of Electromagnetic Compatibility Directive 89/336 (including all amendments).
- Canadian Emissions (ICES) –in compliance to the requirements of Canada's Interference Causing Equipment Standard ICES-003 Class A.
- Taiwan (BSMI) –in compliance to the requirements of Taiwan's requirements, CNS13438 Class A.
- Korea –in compliance to the requirements of Korean EMC Law.

Fiber-optic

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.

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 text 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
```

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
```

Shock, Vibration, and Impact Tests

The SL8500 library successfully completed all shock, vibration and impact tests required in Engineering Design Standard 6-1 (EDS 6-1) Environmental Requirements for StorageTek Products.

4

Power

The SL8500 library has specific power specifications and requirements.

Power Calculator

The intent of the power calculator is to provide guidance for estimating the electrical and heat loads for typical operating conditions and selected configurations.

- The power calculator can be found at: http://www.oracle.com/us/products/servers-storage/storage/tape-storage/sl8500-modular-library-system/overview/index.html.

  Click on the link for the Power Calculator.

- Customers may also go to: http://www.oracle.com/us/products/servers-storage/sun-power-calculators/index.html

  Search for the StorageTek SL8500 Modular Library System under the tape libraries section.

Power Usage

The table below lists the power specifications for the SL8500 library and tape drives.

Table 4–1 SL8500 Power Specifications

Component	Quantity	Idle Watts	Maximum Continuous Watts
Base Library	1	212	320
Dual Robotics (8 Handbots)	1	112	220
Redundant Electronics	1	100	100
Pass-thru Ports	Each	20	22
Rack Space	Each	--	720
T9x40 Tape Drive	Each	93	140
T10000 Tape Drive	Each	53	98
LTO Tape Drive	Each	28	43
SDLT Tape Drive	Each	44	67

Internal Power Configurations

The SL8500 library has two internal power configurations: N+1 or 2N (*optional*).

N+1 Power Configuration

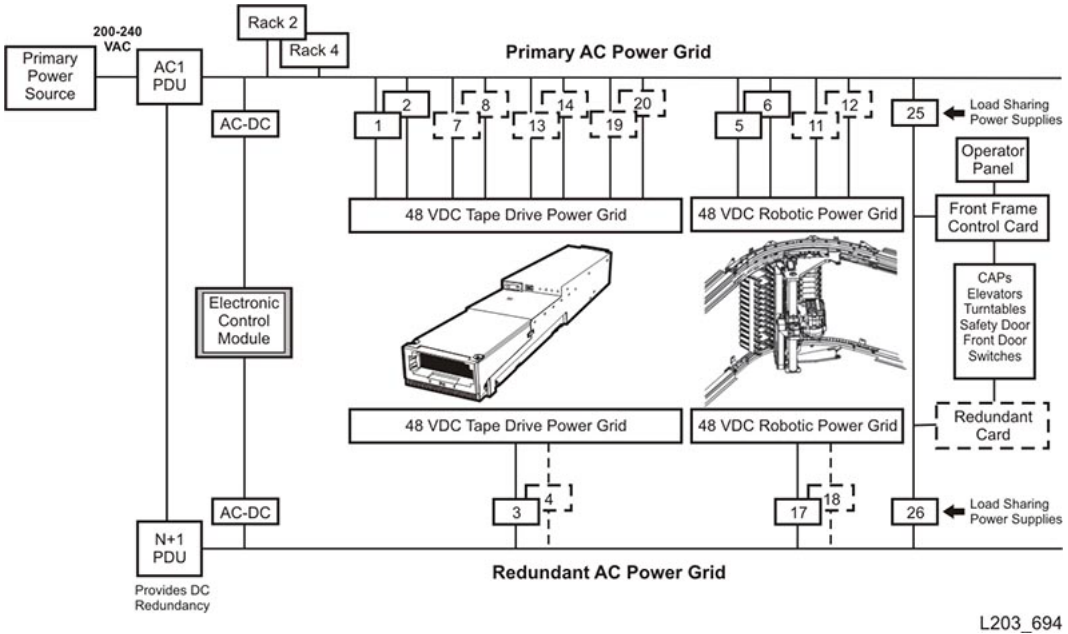
The N+1 power configuration provides DC power redundancy by adding an additional power supply to each DC power grid. The N+1 configuration contains two power distribution units (PDUs): one "system" PDU and one N+1 PDU.

The system PDU distributes AC power from the customer's branch circuit to the three DC power grids, the electronics control module, and the N+1 PDU.

The N+1 PDU provides AC power to an extra 48 VDC load sharing power supply on each of the three DC power grids, plus an extra AC-to-DC converter for the Electronics Control Module. If a single power supply fails, there is still enough DC power available on the failed power supply's corresponding power grid to keep the entire system operational until the power supply can be replaced.

Note: The N+1 power configuration provides only DC power redundancy.

Figure 4–1 N+1 Power Configuration



2N Power Configuration

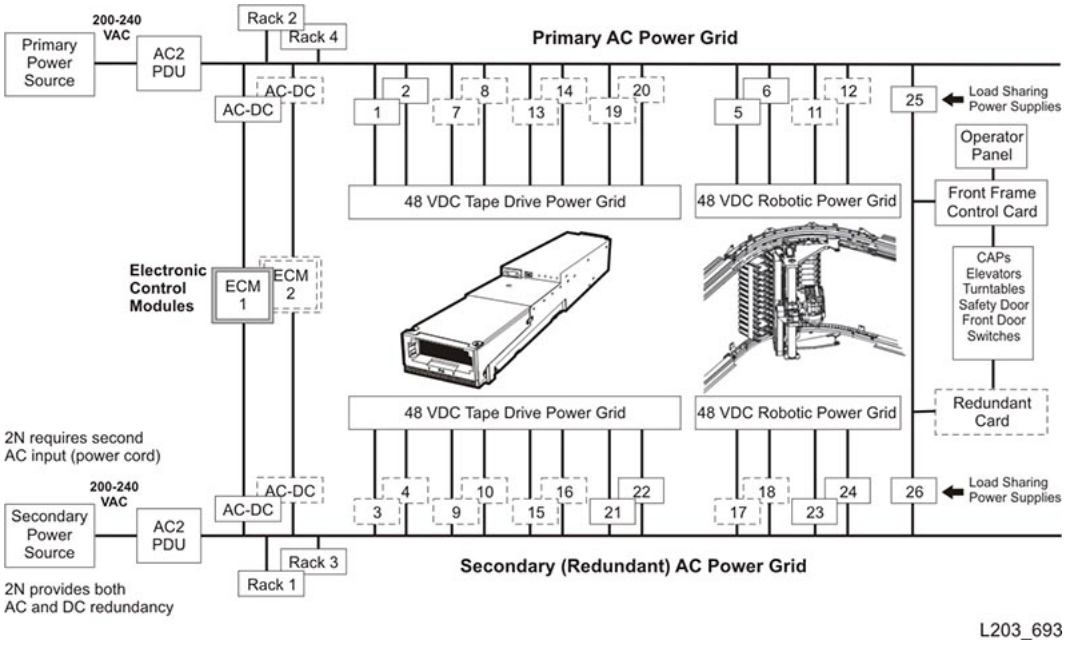
The 2N power configuration is an optional feature that provides both DC and AC redundancy. The configuration requires a second "system" power distribution unit (PDU) attached to a separate branch circuit. Each system PDU delivers AC power to its own group of load sharing power supplies.

If something within an AC power source fails, the second AC power source supplies power to the entire system except the operator panel if AC1 fails. If a DC power supply fails, there is still enough power available to keep the entire system operational until the power supply can be replaced.

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

- Power for the additional 2N load sharing power supplies (required)
- Power for 2 additional 19-inch racks (1 & 3) each with six outlets
- Power for the redundant AC-to-DC converters for the ECM

Figure 4–2 2N Power Configuration (Optional Feature)



AC Power Options

The SL8500 library has three external AC power options:

- **Delta:** One 3-phase input for each system PDU
  - 200–240 VAC, line-to-line, three phase, 40 Amps, 50–60 Hz (mostly used in the United States)
- **Wye:** One 3-phase input for each system PDU
  - 200–240VAC, line-to-neutral, three phase, 24 Amps, 50–60 Hz, (mostly used in Europe)
- **Three single-phase:** inputs are required for each system PDU
  - 200–240 VAC, single phase, 24 Amps, 50–60 Hz

It is *highly recommended* to:

- Connect to three-phase power whenever possible.
- Let a licensed electrician connect the external power cables.

Three-Phase Power - Delta or Wye

Connecting to three-phase power is *highly recommended*. The single-phase power option requires three circuits for the N+1 configuration and uses six circuits for a 2N power configuration and redundancy. The single-phase power option is provided for customers that do not have access to three-phase power.

There are two 3-phase power options to choose from: Delta or Wye:

Delta:

- Used when the voltage measured from phase-to-phase is 200-240 VAC
- Requires four wires (3-phases plus ground), do not use neutral (a fifth wire)

Wye:

- Used when the voltage measured from phase-to-phase is 380–415 VAC
- Requires five wires (3-phases, ground, and neutral), neutral (N) is required

AC Power Connections

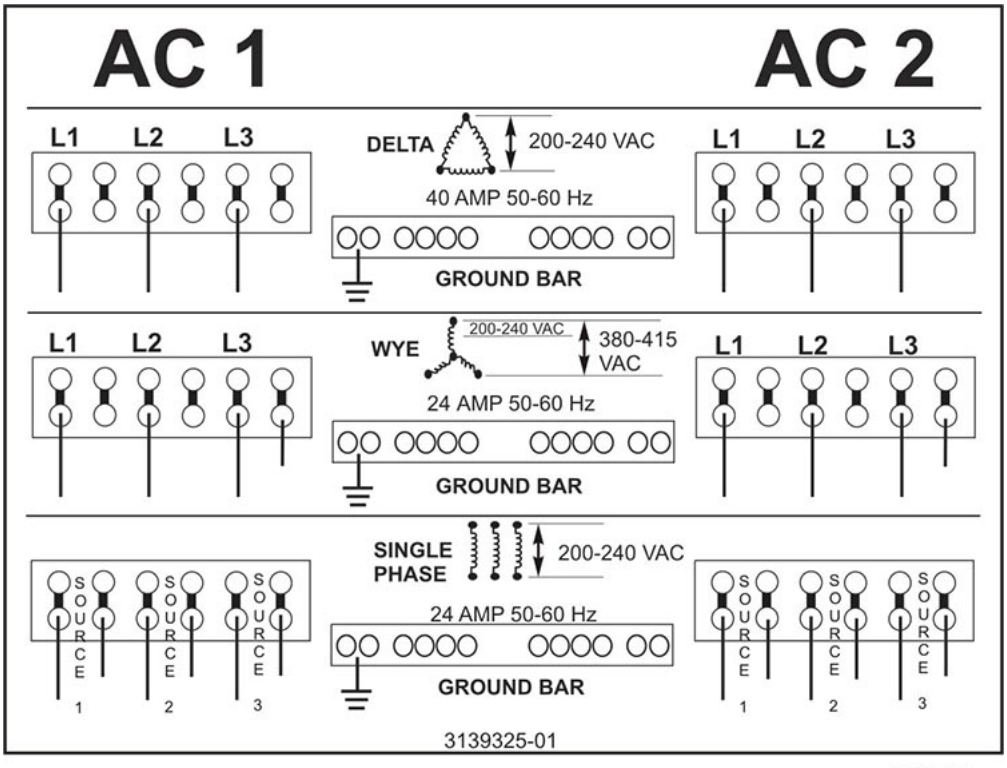
The figure below shows the AC power connections for the SL8500 library.

WARNING: Having a licensed electrician connect the external power cables is *highly recommended*.

AC wiring from the power source branch circuit must be installed in conduit (flexible or rigid) with a 90-degree elbow-down fitting. There are six holes provided for the conduit elbows that measure 2.875 cm (1.125 in.) in diameter. The electrician should choose appropriate conduit and fittings for their application that will fit this. The terminal block hole is 6.35 mm (0.250 in.) in diameter, tin plating over brass, and can accommodate up to #6 wire. Wire Range is 6 mm (14 AWG).

In the figure below, AC 1 on the left corresponds to N+1 PDU(standard) and AC2 on the right corresponds to 2N PDU (optional).

Figure 4–3 Delta or Wye



Note: AC input (cable and wiring) to the 2N PDU is not required if using an N+1 configuration.

Connectors

If plugs and connectors are required instead of using conduit, the table below lists the Hubbell part numbers (or equivalent) that can be used.

Table 4–2 Hubbell Connectors and Plugs (IEC 309)

Part Number	Description
HBL330P6W	Single Phase US plug 30 amp
HBL330C6W	Single Phase US connector 30 amp
HBL332P6W	Single Phase Europe plug 32 amp
HBL332C6W	Single Phase Europe connector 32 amp
HBL532P6W	Wye plug 32 amp
HBL532C6W	Wye connector 32 amp
HBL460P9W	Delta plug 60 amp
HBL460C9W	Delta connector 60 amp
L15-50 R	NEMA Delta receptacle (250 V, 50 Amp)
L15-50 P	NEMA Delta plug (250 V, 50 Amp)

Circuit Breaker Ratings

The *minimum* circuit breaker ratings required for the service panel are listed in the tables below.

Table 4–3 Conduit Circuit Breaker Ratings

Option	Panel Breaker	Service Rating	Connector	PDU Breaker
Single Ph.	30 Amps	30 Amps	—	30 Amps
Delta	50 Amps	50 Amps	—	40 Amps
Wye	30 Amps	30 Amps	—	30 Amps

Table 4–4 Connector (US) Circuit Breaker Ratings

Option	Panel Breaker	Service Rating	Connector	PDU Breaker
Single Ph.	30 Amps	30 Amps	30 Amps	30 Amps
Delta	50 Amps	50 Amps	50 A - NEMA 60 A - IEC 309	40 Amps
Wye	30 Amps	30 Amps	30 Amps	30 Amps

Table 4–5 Connector (Europe) Conduit Circuit Breaker Ratings

Option	Panel Breaker	Service Rating	Connector	PDU Breaker
Single Ph.	30 Amps	30 Amps	32 Amps	30 Amps
Delta	50 Amps	50 Amps	63 Amps	40 Amps

Table 4–5 (Cont.) Connector (Europe) Conduit Circuit Breaker Ratings

Option	Panel Breaker	Service Rating	Connector	PDU Breaker
Wye	30 Amps	30 Amps	32 Amps	30 Amps

Note: Wire size should be determined by the electrician.

DC Power

The SL8500 has three DC power grids that supplies 48 VDC to components throughout the library:

- The tape drive power grid supports up to 64 tape drives.
- The robot power grid powers the HandBots and the pass-thru ports.
- The front frame power grid supplies 48 VDC power to the cartridge access ports, elevators, and the service safety door.

Load Sharing Power Supplies

The DC power grids use load sharing power supplies. Load sharing allows the output voltage of one supply to be monitored and adjusted by other supplies on the bus. In effect, each independent output voltage is adjusted so that all of the independent output voltages are the same to evenly distribute the load. If one output fails or is shorted, it will not bring down the bus.

The two power configurations provide a different number of power supplies for the tape drives and HandBots:

- *N+1* allows one power supply for every eight tape drives and one supply for every two HandBots.
- *2N* allows one power supply for every four tape drives and one supply for every HandBot.

To order power supplies, see "Power Configurations" on page 8-4.

Tape Drive Power Supplies

The tables below explain the quantity of load sharing power supplies required for the two power configurations. The total number of power supplies required is determined by the number of tape drives that will be supported in the library.

Table 4–6 Tape Drive Load Sharing Power Supplies

Quantity of Drives to Power	Power Supplies Required for N+1	Power Supplies Required for 2N
0 - 16	3	4
17 - 24	4	6
25 - 32	5	8
33 - 40	6	10
41 - 48	7	12
49 - 56	8	14
56 - 64	9	16

Robotics Power Supplies

The robotics units in the SL8500 library use the same 1200W DC power supply as the tape drives. The number of DC power supplies required to support the robotics depends on the power configuration selected and whether redundant robotics has be selected.

The N+1 configuration:

- Requires three power supplies for standard robotics
- Requires five power supplies for redundant robotics

The 2N configuration:

- Requires four power supplies for standard robotics
- Requires eight power supplies for redundant robotics

Electronics Control Module Power Supplies

The electronic control module (ECM) power supplies are AC to DC converters and different from the load sharing power supplies used by the HandBots and tape drives.

- The N+1 configuration requires two electronic control module (ECM) power supplies.
- The 2N configuration requires four electronic control module (ECM) power supplies.

5

Systems Assurance

The system assurance process is the exchange of information between the customer and Oracle representatives to ensure that no aspects of the sale, order, installation and implementation for the SL8500 library are overlooked. This process promotes an error-free installation and contributes to the overall customer satisfaction.

The system assurance team members (the customer and Oracle) ensure that all aspects of the process are planned carefully and performed efficiently. This process begins when the customer accepts the sales proposal. At this time, an Oracle representative schedules the system assurance planning meetings.

System Assurance Planning Meetings

The purpose of the system assurance planning meetings are to:

- Introduce the customer to the SL8500 library.
- Explain the system assurance process and establish the team.
- Identify and define the customer requirements and configurations.
- Complete the order.
- Prepare for the installation and implementation.

Engagement Methodology

In addition to system assurance, Oracle has standardized and implemented a delivery methodology that provides continuity and quality assurance in the engagement and delivery approach. This suggested methodology is:

- Assess
- Design
- Implement
- Manage

This methodology consists of a defined path of action exchange of information. A series of templates and checklists found in a site survey document on My Oracle. This document can assist with the systems assurance process. These templates and checklists document the necessary information to ensure that the proposed solution can be delivered and supported to achieve Oracle's customer satisfaction requirements.

The methodology is designed for Oracle marketing, sales, and engagement personnel (such as Systems Engineers and Professional Services Engineers, plus qualified and

approved partners). Following this methodology allows all members to work together, provide consistent documentation for each engagement and to ensure both customer satisfaction and overall sales success. The information in this document is intended to help insure that an SL8500 library is successfully installed.

