StorageTek SL3000

Systems Assurance Guide

E20876-08

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Preface

This guide is an introductory and planning resource for Oracle's StorageTek SL3000 modular library system. For detailed product information, refer to the SL3000 product documentation library on the Oracle Technical Network:

http://www.oracle.com/technetwork/documentation/tape-storage-curr-187744.html

The system assurance process is the exchange of information between Oracle team members and the customer to ensure that no aspects of the sale, order, or installation of the SL3000 library are overlooked. This process promotes an error-free installation and contributes to overall customer satisfaction.

Documentation Accessibility

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Summary of Changes

Date	Revision	Description
November 2013	08	Updated for T10000D power, specifications, and ordering part number. Added brief LTFS description.
February 2013	07	Partial re-write for conversion to new template. Removed worksheets.
December 2012	06	Updated for LTO6 support. Update for non-EU base module.
October 2012	05	Major reorganization of content. Updated illustrations. Updated with marketing comments.
February 2012	04	Updated with engineering and marketing comments.
November 2011	03	Updated with engineering comments. Updated information about the Oracle Software Delivery Cloud. Where you can find downloads for all licensable Oracle products. Updated information about the One-Time Password (OTP).
October 2011	02	Updated with engineering comments. Updated information about Partitioning in an SL3000 library.
July 2011	01	Updated with engineering comments. Updated marketing order numbers. Assigned a new Oracle part number: E20876-xx
May 2010	Twelfth (L)	Refer to this revision for the list of changes.
January 2010	Eleventh (KA)	Refer to this revision for the list of changes.
January 2008	Tenth (K)	Refer to this revision for the list of changes.
March 2007	Ninth (J)	Refer to this revision for the list of changes.
September 2006	Eighth (H)	Refer to this revision for the list of changes.
March 2006	Seventh (G)	Refer to this revision for the list of changes.
September 2005	Sixth (F)	Refer to this revision for the list of changes.
May 2005	Fifth (E)	Refer to this revision for the list of changes.
October 2004	Fourth (D)	Refer to this revision for the list of changes.
July 2004	Third (C)	Refer to this revision for the list of changes.
June 2004	Second (B)	Refer to this revision for the list of changes.

Date	Revision	Description
May 2004	First (A)	Initial Release

1 Introduction

Oracle's StorageTek SL3000 modular library system is a midrange storage solution that offers flexibility, scalability, and high availability. The SL3000 library uses a modular design to meet the demands of rapidly growing and constantly changing environments.

This guide is intended as an introductory and planning resource for the SL3000 library. For detailed information about this product or other Oracle tape storage products, refer to the product documentation library on the Oracle Technical Network:

http://www.oracle.com/technetwork/documentation/tape-storage-curr-187744.html

Library Features

Modular Design

- Consists of five module types: base module, drive expansion module, cartridge expansion module, parking expansion module, and access expansion module
- Provides storage capacity for 200 to 5,925 cartridge slots and 1 to 56 tape drives
- Provides cartridge loading for up to 260 cartridges using rotational cartridge assess ports, as well as bulk cartridge loading capabilities from 234 to 468 cartridges using access expansion modules

Capacity on Demand

- Provides the ability to expand non-disruptively in real time by activating previously installed physical capacity
- Allows customer to purchase hardware in advance, but only pay for currently required capacity

Any Cartridge, Any Slot

- Supports multiple drive types (T9840, T10000, LTO)
- Allows any cartridge type to be placed anywhere in the library

CenterLine Technology

- Allows modules to be added to either side of the base module
- Supports optional redundant robots for improved performance
- Balances work load, improving efficiency and performance

Multiple Software and Connectivity Options

- Supports both open systems and mainframe library management software options

- Allows for multiple host connectivity and partitioning options
- Allows for dual control paths using either TCP/IP or Fibre Channel

Redundancy and Failover Protection

- Supports optional redundant electronics for failover protection
- Provides multiple power redundancy options
- Supports optional redundant robotics to increase library efficiency

Software Options

The main options for library management software 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:

- Linear Tape File System (LTFS)
- Virtual Storage Manager (VSM)
- Library Content Manager (LCM) and Expert Library Reporter (ExPR)
- StorageTek Tape Analytics (STA)
- Independent Software Vendors (ISVs) and other 3rd party backup and archive applications

Tape Drive and Media Compatibility

The SL3000 library supports:

- StorageTek T-Series (T9840C or D and T10000 series)
- Linear Tape-Open (LTO) generations 3, 4, 5, and 6

2

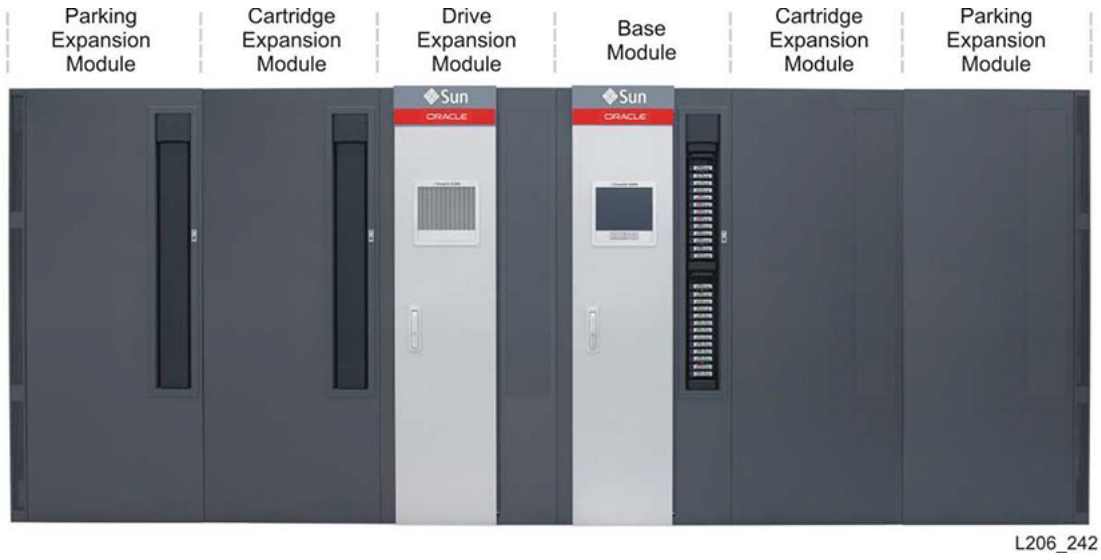
Library Modules and Hardware

This chapter describes each of the library modules and the major hardware components in the SL3000 library. For dimensions and weights of the library modules, see Chapter 7, "Site Planning."

Library Modules

- Base Module (Base): one required per library.
- Drive Expansion Module (DEM): maximum of one on the left side of a base module only.
- Cartridge Expansion Module (CEM): maximum of eight, four to left of centerline and four to right of centerline.
- Parking Expansion Module (PEM): must have two, one on each end of the library for the redundant robotics feature. A PEM is a converted CEM.
- Access Expansion Module (AEM): one or two, on the ends of the library.

Figure 2–1 SL3000 Modular Library System—Configuration Example



Base Module

One Base module is required for every library installation. A standalone Base module is the smallest possible configuration of an SL3000 library. This module contains the

power supplies, robotic units, electronics control module, cartridge access port, storage slots, tape drives, and operator controls.