Actions for Sales Personnel

Sales personnel should do the following to ensure customer satisfaction:

- Ask the right questions
- Design the right solution
- Determine if the customer needs assistance migrating currently owned equipment, networks, and media
- Make sure the site is ready to receive the SL8500 library
- Order, install, and implement that solution
- Make sure the customer knows how to use the library
- Provide qualified service and support
- Follow-up: make sure the solution meets the customers expectations

Key Resources

For more information refer to the following resources:

- Chapter 6, "Site Planning"
- Chapter 7, "Installation Planning"
- Chapter 8, "Ordering"
- The site survey, found at: `http://my.oracle.com/site/pd/sss/products/tape/index.html`
- *SL8500 Modular Library System Site Survey*
- *SL8500 Best Practices Guide*
- *SL8500 User's Guide*

6

Site Planning

This chapter provides planning information and requirements to consider before installation of the SL8500. Key planning considerations include:

A site survey which addresses the following issues:

- *System configuration*: type of customer platform used
- *Applications*: number and type of system backups, type of backup and archive software, type of library management software (such as ACSLS or ELS/HSC)
- *Hardware configuration*: library capacity, tape drive type, media type
- *Network configuration*: connectivity options, required network devices and cables
- *Content Management*: partitioning plans, workloads and host contention issues

Site preparation:

- *Physical space*: floor space, ceiling height, placement
  - A floor template is available to help with planning. This template is an actual size, multi-module design made of corrugated plastic.
- *Weight*: floor support, weight distribution
- *Cabling routes*: floor cutouts, cabling runs, conduit type
- *Power*: source type, required amount
- *Environment*: airflow, contaminants, fire suppression
- *Compatibility*: tape drives, media, software, accessory rack
- *Expansion*: expansion module addition, library complex addition

Physical Planning

The dimensions and weights of the SL8500 library are listed below:

Table 6–1 Library Weights and Measures

Component	Length	Width	Height	Empty Weight	Full Weight
Base Library	109 in. (276.9 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	3,300 lbs (1497 kg)	6,250 lbs (2835 kg)
1 expansion module	146.5 in. (372.1 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	4,150 lbs (1883 kg)	8,025 lbs (3640 kg)
2 expansion modules	184 in. (467.4 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	5,000 lbs (2268 kg)	9,800 lbs (4445 kg)
3 expansion modules	221.5 in. (562.6 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	5,850 lbs (2654 kg)	11,575 lbs (5250 kg)
4 expansion modules	259 in. (657.8 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	6,700 lbs (3039 kg)	13,350 lbs (6055 kg)
5 expansion modules	296.5 in. (753.1 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	7,550 lbs (3425 kg)	15,125 lbs (6860 kg)
Drive&Electronics Mod.	30.0 in. (76.2 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	1,300 lbs (590 kg)	2,725 lbs (1236 kg)
Robotics Interface Mod.	30.0 in. (76.2 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	775 lbs (352 kg)	1,825 lbs (828 kg)
Storage Expan. Mod.	37.5 in. (95.25 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	850 lbs (386 kg)	1,775 lbs (805 kg)
Customer Interface Mod.	37.5 in. (95.25 cm)	67.25 in. (170.8 cm)	93.15 in. (236.6 cm)	1,225 lbs (556 kg)	1,700 lbs (771 kg)
Pass-thru port frame	59.4 in. (150.8 cm)	6.76 in. (17.17 cm)	91 in. (231 cm)	N/A	266 lbs (121 kg)
Front Service Area	26 in. (66 cm)	71.25 in. (181 cm)	N/A	N/A	N/A
Rear Service Area	35 in. (89 cm)	74.30 in. (188.7 cm)	N/A	N/A	N/A

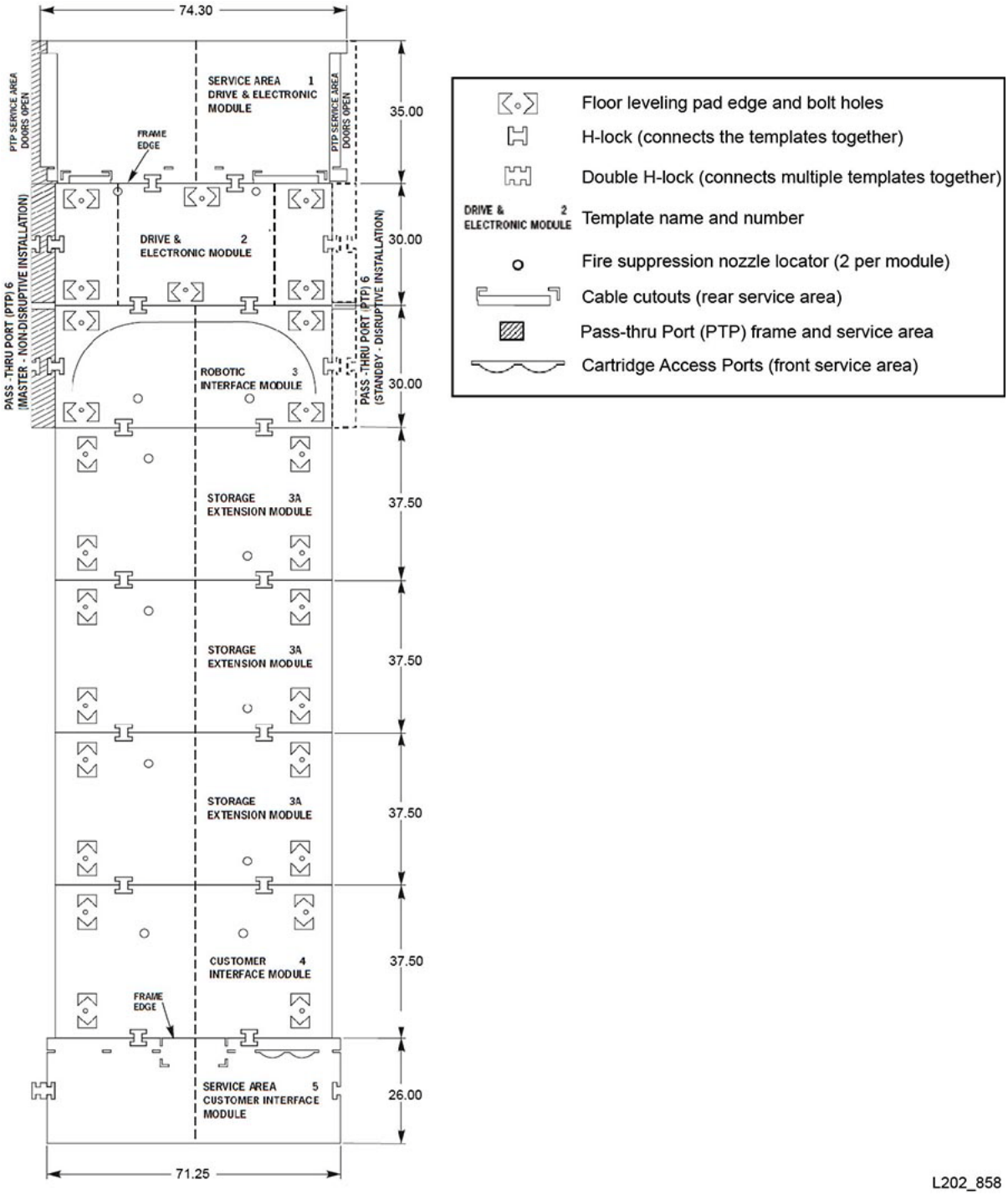
Empty weight: Base library configuration with N+1 power and four robots; without tape drives or tape cartridges.

Full weight: All tape drives, DC power supplies, and cartridges, with 2N power, four robots, doors and facade, but does not include a full rack.

Floor Template

A floor template is available to help with planning. This template is an actual size, multi-module design made of corrugated plastic.

Figure 6–1 Floor Planning Template



Floor Requirements

The SL8500 library does not require a raised floor. The primary concern is that the environmental requirements are met. As long as there is adequate airflow and environmental specifications are met, a raised floor is not required.

Weight

Ensure the site floor can physically support the weight of the library.

Depending on the number of modules, tape drives, and tape cartridges, the weight of the library can vary. See Table 6–1, " Library Weights and Measures" for more information.

Additionally, if the equipment must be transported on elevators, the elevator cars must be capable of safely handling the weight. See "Shipping Weights and Dimensions" on page 7-4 for more information.

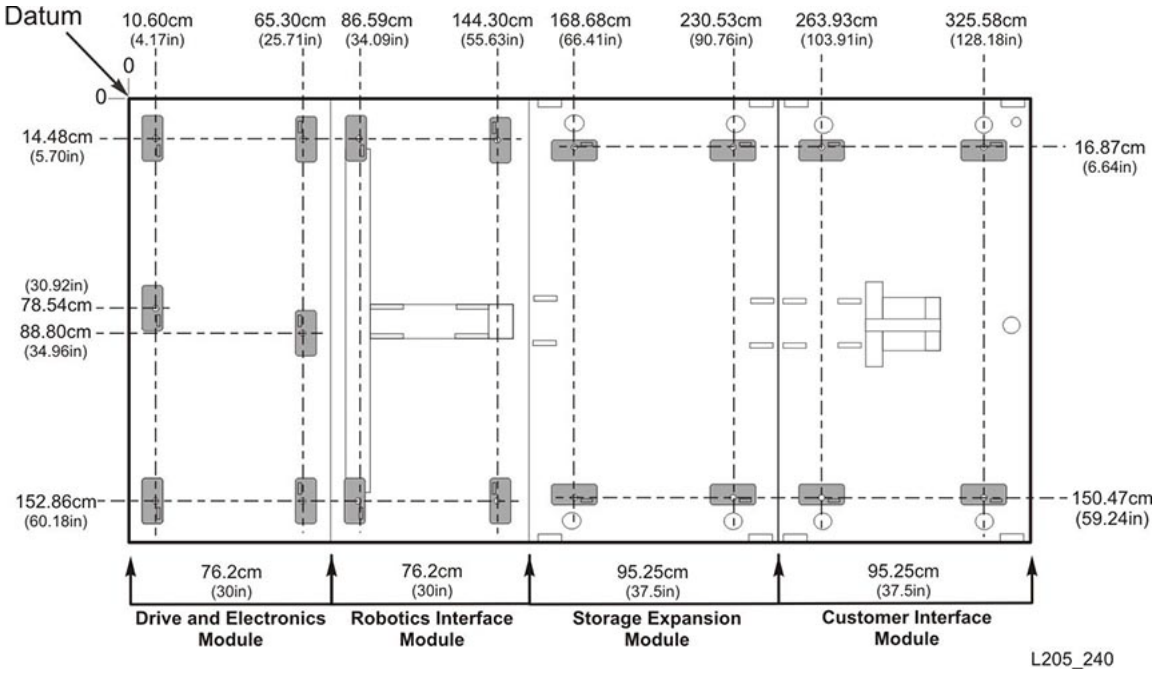
Weight Distribution Pads

The customer's floor must be capable of supporting 454 kg (1,000 lb) per weight distribution pad. These pads measure 4 inches by 8 inches. The minimum weight limit includes the modules plus a factor of safety to accommodate torque values, installation procedures, and component variances.

The figure below shows the weight distribution pad placements for the various modules. The distribution pads are represented by the dark grey boxes.

Note: Notice the placement and direction of the pads.

Figure 6–2 Weight Distribution Pad Locations (viewed from top of library)



Co-planar Requirements

The customer's floor should be laser-leveled before receiving any equipment. The library modules must be level across the width (from left to right) and installed on the same horizontal plane to within ±25 mm (1 in.) tolerance.

WARNING: Frame damage, premature wear, and targeting errors may occur if the library floor is not co-planar.

For future library complex expansion, check the entire floor adjacent to the library for pass-thru port operations or in front of the library for storage expansion modules.

Because the HandBots travel along rails, the library must be adjusted for the rails to be on the same plane (co-planar). Some customer floors may contain slight slopes in them (despite the laser leveling requirement).

- The floor variations cannot exceed 28 mm ± 0.8 mm (1.1 in. ± 0.0325 in.) throughout the length of the library.

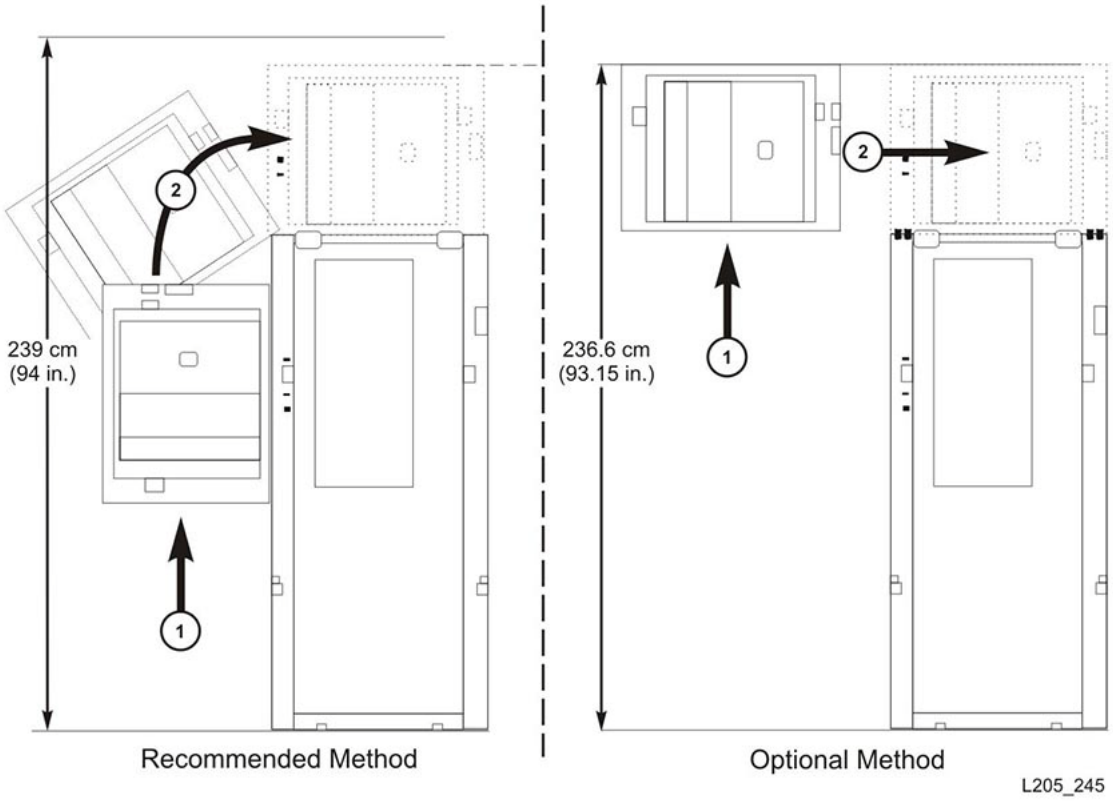
Ceiling Requirements

The figure below shows the upper sections of the Drive and Electronics Module and the Robotics Interface Module. These modules must be installed on top of the lower modules. To install the upper modules:

- The **recommended method** is to hang the modules on the clamps then swing the upper modules into place. This method requires at least 239 cm (94 in.) of floor-to-ceiling clearance and three people to lift the module.
- The **optional method** is to remove the clamps (for clearance), lift the upper modules up and slide them over the lower modules. This requires *four* people to accomplish (one person on each corner) and 236.6 cm (93.15 in).

CAUTION: *Overhead hazard:* Make sure that sprinkler heads, sensors, and other equipment that may hang from the ceiling are not interfered with when you install the upper modules.

Figure 6–3 Upper Module Installation



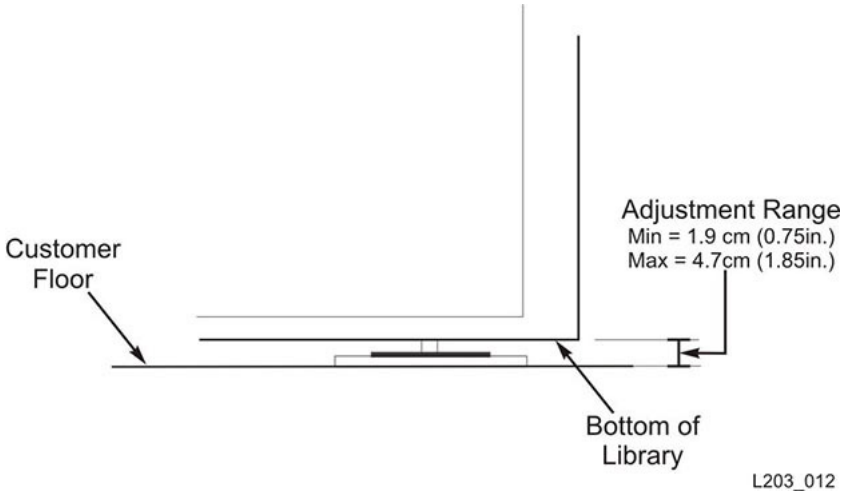
Height Adjustments

The figure below shows the minimum and maximum library height specifications:

- Minimum height =231.4 cm (91 in.)
- Maximum height =236.6 cm (93.15 in.)

On a level floor, the first module's height, between the module and floor, should be adjusted to 25.4 mm ± 0.8 mm (1 in. ± 0.0325 in.). The absolute minimum module-to-floor height permitted is 19 mm (0.75 in.). Following these guidelines allows you to adjust the library to meet the "Co-planar Requirements" on page 6-4.

Figure 6–4 Height Adjustment Specifications



Clearances

The table below lists the clearances—library to ceiling—required to install side covers, front and rear doors, and the upper modules.

Table 6–2 Overhead Clearances

Overhead Clearance	Description
1.9 cm (0.75 in.)	Side cover installation
1.3 cm (0.5 in.)	Upper robotics interface module installation
2.5 cm (1 in.)	Facade installation
	Hanging the front and rear doors on the hinges
	Upper drive and electronics module installation
4.5 cm (1.75 in.)	Customer interface module roof installation
	Storage expansion module roof installation

To calculate maximum height and installation clearances, use the library height range and add the overhead clearance.

Cabling

The library doors have four notches for routing interface and power cables to the tape drives and PDUs. There are two notches in each door: one on top and one on bottom.

The figure below shows an example of cable routing using fibre-optic interface cables. This would be the same method for the power cables on the right side. Figure 6–7, "Internal Conduit and Cable Routing" shows guidelines for internal cable or conduit routing.

Remember: when routing cables or conduit inside the library, make sure they do not interfere with the removal and replacement of any components, such as the DC power supplies, tilting open the electronics control module, sliding out the tape drives, or the accessory racks or rack equipment.

Figure 6–5 Cabling Routing

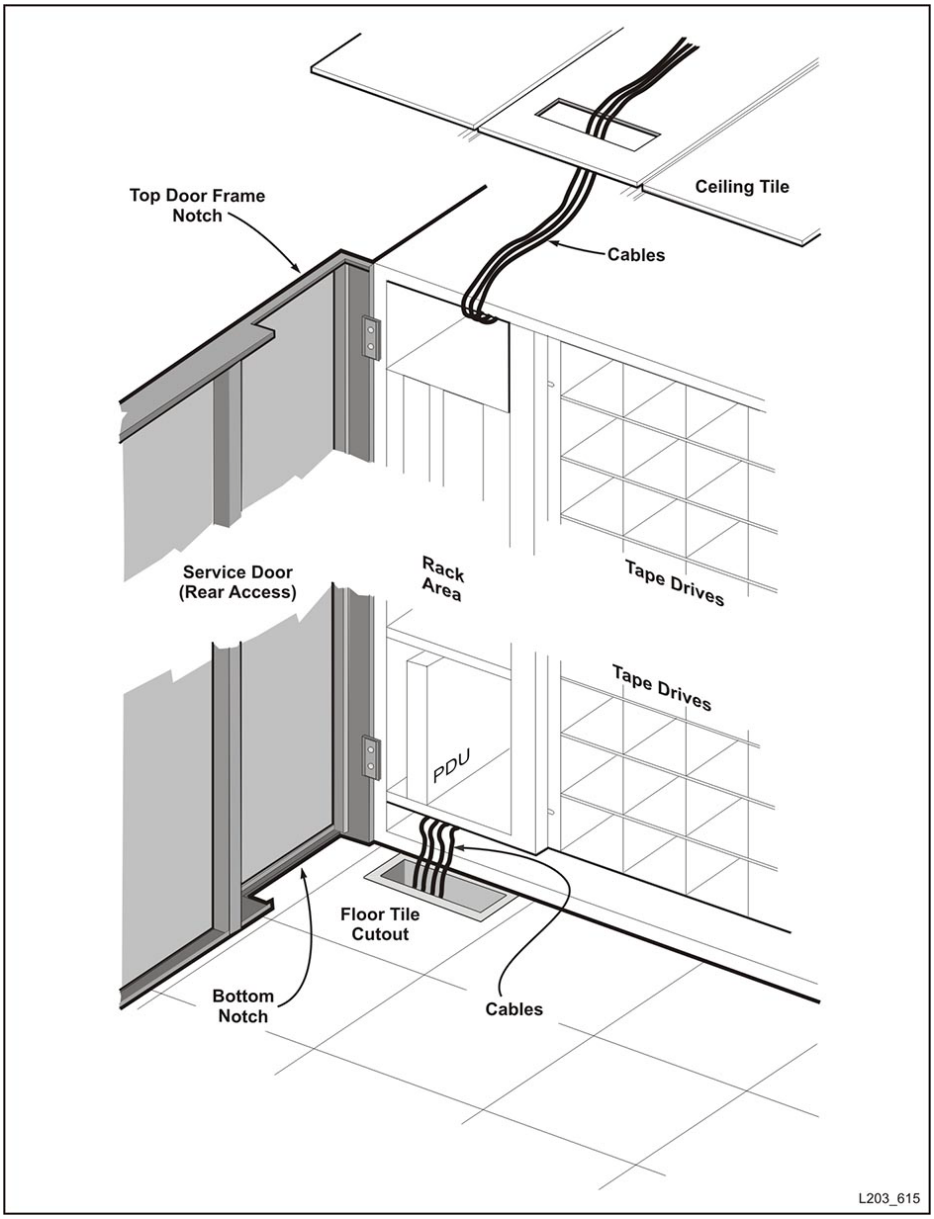


Table 6–3 Door Notch Dimensions

Location	Length	Width	Location	Length	Width
Top Left	25 cm (10 in.)	3.8 cm (1.5 in.)	Top Right	25 cm (10 in.)	3.8 cm (1.5 in.)
Bottom Left	40.6 cm (16 in.)	7 cm (2.75 in.)	Bottom Right	33 cm (13 in.)	7 cm (2.75 in.)

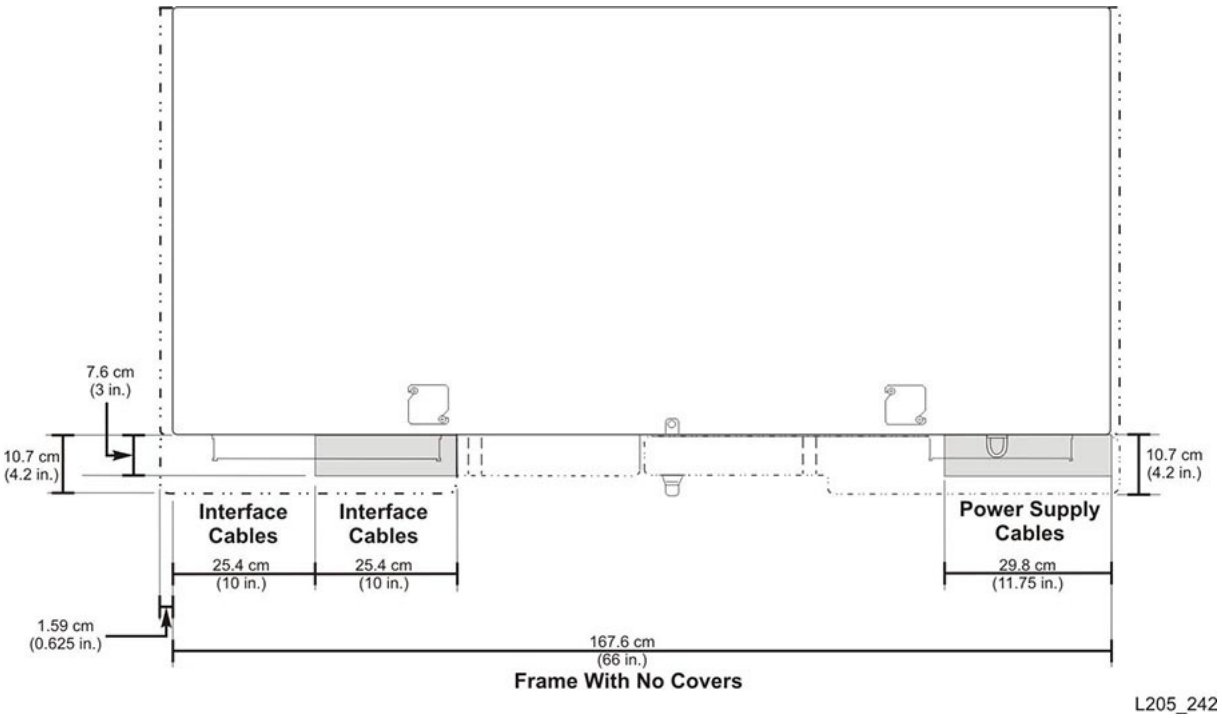
Floor Cutouts

Floor cutouts for cable routing must be supplied for the library. Cables include:

- Power cables
- Ethernet cables
- Interface cables

The figure below shows an example with dimension for the floor cutouts which are placed near the two, rear corners of the Drive and Electronics Module.

Figure 6–6 Floor Cutouts for Power and Signal Cables



The recommended "rough-in" AC feed (power cable) measured from the top of the raised floor to the input of the power distribution unit is 46 cm (18 in.).

Note: You can also route cables from the ceiling. See "Cabling" on page 6-6, for more information.

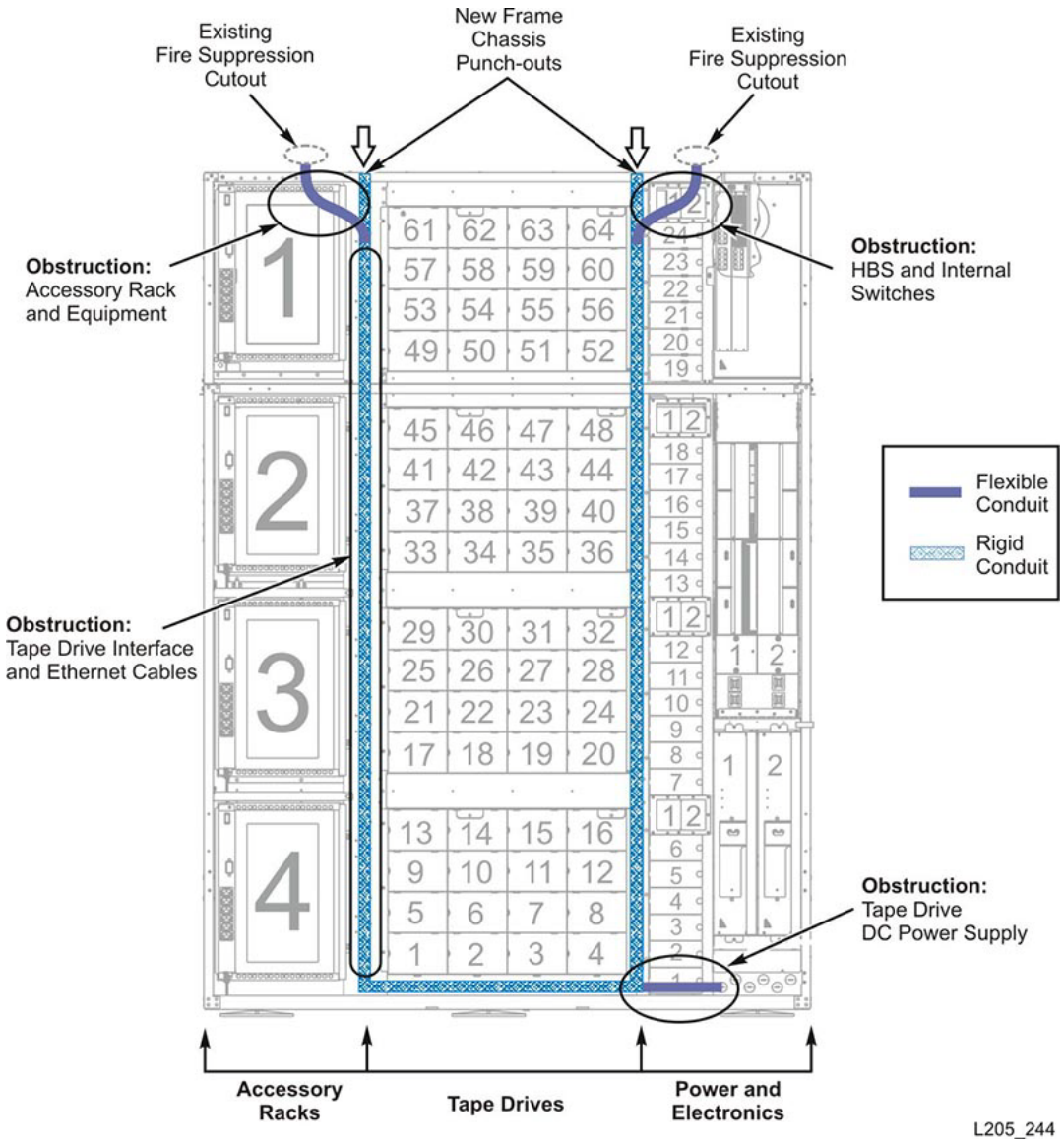
Internal Cabling

When routing cabling, avoid the accessory racks, tape drives, the electronics module, and any obstructions noted in the figure below.

If the existing fire suppression cutouts are *not* being used, use flexible conduit or cables to route power connections to the AC power supply from above the library. If the fire suppression cutouts are being used, new cutouts should be made in the frame to route conduit or cables to the AC power supply.

Optional routing to the left of the tape drive bays may be used for clearance. However, use flexible conduit for the Tape Drive DC power supply grid.

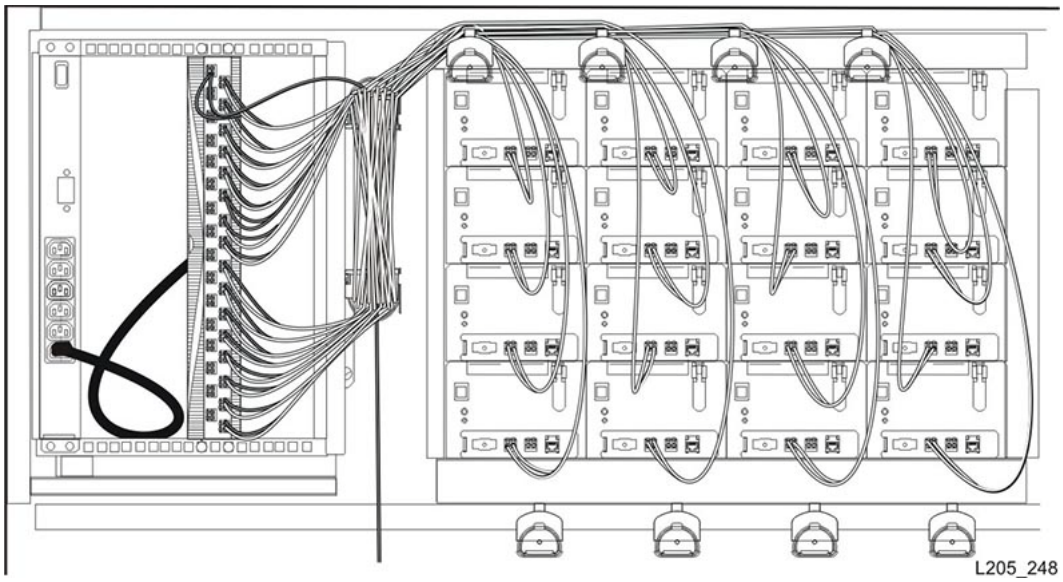
Figure 6–7 Internal Conduit and Cable Routing



Tape Drive Cable

By consolidating network components in the SL8500 rack areas, cabling and establishing a storage area network (SAN) is less difficult. The figure below shows network components (Fibre Channel switches and Ethernet hubs) in the rack space of the SL8500 library with 16 tape drives.

Figure 6–8 Cabling Tape Drives (example only, figure is not exact)



Remember the following when routing cabling:

- Every tape drive needs an interface cable.
- Not all tape drives require an Ethernet cable.
- When ordering cables, plan for 1–2 m (3–7 ft) of slack cable for routing.

Make sure you have the correct tape drive and cartridge tape associated for every LSM in the library to support mixed media Any Cartridge Any Time.

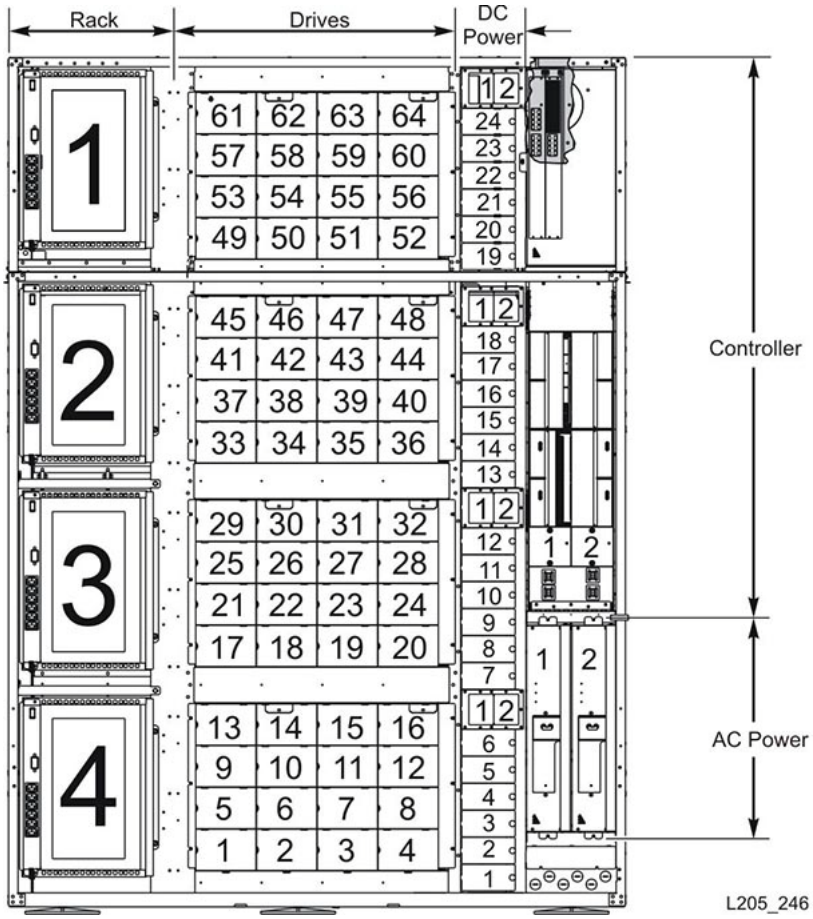
Hardware and Expansion Planning

There is a set of guidelines that should be followed when expanding the library. This includes adding drives, installing redundant electronics, or creating a library complex.

Drive and Electronics Module

The figure below shows the location of components at the rear of the library (the Drive and Electronics Module). Up to 64 drives and 4 rack modules can be placed in the library. The power configuration and number of power supplies required depends on the library configuration selected. See Chapter 2, "Features, Software, and Connectivity" for more information.

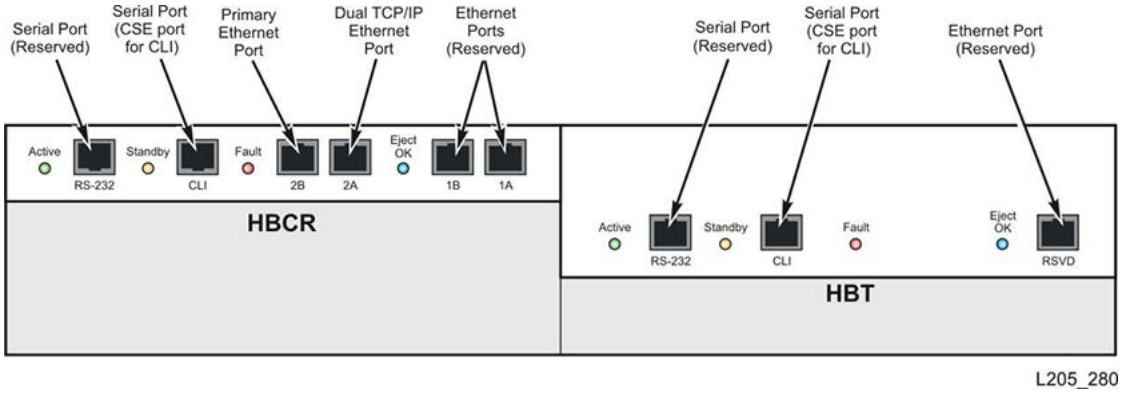
Figure 6–9 Drive and Electronics Module Planning



Electronics Control Module

The figure below shows the electronics control module (ECM) which resides in a card cage in the rear of the library. The ECM is split into two parts and can hold two independent and redundant card sets and four AC-to-DC converters.

Figure 6–10 Electronic Control Module



Accessory Racks

The SL8500 library provides space where up to four standard RETMA 19 inch racks can be installed. Oracle cannot mandate what the customer installs in these racks; therefore, certain guidelines should be followed to prevent voiding the warranty.

Table 6–4 Rack Guidelines

Description	Value/Range
Accessory rack	The accessory rack is mounted on slides rated for 80 kg (175 lb). Safe load is 64 kg (140 lb).
Mounting hardware (equipment in the rack)	Components must function in a *vertical* position. Rails are not provided; use the mounting hardware supplied by the manufacturer.
Height	48.25 cm (19 in.)
Width	27.3 cm (10.75 in.) including power strip
Depth	72 cm (28 in.) safe length is 66 cm (26 in.)
Mount-points	72.4 cm (28.5 in.) between mounting points
Thermal Requirements	880 watts (3,000 Btu/hr) per rack module.
Power	200–240 VAC, 50 to 60 Hz, 4 Amps. Six IEC320 C13 outlet receptacles

Two of the racks (2 and 4) receive power from the primary AC power grid. The other two racks (1 and 3) require the 2N power configuration.

Tape Drives and Cartridges

The supported tape drives fit into a drive tray that slides into the slots of the drive bay in the rear of the library. The weights below are for reference only, check the drive specific documentation for the weights and measures of a specific generation of drive.

Table 6–5 Drive Tray Weights and Measures

Drive Tray	Height	Width	Length	Weight
Drive tray only	10.8 cm (4.25 in.)	16.5 cm (6.5 in.)	85 cm (33.5 in.)	4.3 kg (9.5 lb)

The total tape drive weights including drive trays are listed below, along with the tape cartridge weights.

Table 6–6 Tape Drive and Cartridge Weights

Drive Type	Tape Drive Weight (with drive tray)	Cartridge Tape Weight
T9840	8.2 kg (18.0 lb)	262 g (9.2 oz)
T9940	11 kg (24.3 lb)	262 g (9.2 oz)
T10000	9.4 kg (20.75 lb)	264 g (9.31 oz)
LTO	6.9 kg (15 lb)	210 g (7.4 oz)
SDLT	6.7 kg (14.8 lb)	222.5 g (7.85 oz)

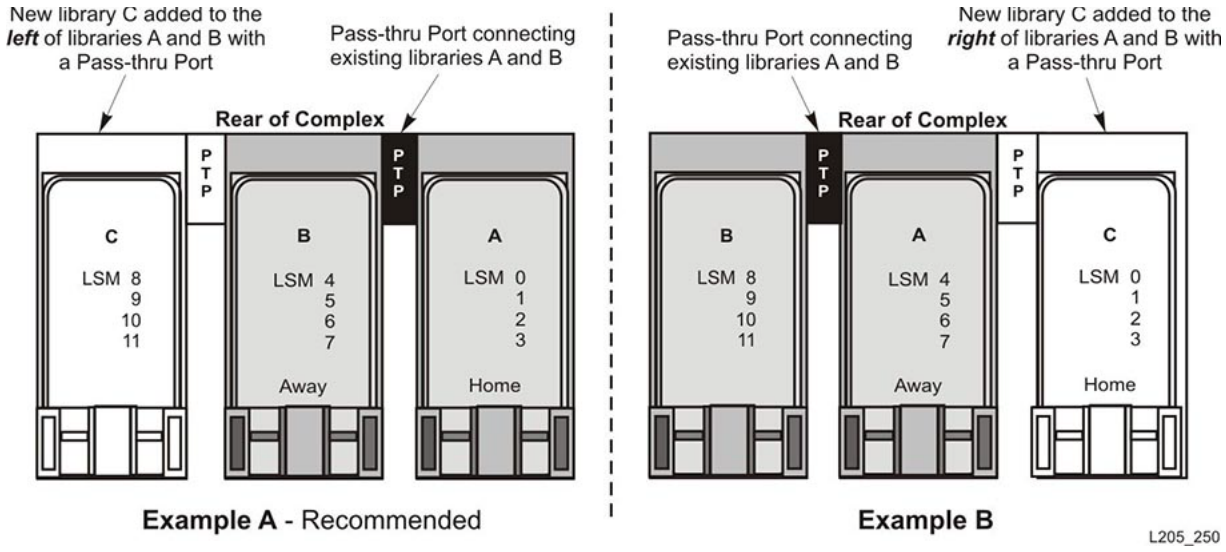
Pass-thru Port Planning

For non-disruptive growth, the preferred method is to add libraries from right to left (viewed from front/CAP-side of library complex). However, the library can grow in the other direction, from left to right, but this requires a disruption to re-configuration the system, re-number the LSMs, and re-IPL the library.

The figure below shows two examples of three libraries connected with PTPs.

- **Example A** shows the LSM numbering as you add libraries to the left. Adding another library (C) to the left of the library complex increases the LSM numbering sequentially. *This is the preferred method.*
- **Example B** shows the LSM numbering as you add libraries to the right. Adding another library (C) to the right of the library complex requires a reconfiguration of LSM numbering.