Configuration Options

The standard configuration has eight drive slots, CAP, and a perforated window. The physical capacity varies from 205 to 431 cartridge slots depending on the configuration (see Chapter 4, "Capacity").

Configuration options include:

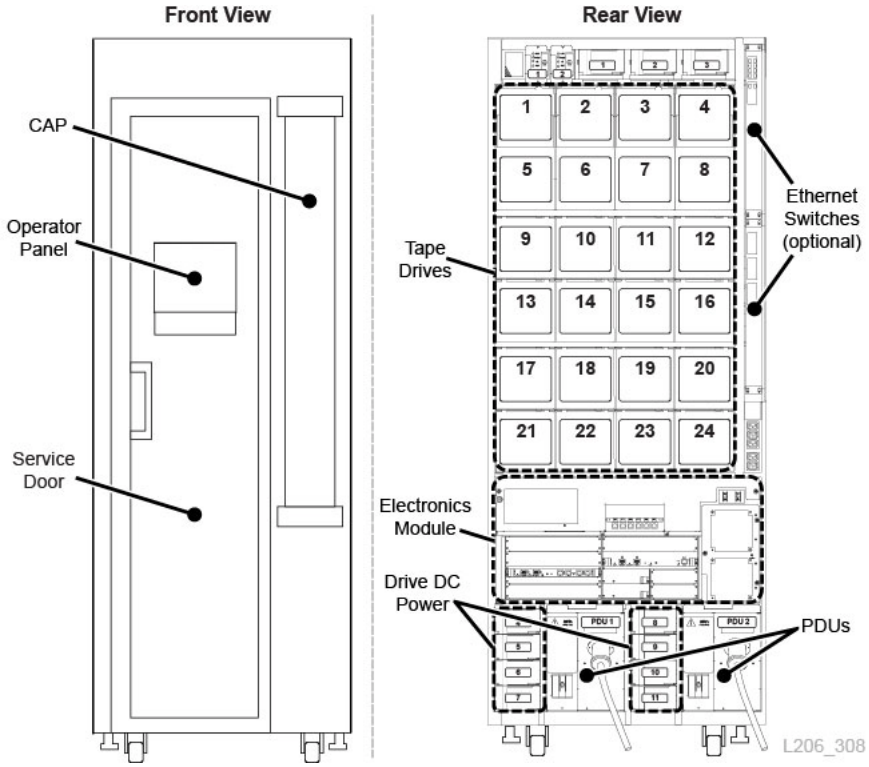
- 8 (standard), 16, or 24 drive slots
- Perforated window (standard), window storage array, or operator panel
- CAP required

Components

The front of the Base module contains a single CAP, service door, front panel with LEDs, and a perforated window or optional touch screen operator panel.

The rear of the Base module contains the electronics control module with two cPCI power supplies, two cooling fans, and two power switches. The Base module also contains the power distribution units (PDUs), DC power supplies, tape drives, and two 1-unit rack spaces not for customer use (1 unit = 44.5 mm [1.75 inches]).

Figure 2–2 Base Module: Front and Rear View



Drive Expansion Module

The DEM is attached to the left edge of the base module (when viewed from the front/cap-side of the library). The DEM allows further expansion of tape drives and

provides additional cartridge capacity. There can be only one drive expansion module per library.

Configuration Options

The standard configuration is eight drive slots and a perforated window. The physical capacity varies from 153 to 522 cartridge slots depending on the configuration (see Chapter 4, "Capacity").

Configuration options include:

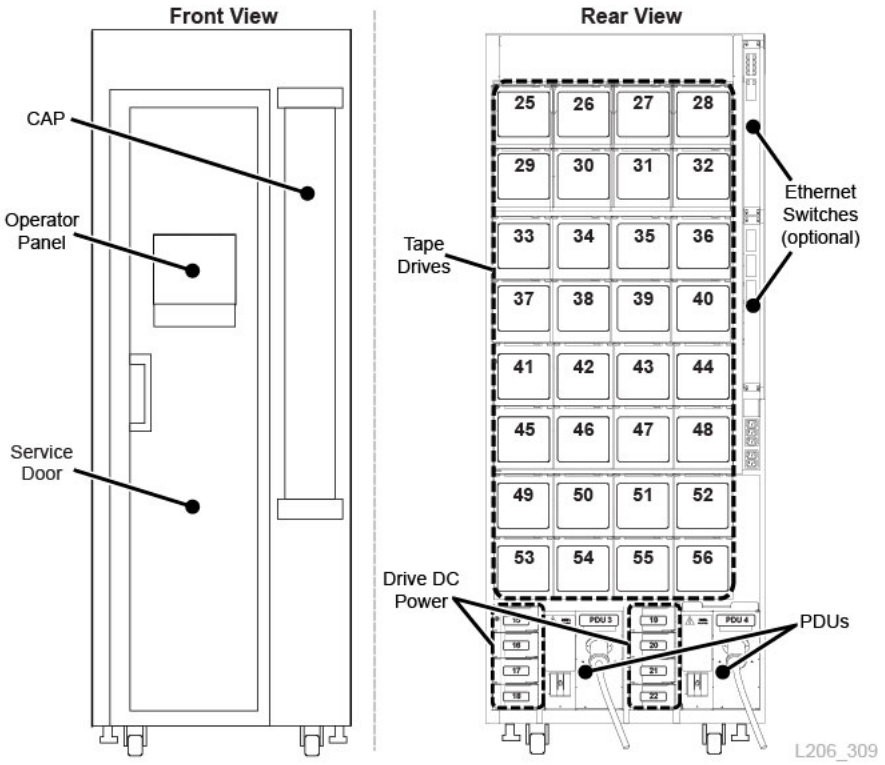
- 8 (standard), 16, 24, or 32 drive slots
- Perforated window (standard), window storage array, or operator panel
- Optional CAP

Components

The front of the DEM contains a service door, optional CAP, optional front panel with LEDs, and a perforated window or optional touch screen operator panel (if not already in the Base module).

The rear of the DEM contains tape drives, PDUs, DC power supplies, and two 1-unit rack spaces not for customer use (1 unit = 44.5 mm [1.75 inches]).

Figure 2–3 DEM: Front and Rear View



Cartridge Expansion Module

The CEM provides additional cartridge slot capacity. There are no tape drives present within this module. A maximum of eight CEMs are supported in a single library.

Configuration Options

The physical capacity varies from 438 to 620 cartridge slots depending on the configuration (see Chapter 4, "Capacity").

Configuration options include:

- Optional CAP.
- May be placed to the left or right of a base module and DEM.
- There can be a maximum of four CEMs on each side of centerline (eight total per library).