Figure 6–11 Pass-thru Port Planning Example



To implement the pass-thru port feature, you must have:

- Accessory racks: 1 rack (required) 2 racks for power redundancy
- Inter-library Communications kit
- PTP conversion bill and instructions
- Software upgrade and reconfiguration

The following terms and definitions apply to SL8500 PTP operations:

- **Home library:** Provides power, signal, and control lines to the PTP mechanisms.
- **Away library:** Located on the left side of a Home library, as viewed from the front.
- **Source:** Contains the home slot for cartridges that pass to adjacent libraries.
- **Destination:** Contains the tape drive or slot location in the adjacent library where the cartridge will be mounted or stored.

Power Planning

It is highly recommended to have a licensed electrician install the library's external AC wiring. For more information about power requirements of the SL8500, see Chapter 4, "Power".

AC Power

There are two possible AC power configurations for the library.

- **N+1 power**: the standard power configuration for **DC power redundancy**.
- **2N power**: an *optional* configuration for both **AC and DC power redundancy.**

> **Note:** The 2N power distribution unit must connect to a separate power source to provide both AC and DC power redundancy.

There are three possible power source options:

- **Delta:** 200–240 VAC, three phase, 50–60 Hz, 40 Amps
- **Wye:** 200–240VAC, three phase, 50–60 Hz, 24 Amps
- **Single-phase:** 200–240 VAC, 50–60 Hz, 24 Amps (3-separate inputs)

For more information about AC power requirements of the SL8500, see "AC Power Options" on page 4-3.

DC Power

The DC power grids use *load sharing power supplies*. The number of power supplies needed depends on the library configuration. For more information about DC power options, see "DC Power" on page 4-6

Environmental Requirements

There are several environmental requirements, such as temperature and humidity, airflow, and controlling contaminates that should be followed to maintian optimal reliability of the SL8500 library.

Temperature and Humidity

Optimal reliability of the SL8500 library is achieved if the environment is maintained between the recommended ranges.

Table 6–7 Environmental Ranges

Description	Optimum	Recommended	Full Range
Temperature	22°C (72°F)	20° –25°C (68° –77°F)	*Operating*: 16° to 32°C (60° to +90°F) *Shipping*: -30° to +49°C (-23° to +120°F) *Storing*: +4.4° to +32°C (+40° to +90°F)
Relative Humidity	45%	40% –50%	*Operating*: 20% to 80% *Shipping*: 5% to 90% *Storing*: +20% to 80%
Wet Bulb	+25.6°C (+78°F) maximum, non-condensing	N/A	N/A

Note: Although this equipment is designed to operate in environmental conditions of 20% to 80% humidity, industry best practices recommends computer rooms maintain a relative humidity of 40% to 50% for best performance.

Seismic or Earthquake Ratings

The requirements for seismic compatibility vary dramatically throughout the world. As such, a standard "seismic" feature for the SL8500 modular library system is not offered.

It is recommended that any customer who has seismic concerns work with local experts who are familiar with the local code and requirements. Professional Services can also be engaged to help coordinate this activity.

Air Flow

The air flow required to cool the SL8500 library depends on the total number of components installed, such as tape drives, load sharing DC power supplies, and accessory racks.

Table 6–8 Air Flow Requirements (at 1atm, 22°C/72°C)

Component	Required Air flow	Quantity
Tape drive	0.57m^3/min. (20 ft^3/min.) each	64 max
DC power supply	0.71m^3/min. (25ft^3/min.) each	24 max
Rack Modules	13.59m^3/min. (480ft^3/min.) each	4 max
Electronics Module	4.42m^3/min. (156ft^3/min.) each	1

A maximum configured library with 64 tape drives, 24 DC power supplies, four rack modules, and the electronic control module would require:

- 112.0 m^3/min. (3956 ft^3/min.) of air supply to avoid recirculation.

Most configurations are smaller than this and require less air flow. For example, 12 tape drives split between drive bays for redundancy, one robot on each level, one rack module, and the electronic control module would require:

- 33.30 m^3/min. (1176 ft^3/min.)

The layout of the data center should account for the cooling requirements of SL8500 as well as other equipment in the center—possibly through the concept of having a cool aisle and hot aisle in accordance with environmental best practices and controls.

Airborne Contaminants

Control over contaminant levels in a computer room is an extremely important consideration when evaluating an environment. The impact of contamination on sensitive electronic hardware is well recognized, but the most harmful contaminants are often overlooked because they are so small.

Automated Tape Library components and electronics, tape drives, and media are subject to damage from airborne particulates. The operating environment *must adhere* to the requirements of:

- ISO 14644-1 Class 8 environment

For more information see Appendix C, "Controlling Contaminants".

Gasses that are particularly dangerous to electronic components include chlorine compounds, ammonia and its derivatives, oxides of sulfur and petrol hydrocarbons. In the absence of appropriate hardware exposure limits, health exposure limits must be used.

Humidification with chlorinated water is a common source of damaging airborne chlorine. Appropriately designed carbon filters must be used to insure safe levels of airborne chlorine when chlorinated water is used for humidification.

The following table lists some recommendations for gaseous limits.

Table 6–9 Gas Limit Recommendations

Chemical Name	Formula	ASHRAE	OSHA (PEL)	ACGIH	NIOSH
Acetic Acid	CH_3COOH	Not defined	10 ppm	Not defined	Not defined
Ammonia	NH	3500 µg/m^3	350 ppm	25 ppm	Not defined
Chlorine	Cl	2100 µg/m^3	31 ppm (c)	Not defined	0.5 ppm (c)
Hydrogen Chloride	HCl	Not defined	5 ppm (c)	Not defined	Not defined
Hydrogen Sulfide	H_2S	50 µg/m^3	320 ppm (c)	10 ppm	10 ppm
Ozone	O_3	235 µg/m^3	30.1 ppm	Not defined	Not defined
Petrol-hydrocarbons	C_nH_n	Not defined	500 ppm	75 ppm	300 ppm
Sulfur Dioxide	SO_2	80 µg/m^3	35 ppm	2 ppm	0.5 ppm (c)
Sulfuric Acid	H_2SO_4	Not defined	1 ppm	Not defined	1 ppm (c)

PEL: Permissible Exposure Limit

ppm: Parts Per Million

µg/m^3: Micrograms Per Cubic Meter

(c): ceiling

Fire Suppression Planning

The library does *not* ship with a Fire Suppression System installed, although features have been incorporated into the library to allow for one.

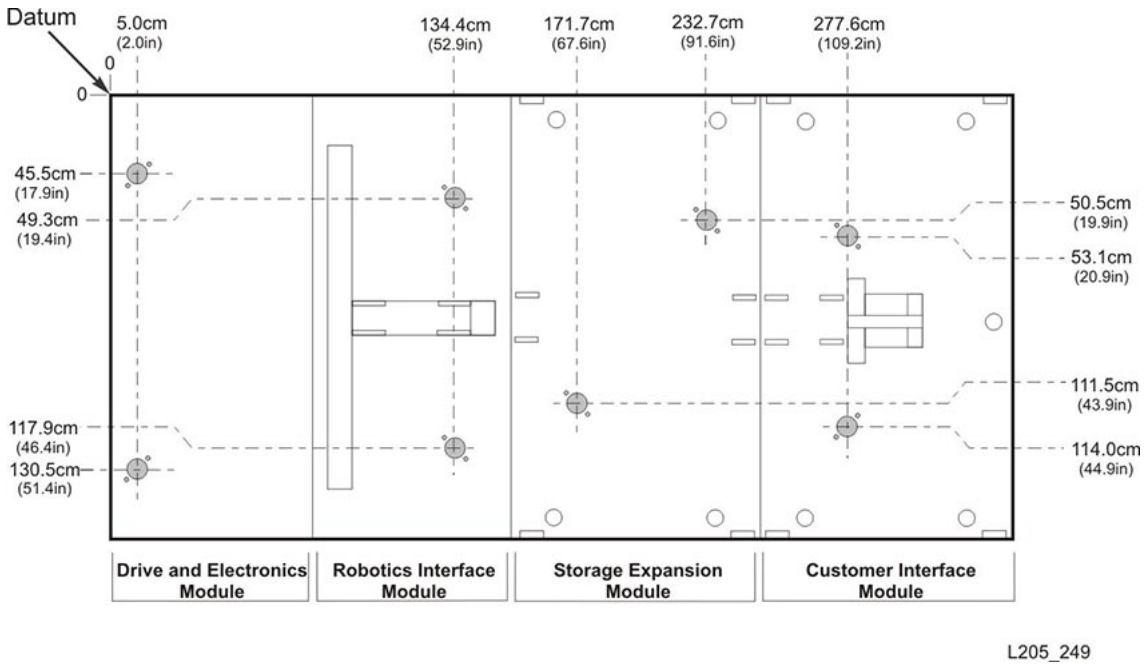
As a standard safety feature, the library comes equipped with a photo-electric smoke detector that *removes all power from the library* if smoke is detected in and around the library. Power is restored to the library by resetting the AC circuit breakers on the power distribution units.

Professional Services offer fire suppression systems which are installed on site. Visit the Professional Services Web site for more information about these services or contact your local Professional Services representative (names are also listed on this Web site).

The figure below shows the cutouts for fire suppression planning.

Note: The measurements are without covers and doors.

Figure 6–12 Fire Suppression Ceiling Access (viewed from the top of the library)



The following list describes the key fire supression features:

- *Openings* - two per module that measure 5 cm (2 in.) diameter
- *Plates* - these cover the openings and measure 7 cm (2.75 in.) square and 1 cm (0.48 in.) thick. The contractors can use these plates to drill in to for a custom fit of the nozzles.
- *Screws* -two T25 Torx screws
- *Nozzle protrusion (clearance)* - 1 cm (0.4 in.) from the *top* of the library for robotic operation

7

Installation Planning

This chapter outlines information about installation to consider before the equipment arrives. The SL8500 library requires extensive preparation to accomplish a successful installation.

Personnel

When preparing for an SL8500 installation, it is important to consider personnel requirements, which include safe lifting and time.

Lifting

The upper drive bay and robotic rail modules must be manually lifted for installation. These modules weigh approximately 40 kg (85 lb) and are raised a height of 1.7 m (5.5 ft).

There are two methods for installing the upper module. Be aware that one of the methods requires four people to complete. See "Ceiling Requirements" on page 6-5for more information about the upper module installation methods.

Time

The estimated time to physically install a library is about 24 hours. This is based on three qualified people working approximately eight hours each. For initial planning, allow for two days to completely install the library. This provides plenty of time to ensure a quality installation and allow for training.

To make the best use of personnel, multiple tasks should be done simultaneously. Time factors to consider include:

- Guiding the pallets from the dock to the computer room
- Removing packaging material when floor space is limited
- Lifting requirements of 40 kg (85 lb) to attach upper frame assemblies
- Configuring the library and up to 64 drives with switches and cables

Waste Disposal

Sales and service personnel should plan with customers on the disposal of all packing material. Determine if waste bins/recycling containers will be provided on site or whether an independent company will handle the disposal at additional cost.

Power

Keep in mind the following power considerations:

- A *qualified electrician* is required to install the power cable. Make sure time has been scheduled and coordinated with the electrician. The electrician must:
  - Use flexible or rigid conduit.
  - Adhere to the torque specifications; *2 Nm (18 in-lb) torque.*
  - Attach a 90-degree elbow-down fitting to the library's PDU or there will be problems attaching the cover and closing the rear door.
- Remember that there are two power configurations and four branch circuit options from which the customer can choose.

  Make sure the correct configuration and branch circuit is selected.
- Plan the location for the second set of power wiring even if the customer is not purchasing the redundant power feature.

  Make sure each power source is on a separate branch circuit; otherwise the redundant power feature is defeated (for 2N power configurations).

For detailed power information, see Chapter 4, "Power".

Physical Space

Although the library is modular and is shipped in pieces, there must be adequate space in elevators, passageways, and construction area. The key considerations for physical space planning are listed below.

Floor

Several requirements exist for the customer's floor, review the "Floor Requirements" on page 62. Ensure that the weight and coplanar requirements are satisfied.

Transportation

If the equipment must be transported on elevators, the elevator cars must be capable of safely handling the weight. Additionally, ensure that the components can pass through doorways and fit in elevators. See "Shipping Weights and Dimensions" on page 7-4for more information.

Construction Area

The minimum working area (not including the space required for the pallets) is approximately 56 m^2 (600 ft^2).

Installation Tools

The table below lists the tools contained in the installation kit (part number 24100250). The installation kit is currently not available for order. There are sufficient kits in the field to support intallation needs. Obtain a kit from your local area. Once used, retain the kit for re-use locally or ship within your region. It is the responsibility of every person using the kit to ensure that the following tools are contained in the kit after use.

- Kit dimensions are: 99 cm (39 in.) long, 71 cm (28 in.) wide, and 51 cm (20 in.) high. The kit comes with an extendable handle and wheels.

Table 7–1 Installation Tools for Tool Kit

Description	Part Number
Copper rail connector extraction tool	313921001
Frame jacks with handles (adjustable jack)	313880803 (check availability)
Tool bag	Obtain locally
Torx screwdriver and bits	Obtain locally
3/8-in. drive ratchet wrench	Obtain locally
6 in. extension for 3/8-in. drive ratchet	Obtain locally
3/4-in., 3/8-in., and 5/16-in. socket for 3/8-in. drive ratchet	Obtain locally
1/4-in. and 5/16-in. hex(Allen) on 3/8-in. drive	Obtain locally
3/4-in. and 5/8-in. open end/box end wrench	Obtain locally
9/16-in. combination open end/box end wrench	Obtain locally
25 ft tape measure	Obtain locally
2 ft level	Obtain locally
Utility knife	Obtain locally
Wire side cutters	Obtain locally
Safety glasses	Obtain locally
Rubber mallet	Obtain locally
Flashlight, step stool, work gloves	Local tools
Volt/Ohmmeter	Local tools
Serial cable for laptop	24100134
Crossover cable for laptop	24100163
Tape drive power kit	314831204
Floor planning template	109487201

Track Stop Installation Tools

Tool Kit part number 418644901 includes one long tool, one short tool, and a serialized shipping container.

- PN 418623102 is the short tool.
- PN 418623002 is the long tool.

Additional tools required (to be acquired locally):

- 1/16 HEX ALLEN DRIVER
- Original Field Track Alignment Tool, PN: 419894001

Recommended:

- Step Stool; access to top rail
- Knee Pads; access to bottom rail
- SL8500 Array Extraction Tool PN: 24100275 if available

Table 7–2 Rack Stops Per Library

Expansion Modules	Rack Stops Per Rail	Total Rack Stops Per Library	Quantity of PN 418626901
0	1	16	1
1	1	16	1
2	1	16	1
3	1	16	1
4	5	80	5
5	6	96	6

The rack stops are packaged in kits of 17 stops and are used in groups of 16 so spares will always be available.

Both special tools have been distributed to regional depots and can be ordered and checked out as typically done for spare parts:

- PN: 418644901 –rack alignment tool kit
- PN: 419894001 –original track alignment tool

Note: Installation time is estimated at 5 hours for a library containing five Storage Expansion Modules (SEMs) using two people.

Recommend two rack alignment kits and two track alignment tools be used to work both sides of the library in parallel.

Shipping Weights and Dimensions

The SL8500 library is delivered on pallets that can measure up to 2.4 m (8 ft) in length and weigh up to 491 kg (1082 lb). Make sure there are forklifts or pallet jacks that can handle these pallets. If moving between floors, make sure the elevator can handle these loads.

Note: The values listed are estimates and subject to change. Fractions are rounded up to the next whole number.

Total Pallet Weights

The total weight of the pallets for a library configuration is listed below. The weight of one CAP is included in the total weights listed. If ordering the optional CAP, increase the total weight by 22 kg (48 lb). CAPs are shipped in their own container and usually added to pallet 9.

Table 7–3 Total Pallet Weights for a Selected Library Configuration

Library Configuration	Pallets Needed /Shipped	Total Weight
Basic Library	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	2135 kg (4,716 lb)

Table 7–3 (Cont.) Total Pallet Weights for a Selected Library Configuration

Plus First Expansion Module	1, 2, 3, 4, 4a, 5, 6, 7a, 8, 8a, 9, 10	2724 kg (6,016 lb)
Plus Second Expansion Module	1, 2, 3, 4, 4a (x2), 5, 6, 7b, 8, 8a (x2), 9, 10	3323 kg (7,336 lb)
Plus Third Expansion Module	1, 2, 3, 4, 4a (x3), 5, 6, 7b, 7c, 8, 8a (x3), 9, 10	3931 kg (8,676 lb)

Shipping Pallets Weights and Dimensions

The individual pallet sizes and weights are listed below:

Table 7–4 Shipping Pallets –Weights and Dimensions

Pallet	Description	Weight	Height	Width	Length
1	Lower DEM	491 kg (1082lb)	196 cm (77 in.)	92 cm (36 in.)	185 cm (73 in.)
2*	Upper DEM	114 kg (250 lb)	76 cm (30 in.)	92 cm (36 in.)	185 cm (73 in.)
2/4*	Upper Modules	201 kg (443 lb)	137 cm (54 in.)	92 cm (36 in.)	185 cm (73 in.)
3	Lower RIM	241 kg (532 lb)	196 cm (77 in.)	92 cm (36 in.)	185 cm (73 in.)
4*	Upper RIM	91 kg (200 lb)	76 cm (30 in.)	92 cm (36 in.)	185 cm (73 in.)
4a	SEM	327 kg (720 lb)	122 cm (48 in.)	102 cm (40 in.)	246 cm (97 in.)
5	CIM	319 kg (703 lb)	122 cm (48 in.)	82 cm (32 in.)	246 cm (97 in.)
6	Z-frame	145 kg (320 lb)	76 cm (30 in.)	64 cm (25 in.)	246 cm (97 in.)
7	Basic library rails	100 kg (220 lb)	33 cm (13 in.)	112 cm (44 in.)	125 cm (49 in.)
7a	Rails 1st exp.module	182 kg (400 lb)	33 cm (13 in.)	112 cm (44 in.)	218 cm (86 in.)
7b	Rails 2nd exp. module	272 kg (600 lb)	33 cm (13 in.)	112 cm (44 in.)	315 cm (124 in.)
7c	Rails 3rd exp. module Stacked and re-packed	372 kg (820 lb)	51 cm (20 in.) 51 cm (20 in.)	112 cm (44 in.) 56 cm (22 in.)	315 cm (124 in.) 315 cm (124 in.)
8	Arrays, basic library (16 boxes)	160 kg (350 lb)	122 cm (48 in.)	115 cm (45 in.)	153 cm (60 in.)
8a	Arrays, expan. mods. (16 boxes)	182 kg (400 lb)	122 cm (48 in.)	115 cm (45 in.)	153 cm (60 in.)
9	Covers and Doors (painted)	356 kg (785 lb)	122 cm (48 in.)	110 cm (43 in.)	254 cm (100 in.)
9c	Covers and Doors with CAP	356 kg (850 lb)	137 cm (54 in.)	110 cm (43 in.)	254 cm (100 in.)
10	4x Robotics (4 boxes)	57 kg (124 lb)	63.5 cm (25 in.)	100 cm (39 in.)	82 cm (60 in.)
10	8x Robotics (8 boxes)	102 kg (224 lb)	115 cm (45 in.)	100 cm (39 in.)	82 cm (60 in.)
–	CAP	22 kg (48 lb)	36 cm (14 in.)	38 cm (15 in.)	229 cm (90 in.)

* When both upper modules are shipped together, labels 2 and 4 are applied to the same pallet =201 kg (443 lb).