Components

- An optional cartridge access port with a 26 cartridge magazine
- The ability to be converted to a parking expansion module (see "Parking Expansion Module" on page 2-4)
- Approximately 438 to 620 data cartridge slots depending on the direction of growth (left or right) and options (CAP or no CAP)
- No tape drives

Parking Expansion Module

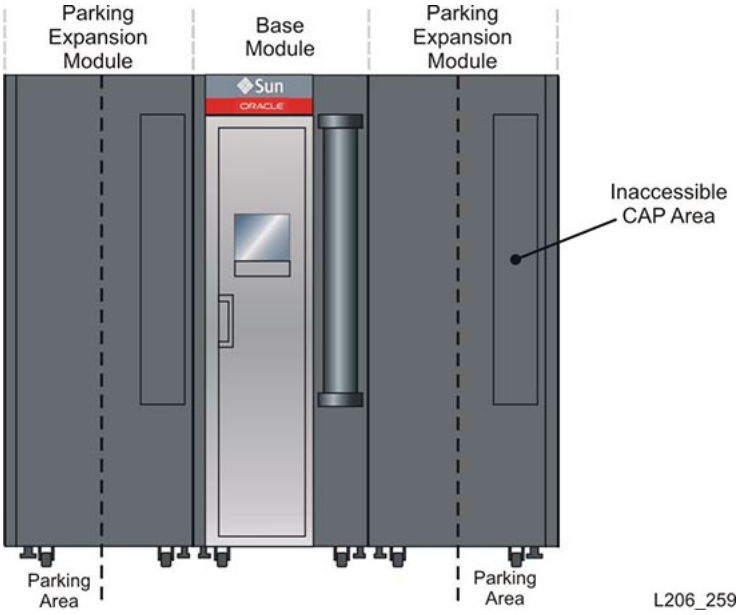
The PEM is a converted CEM used in a redundant robotics configuration. The library uses the PEM to "park" a defective robot without blocking access to cartridges for the other operational robot. The parking space causes six columns of cartridge arrays in a CEM to become inaccessible (three on the front wall and three on the rear wall). Performing maintenance on an inactive robot parked in a PEM is disruptive to library operations. A PEM:

- Must be installed on the ends of the library, on both right and left-sides
- Is a CEM converted by changing an internal module ID label that is shipped with the redundant TallBot feature
- Allows an optional CAP with a left expansion module, but a CAP on the right PEM is inaccessible

Configuration Options

The physical capacity varies from 230 to 312 cartridge slots depending on the configuration (see Chapter 4, "Capacity"). PEMs can be configured with an optional CAP on a left expansion module only.

Figure 2–4 Parking Expansion Module



Access Expansion Module

The AEM is placed on the end of the library. It provides bulk loading and unloading or space to park an inactive robot for non-disruptive robot maintenance. AEMs and PEMs cannot be installed in the same library.

The AEM provides:

- Bulk loading and unloading of up to 234 cartridges at a time per AEM.
- Non-disruptive robot maintenance through the use of a safety door, which sections off a defective robot from the other library modules. A service representative can safely access the disabled robot through the AEM access door while the library remains online.

Configuration Options

Each AEM supports bulk loading and unloading of up to 234 cartridges (see Chapter 4, "Capacity").

Configuration options include:

- Single AEM for bulk load capabilities only. It is recommended to install a single AEM on the left for an additional 104 storage slots.
- Dual AEMs for bulk load and redundant robotics support.

Figure 2–5 Access Expansion Module

Hardware

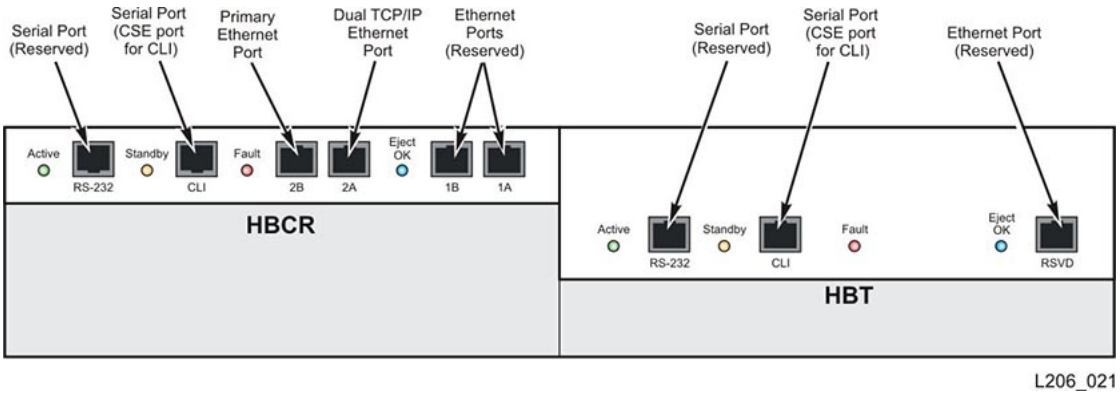
The major hardware components of an SL3000 library include:

- Electronics Control Module
- Robotics
- Cartridge Access Ports - Rotational
- Cartridge Access Ports - Bulk Load

Electronics Control Module

The electronics control module (ECM) is responsible for electronics control, robotic and drive control, and host connectivity. The ECM is located in the rear of the Base module. The main controller cards of the electronics control module are the HBCR and HBT.

Figure 2–6 Electronics Control Module



Note: The ECM also ships with an optional MPU2 card (2Gb) or PUA2 card (8 Gb) for Fibre Channel interface connections. This card is not shown, but is installed below the HBCR card.

A redundant electronics feature is available for failover protection should a controller card fail (see "Redundant Electronics Option" on page 2-7).

Command Line Interface

The command line interface (CLI) is used by service representatives to configure and diagnose the library. Customers are not allowed to access the CLI interface.

The CLI can be accessed through the electronic control module through:

- Serial Port Connection on the HBCR card (RS-232) and a HyperTerminal connection to enter the commands
- Ethernet Port Connection (ports 1A, 2A, or 2B) on the HBCR card and using a secure shell (PuTTY) to enter the commands

Redundant Electronics Option

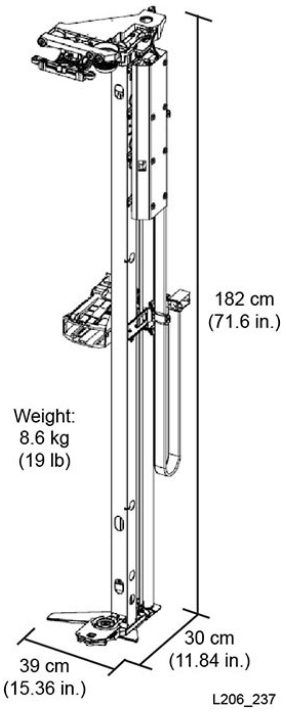
A redundant electronics (RE) feature is available for failover protection for the HBCR controller card. With the RE feature, each library has two HBCR controller cards. If the active library controller experiences errors, operations switch automatically to the stand-by library controller, with minimal disruption to library and host operations.

RE is an optional feature. It is not available for libraries that use the direct FC connection to hosts. For more information about the RE feature, see the *SL3000 Host Connectivity Guide*.

Robotics

The robotics unit in the SL3000 library is called a TallBot. Each library can have either one (standard) or two TallBots (redundant robotics option). TallBots are responsible for the movement and auditing of cartridges throughout the library.

Figure 2–7 TallBot



TallBots move along two rails on the rear wall of the library. One rail is at the top of the library and one rail attaches to the floor. Each module contains pre-installed, segmented rails. Two copper strips insert into the top rail which provides both a power and a signal path for TallBot operations. Gears on the TallBot motors mesh with molded plastic tracks on the rails. TallBots retrieve and insert cartridges into CAPs or slots and mount or dismount cartridges from tape drives.