Package Component Weights and Dimensions

The package weights and dimensions for additional components are listed below:

Table 7–5 Component Package Weights and Dimensions

Description	Weight	Height	Width	Length
CAP	22 kg (48 lb)	36 cm (14 in.)	38 cm (15 in.)	229 cm (90 in.)
Façade- Upper and Lower Ships with pallet 9	19 kg (40 lb)	13 cm (5 in.)	49 cm (19 in.)	242 cm (95 in.)
Copper Kit for Rails 76 in. Ships with pallet 7A	9 kg (20 lb)	8 cm (3 in.)	44 cm (17 in.)	196 cm (77 in.)
Copper Kit for Rails 114 in. Ships with pallet 7B	12 kg (25 lb)	8 cm (3 in.)	92 cm (36 in.)	178 cm (70 in.)
Copper Kit for Rails +114in. Ships with pallet 7C	14 kg (30 lb)	8 cm (3 in.)	92 cm (36 in.)	178 cm (70 in.)
Drive Bay, ships on a pallet	37 kg (80 lb)	94 cm (36 in.)	59 cm (23 in.)	83 cm (32 in.)
HBS	5 kg (10 lb)	16 cm (6 in.)	26 cm (10 in.)	61 cm (24 in.)
Op Panel/Display	11 kg (23 lb)	31 cm (12 in.)	41 cm (16 in.)	46 cm (18 in.)
PDU	9 kg (19 lb)	28 cm (11 in.)	74 cm (29 in.)	74 cm (29 in.)
PDU N+1	9 kg (19 lb)	21 cm (8 in.)	61 cm (24 in.)	69 cm (27 in.)
Power Supplies	5 kg (10 lb)	23 cm (9 in.)	26 cm (10 in.)	46 cm (18 in.)
Drive Tray - Common SL8500	14 kg (30 lb)	31 cm (12 in.)	33 cm (13 in.)	102 cm (40 in.)
Drive - Common, on a pallet	173 kg (380 lb)	107 cm (42 in.)	107 cm (42 in.)	138 cm (54 in.)
LTO Drive on SL8500 Tray	12 kg (26 lb)	31 cm (12 in.)	33 cm (13 in.)	102 cm (40 in.)
9940 Drive on SL8500 Tray	18 kg (38 lb)	31 cm (12 in.)	33 cm (13 in.)	125 cm (49 in.)
9940 Drive- Pallet Load Ships on a pallet	118 kg (260 lb)	107 cm (42 in.)	72 cm (28 in.)	127 cm (50 in.)
Rack Module (19" Rack)	19 kg (40 lb)	64 cm (25 in.)	51 cm (20 in.)	92 cm (36 in.)
Safety Door, ships on pallet	20 kg (42 lb)	33 cm (13 in.)	66 cm (26 in.)	229 cm (90 in.)

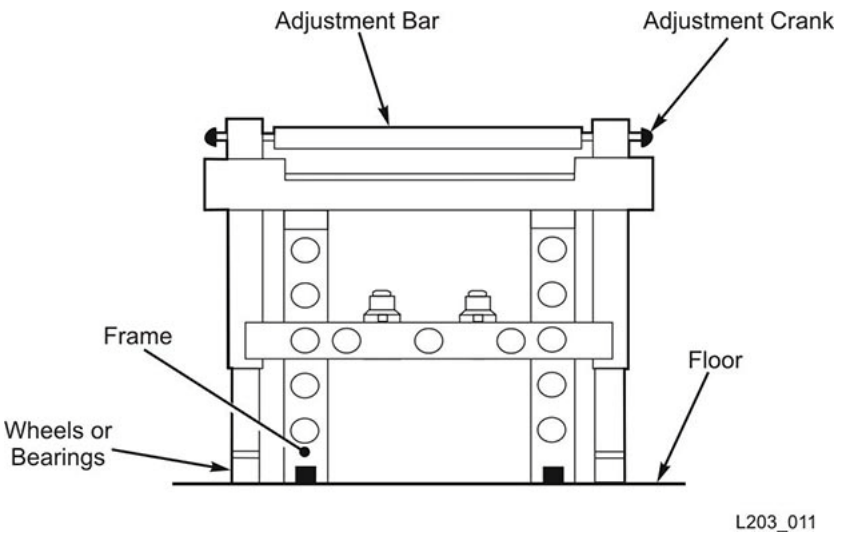
Transporting the Library

There are special considerations that need to be followed when transporting the components of the library to the installation site.

Adjustable Jacks

Special jacks maybe needed to assist in unpacking, moving, and positioning the larger modules. This jack is part of the tool kit, which is required for an installation. See "Installation Tools" on page 7-2 for a list of tools.

Figure 7–1 Adjustable Jack



The figure below shows two ways to position the adjustable jack. The jack on the left is shown in position to move or adjust the location of the Storage Expansion Module or Customer Interface Module. The jack on the right is shown in position to move the lower Drive and Electronics Module. Notice the clearance below the module.

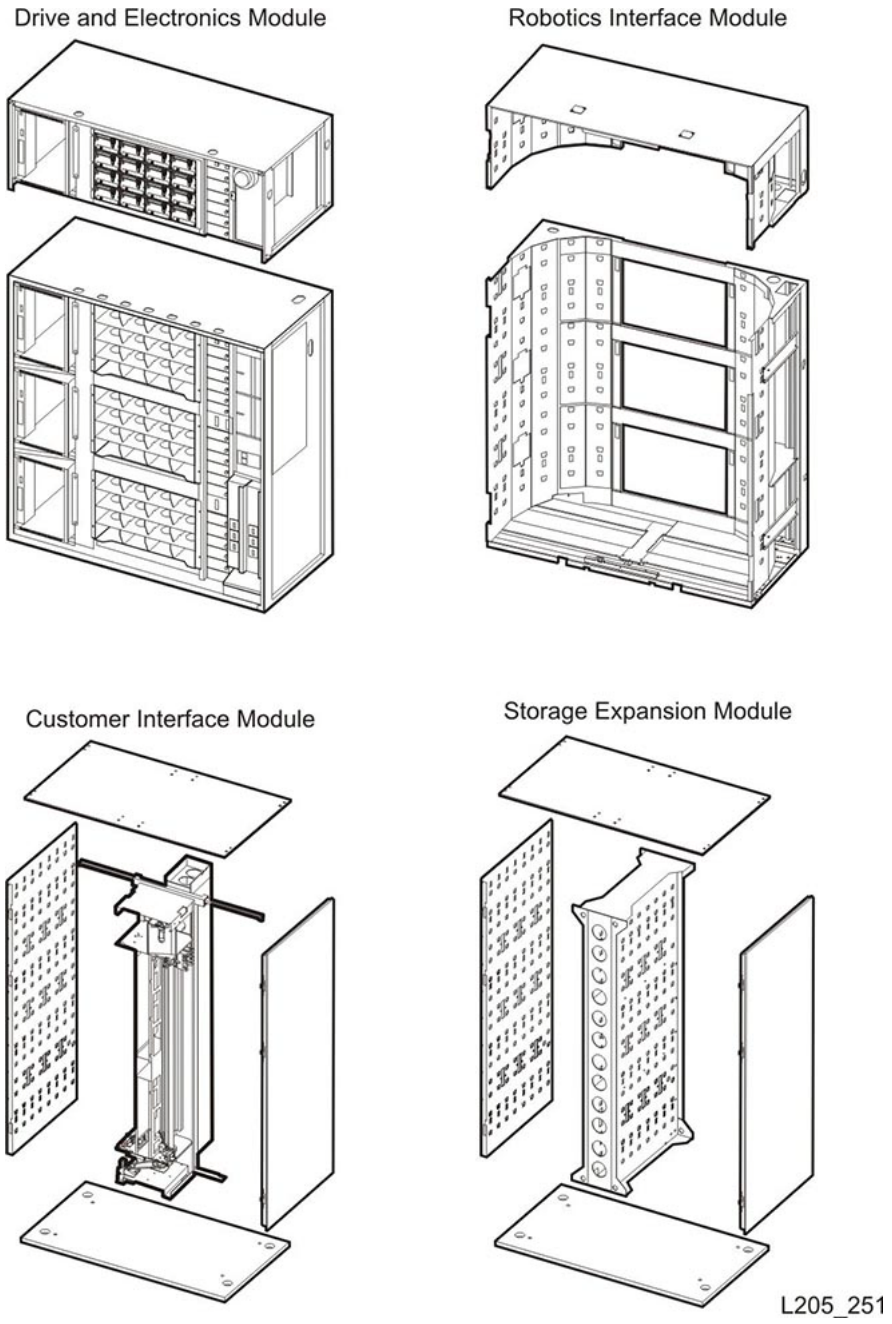
Figure 7–2 Jack Positioning

Moving Unpacked Components

If necessary, you can unpack the library components from the pallets to move them to the installation site. Follow the unpacking instructions on the outside packaging material or installation manual.

The figure below shows the unpacked components for the modules of the library. The tables that follow list the specifications for these components.

Figure 7–3 Unpacked Components



Drive and Electronics Module

The drive and electronics module comes in two parts: a lower and an upper module.

	Lower Module	Upper Module
Height	173 cm (68 in.)	58.5 cm (23 in.)
Width	168 cm (66 in.)	168 cm (66 in.)
Depth	76 cm (30 in.)	76 cm (30 in.)

	Lower Module	Upper Module
Weight	386 kg (850 lb)	37 kg (80 lb)
Pallet #	1	2

Note: The lower drive and electronics module is the heaviest component of the library. Use care when moving this component.

Robotics Interface Module

The robotics interface module comes in two parts: a lower and an upper module.

Specification	Lower Module	Upper Module
Height	176.5 cm (69.5 in.)	54.6 cm (21.5 in.)
Width	168 cm (66 in.)	168 cm (66 in.)
Depth	76 cm (30 in.)	76 cm (30 in.)
Pallet #	3	2

Note: Because of the open design of these modules, diagonal stabilizers are attached to help move and handle the modules.

Customer Interface Module

The customer interface module is *not* pre-assembled and must be constructed on-site. Allow 3 m (10 ft) of space at the end of the box or pallet to unpack these components.

There are two center sections that must be attached to the floor of this module:

- A rear section that does not contain components
- A front section, called the Z frame, which contains the elevator and turntable assemblies.

Specification	Z Frame	Floor	Ceiling (roof)	Walls (left/right)
Height	227.3 cm (89.5 in.)	167.6 cm (66 in.)	167.6 cm (66 in.)	231 cm (91 in.)
Width	44.5 cm (17.5 in.)	94.6 cm (37.25 in.)	95.25 cm (37.5 in.)	186.7 cm (73.5 in.)
Depth	51 cm (20 in.)	3.8 cm (1.5 in.)	3.8 cm (1.5 in.)	4.4 cm (1.75 in.)
Weight	77 kg (170 lbs)	N/A	N/A	N/A
Pallet #	6	5	5	5

Storage Expansion Module

The storage expansion modules is not pre-assembled and must be constructed on-site. Allow 3 m (10 ft) of space at the end of the box or pallet to unpack these components.

Specification	Floor	Ceiling (roof)	Wall (center)	Walls (left/right)
Height	167.6 cm (66 in.)	167.6 cm (66 in.)	227.3 cm (89.5 in.)	231 cm (91 in.)

Specification	Floor	Ceiling (roof)	Wall (center)	Walls (left/right)
Width	94.6 cm (37.25 in.)	95.25 cm (37.5 in.)	44.5 cm (17.5 in.)	186.7 cm (73.5 in.)
Depth	3.8 cm (1.5 in.)	3.8 cm (1.5 in.)	95.25 cm (37.5 in.)	4.4 cm (1.75 in.)
Pallet #	4	4	4	4

Doors and Rack Assembly

There are two sets of doors for the library: the front and rear access.

Specification	Doors (front)	Doors (rear access)	Rack Assembly
Height	231 cm (91 in.)	231 cm (91 in.)	48.26 cm (19 in)
Width	61.5/66 cm (24.25/26 in.)	85.7 cm (33.75 in.)	33.65/38 cm (13.25/15 in.)
Depth	8.25 cm (3.25 in.)	10 cm (4 in.)	N/A
Pallet #	9	9	N/A

Rails

Rails are composed of five major parts listed below. And depending on the configuration, are the longest components in the library:

1. Clamps (installed at the factory)
2. Rail extrusions
3. Bottom floor extrusion
4. Geared tracks
5. Power/signal strips

The extrusion lengths are:

- 1 m (3.3 ft)
- 2 m (6.4 ft)
- 3 m (9.5 ft)
- 3.9 m (12.6 ft)

Pallet #: 7

8

Ordering

This chapter provides the part numbers for ordering SL8500 library components, tape drives, media, and external cables. Contact Sales Assistance at +1.888.672.2534 for more information.

Ordering Process

Follow these basic steps to successfully order an SL8500 library:

1. Decide upon the physical configuration, by selecting the base library and expansion modules.
2. Add any of the hardware options, which include CAPs, PTPs, redundant robotics, and redundant electronics.
3. Specify the power options to support the configuration.
4. Choose any software options.
5. Select the following:

- Type of library management software
- Type and quantity of tape drives and media (cartridge tapes)
- Supporting cables and network equipment

Downloading Upgrades from E-Delivery

Upgrades (such as slots) are available for download through Oracle's Software Delivery Cloud.

Go to: https://edelivery.oracle.com/

1. Choose a Language.
2. Enter your information.
3. Read and agree to legal/export terms and conditions.
4. Under select a product pack, choose Oracle StorageTek Products.
5. Under platform select "Generic Platform."
6. Select the StorageTek SL8500 Modular Library System. Download the purchased features.

Physical Configuration

Order a base library and select the desired number of storage expansion modules.

Base Library

The base library is the smallest configuration of an SL8500 that can be ordered.

Table 8–1 Base Library Part Number

Description	ATO
Base Module with 1,448 slots (1,450 active slots)	7100879

The SL8500 Base library includes:

- Customer interface module, robotics interface module, drive and electronics module
- Operator panel
- 4 HandBots
- Service safety door
- 1 CAP
- Web cameras

Storage Expansion Modules

Up to *five* additional storage expansion modules can be added to increase capacity of the library.

Table 8–2 Storage Expansion Module Part Number

Description	ATO	PTO
Storage Expansion Module with 1,728 slots (no active slots)	7100898	SL8500-EXP-FRZ-N

Rails

Order one rail kit that correspond to the total number of expansion modules.

Table 8–3 Rail Part Numbers

Description	ATO	PTO
Rail kit for the Base Module, no Expansion Frames	7100885	XSL8500-0EF-RAIL-N
Rail kit for 1 Expansion Frame	7100886	XSL8500-1EF-RAIL-N
Rail kit for 2 Expansion Frames	7100888	XSL8500-2EF-RAIL-N
Rail kit for 3 Expansion Frames	7100889	XSL8500-3EF-RAIL-N
Rail kit for 4 Expansion Frames	7100891	XSL8500-4EF-RAIL-N
Rail kit for 5 Expansion Frames	7100892	XSL8500-5EF-RAIL-N

Hardware Options

Hardware options include an accessory rack, additional CAPs, additional HandBots, pass-thru port components, and redundant electronics.

Accessory Racks

The library provides space for up to four traditional 19-inch racks to be installed in the Drive and Electronics Module. These racks are oriented so the components mount vertically instead of horizontally and can hold up to 6Us (1U =1.75 inches) of equipment, such as switches, hubs, and servers.

Note: Equipment must be qualified to be installed in the racks.

Table 8–4 Accessory Rack Part Number

Description	ATO	PTO
6U Accessory Rack	7100942	XSL8500-RACK-Z-N

The number of racks supported in the library is determined by the power configuration of the library:

- N+1 power configuration =2 racks max
- 2N power configuration =4 racks

Cartridge Access Ports

The library includes one 39-slot cartridge access port (CAP) with an *optional* feature to add a second 39-slot CAP.

Note: A second HBZ card must be ordered to support a second 39-slot CAP.

Table 8–5 Cartridge Access Port Part Numbers

Description	ATO	PTO
Additional cartridge access port	7100908	XSL8500-UPG-CAP-N
Cartridge CAP magazine with 13 physical slots	7100900	XSL8500-MAG13-Z-N

HandBots

Each library comes standard with four HandBots. It is *optional* to add another four Handbots for a total of eight. See also "HandBot Power" on page 8-5.

Table 8–6 HandBot Part Number

Description	ATO	PTO
Redundant HandBots (four additional)	7100928	XSL8500-4BOT-Z-N

Pass-thru Ports

A library complex is created by connecting two or more SL8500 libraries together with pass-thru ports (PTPs). The PTPs are installed between the drive and electronics module and the robotics interface module of one library, and the same modules of an adjacent library.

Table 8–7 PTP Part Number

Description	ATO	PTO
Pass-thru port frame *without* mechanisms	7100926	XSL8500P-BLANK-N
PTP mechanisms (set of four)	7100919	XSL8500-MECH-Z-N
Hub and intra-library communications (ILC) kit	7100924	XSL8500P-HUB-Z-N

A single order of PTP mechanisms includes a set of four PTP mechanisms, one mechanism for each rail area between the libraries.

The ILC kit includes the Ethernet hub and cables to connect the additional libraries. Order a hub and intra-library communication (ILC) kit if:

- You are installing the first PTP between libraries 1 and 2. This hub can service libraries 1, 2, 3, 4, and 5.
- You are expanding the complex between libraries 5 and 6. This hub can service libraries 6, 7, 8, 9, and 10.

Redundant Electronics

Redundant Electronics is an *optional* feature that provides a second set of controller electronics in case the primary set has a failure.

Table 8–8 Redundant Electronics Part Number

Description	ATO	PTO
Redundant Electronics	7100917	XSL8500-REDELCT-Z +7101366

Power Configurations

The power configuration of the library depends on three component types:

- Library AC power
- Robotic DC power
- Tape Drive DC power

You must selected a power redundancy and AC power configuration. The number of power supplies and power distribution units required depends on the power redundancy option and AC power configuration chosen for the library. See Chapter 4, "Power" for more information.

Library Power Options

There are two possible AC power configurations for the library.

- **N+1 power**: the standard power configuration for **DC power redundancy**.
- **2N power**: an *optional* configuration for both **AC and DC power redundancy**.

> **Note:** The 2N power distribution unit must connect to a separate power source to provide both AC and DC power redundancy.

There are three possible power options:

- **Delta:** 200–240 VAC, three phase, 50–60 Hz, 40 Amps,

- **Wye:** 200–240VAC, three phase, 50–60 Hz, 24 Amps
- **Single-phase:** 200–240 VAC, 50–60 Hz, 24 Amps (3-separate inputs)

Table 8–9 Power Configuration Part Number

Description	ATO	PTO
Assembly for N+1 power	7100894	XSL8500-AC-ASSY-N
Delta Power	7100930	XSL8500-1PH-Z-N
Wye Power	7100938	XSL8500-DELTAZ-N
Single Phase Power	7100929	XSL8500-WYE-Z-N

DC Power Supplies

The number of DC 1200W power supplies required depends on the power configuration (N+1 or 2N) and the number of components in the library. The electronic control module (ECM) power supplies are AC to DC converters and are different from the load sharing power supplies used by the HandBots and tape drives. Refer to"Load Sharing Power Supplies" on page 4-6 to determine the number of power supplies required.

The 1200W DC power supply listed below can be used for both the tape drives and robotics.

Table 8–10 DC Power Supply Part Numbers

Description	ATO	PTO
DC 1200W Power Supply	7100931	XSL8500-DR-PWR-Z-N

HandBot Power

The HandBots use 1200W DC power supplies that plug into the Robot and Pass-thru Port Power Grid and provide 48 VDC power to the HandBots and pass-thru ports.

Power supply requirements depends on the number of HandBots and the type of library power configuration (N+1 or 2N). See "Robotics Power Supplies" on page 4-7 for calculating the quantity of power supplies to order.

- The N+1 power configuration provides two load sharing power supplies for every four HandBots plus one redundant power supply.
- The 2N power configuration provides one load sharing power supply for each HandBot.

Tape Drive Power

Location and selection of the power supplies depends on the number of tape drives selected and the type of power configuration (N+1 or 2N). See "Tape Drive Power Supplies" on page 4-6 for calculating the quantity of power supplies to order.

- The N+1 power configuration provides two load sharing power supplies for every 16 drives with one redundant power supply.
- The 2N power configuration provides one load sharing power supply for every four tape drives.

Note: Power supplies are hot-pluggable and can be added to the library without any down time.

Software Options

The following section lists the software options for the SL8500 library.

See https://edelivery.oracle.com/ for information about downloading activation files.

Activated Slot Capacity

For libraries with firmware 7.x and higher, utilize the table below for slot upgrade part numbers.

Table 8–11 Activated Capacity Feature Numbers

Description	ATO	PTO
100 Slot Upgrade activation permit	7100880	7100945
250 Slot Upgrade activation permit	7100881	7100946
500 Slot Upgrade activation permit	7100882	7100947
1,000 Slot Upgrade activation permit	7100883	7900948

Partitioning

Partitioning is only available on single, stand alone libraries; complexes are not allowed. Each partition can be under the control of either ACSLS or HSC/ELS.