Power is supplied from +48 VDC 1200 W load sharing supplies. A Rail Power Enable module is installed as a safety circuit for rail power. See Chapter 5, "Power and Cooling" for more information. Signals are received and transmitted between the TallBots and the library controller (HBCR card) through the two copper strips along the top rail.

TallBots contain a bar-code scanner that read the configuration blocks in each module during library initialization and identify volume serial numbers (VOLSERs) of cartridges during CAP entries and Audits.

Redundant TallBot

Redundant TallBot operation provides the following advantages:

- Increases the speed for robotic operations
- Backs up robotic operation in case one should fail

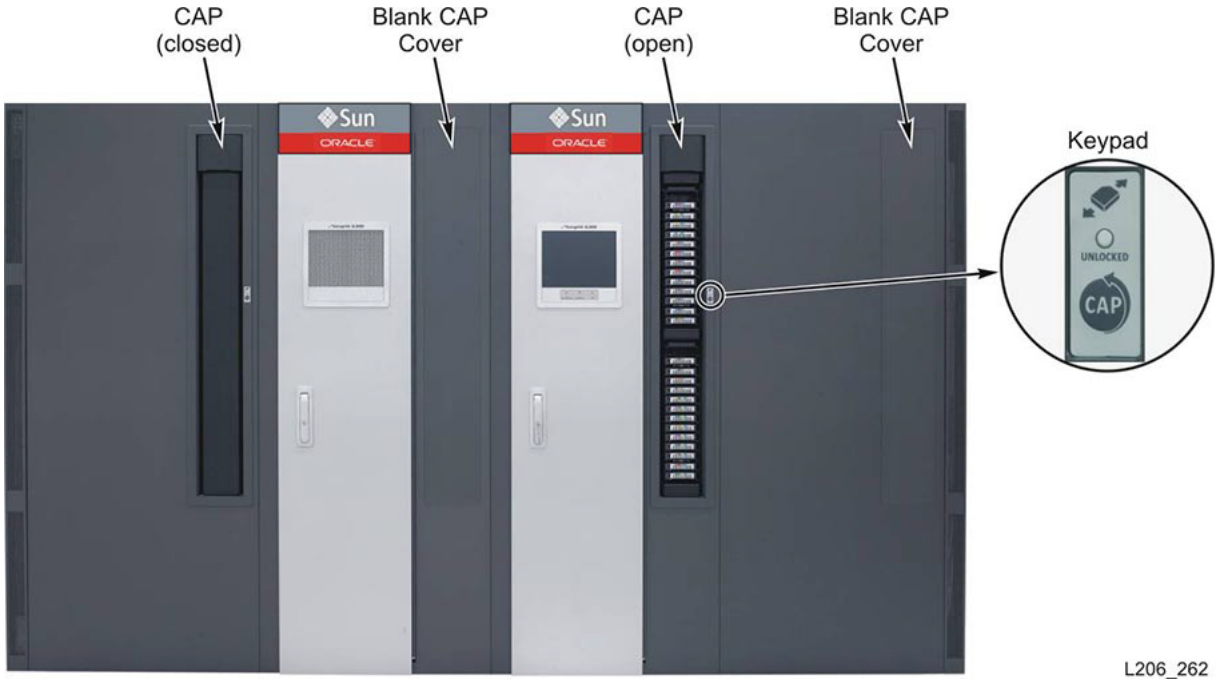
The redundant TallBot option requires 240 VAC, 2N power and parking expansion modules or the access expansion modules at each end of the library. A defective TallBot will take itself offline and move into one of these modules. This allows the library to continue operations with one TallBot until time can be scheduled to replace the defective TallBot.

Cartridge Access Ports - Rotational

The cartridge access port (CAP) is a vertically-mounted, rotating cylinder with two removable 13-slot magazines (26 slots total).

- The Base comes standard with a CAP.
- The DEM and CEMs can have one optional CAP per module.
- There can be a maximum of 10 rotational CAPs per SL3000 library. However, a CAP in a right-side PEM is not accessible and should be unplugged.
- Each CAP comes with a small keypad including indicators and a button to operate that specific CAP.

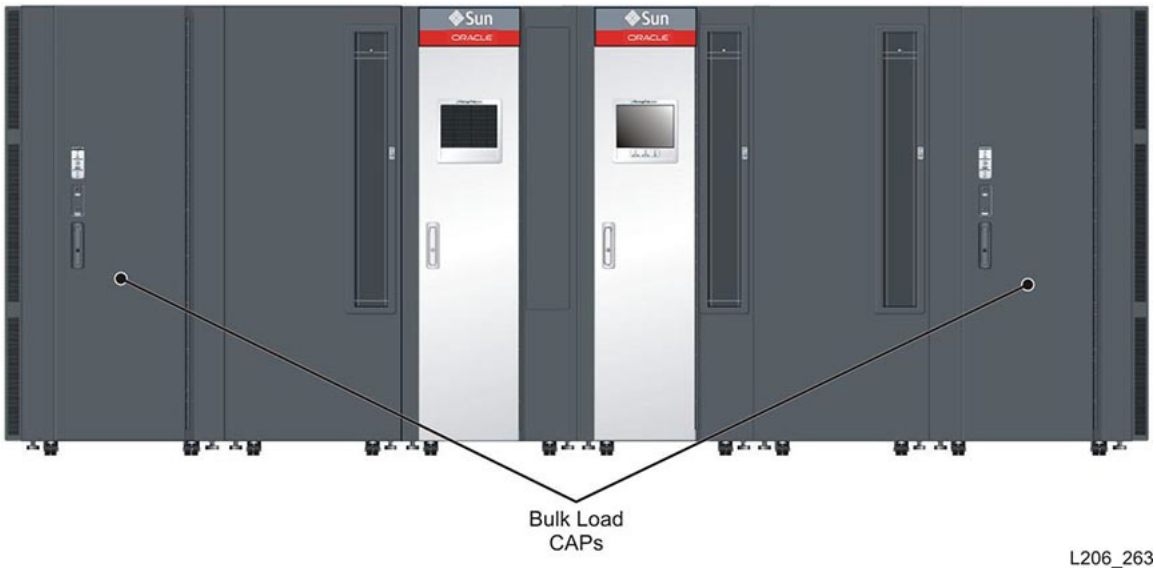
Figure 2–8 Cartridge Access Ports and CAP Keypad



Cartridge Access Ports - Bulk Load

AEMs allow the customer to add cartridges in bulk, up to 234 cartridges on each side, without disrupting library operations. Only one AEM is required in a library to support the bulk loading feature.

Figure 2–9 Bulk Load CAPs - Access Expansion Modules



3

Software and Connectivity

This chapter provides information on library connectivity and software options.

Host Connectivity

The SL3000 library supports two types of host connections:

- Small computer system interface (SCSI) over a physical Fibre Channel interface
- Ethernet (TCP/IP) using 10/100 Base-T and CAT-5 cable

In a non-partitioned configuration, the library can use only one interface type, either Fibre Channel or Ethernet (a second Ethernet connection can be used to access StorageTek Library Console). In a partitioned configuration, the library can have one interface type per partition. Therefore, the library may have SCSI partitions, Ethernet partitions, or a combination of both, for up to a total of eight partitions.

SCSI Over Fiber Channel Connection

The SL3000 library uses the small computer system interface (SCSI) protocol and command set over a physical Fibre Channel (FC-SCSI) connection. A PUA2 Fibre Channel card must be purchased to provide connection SCSI to the library. The card provides a single or optional dual port feature, with an 8 Gb connection.

Refer to the *SL3000 Interface Reference Manual* for more information. This manual contains information about the small computer system interface command set plus information about Fibre Channel operations, command implementations, topologies, cables, and connectors.

Supported Topologies

The SL3000 library supports the following topologies:

- *Switched Fabric*
  - This topology is recommended for the library. A switched fabric topology provides dynamic inter-connections between nodes and multiple, simultaneous Fibre Channel connections for the network. If the library is connected to a Fibre Channel switch or fabric-capable host, it configures itself as a switched topology and can support up to 16 million ports logged into the fabric.
- *Arbitrated Loop*
  - While the library supports the arbitrated loop topology, this connection scheme is not recommended for new or future implementations. Oracle does

not recommend the arbitrated loop connection by setting Hard ALPAs (Arbitrated Loop Physical Addresses).

– Arbitrated Loops provide multiple connections for devices that share a single loop and allows only point-to-point connections between an initiator and target during communications. An arbitrated loop can connect only up to 126 ports.

TCP/IP Connection

The library can also use TCP/IP protocol over an Ethernet physical interface, (CAT-5, Ethernet, 10/100 BaseT cable) to manage and communicate with the host and library management applications, such as:

- Open system platforms with ACSL
- Enterprise-level mainframes with ELS /HSC

The library controller (HBCR card) is responsible for coordinating all component operations within the library and providing the interface connection with the host. There are two separate Ethernet connections on the HBCR card for host to library communications—Ports 2A and 2B.

- Port 2A provides the Dual TCP/IP connection—this is an optional feature for SL3000 libraries. If not used for Dual TCP/IP, it can be used for connection to StorageTek Library Console.
- Port 2B provides the primary host connection—this is the standard connection for SL3000 libraries.

Dual TCP/IP Option

Dual TCP/IP provides two connections between a library and ACSLS or ELS/HSC host(s). This eliminates a single point of failure that might occur when there is only one connection between the library and the host. For more information, see the *SL3000 Host Connectivity Guide*.

Library Monitoring

The library can be monitored using StorageTek Library Console or Simple Network Management Protocol (SNMP). Additionally, service representatives can use the Log SnapShot feature to collect logs from the controller cards.

StorageTek Library Console

The StorageTek Library Console (SLConsole) is a software application used to manage and monitor an SL3000 library. The SLConsole can be accessed from the local operator panel, a stand-alone version on a workstation, or through the web-based SLConsole. For installation requirements and additional information, see the *SL3000 User's Guide* "Chapter 2: StorageTek Library Console".

Simple Network Management Protocol

Simple Network Management Protocol (SNMP) is an application layer protocol that performs network management operations over an Ethernet connection using a User Datagram Protocol (UDP/IP). SNMP allows libraries to inform the system administrator of potential problems and system administrators to query the library for

configuration, operation, and statistical information using SNMP traps. The SL3000 library supports SNMPv2c and SNMPv3 (preferred).

This functionality requires the use of a Management Information Base (MIB) on the controller card. The MIB contains information that specifically describe the library, components, and configuration. Refer to the *SL3000 SNMP Reference Guide* for more information.

Log SnapShot Feature

The Log SnapShot feature is a utility that gathers, compresses, and encrypts logs from a given controller card or from an entire library such as the SL3000 library. A log snapshot can be generated using the CLI or SLConsole. Only authorized Oracle engineers or advanced service representatives have access to the data obtained from the Log SnapShot utility.

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.

Automated Cartridge System Library Software (ACSLS)

StorageTek ACSLS provides centralized, multi-platform library management software. ACSLS manages all library operations, efficiently sharing library resources with any ACSLS-enabled application. ACSLS can manage multiple libraries from a single point of control. The key benefits of using ACSLS include:

- Centralized library control across multiple StorageTek libraries, including legacy technology
- Optimized library performance by load-balancing hardware and executing parallel commands
- Reduced downtime through dynamic configuration capabilities and queuing commands during short-term library outages
- Enriched reporting and management capabilities for ease of use

ACSLS version 7.3 or greater is required for interfacing with the SL3000 library. ACSLS 7.3 requires PUT 0801 for AEM support.

Enterprise Library Software

Enterprise Library Software (ELS) incorporates NCS products, VTCS products, and provides customers with a single, integrated software suite. This suite:

- Provides the ability to enable tape libraries and virtual solutions
- Pro-actively monitors and manages this environment on a continuous basis

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

The Host Software Component (HSC) manages volume pools and communication with the SL3000 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. HSC and SMC translate user requests into library commands and provide message handling.

The following LINKLIBs are not replacements for any current LINKLIBs. They need to be added to the top of the STEPLIB chain in the HSC PROCs.

- SOS610.SPRG1.EVT.I6673474.DR022709.LINKLIB
- SOS620.SPRG1.EVT.I6673474.DR022709.LINKLIB
- SES700.SPRG1.EVT.I6673474.DR022709.LINKLIB

Virtual Tape Control System (VTCS)

Virtual Tape Control System (VTCS) is the host software that enables centralized management of StorageTek virtual tape libraries, such as Virtual Storage Manager (VSM) and Virtual Library Extension (VLE). VTCS manages virtual tape volumes and drives, which includes the migration and recall of virtual volumes and the 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.

Independent Software Vendors

There are a variety of Independent Software Vendors (ISVs) that have tested their applications and support the SL3000 library. ISV applications can connect through ACSLS or direct-attach. Some applications include:

- BakBone NetVault
- CA ArcServe
- HP Data Protector
- Legato NetWorker
- SAM FS
- Tivoli Storage Manager
- Veritas BackupExec
- Veritas Netbackup

Not every application is tested on every platform or version. Check with a Marketing or Sales Representative, or Application Vendor that the application is supported on your platform. To make sure the selected solution (platform, application, tape drives, network, etc.) is supported, an Oracle representative can use the Interoperability Tool at: `http://tapeinterop.us.oracle.com`.

Other Storage System Solutions

The SL3000 library 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 website or contact an Oracle sales representative.

Linear Tape File System (LTFS)

LTFS software improves file access and portability of data on StorageTek T10000 tape or Linear Tape-Open (LTO) technology. LTFS software enables applications to write and retrieve files directly from tape through standard file format interfaces: CIFS or POSIX. Files may also be accessed with ease through a browser or operating system graphical interface. Users can drag and drop files to and from any storage medium: disk, tape, or flash.

Oracle offers Linear Tape File System, Library Edition (LTFS-LE) software which supports the SL3000 tape library, managing multiple tape drives and media. When a user selects a file, the system's robotics automatically mounts the corresponding tape and the file is made available to that application.

Virtual Storage Manager (VSM)

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, which includes the migration and recall of virtual volumes and the 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 used 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. One CSC is Library Station, which 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 of tape investments by performing detailed performance trending analyses. These analyses are based on a regularly updated database of library operations.

4

Capacity

There are two types of capacity:

- **Physical Capacity** — the number of data cartridge slots in the library (which excludes reserved slots for cleaning cartridges, diagnostic cartridges, and the module identification block).
- **Active Capacity** — the number of slots in the library that have been activated by an activation permit file. Only these active storage slots can be used for data storage and accessed by a client. Inactivated slots are not recognized by the library.