Table 8–12 Partitioning Part Number

Description	ATO	PTO
Partitioning activation permit	7100936	XSL8500-UPG-PART-N

Dual TCP/IP

The Dual TCP/IP feature provides a dual control path for host connectivity to a single SL8500 library.

Table 8–13 Dual TCP/IP Part Number

Description	ATO	PTO
Dual TCP/IP host interface activation permit	7100932	XSL8500-DTCPIP-N

Multi-TCP/IP

The Multi-TCP/IP feature provides a multi-control path connection to the host and a single SL8500 library.

Table 8–14 Multi-TCP/IP Part Number

Description	PTO
Multi-TCP/IP host interface activation permit	XSL8500-MTCPIP-N

Tape Cartridges and Labels

Contact your authorized selling agent for approved labeled cartridges.

- Call 1.877.STK.TAPE to order media from your local reseller or to obtain media pre-sales support.

- E-mail tapemediaorders_ww@oracle.com

See the tape media area on the corporate web site for additional information: http://www.oracle.com/us/products/servers-storage/storage/tape-storage/overview/index.html

Tape Drives

See the tape media area on the corporate web site for additional information: http://www.oracle.com/us/products/servers-storage/storage/tape-storage/overview/index.html

For more detailed ordering information about T-series tape drives, refer to the drive specific *Systems Assurance Guide* on the Oracle Technical Network. Additionally, encryption is available for some drives, refer to the *Oracle Key Management System, Systems Assurance Guide* for more information about encryption-capable tape drives.

Tape drive conversion kits convert tape drives used in other StorageTek modular libraries to the drive tray of the SL8500 library.

Note: Tape drives that are migrated from other libraries and was previously known to the SAN under its own, drive-specific WWN will no longer be recognized. For this reason, the 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 SAN.

T-Series Drives

There may be other configurations for the T-series tape drives than the ones listed below. Refer to the drive specific *Systems Assurance Guide* on the Oracle Technical Network or contact Sales Assistance on +1-888-672-2534 for more information.

T10000C

The currently sold T10000C drives are listed in the table below.

Table 8–15 T10000C Tape Drives

Description	Part Number
T10000C 4Gb Fibre Channel, Short Wave Transceiver	T10C-4FC-SW-85Z
T10000C 4Gb FICON, Long Wave Transceiver	T10C-4FI-LW-85Z

Note: All T10000C drives are Oracle Key Management (OKM) encryption ready.

T9840D

The currently sold T9840D drives are listed in the table below.

Table 8–16 T9840D Tape Drives

Description	Part Number
T9840D 2Gb Fibre Channel, Short Wave Transceiver	9840D-FCDPSW-85Z-N
T9840D 2Gb FICON, Long Wave Transceiver	9840D-FIDPLW-85Z-N

Conversion Trays

The conversion trays for the T-series drives are listed in the table below.

Table 8–17 T-series Tape Drive Conversion Kits

Description	Part Number
T9840B from 9310/9740/L180/700/1400/5500/SL3000 to SL8500	9840B-LEGSL3SL85-N
T9840C from 9310/9740/L180/700/1400/5500/SL3000 to SL8500	9840C-LEGSL3SL85-N
T9840D from 9310/L180/700/1400/5500/SL3000 to SL8500	9840D-LEGSL3SL85-N
T10000A 2Gb from 9310/L180/700/1400/5500 to SL8500	T10A-LSER/85-KIT-N
T10000A 4Gb from 9310/L180/700/1400/5500 to SL8500	T10K-4-SL85-CKIT-N
T10000A(4Gb)/T10000B from SL3000 to SL8500	T10K-S30/S85CKIT-N
T10000B from L180/700/1400 to SL8500	T10K-4-SL85-CKIT-N
T10000C from SL3000 to SL8500	T10C-S30/S85-CKITZ

LTO Drives

The LTO standard for backward compatibility is to write back one generation and read back two generations. Oracle only sells HP and IBM LTO tape drive. Conversion kits can be purchased to convert tape drives used in other StorageTek modular libraries to the drive tray of the SL8500 library.

LTO Drives

The table below lists the LTO drives that are currently sold.

Table 8–18 LTO Tape Drives

Description	Part Number
HP LTO6 Fibre Channel, Encryption Ready	7104451
IBM LTO6 Fibre Channel, Encryption Ready	7104435
HP LTO5 Fibre Channel, OKM Encryption Ready	LTO5-HP8FC-SL85Z
IBM LTO5 Fibre Channel, OKM Encryption Ready	LTO5-IB8FC-SL85Z
IBM LTO5 FC for IBM AS400	7104076

LTO Conversion Kits

The table below lists the LTO conversion kits for the SL8500 library.

Table 8–19 LTO Conversion Kits

Description	Part Number
HP LTO5 FC from SL500/SL3000 to SL8500 conversion kit	7103005
IBM LTO5 FC from SL500/SL3000 to SL8500 conversion kit	7103002
HP LTO4 FC from SL500/L180/700 to SL8500 conversion kit	7103008
HP LTO4 FC from SL3000 to SL8500 conversion kit	LTO-4F-S30S8-CKZ-N
IBM LTO4 FC from L180/700/1400 to SL8500 conversion kit	7103010
IBM LTO4 FC from SL500 to SL8500 conversion kit	7103009
IBM LTO4 FC from SL3000 to SL8500 conversion kit	LTO-4F-S30S8-CKZ-N

Table 8–19 (Cont.) LTO Conversion Kits

Description	Part Number
IBM LTO4 FC from L5500 to SL8500 conversion kit	7103013
HP LTO3 FC from SL500/180/700 to SL8500 conversion kit	7103008
HP LTO3 FC from SL3000 to SL8500 conversion kit	LTO-3F-S30S8-CKZ-N
IBM LTO3 FC from SL180/700/1400 to SL8500 conversion kit	7103010
IBM LTO3 FC from SL500 to SL8500 conversion kit	7103009
IBM LTO3 FC from SL3000 to SL8500 conversion kit	LTO-3F-S30S8-CKZ-N
IBM LTO3 FC from L5500 to SL8500 conversion kit	7103013

Cables

The following sections provide information about the different interface cables. When ordering cables, keep this in mind:

- *Riser cables* can be used in computer rooms and are not classified according to flammability or toxic gas emissions.
- *Plenum cables* are designed for installation in air ducts and manufactured to meet UL standards for flammability and produce little smoke.

Note: The part numbers for all cables are PTO only.

Ethernet Cables

The library uses Ethernet cables for TCP/IP connections, which include host and library-to-library communications.

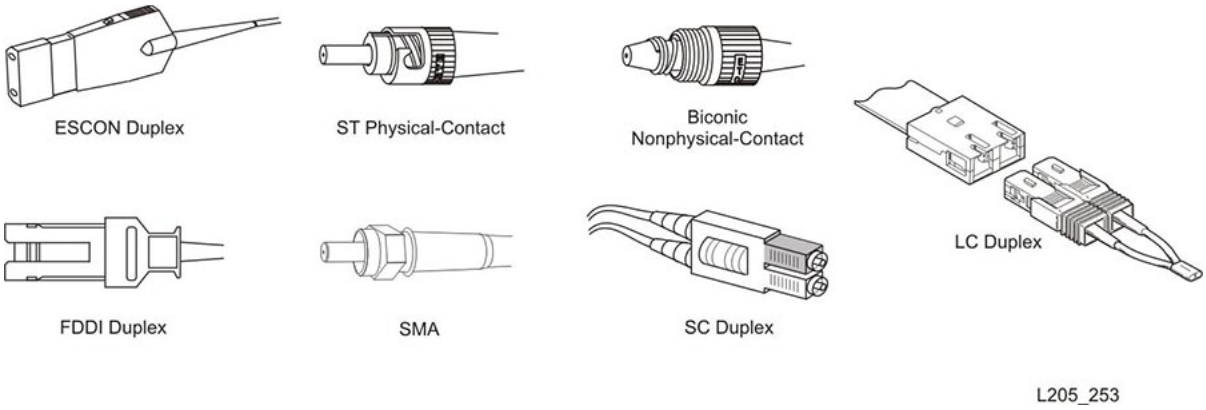
Table 8–20 Tape Drive Power Supply Part Number

Description	Part Number
CAT5E, 8 ft, 24 AWG, Shielded	CABLE10187033-Z-N
CAT5E, 35 ft, 24 AWG, Shielded	CABLE10187034-Z-N
CAT5E, 50 IN, 24 AWG, Shielded	CABLE10187035-Z-N

Fiber-Optic Cables

The figure below shows various Fiber-Optic connection types for identification purposes.

Figure 8–1 Cable Connection Identification Chart



LC and SC Duplex Connector

LC connectors are the industry standard for all 2 Gbps Fibre Channel devices.

SC connectors are the standard for 1 Gbps Fibre Channel devices such as the T9840A tape drive.

> **Note:** The SL8500 drive tray requires LC plugs for connection on the rear panel. When re-using T9840A tape drives, you will need to use an SC to LC adapter. The drive tray only supports LC connectors.

The table below lists the LC to LC, 50/125 2Gb fiber-optic cables.

Table 8–21 LC to LC, 50/125 Micron Two Gigabit Fiber-Optic Cables

Description	Part Number
3 m (9.8 ft) Duplex, Riser	CABLE10800340-Z-N
5 m (16.4 ft) Duplex, Riser	CABLE10800341-Z-N
10 m (32.8 ft) Duplex, Riser	CABLE10800310-Z-N
50 m (164 ft) Duplex, Riser	CABLE10800311-Z-N
100 m (328 ft) Duplex, Riser	CABLE10800312-Z-N
10 m (32.8 ft) Duplex, Plenum	CABLE10800313-Z-N
50 m (164 ft) Duplex, Plenum	CABLE10800314-Z-N
100 m (328 ft) Duplex, Plenum	CABLE10800315-Z-N

The table below lists the LC to LC, 9/125 2Gb fiber-optic cables.

Table 8–22 LC to LC, 9/125 Micron Two Gigabit Fiber-Optic Cables

Description	Part Number
10 m (32.8 ft) Duplex, Riser	CABLE10800331-Z-N
50 m (164 ft) Duplex, Riser	CABLE10800333-Z-N
100 m (328 ft) Duplex, Riser	CABLE10800306-Z-N
10 m (32.8 ft) Duplex, Plenum	CABLE10800330-Z-N

Table 8–22 (Cont.) LC to LC, 9/125 Micron Two Gigabit Fiber-Optic Cables

Description	Part Number
50 m (164 ft) Duplex, Plenum	CABLE10800332-Z-N
100 m (328 ft) Duplex, Plenum	CABLE10800305-Z-N

ESCON Cables

ESCON cables, depending on the platform or network components, can have different types of connectors.

Table 8–23 ESCON Cable Part Numbers

Description	Part Number
13 m (4 ft) Riser	CABLE10800289-Z-N
107 m (350 ft) Riser	CABLE10800292-Z-N
13 m (4 ft) Plenum	CABLE10800285-Z-N
31 m (100 ft) Plenum	CABLE10800286-Z-N
107 m (350 ft) Plenum	CABLE10800288-Z-N

A

Software Requirements

This appendix outlines the levels of software, firmware, and PTFs required for various library features and storage solutions. For the most up to date version requirements refer to the to the product specific documentation library on the Oracle Technical Network.

Software Compatibility

The table below lists the compatibility matrix for library management software. For the most up to date version requirements refer to the to the product specific documentation library on the Oracle Technical Network. Make sure the latest PTFs and PUTs are installed.

Table A–1 Library Software Compatibility Matrix

Product	Required Version (or higher)
ACSLS	7.1 or higher 7.3 or higher for Redundant Electronics 8.0 and above (T10000C, IPv6 support)
ELS	7.0 and above
ExHPDM	6.1 or 6.2
LCM	6.0 or 6.2
ExPR	6.1 or 6.2
HSC LibStation 1.4.3 VTCS	6.2 (VM only) Check for the latest PTF availability and compatibility.
VSM	6.1 or 6.2 (includes VTCS and VTSS)
VTL, VTL Plus, VTL-V, VTL-E	1.0 or 2.0

ELS/HSC Requirements

The mainframe library management software requirements are listed in this section.

HSC/ELS Support

The table below lists the support for each level of ELS/HCS.

Table A–2 HSC/ELS PTF HLI Compatibility Level Support

HSC/ELS Level	Compat Level 20 or Below	Compat Level 21	Compat Level 22	Level 23 Minimum RE Support	Level 23 Enhanced RE Support	Level 23 Multi-RE Support	Level 23 Enhanced Partitioning
6.2 (VM only)	Level 21 PTF	L1HA4UW	L1H15DH	L1H15H9	L1H15MF	L1H168F	L1H16EM
7.0 (MVS only)	Level 21 PTF	L1H14UY	L1H15DJ	L1H15HB	L1H15MH	L1H168H	L1H16EO
7.1(MVS only)	Included	Included	Included	Included	Included	L1H168I	L1H16EP

Level 23 Minimum RE support

- Allows a customer to connect to one SL8500 RE library in an ACS string.
- The single connected RE library can be switched through the HSC switch command, but other libraries in a string can only be switched through SLConsole.

Level 23 Enhanced RE support

- Allows a customer to connect to one SL8500 RE library in an ACS string.
- All RE libraries can be switched through HSC switch command.
- Can support up to 32 TPC/IP connections in an ACS string (LMU ADDR change).
- Other enhancements include:
  - Dual TCP/IP support
  - Display ACS acs-id to display all RE connections
  - Auto CAP recovery after a switch
  - Support for 64 read in-transit cartridges during cartridge recovery

Level 23 Multi RE support

- Allows a customer to connect to multiple SL8500 RE libraries in an ACS string up to 32 TCP/IP connections.
- Includes the same functionality as the Enhanced RE support.

Level 23 Single SL8500 Enhanced Partitioning

- Support for up to 8 partitions
- Allows a customer to add or remove library resources (transports, cell magazines, and CAPs) of a partition

Virtual Storage Manager

The virtual tape control system (**VTCS**) software resides on the host operating system in the same address space as HSC. VTCS 6.0.0+ is preferred and HSC 6.0+ is the minimum version required.

ACSLS Requirements

The following lists the requirements to support ACSLS:

- ACSLS 7.1 or higher is required for support (with PTF-809236).

- A TCP/IP connection is needed to connect the server to the library.
- There are no required configuration changes for ACSLS to function.
- For library firmware 6.x or later, ACSLS 7.3.1 or 8.0.2 is needed to insure ACSLS will automatically bring LSMs back online after a library outage.

For version specific requirements, refer to the *ACSLS Product Information* document for the specific version of ACSLS. This document can be found in the ACSLS product documentation library on the Oracle Technical Network.

AS/400 Configuration Requirements

Requirements for AS/400 to function as another type of management software to control the SL8500 library include:

- **RMLS/CSC must be at 1.3.0.**

  RMLS/CSC is the client component of ACSLS that runs on the AS/400. It performs the mounts, dismounts, enters, and ejects on the AS/400. This product integrates into the tape management systems for the AS/400. The tape management systems that RMLS/CSC integrates with are: IBM/BRMS, HelpSystems/RobotSave, and LXI/MMS.

- **OS/400 must be at V5R2.**

  OS/400 is the operating system that runs on an AS/400 and the iSeries platform. (iSeries is interchangeable with AS/400.)

- ACSLS only supports TCP/IP communications to RMLS/CSC.
- SNA (Systems Network Architecture) is not supported.

Independent Software Vendors

For the most current versions and compatibility refer to the independent software vendor website and documentation, or check with a Oracle representative and application vendor to make sure the selected solution is supported.

Table A–3 Independent Software Vendors

Backup Application	Solaris	IBM AIX	HP-UX	Microsoft Windows	Linux Red Hat	Linux SUSE
EMC NetWorker 7.3/7.4/7.5+	Yes	Yes	Yes	Yes	Yes	Yes
Tivoli Storage Manager 5.5.1/6+	Yes	Yes	Yes	Yes	Yes	Yes
Symantec Netbackup 6.0/6.5/7+	Yes	Yes	Yes	Yes	Yes	Yes
CA BrightStor 11.5	Yes	Yes	Yes	No	Yes	Yes
CA ArcServe 16+	N/A	N/A	YN/A	Yes	N/A	N/A
HP Data Protector 5.5/6.0+	Yes	N/A	Yes	Yes	N/A	N/A
Quest NetVault 8.2+	Yes	Yes	Yes	Yes	Yes	Yes
SAM-FS 5.2	Yes	N/A	N/A	N/A	N/A	N/A

The table below lists supported ISVs.

Table A–4 Supported Independent Software Vendors

ISV	Platform Supported
CA BrightStor, Enterprise Backup	Windows, Solaris , AIX, HP-UX
CA ARCserve	Windows, Solaris
EMC NetWorker	Windows, Solaris, AIX, HP-UX, Linux
Tivoli Storage Manager	Windows, Solaris, AIX, HP-UX, Linux
Symantec NetBackup	Windows, Solaris, AIX, HP-UX, Linux

The table below lists Tier 1 and Tier 2 partners.

Table A–5 Tier 1 and Tier 2 Partners

Tier 1	Tier 2
Symantec NetBackup	CommVault Galaxy
Symantec Backup Exec	StorNext
EMC NetWorker	Quest NetVault
Tivoli Storage Manager	Atempo Time Navigator
HP DataProtector	ASM (Windows/Sun)
CA BrightStor, Enterprise Backup	Syncsort Backup Express
CA ARCserve (No ACSLS Support)	

Partitioning Requirements

Requirements for enhanced partitioning in the SL8500 library include:

- SL8500 firmware FRS_7.0x or higher
- SL Console at Version FRS_5.5x or higher
- ACSLS 7.3.1 or 8.0.2 maintenance levels
- ACSLS HA 8
- NCS (NearLine Control Solution) Version 6.2
- HSC (MVS) Version 6.2 with required PTFs
- HSC (VM) Version 6.2 with required PTFs
- VSM (Virtual Storage Module) all supported versions
- ExPR (Expert Performance Reported) with PTF L1E025H
- LCM (Library Content Manager)
  - Version 6.0 with PTF L1L00F6,
  - Version 6.1 (none),
  - Version 6.2 with PTF L1L00F7

Hosts without the latest level of software (ACSLS or HSC) or without the latest maintenance will not be able to manage a partitioned ACS online.

Always refer to My Oracle Support (MOS) for the latest versions of software and firmware and the Oracle Technology Network (OTN) for the latest versions of the documentation

Note: Software and firmware levels can be downloaded and ready in advance of activation. When the time and window is available, these codes can be activated. This preparation can limit down time of the library and operating system.

B

Tape Drives and Media

This appendix provides information about the tape drives and media supported by the SL8500 library. See the tape drive section on the corporate web site for more information about currently available tape drives:
http://www.oracle.com/us/products/servers-storage/storage/tape-storage/overview/index.html

For more information about the T-series tape drives, refer to the drive specific *System Assurance Guide*. For more information about LTO drives, refer to the LTO specific documentation. Both resources can be found on the Oracle Technical Network at:
http://www.oracle.com/technetwork/documentation/tape-storage-curr-187744.html

Supported Tape Drives

Table B–1 Supported Tape Drives

Drive Type	Vendor	Capacity and Transfer Rate	Interface Type
T9840 A, B, C, D	Oracle	**A:** 20 GB with rates at 10 MB/s* (legacy) **B:** 20 GB with rates at 19 MB/s (legacy) **C:** 40 GB with rates at 30 MB/s (legacy) **D:** 75 GB with rates at 30 MB/s (encryption-capable)	Fibre Channel, FICON, ESCON
T9940 B (only)	Oracle	**B:** 200 GB with transfer rates of 30 MB/s (legacy)	Fibre Channel, FICON, ESCON
T10000 A, B, C	Oracle	**A:** 500 GB native capacity at 120 MB/s (legacy) **B:** 1 TB native capacity at 120MB/s (legacy) **C:** 5 TB capacity with rates up to 252 MB/s native	Fibre Channel, FICON
LTO 2, 3, 4, 5, 6	Hewlett Packard IBM	**LTO2** drives: 200 GB at 35 MB/s (legacy) **LTO3** drives: 400 GB at 80 MB/s (legacy) **LTO4** drives: 800 GB at 120 MB/s **LTO5** drives: 1.5 TB at 140 MB/s **LTO6** drives: 2.5 TB at 160 MB/s	Fibre Channel
SDLT 600 DLT-S4	Quantum	**SDLT 600**: 300 GB, with transfer rates of 36 MB/s **DLT-S4** (legacy)	Fibre Channel

Supported Tape Drives

This section provides brief descriptions of the various tape drives supported by the SL8500 library. For more detailed information refer to the drive specific documentation.