Physical storage capacity can range from 205 to 5,925 data cartridge slots depending on library configuration. The capacity of a module in the library depends on its position relative to other modules and the features selected for the module. The features that affect capacity include: additional drive arrays, CAPs, operator panels, and window arrays.

When determining the required storage capacity, it is suggested to plan for future expansion. Although modules can be added to an SL3000 library at any time, adding a module is disruptive to library operations. Therefore, Oracle recommends adding physical capacity in advance to meet future storage needs. With additional physical capacity pre-installed, increasing library capacity only involves purchasing and downloading an activation file. Activating additional capacity is non-disruptive to library operations.

A diagram of the slot locations within each module can be helpful to understanding capacity. For wall maps that show the individual slot locations in the library, refer to the *SL3000 User's Guide*.

Physical Capacity

The features selected and the position of a module affect the capacity of the library. Use the table below to calculate the physical capacity of an SL3000 library. Each module type is listed in the table, followed by the options that can be selected for that module.

To calculate the slot capacity, start with the standard configuration slot count. Then, either add or subtract slots from the standard slot count to reflect the options selected and position of the module in the library. Finally, add the slot counts of each module together to get the total slot count for the library.

Note: For *additional drive arrays*, if a base module or DEM has a module to the left, subtract the "Adjacent Module Left" value *and* the "Standard" value. For example, a Base with two drive arrays and a module to the left would subtract 66 slots from the standard capacity.

A library can be configured with a maximum of eight CEMs and two AEMs or six CEMs and two PEMs. PEMs and AEMs must be placed at the ends of the library. A single AEM may be installed in a library to support bulk loading, but it is recommended that a single AEM be placed on the left-side of centerline to maximize library capacity. Two AEMs support bulk loading and dual robotics.

Table 4–1 Physical Slot Capacity Per Module

Physical Configuration	AEM	PEM	CEM	DEM	Base	CEM	PEM	AEM
Standard	0	308	516	410	320	620	312	0
2nd Drive Array (Adjacent Module Left/Standard)	--	--	--	-11/-55	-11/-55	--	--	--
3rd Drive Array (Adjacent Module Left/Standard)	--	--	--	-12/-60	-12/-60	--	--	--
4th Drive Array (Adjacent Module Left/Standard)	--	--	--	-13/-65	--	--	--	--
Adjacent Module to Left	--	--	+104	+88	+88	0	0	--
Adjacent Module to Right	--	0	0	0	+13	0	--	--
CAP	--	-78	-78	-77	Std.	-78	--	--
Window Storage Array	--	--	--	+23	+23	--	--	--

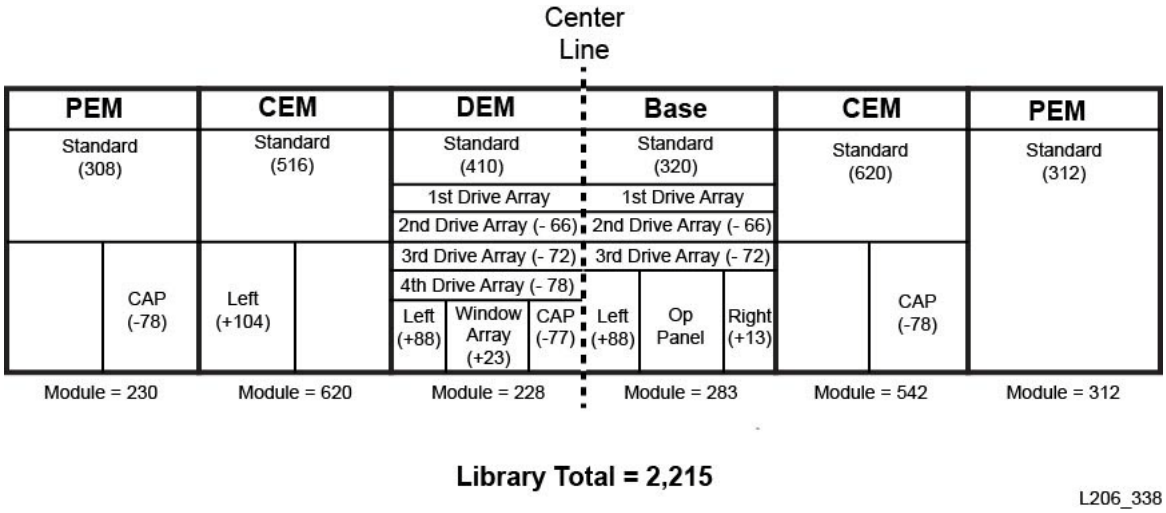
Calculating Physical Capacity Examples

This section provides example calculations of the total physical capacity for three library configurations.

Example 1: Base, DEM, CEMs, PEMs

The sample library in the figure below has a base module, a DEM, two CEMs (one on each side of CenterLine), and two PEMs (one on each end of library).

Figure 4–1 Physical Capacity Example with Base, DEM, CEMs, PEMs



The capacity of each module and the library total capacity is described below:

- Base module with operator's panel, a module installed on the right and on the left, and three total drive arrays:

  320(standard) + 0(op panel) + 13(right module) + 88(left module) – 66(2nd drive array) – 72(3rd drive array) = 283

- DEM, a module installed on the left, window array, a CAP, and four drive arrays:

  410(standard) + 88(left module) + 23(window array) – 77(CAP) – 66(2nd drive array) – 72(3rd drive array) – 78(4th drive array) = 228

- CEM installed to the left of CenterLine and a module installed on the left:

  516(standard) + 104(left module) = 620

- CEM installed to the right of CenterLine, a module installed on right, and a CAP:

  516(standard) + 104(left module) – 78(CAP) = 542

- PEMs (always installed in pairs), one with a CAP, one without:

  308(left of center) + 312(right of center) – 78(CAP) = 542

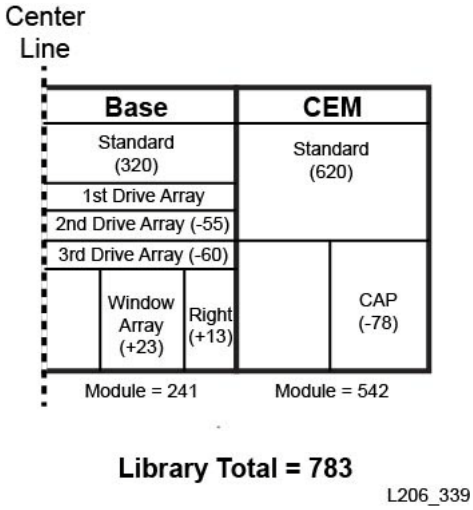
- The library TOTAL capacity would be:

  283(base) + 228(DEM) + 620(left CEM) + 542(right CEM) + 542(PEMs) = 2,215

Example 2: Base and CEM

The sample library in the figure below has a base module and a CEM to the right of center line.

Figure 4–2 Physical Capacity Example with Base and CEM



The capacity of each module and the library total capacity is described below:

- Base module with a window array, a module installed on the right, and three total drive arrays:

  320(standard) + 13(right module) + 23(window array) – 55(2nd drive array) – 60(3rd drive array) = 241

- CEM installed to the right of CenterLine, and a CAP:

  516(standard) + 104(left module) – 78(CAP) = 542

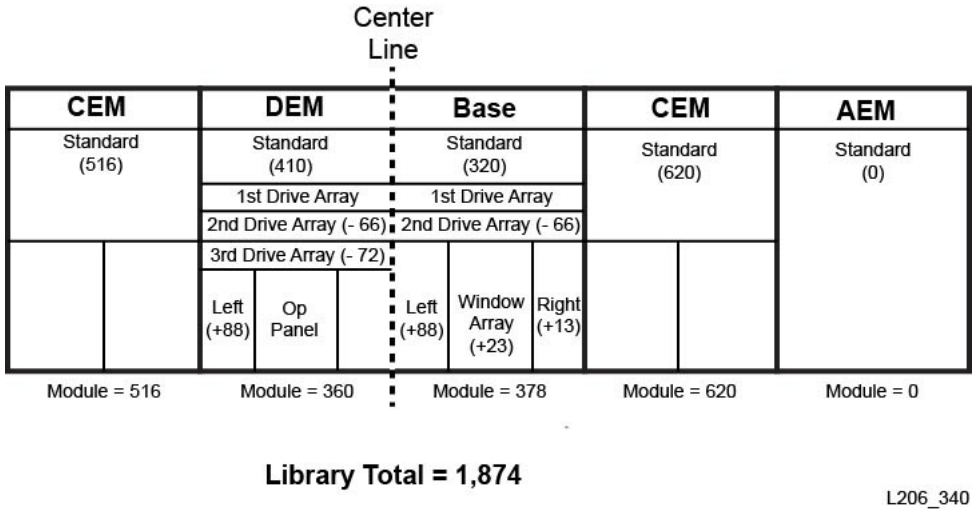
- The library TOTAL capacity would be:

  241(base) + 542(right CEM) = 783

Example 3: Base, DEM, CEMs, AEM

The sample library in the figure below has a base module, DEM, two CEMs, and a single AEM for bulk loading

Figure 4–3 Physical Capacity Example with Base, DEM, CEMs, AEM



Note: It is not recommended to install a single AEM on the right, as shown in the figure above. If the AEM was installed on the left end of the library, 104 additional cartridge slots would be accessible in the far left CEM.

The capacity of each module and the library total capacity is described below:

- Base module with a window array, a module installed on the right and on the left, and two total drive arrays:

  320(standard) + 23(window array) + 13(right module) + 88(left module) – 66(2nd drive array) = 378

- DEM, a module installed on the left, op panel, and three drive arrays:

  410(standard) + 88(left module) + 0(op panel) – 66(2nd drive array) – 72(3rd drive array) = 360

- CEM installed to the left of CenterLine:

  516(standard) = 516

- CEM installed to the right of CenterLine, a module installed on right:

  516(standard) + 104(left module) = 542

- AEM installed to right of CenterLine (not recommended for single AEM):

  0(standard) = 0

- The library TOTAL capacity would be:

  378(base) + 360(DEM) + 516(left CEM) + 620(right CEM) + 0(AEM) = 1,874

Active Capacity

The capacity for the SL3000 library uses Capacity on Demand and RealTime Growth to allow customers to instantly increase and activate capacity without disruption.

RealTime Growth

RealTime Growth allows physical capacity to be pre-installed and then activated as needed. Additional library modules are installed during the initial install. Then, through Capacity on Demand, the customer pays to activate slots when additional capacity become necessary. No additional physical library components are required.

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 SL3000 library offers capacity slot upgrades in 25, 100, 200, 500, and 1000 slot increments. To activate a capacity upgrade, a hardware activation file is required (see "Hardware Activation Files" on page 9-2).

Non-disruptive Capacity and Partitioning Changes

Changes to active capacity result in minimal disruptions to library operations. With HLI libraries, 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.

The specific library behavior depends on the type of host connection, HLI or FC-SCSI. For details, refer to the *SL3000 User's Guide*.

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.

5

Power and Cooling

There are several power options for the SL3000 library. When selecting the proper power configuration, the customer should consider any power redundancy requirements along with the features and number of drives that will be supported in the library.

All power supplies and power distribution units (PDUs) within the SL3000 library reside in the Base Module (Base) and Drive Expansion Module (DEM).

Power Configurations

The power configuration for the SL3000 library depends on the AC power source option selected and the power redundancy.

AC Power Source Options

The SL3000 library has two AC power source options for the Base and DEM. Both are single phase:

- 120 VAC, 50/60 Hz, at 20 amps (range: 100–127 VAC, 47–63 Hz, 16 amps)
  - Limited support for T9840 and T10000 drives; no redundant robotics support.
- 240 VAC, 50/60 Hz, at 30 amps (range: 200–240 VAC, 47–63 Hz, 24 amps)
  - Supports all drive types and redundant robotics.

Each PDU installed in the library requires a separate AC power source. There can be a maximum of four PDUs in the library, depending on the configuration selected.

Power Redundancy Options

There are three power configurations that offer various levels of power redundancy.

N+1 power configuration (standard)

- Offers DC power redundancy only
- Consists of one AC PDU (per Base or DEM), with one extra drive DC supply and one extra robotics DC supply
- Provides N+1 DC power supply redundancy
- Limited support for T9840 and T10000 drives and no redundant TallBot support

2N power configuration

- Offers both AC and DC power redundancy

- Consists of two PDUs (per Base or DEM) for AC redundancy, with a set of DC power supplies for each PDU
- Provides N DC power supplies per PDU
- Requires two separate AC input sources per Base or DEM
- Required for redundant TallBot and redundant electronics support

2N+1 power configuration

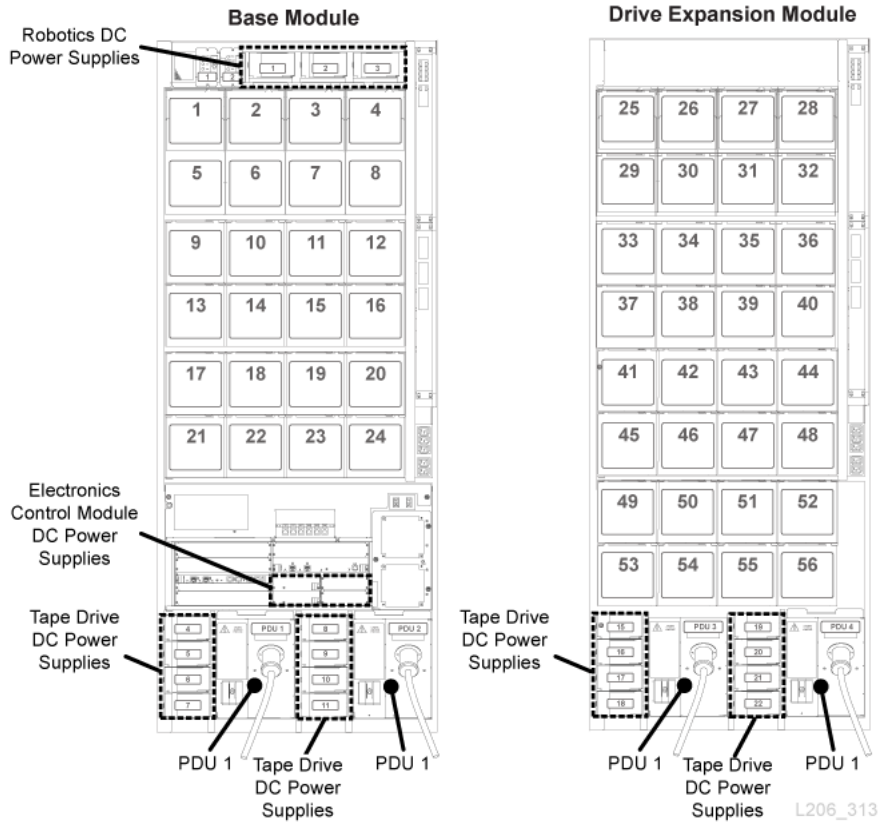
- Offers both AC and DC power redundancy with additional DC redundancy
- Consists of two PDUs (per Base or DEM) for AC redundancy, with additional DC power supplies for each PDU
- Provides N+1 DC power redundancy for each PDU, except the second PDU only has N DC power supply redundancy for the TallBot
- Requires two separate AC input sources per Base or DEM
- Supports redundant TallBot and redundant electronics