T9840

T9840 are access-centric tape drives that are ideal for applications that demand high data throughput and fast recall. Although all models are compatible with the SL8500 library, only the T9840D is currently sold.

These drives obtain their high-performance by using a unique dual-hub cartridge design with midpoint load technology. This design enables fast access and reduces latency by positioning the read/write head in the middle of the tape. The entire tape path is contained within the cartridge, which reduces contamination and enables the drives fast access.

For enhanced security VolSafe cartridges are available. VolSafe is an extension of the write protect function for a StorageTek tape drive. These cartridges are for write once read many (WORM) applications and cannot be erased

T9940

T9940 are high-capacity tape drives designed for storage applications and use a single reel tape cartridge. Although the T9940B drive is compatible with the SL8500 library, it is not currently sold.

The tape cartridge for this drive uses a single-reel hub design—the supply reel is inside the cartridge and the take-up reel is inside the tape drive. The tape cartridge can store up to 200 gigabytes of uncompressed data on a single tape cartridge at rates as high as 30 megabytes per second.

T10000

T10000 are high-capacity, high-performance drives that use a single reel tape cartridge. Although all models are compatible with the SL8500 library, only the T10000C is currently sold.

Optimized for high capacity, the T10000 series of tape cartridges use a single reel hub to maximize capacity. The T10000 T2 tape cartridge has 5 TB of native capacity and is compatible with the T10000C tape drive. The T10000 tape cartridge can store up to 1 TB of data and is designed for the T10000A and B tape drives. In addition to the standard data cartridge, a sport cartridge is available. The sport cartridge has smaller overall capacity, but provides faster data access.

For enhanced security VolSafe cartridges are available. VolSafe is an extension of the write protect function for a StorageTek tape drive. These cartridges are for write once read many (WORM) applications and cannot be erased without destroying the tape itself.The tape cartridge for this drive uses a single-reel hub design. The supply reel is inside the cartridge and the take-up reel is inside the tape drive.

The interface connections to the T10000 are strictly fiber-optic—either Fibre Channel or FICON to support the high rate of data transfers.

Linear Tape-Open

Ultrium Linear Tape-Open (LTO) is an "open format" technology that provides media compatibility across all brands and manufacturers of LTO Ultrium products. Currently, only HP and IBM LTO tape drives are sold through Oracle.

> **Note:** The LTO standard for backward compatibility is to write back one generation and read back two generations.

LTO tape drives are a small, modular, capacity-centric drive. The tape cartridge for LTO Ultrium drives is a single-reel hub design—the supply reel is inside the cartridge and the take-up reel is inside the tape drive. The drives require specific media with specific labels.

Super DLT600

The SDLT is a modular design, capacity-centric tape drive that supports multiple product generations. The SDLT drive is not currently sold. The Super DLT/DLT tape cartridges are a legacy format and are only compatible with SDLT/DLT tape drives. The types of DLT tape cartridges are:

- SDLTtape I: for use with SDLT models 220 and 320 (160 GB native capacity)
- SDLTtape II: for use with the SDLT 600 (300 GB native capacity)
- DLT-S4: for use with DLT-S4 drive (800GB native capacity)

Tape Drive Comparison

Table B–2 Tape Drive Comparisons

Specification	T10K C	T9840D	HP LTO5	HP LTO6	IBM LTO5	IBM LTO6
Capacity (native)	5 TB	75 GB	1.5 TB	2.5 TB	1.5 TB	2.5 TB
Transfer rates (native)	252 MB/s	30 MB/s	140 MB/s	160 MB/s	140 MB/s	160 MB/s
Buffer size	2 GB	64 MB	256 MB	—	256 MB	—
Load Time (sec)	13.1	8.5	19	22	19	22
Access (sec)	57	8	52	50	52	50
Tape speed (m/s)	5.62	3.4	—	—	—	—
Maximum/average Rewind time (sec)	115	16 /8	96/ 48	98/51	96/ 48	98/51
Unload Time (sec)	26	12.5	19	19	19	19
Availability(MTBF) hours	290,000	290,000	250,000	250,000	250,000	250,000
Length–usable	1,107 m (3,632 ft)	251 m (889 ft)	850 m (2789 ft)	—	850 m (2789 ft)	—
Fibre Channel	4 Gb/s	2 Gb/s	8 Gb/s	8 Gb/s	8 Gb/s	8 Gb/s
SCSI /SAS	—	—	6 Gb SAS	6 Gb SAS	6 Gb SAS	6 Gb SAS
FICON	4 G/bs	2 Gb/s	—	—	—	—
ESCON	—	2 Gb/s	—	—	—	—

Media

Most drives are capable of reading the data recorded by an earlier generation tape drive from the same family. Therefore, the customer can use their existing cartridges. However, the media must be compatible with the tape drives supported by the SL8500 and still within their warranty period. Generally, there are four types of tape cartridges (media) used with these drives: data, write once read many (WORM) or VolSafe secure media, cleaning, and diagnostic (special, reserved data tapes).

For information about labels and barcodes for tape media, refer to the Barcode Technical Brief on OTN.

Contact an Oracle representative to obtain more information about tape cartridges and labels, or see the tape media section on the corporate website: http://www.oracle.com/us/products/servers-storage/storage/tape-storage/overview/index.html

The table below provides a comparison of tape drive media types. For more technical specifications, refer to the media specific documentation.

Table B–3 Tape Drive Media Comparisons

Specifications	9840 (D)	T10K (C)	LTO5	LTO6
Capacity, native	75 GB	5 TB	1.5 TB	2.5 TB
Transfer rate (MB/s)	30	252	140	160
Number of tracks	576	3584	1280	2176
Total length	271 m (889 ft)	1147 m (3763.1 ft)	846m (2776 ft)	846m (2776 ft)
Archival life (years)	15–30	30	15–30	—
Load/unloads	10,000	25,000	5,000	—
Uncorrected bit error rate	$1x10^{-18}$	$1x10^{-19}$	$1x10^{-17}$	$1x10^{-17}$

C

Controlling Contaminants

This appendix explains controlling contaminants.

Environmental Contaminants

Control over contaminant levels in a computer room is extremely important because tape libraries, tape drives, and tape media are subject to damage from airborne particulates. Most particles smaller than ten microns are not visible to the naked eye under most conditions, but these particles can be the most damaging. As a result, the operating environment must adhere to the following requirements:

- ISO 14644-1 Class 8 Environment.
- The total mass of airborne particulates must be less than or equal to 200 micrograms per cubic meter.
- Severity level G1 per ANSI/ISA 71.04-1985.

Oracle currently requires the ISO 14644-1 standard approved in 1999, but will require any updated standards for ISO 14644-1 as they are approved by the ISO governing body. The ISO 14644-1 standard primarily focuses on the quantity and size of particulates as well as the proper measurement methodology, but does not address the overall mass of the particulates. As a result, the requirement for total mass limitations is also necessary as a computer room or data center could meet the ISO 14644-1 specification, but still damage equipment because of the specific type of particulates in the room. In addition, the ANSI/ISA 71.04-1985 specification addresses gaseous contaminations as some airborne chemicals are more hazardous. All three requirements are consistent with the requirements set by other major tape storage vendors.

Required Air Quality Levels

Particles, gasses and other contaminants may impact the sustained operations of computer hardware. Effects can range from intermittent interference to actual component failures. The computer room must be designed to achieve a high level of cleanliness. Airborne dusts, gasses and vapors must be maintained within defined limits to help minimize their potential impact on the hardware.

Airborne particulate levels must be maintained within the limits of ISO 14644-1 Class 8 Environment. This standard defines air quality classes for clean zones based on airborne particulate concentrations. This standard has an order of magnitude less particles than standard air in an office environment. Particles ten microns or smaller are harmful to most data processing hardware because they tend to exist in large numbers, and can easily circumvent many sensitive components' internal air filtration

systems. When computer hardware is exposed to these submicron particles in great numbers they endanger system reliability by posing a threat to moving parts, sensitive contacts and component corrosion.

Excessive concentrations of certain gasses can also accelerate corrosion and cause failure in electronic components. Gaseous contaminants are a particular concern in a computer room both because of the sensitivity of the hardware, and because a proper computer room environment is almost entirely recirculating. Any contaminant threat in the room is compounded by the cyclical nature of the airflow patterns. Levels of exposure that might not be concerning in a well ventilated site repeatedly attack the hardware in a room with recirculating air. The isolation that prevents exposure of the computer room environment to outside influences can also multiply any detrimental influences left unaddressed in the room.

Gasses that are particularly dangerous to electronic components include chlorine compounds, ammonia and its derivatives, oxides of sulfur and petrol hydrocarbons. In the absence of appropriate hardware exposure limits, health exposure limits must be used.

While the following sections will describe some best practices for maintaining an ISO 14644-1 Class 8 Environment in detail, there are some basic precautions that must be adhered to:

- Do not allow food or drink into the area.
- Cardboard, wood, or packing materials must not be stored in the data center clean area.
- Identify a separate area for unpacking new equipment from crates and boxes.
- Do not allow construction or drilling in the data center without first isolating sensitive equipment and any air targeted specifically for the equipment. Construction generates a high level of particulates that exceed ISO 14644-1 Class 8 criteria in a localized area. Dry wall and gypsum are especially damaging to storage equipment.

Contaminant Properties and Sources

Contaminants in the room can take many forms, and can come from numerous sources. Any mechanical process in the room can produce dangerous contaminants or agitate settled contaminants. A particle must meet two basic criteria to be considered a contaminant:

- It must have the physical properties that could potentially cause damage to the hardware.
- It must be able to migrate to areas where it can cause the physical damage.

  The only differences between a potential contaminant and an actual contaminant are time and location. Particulate matter is most likely to migrate to areas where it can do damage if it is airborne. For this reason, airborne particulate concentration is a useful measurement in determining the quality of the computer room environment. Depending on local conditions, particles as big as 1,000 microns can become airborne, but their active life is very short, and they are arrested by most filtration devices. Submicron particulates are much more dangerous to sensitive computer hardware, because they remain airborne for a much longer period of time, and they are more apt to bypass filters.

Operator Activity

Human movement within the computer space is probably the single greatest source of contamination in an otherwise clean computer room. Normal movement can dislodge tissue fragments, such as dander or hair, or fabric fibers from clothing. The opening and closing of drawers or hardware panels or any metal-on-metal activity can produce metal filings. Simply walking across the floor can agitate settled contamination making it airborne and potentially dangerous.

Hardware Movement

Hardware installation or reconfiguration involves a great deal of subfloor activity, and settled contaminants can very easily be disturbed, forcing them to become airborne in the supply air stream to the room's hardware. This is particularly dangerous if the subfloor deck is unsealed. Unsealed concrete sheds fine dust particles into the airstream, and is susceptible to efflorescence -- mineral salts brought to the surface of the deck through evaporation or hydrostatic pressure.

Outside Air

Inadequately filtered air from outside the controlled environment can introduce innumerable contaminants. Post-filtration contamination in duct work can be dislodged by air flow, and introduced into the hardware environment. This is particularly important in a downward-flow air conditioning system in which the sub-floor void is used as a supply air duct. If the structural deck is contaminated, or if the concrete slab is not sealed, fine particulate matter (such as concrete dust or efflorescence) can be carried directly to the room's hardware.

Stored Items

Storage and handling of unused hardware or supplies can also be a source of contamination. Corrugated cardboard boxes or wooden skids shed fibers when moved or handled. Stored items are not only contamination sources; their handling in the computer room controlled areas can agitate settled contamination already in the room.

Outside Influences

A negatively pressurized environment can allow contaminants from adjoining office areas or the exterior of the building to infiltrate the computer room environment through gaps in the doors or penetrations in the walls. Ammonia and phosphates are often associated with agricultural processes, and numerous chemical agents can be produced in manufacturing areas. If such industries are present in the vicinity of the data center facility, chemical filtration may be necessary. Potential impact from automobile emissions, dusts from local quarries or masonry fabrication facilities or sea mists should also be assessed if relevant.

Cleaning Activity

Inappropriate cleaning practices can also degrade the environment. Many chemicals used in normal or "office" cleaning applications can damage sensitive computer equipment. Potentially hazardous chemicals outlined in the "Cleaning Procedures and Equipment" section should be avoided. Out-gassing from these products or direct contact with hardware components can cause failure. Certain biocide treatments used in building air handlers are also inappropriate for use in computer rooms either because they contain chemicals, that can degrade components, or because they are not

designed to be used in the airstream of a re-circulating air system. The use of push mops or inadequately filtered vacuums can also stimulate contamination.

It is essential that steps be taken to prevent air contaminants, such as metal particles, atmospheric dust, solvent vapors, corrosive gasses, soot, airborne fibers or salts from entering or being generated within the computer room environment. In the absence of hardware exposure limits, applicable human exposure limits from OSHA, NIOSH or the ACGIH should be used

Contaminant Effects

Destructive interactions between airborne particulate and electronic instrumentation can occur in numerous ways. The means of interference depends on the time and location of the critical incident, the physical properties of the contaminant and the environment in which the component is placed.

Physical Interference

Hard particles with a tensile strength at least 10% greater than that of the component material can remove material from the surface of the component by grinding action or embedding. Soft particles will not damage the surface of the component, but can collect in patches that can interfere with proper functioning. If these particles are tacky they can collect other particulate matter. Even very small particles can have an impact if they collect on a tacky surface, or agglomerate as the result of electrostatic charge build-up.

Corrosive Failure

Corrosive failure or contact intermittence due to the intrinsic composition of the particles or due to absorption of water vapor and gaseous contaminants by the particles can also cause failures. The chemical composition of the contaminant can be very important. Salts, for instance, can grow in size by absorbing water vapor from the air (nucleating). If a mineral salts deposit exists in a sensitive location, and the environment is sufficiently moist, it can grow to a size where it can physically interfere with a mechanism, or can cause damage by forming salt solutions.

Shorts

Conductive pathways can arise through the accumulation of particles on circuit boards or other components. Many types of particulate are not inherently conductive, but can absorb significant quantities of water in high-moisture environments. Problems caused by electrically conductive particles can range from intermittent malfunctioning to actual damage to components and operational failures.

Thermal Failure

Premature clogging of filtered devices will cause a restriction in air flow that could induce internal overheating and head crashes. Heavy layers of accumulated dust on hardware components can also form an insulative layer that can lead to heat-related failures.

Room Conditions

All surfaces within the controlled zone of the data center should be maintained at a high level of cleanliness. All surfaces should be periodically cleaned by trained

professionals on a regular basis, as outlined in the "Cleaning Procedures and Equipment" section. Particular attention should be paid to the areas beneath the hardware, and the access floor grid. Contaminants near the air intakes of the hardware can more easily be transferred to areas where they can do damage. Particulate accumulations on the access floor grid can be forced airborne when floor tiles are lifted to gain access to the sub-floor.

The subfloor void in a downward-flow air conditioning system acts as the supply air plenum. This area is pressurized by the air conditioners, and the conditioned air is then introduced into the hardware spaces through perforated floor panels. Thus, all air traveling from the air conditioners to the hardware must first pass through the subfloor void. Inappropriate conditions in the supply air plenum can have a dramatic effect on conditions in the hardware areas.

The subfloor void in a data center is often viewed solely as a convenient place to run cables and pipes. It is important to remember that this is also a duct, and that conditions below the false floor must be maintained at a high level of cleanliness. Contaminant sources can include degrading building materials, operator activity or infiltration from outside the controlled zone. Often particulate deposits are formed where cables or other subfloor items form air dams that allow particulate to settle and accumulate. When these items are moved, the particulate is re-introduced into the supply airstream, where it can be carried directly to hardware.

Damaged or inappropriately protected building materials are often sources of subfloor contamination. Unprotected concrete, masonry block, plaster or gypsum wall-board will deteriorate over time, shedding fine particulate into the air. Corrosion on post-filtration air conditioner surfaces or subfloor items can also be a concern. The subfloor void must be thoroughly and appropriately decontaminated on a regular basis to address these contaminants. Only vacuums equipped with High Efficiency Particulate Air (HEPA) filtration should be used in any decontamination procedure. Inadequately filtered vacuums will not arrest fine particles, passing them through the unit at high speeds, and forcing them airborne.

Unsealed concrete, masonry or other similar materials are subject to continued degradation. The sealants and hardeners normally used during construction are often designed to protect the deck against heavy traffic, or to prepare the deck for the application of flooring materials, and are not meant for the interior surfaces of a supply air plenum. While regular decontaminations will help address loose particulate, the surfaces will still be subject to deterioration over time, or as subfloor activity causes wear. Ideally all of the subfloor surfaces will be appropriately sealed at the time of construction. If this is not the case, special precautions will be necessary to address the surfaces in an on-line room.

It is extremely important that only appropriate materials and methodology are used in the encapsulation process. Inappropriate sealants or procedures can actually degrade the conditions they are meant to improve, impacting hardware operations and reliability. The following precautions should be taken when encapsulating the supply air plenum in an on-line room:

- Manually apply the encapsulant. Spray applications are totally inappropriate in an on-line data center. The spraying process forces the sealant airborne in the supply airstream, and is more likely to encapsulate cables to the deck.
- Use a pigmented encapsulant. The pigmentation makes the encapsulant visible in application, ensuring thorough coverage, and helps in identifying areas that are damaged or exposed over time.

- It must have a high flexibility and low porosity to effectively cover the irregular textures of the subject area, and to minimize moisture migration and water damage.
- The encapsulant must not out-gas any harmful contaminants. Many encapsulants commonly used in industry are highly ammoniated or contain other chemicals that can be harmful to hardware. It is very unlikely that this out-gassing could cause immediate, catastrophic failure, but these chemicals will often contribute to corrosion of contacts, heads or other components.

Effectively encapsulating a subfloor deck in an on-line computer room is a very sensitive and difficult task, but it can be conducted safely if appropriate procedures and materials are used. Avoid using the ceiling void as an open supply or return for the building air system. This area is typically very dirty and difficult to clean. Often the structural surfaces are coated with fibrous fire-proofing, and the ceiling tiles and insulation are also subject to shedding. Even before filtration, this is an unnecessary exposure that can adversely affect environmental conditions in the room. It is also important that the ceiling void does not become pressurized, as this will force dirty air into the computer room. Columns or cable chases with penetrations in both the subfloor and ceiling void can lead to ceiling void pressurization.

Exposure Points

All potential exposure points in the data center should be addressed to minimize potential influences from outside the controlled zone. Positive pressurization of the computer rooms will help limit contaminant infiltration, but it is also important to minimize any breaches in the room perimeter. To ensure the environment is maintained correctly, the following should be considered:

- All doors should fit snugly in their frames.
- Gaskets and sweeps can be used to address any gaps.
- Automatic doors should be avoided in areas where they can be accidentally triggered. An alternate means of control would be to remotely locate a door trigger so that personnel pushing carts can open the doors easily. In highly sensitive areas, or where the data center is exposed to undesirable conditions, it may be advisable to design and install personnel traps. Double sets of doors with a buffer between can help limit direct exposure to outside conditions.
- Seal all penetrations between the data center and adjacent areas.
- Avoid sharing a computer room ceiling or subfloor plenum with loosely controlled adjacent areas.

Filtration

Filtration is an effective means of addressing airborne particulate in a controlled environment. It is important that all air handlers serving the data center are adequately filtered to ensure appropriate conditions are maintained within the room. In-room process cooling is the recommended method of controlling the room environment. The in-room process coolers re-circulate room air. Air from the hardware areas is passed through the units where it is filtered and cooled, and then introduced into the subfloor plenum. The plenum is pressurized, and the conditioned air is forced into the room, through perforated tiles, which then travels back to the air conditioner for reconditioning. The airflow patterns and design associated with a typical computer room air handler have a much higher rate of air change than typical comfort cooling air conditioners so air is filtered much more often than in an office environment.

Proper filtration can capture a great deal of particulates. The filters installed in the in-room, re-circulating air conditioners should have a minimum efficiency of 40% (Atmospheric Dust-Spot Efficiency, ASHRAE Standard 52.1). Low-grade pre-filters should be installed to help prolong the life of the more expensive primary filters.

Any air being introduced into the computer room controlled zone, for ventilation or positive pressurization, should first pass through high efficiency filtration. Ideally, air from sources outside the building should be filtered using High Efficiency Particulate Air (HEPA) filtration rated at 99.97% efficiency (DOP Efficiency MILSTD-282) or greater. The expensive high efficiency filters should be protected by multiple layers of pre-filters that are changed on a more frequent basis. Low-grade pre-filters, 20% ASHRAE atmospheric dust-spot efficiency, should be the primary line of defense. The next filter bank should consist of pleated or bag type filters with efficiencies between 60% and 80% ASHRAE atmospheric dust-spot efficiency.

ASHRAE 52-76

Dust spot efficiency %	3.0 micron	1.0 micron	0.3 micron
25-30	80	20	<5
60-65	93	50	20
80-85	99	90	50
90	>99	92	60
DOP 95	--	>99	95

Low efficiency filters are almost totally ineffective at removing sub-micron particulates from the air. It is also important that the filters used are properly sized for the air handlers. Gaps around the filter panels can allow air to bypass the filter as it passes through the air conditioner. Any gaps or openings should be filled using appropriate materials, such as stainless steel panels or custom filter assemblies.

Positive Pressurization and Ventilation

A designed introduction of air from outside the computer room system will be necessary to accommodate positive pressurization and ventilation requirements. The data center should be designed to achieve positive pressurization in relation to more loosely controlled surrounding areas. Positive pressurization of the more sensitive areas is an effective means of controlling contaminant infiltration through any minor breaches in the room perimeter. Positive pressure systems are designed to apply outward air forces to doorways and other access points within the data processing center to minimize contaminant infiltration of the computer room. Only a minimal amount of air should be introduced into the controlled environment. In data centers with multiple rooms, the most sensitive areas should be the most highly pressurized. It is, however, extremely important that the air being used to positively pressurize the room does not adversely affect the environmental conditions in the room. It is essential that any air introduction from outside the computer room is adequately filtered and conditioned to ensure that it is within acceptable parameters. These parameters can be looser than the goal conditions for the room since the air introduction should be minimal. A precise determination of acceptable limits should be based on the amount of air being introduced and the potential impact on the environment of the data center.

Because a closed-loop, re-circulating air conditioning system is used in most data centers, it will be necessary to introduce a minimal amount of air to meet the ventilation requirements of the room occupants. Data center areas normally have a very low human population density; thus the air required for ventilation will be

minimal. In most cases, the air needed to achieve positive pressurization will likely exceed that needed to accommodate the room occupants. Normally, outside air quantities of less than 5% make-up air should be sufficient (ASHRAE Handbook: Applications, Chapter 17). A volume of 15 CFM outside air per occupant or workstation should sufficiently accommodate the ventilation needs of the room.

Cleaning Procedures and Equipment

Even a perfectly designed data center requires continued maintenance. Data centers containing design flaws or compromises may require extensive efforts to maintain conditions within desired limits. Hardware performance is an important factor contributing to the need for a high level of cleanliness in the data center.

Operator awareness is another consideration. Maintaining a fairly high level of cleanliness will raise the level of occupant awareness with respect to special requirements and restrictions while in the data center. Occupants or visitors to the data center will hold the controlled environment in high regard and are more likely to act appropriately. Any environment that is maintained to a fairly high level of cleanliness and is kept in a neat and well organized fashion will also command respect from the room's inhabitants and visitors. When potential clients visit the room they will interpret the overall appearance of the room as a reflection of an overall commitment to excellence and quality. An effective cleaning schedule must consist of specially designed short-term and long-term actions. These can be summarized as follows:

Frequency	Task
Daily Actions	Rubbish Removal
Weekly Actions	Access floor maintenance (vacuum and damp mop)
Quarterly Actions	Hardware decontamination
	Room surface decontamination
Biennial Actions	Subfloor void decontamination
	Air conditioner decontamination (as necessary)

Daily Tasks

This statement of work focuses on the removal of each day's discarded trash and rubbish from the room. In addition, daily floor vacuuming may be required in Print Rooms or rooms with a considerable amount of operator activity.

Weekly Tasks

This statement of work focuses on the maintenance of the access floor system. During the week, the access floor becomes soiled with dust accumulations and blemishes. The entire access floor should be vacuumed and damp mopped. All vacuums used in the data center, for any purpose, should be equipped with High Efficiency Particulate Air (HEPA) filtration. Inadequately filtered equipment cannot arrest smaller particles, but rather simply agitates them, degrading the environment they were meant to improve. It is also important that mop-heads and dust wipes are of appropriate non-shedding designs.

Cleaning solutions used within the data center must not pose a threat to the hardware. Solutions that could potentially damage hardware include products that are:

- Ammoniated

- Chlorine-based
- Phosphate-based
- Bleach enriched
- Petro-chemical based
- Floor stripper or re-conditioners

It is also important that the recommended concentrations are used, as even an appropriate agent in an inappropriate concentration can be potentially damaging. The solution should be maintained in good condition throughout the project, and excessive applications should be avoided.

Quarterly Tasks

The quarterly statement of work involves a much more detailed and comprehensive decontamination schedule and should only be conducted by experienced computer room contamination-control professionals. These actions should be performed three to four times per year, based on the levels of activity and contamination present. All room surfaces should be thoroughly decontaminated including cupboards, ledges, racks, shelves and support equipment. High ledges and light fixtures and generally accessible areas should be treated or vacuumed as appropriate.

Vertical surfaces including windows, glass partitions, doors, etc. should be thoroughly treated. Special dust cloths that are impregnated with a particle absorbent material are to be used in the surface decontamination process. Do not use generic dust rags or fabric cloths to perform these activities. Do not use any chemicals, waxes or solvents during these activities.

Settled contamination should be removed from all exterior hardware surfaces including horizontal and vertical surfaces. The unit's air inlet and outlet grilles should be treated as well. Do not wipe the unit's control surfaces as these areas can be decontaminated by the use of lightly compressed air. Special care should also be taken when cleaning keyboards and life-safety controls. Specially treated dust wipes should be used to treat all hardware surfaces. Monitors should be treated with optical cleansers and static-free cloths. No Electro-Static Discharge (ESD) dissipative chemicals should be used on the computer hardware, since these agents are caustic and harmful to most sensitive hardware. The computer hardware is sufficiently designed to permit electrostatic dissipation thus no further treatments are required. After all of the hardware and room surfaces have been thoroughly decontaminated, the access floor should be HEPA vacuumed and damp mopped as detailed in the Weekly Actions.

Biennial Tasks

The subfloor void should be decontaminated every 18 months to 24 months based on the conditions of the plenum surfaces and the degree of contaminant accumulation. Over the course of the year, the subfloor void undergoes a considerable amount of activity that creates new contamination accumulations. Although the weekly above floor cleaning activities will greatly reduce the subfloor dust accumulations, a certain amount of surface dirt will migrate into the subfloor void. It is important to maintain the subfloor to a high degree of cleanliness since this area acts as the hardware's supply air plenum. It is best to perform the subfloor decontamination treatment in a short time frame to reduce cross contamination. The personnel performing this operation should be fully trained to assess cable connectivity and priority. Each exposed area of the subfloor void should be individually inspected and assessed for possible cable handling and movement. All twist-in and plug-in connections should be

checked and fully engaged before cable movement. All subfloor activities must be conducted with proper consideration for air distribution and floor loading. In an effort to maintain access floor integrity and proper psychrometric conditions, the number of floor tiles removed from the floor system should be carefully managed. In most cases, each work crew should have no more than 24 square feet (six tiles) of open access flooring at any one time. The access floor's supporting grid system should also be thoroughly decontaminated, first by vacuuming the loose debris and then by damp-sponging the accumulated residue. Rubber gaskets, if present, as the metal framework that makes up the grid system should be removed from the grid work and cleaned with a damp sponge as well. Any unusual conditions, such as damaged floor suspension, floor tiles, cables and surfaces, within the floor void should be noted and reported.

Activity and Processes

Isolation of the data center is an integral factor in maintaining appropriate conditions. All unnecessary activity should be avoided in the data center, and access should be limited to necessary personnel only. Periodic activity, such as tours, should be limited, and traffic should be restricted to away from the hardware so as to avoid accidental contact. All personnel working in the room, including temporary employees and janitorial personnel, should be trained in the most basic sensitivities of the hardware so as to avoid unnecessary exposure. The controlled areas of the data center should be thoroughly isolated from contaminant producing activities. Ideally, print rooms, check sorting rooms, command centers or other areas with high levels of mechanical or human activity should have no direct exposure to the data center. Paths to and from these areas should not necessitate traffic through the main data center areas.

D

Electrical Conversions

This appendix describes how to calculate and convert common electrical values.

Units

The units used in most basic electrical conversions are in the following table.

Table D–1 Basic Electrical Units

A =Amperes (Amps)	*PF* =Power Factor
Btu =British Thermal Unit	*V* =Volts
kVA =Kilovolt-amperes	*VA* =Volt-amperes
kW =Kilowatts	*W* =Watts

Volts, Watts, and Amperes

Equation: Watts [W] =Amperes [A] x Volts [V]

Example

Given the following values you can use any two values to calculate a third: Watts =2400 (2.4 kW), Volts =120, Amps =20.

2.4 kW ÷ 20 A =120 V

120 V x 20 A =2,400 W (or 2.4 kW)

2,400 W ÷ 120 V =20 A

Volt-Amperes (VA)

Equation: Volts [VAC] x Amps [A-rms] =Volt-amperes [VA]

Example: A small server is plugged into a 120 VAC 60 Hz power source and is rated at 2.5 amps.

120 VAC x 2.5 amps =300 VA

Kilovolt-Amperes (kVA)

Equation: Volts [VAC] x Amps [A-rms] ÷ 1000 =kilo-volt-amperes [kVA]

Three Phase Equation: kVA (phase 1) +kVA (phase 2) +kVA (phase 3) =kVA (total)

Examples:

- *Single Phase:*

  120 VAC x 2.5 amps ÷ 1000 =0.3 kVA

- *Three Phase:*

  Phase 1: 120 VAC x 2.5 amps ÷ 1000 =0.3 kVA

  Phase 2: 120 VAC x 2.5 amps ÷ 1000 =0.3 kVA

  Phase 3: 120 VAC x 2.5 amps ÷ 1000 =0.3 kVA

  Total kVA: 0.3 kVA +0.3 kVA +0.3 kVA =0.9 kVA

Kilowatts

The formula requires a value for the "power factor." The power factor (PF) is not a precise value (unless specifically known for the equipment). This factor can vary from 60–95% and is rarely published on the equipment.

Equation: Volts [V] x Amps [A] x Power Factor [PF] ÷ 1000 =Kilowatts [kW]

Examples: For these calculations a power factor of 0.85 is used.

- *Single Phase*:

  A medium-sized server is plugged into a 120 VAC 60 Hz power source and is rated at 6.0 amps.

  120 VAC x 6 amps x 0.85 (PF) =612 ÷ 1,000 is 0.612 kW

- *208–240 Two Phase*:

  A server using a 220 VAC power source is rated at 4.7 amps.

  220 VAC x 4.7 amps x 2 (phases) x 0.85 (PF) =1757.8 ÷ 1,000 =1.76 kW

- *Three Phase:*

  For 3-Phase power configurations you also need to multiply by 1.73.

  A large disk subsystem has 192 physical volumes, a power source of 208 VAC, and is rated at 22 amps.

  208 VAC x 22 amps x 1.73 x 0.85 (PF) ÷ 1000 =6.729 kW

Convert kW and kVA

The power factor is used to convert between kW and kVA. The power factor is an approximation (unless known for the equipment).

Equation: Kilowatts [kW] x Power Factor [PF] =kilo-volt-amperes [kVA]

British Thermal Units

Equation: 1 kW =3,413 Btu

Thus: 3.41214 x Watts [W] =Btu/hr

Many manufacturers publish kW, kVA and Btu in their equipment specifications. Often, dividing the Btu value by 3413 does not equal the published kW value.

- Use the value provided by the manufacturer, otherwise use the formula.

Glossary

This glossary defines terms and abbreviations in this and other SL8500 library related publications.

2N

A power configuration that gives the Product Name library 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**.

access door

A 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.

ACS

Automated cartridge system. The ACS consists of host software, a library management unit, a library control unit, library storage modules, and cartridge subsystems. These components provide automatic mounting and dismounting of cartridge tapes into a transport, cartridge access port, or pass-thru port. This term is synonymous with **library**.

ACSLS

Automated Cartridge System Library Software. Software that manages ACS library contents and controls ACS library hardware to mount and dismount cartridges on ACS drives.

Any Cartridge Any Slot technology

The StorageTek technology that allows seamless sharing of different media types and drives without hard partitions.

array

A partitioned unit that holds multiple objects, such as cartridges or tape drive tray assemblies.

audit

A physical inventory of the contents of all or part of a library.

Automated Cartridge System Library Software (ACSLS)

See *ACSLS*.

barcode line scan camera

A component of the robot that is used for cartridge identification and position calibration.

camera

(1) The barcode line scanner that is part of the robot hand assembly.

(2) The two LibCam monitoring cameras that display activity inside the library on the touch screen operator control panel.

CAP

Cartridge access port. A device in the library that allows an operator to insert or remove cartridges during library operations.

cartridge access port (CAP)

See CAP.

cartridge array

An array that holds multiple cartridges. The SL8500 library contains 8, 13, or 14 slots, depending on their location.

cartridge tape

A 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.

CIM

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.

cleaning cartridge

A tape cartridge that contains special material to clean the tape path in a transport or drive.

CLI

Command line interface.

CompactPCI (cPCI®)

See **cPCI**.

controller

The module that houses the controls for the elevators, CAPs, and service safety door.

cPCI

CompactPCI. Industry standard bus used for card-to-card bus expansion.

customer interface module (CIM)

See CIM.

database.

A collection of interrelated data records.

database management system.

The process that accesses, controls, organizes, and modifies a database.

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.

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 bay

A partitioned section of the tape 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.

Dual TCP/IP

Provides two separate host connections between the host software (ACSLS or HSC) and a library.

dWWN

Dynamic World Wide Name. A feature that applies dynamic names to network devices rather than fixed names. When a dWWN-named device is replaced, it is assigned the same WWN as the one replaced, preventing reconfiguration of the network.

dynamic World Wide Name (dWWN)

*See **dWWN**.*

ECM

Electronics control module. The assembly that processes commands from a host system, coordinates the activities of robots, elevators, pass-thru ports, and tape drives, and monitors status inputs from sensors and switches.

eject

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 export.

electronics control module (ECM)

*See **ECM**.*

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.

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)

See ***ESCON***.

ESCON

Enterprise Systems Connection. 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.

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-megabits-per-second LAN.

external label identifiers

A six–character alphanumeric label on the outside edge of a cartridge used to identify a physical tape volume. It may consist of uppercase letters A through Z, numerals 0 through 9, $, #, and blanks.

failover

The act of moving to a secondary or redundant path when the primary path fails.

Fibre Channel

A 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 100 Mb per second (full speed), 50 Mb per second (half speed), 25 Mb (quarter speed), or 12.5 Mb (eighth speed). Fibre Channel operates over distances of up to 100 m over copper media or up to 10 km over optical links.

fibre connection (FICON)

See **FICON**.

FICON

Fibre connection. 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.

FRU

Field-replaceable unit

get

An activity in which a robot obtains a cartridge from a slot or drive.

gripper

The portion of the hand assembly that grasps the cartridge.

hand assembly

A 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

High performance small robot. Four or eight HandBots are used in an SL8500 library. *Contrast with* **TallBot**.

HBZ module

See **controller**.

HLI

Host/Library Interface. One way that the library management software (HSC and ACSLS) communicates with a library.

HLI-PRC address

A 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.

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)

See ***HSC***.

hot swap

Removal and replacement of a system component while system power remains on and system operations continue. Contrast with cold swap and **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

Host Software Component. Software running on an IBM mainframe that controls multiple libraries as a library server.

import

The process of placing a cartridge into the cartridge access port so that the library can insert it into a storage slot. Synonymous with enter.

interlock switch

A switch that disconnects power to library mechanisms, excluding tape drives, when the front door is opened.

initial program load (IPL)

A process that activates a machine reset and loads system programs to prepare a computer system for operation. Processors having diagnostic programs activate these programs at initial program load execution. Devices running firmware usually reload the functional firmware from a diskette or disk drive at initial program load execution. Synonymous with initial microprogram load (IML).

keypad interface

A keypad mounted on the front facade used to monitor the status of the SL8500 library and to operate the CAPs.

library

A library is composed of one or more ACSs, attached cartridge drives, volumes in the ACSs, and the library management software that controls and manages the ACSs.

library complex

Two or more SL8500 libraries attached to each other with PTPs.

Library Console

The operator panel software application used for the SL8500.

library controller

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 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. *See also* **physical library**.

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)**.

Multi-TCP/IP

Using TCP/IP connections to multiple libraries to provide redundant communication paths between the host software (ACSLS or HSC) and an SL8500 library complex.

N+1

A power configuration that provides AC power and redundant DC power by adding a second DC power supply to each DC bus. See also **2N**.

operator panel

See **touch screen operator control panel**.

partition

Partition of a library cell's, cartridges, drives, and CAPs assigned to a physical partition that is managed by ACSLS as a separate ACS.

pass-thru port (PTP)

A mechanism that enables a cartridge to pass through from one library to another in a multiple modular library complex.

PCI

Peripheral component interconnect.

PDU

Power distribution unit. 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.

physical library

A single SL8500 library consisting of a customer interface module, robotics interface module, and a drive and electronics module, with one to five storage expansion modules optional. See also **logical library**.

power distribution unit (PDU)

See **PDU**.

power grid

A 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 rail

A 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.

put

An activity in which a robot places a cartridge into a slot or drive.

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.

Redundant Electronics

Redundant electronics is a hardware activated and software controlled optional feature for the SL8500 Library. This feature supplies automatic and manual switch over for failing HBC and HBT controller cards.

remote operator console

The customer's operator panel that interfaces with the PLI. *See also* **Library Console**.

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 tape cartridges to and from other locations in the library. Also called a **HandBot** or **TallBot**.

robotics interface module (RIM)

The module containing the curved rails and pass-through port (PTP) assemblies. See also **RaceTrack architecture**.

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**.

SEM

Storage expansion module. An optional module for the SL8500 library that provides up to 1728 additional cartridge storage slots. Up to five modules can be attached to each SL8500 library.

service area

An area between the access doors of the customer interface assembly and the service safety door in which an inoperable robot is stored for service and other mechanisms can be repaired or replaced.

service safety door

A motor-driven barrier that separates the service areas of the front interface assembly 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.

SL8500

See **SL8500 modular library system**.

SL8500 address

A 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 modular library system

An automated tape library comprised of: customer interface module, robotics interface module, drive and electronics module, and storage expansion module (optional).

slot

Location in the library in which a tape cartridge is stored. Synonymous with cell.

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 expansion module

See **SEM**.

TallBot

High capacity tall robot. One or two TallBots are used in an SL8500 library. Contrast with **HandBot**.

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.

touch screen operator control panel

A 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.

turntable

A mechanism that transfers cartridges between the aisles within a single library.

U

A standard unit of measurement of vertical space inside a rack-mount cabinet equal to 44.5 mm (1.75 in.).

unlocked

In the SL8500 library, status indicating that software has made a CAP available for operator use. An LED is lit when a CAP is unlocked.

vacancy plate

A plate that covers an unused bay, such as a drive bay or power supply bay.

VOLSER

Volume serial number. A synonym for external label identifier.

volume

A tape cartridge.

volume identifier

A six–character string that uniquely identifies a tape cartridge to the database.

World Wide Name

A 64-bit integer that identifies a Fibre Channel port. See also **dWWN**.

wrist

A mechanism in the robot assembly that allows the robot to access the outer and inner storage walls.

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