DC Power Supplies

The SL3000 library uses two types of DC power supplies:

- Load sharing 1200W DC (used for the robotics unit and tape drives)
- 200W cPCI (used for the electronics control module)

Figure 5–1 Power Supply Locations - Base and DEM (Rear View)



Robotics Unit Power Supplies

The robotics unit in the SL3000 library uses load sharing 1200 W DC power supplies located at the top of the Base (there are no robotics DC supplies in the DEM) — see Figure 5–1. The 1200 W DC power supply used for the robotics unit is the same power supply used for the tape drives. For ordering information, see "DC Power Supplies" on page 9-7.

Each Base ships standard with two robotics DC power supplies used for N+1 and 2N configurations. A third DC power supply is required with the 2N+1 configuration.

Electronic Control Module Power Supplies

The electronics control module (ECM) uses 200 W cPCI power supplies. These power supplies are located below the HBT card in the Base (there are no ECM power supplies in the DEM) — see Figure 5–1. The power supply for the electronics control module is different from the power supplies used for the robotics unit and the tape drives. Only the 2N+1 configuration requires ordering two additional ECM supplies, for ordering information, see "DC Power Supplies" on page 9-7.

Each Base ships standard with two ECM power supplies used for N+1 and 2N+1 configurations. Two additional ECM power supplies are required with the 2N+1 configuration.

Tape Drive Power Supplies

The tape drives in the SL3000 library use load sharing 1200 W DC power supplies. Up to four tape drive power supplies are located to the left of each PDU in both the Base and the DEM — see Figure 5–1.

The library ships with two tape drive DC power supplies per Base and two tape drive DC power supplies per DEM. The number of tape drive DC power supplies required depends on the power configuration selected and the number and type of tape drives in the library. To calculate the number of power supplies to order, see "Calculating Tape Drive Power Supply Quantities" below.

Calculating Tape Drive Power Supply Quantities

The number of supplies required, depends on:

- Power configuration (120 VAC or 240 VAC with N+1, 2N, or 2N+1)
- Number and type of tape drive (T10000, T9840, or LTO)

To determine the number of power supplies required in a specific library configuration:

1. Determine the total number of each drive type.
2. Multiply by the watts-per-drive for each drive type, see Table 5–1, " Watts Per Drive".
3. Add together the watts used by each drive type to calculate the total watts consumed.
4. Use Table 5–2 through Table 5–5 to determine the number of DC power supplies needed.

Refer to "DC Power Supplies" on page 9-7 for ordering part number information.

Watt Consumption Per Drive

Table 5–1 Watts Per Drive

Drive Type	Maximum Watts Used by Each Drive
T9840D	100
T10000A/B/C	93
T10000D	127
LTO	46

Power Supplies Required for 120 VAC PDUs

To use 120 VAC PDUs, the total watts used by the drives must be less than 843 W in the Base and less than 1,481 W in the DEM. 240 VAC PDUs are required if the total watts exceeds 843 W in the Base or 1,481 W in the DEM.

Table 5–2 DC Power Supplies for Base (120 VAC PDU)

Total Watts Used by All Drives	Power Supplies Required for N+1	Power Supplies Required for 2N	Power Supplies Required for 2N+1
1 - 563	2	2	4
564-843	3	4	6

Use the following table to calculate the number of power supplies required in the DEM when using a 120 VAC PDU.

Table 5–3 DC Power Supplies for DEM (120 VAC PDU)

Total Watts Used by All Drives	Power Supplies Required for N+1	Power Supplies Required for 2N	Power Supplies Required for 2N+1
1 - 700	2	2	4
701 - 1,400	3	4	6
1,401-1,481	4	6	8

Note: You cannot mix 120 VAC with 240 VAC PDUs within the library. All PDUs must be the same type.

Power Supplies Required for 240 VAC PDUs

240 VAC PDUs are required if the total watts used by the drives exceeds 843 W in the Base or 1,481 W in the DEM.

Table 5–4 DC Power Supplies for Base (240 VAC PDU)

Total Watts Used by All Drives	Power Supplies Required for N+1	Power Supplies Required for 2N	Power Supplies Required for 2N+1
1 - 1,063	2	2	4
1,064 - 2,263	3	4	6
2,264 - 3,463	4	6	8
3,464 - 3,805	5	8	8

Table 5–5 DC Power Supplies for DEM (240 VAC PDU)

Total Watts Used by All Drives	Power Supplies Required for N+1	Power Supplies Required for 2N	Power Supplies Required for 2N+1
1 - 1,200	2	2	4
1,201 - 2,400	3	4	6
2,401 - 3,600	4	6	8
3,601 - 4,443	5	8	8

Note: You cannot mix 120 VAC with 240 VAC PDUs within the library. All PDUs must be the same type.

Example: Calculating Required Number of Drive DC Power Supplies

The following example shows how to calculate the DC power supplies required in a mixed media library. The sample library has a Base and a DEM with all three drive types (T10000, T9840, LTO). Table 5–6 shows how to calculate the total watts used by the mixed tape drives in both the Base and DEM:

Table 5–6 Base Module Tape Drive Watts Consumption Example

Drive Type	Quantity of Drives	Multiply by Watts Per Drive	Total Watts Per Drive Type
T10000D	6	127	762
T9840D	6	100	600
LTO4	4	46	184

The drives in the Base use 1,546 W. In Table 5–2, 1,546 W exceeds the maximum 843 W supported by a 120 VAC PDU. Therefore, the Base requires a 240 VAC PDU to support the drive configuration, so refer to Table 5–4.

Table 5–7 DEM Tape Drive Watts Consumption Example

Drive Type	Quantity of Drives	Multiply by Watts Per Drive	Total Watts Per Drive Type
T10000C	4	93	372
T9840D	2	100	200
LTO5	4	46	184

The drives in the DEM use 756 W. In Table 5–3 and Table 5–5, either a 120 VAC or 240 VAC PDU can support 756 W. However, you cannot mix 120 VAC with 240 VAC PDUs within the library. Therefore, the example library requires 240 VAC PDUs.

Two tape drive DC power supplies ship standard with the Base and two power supplies ship standard with the DEM. Therefore, subtract two from the DC supplies required. Use Table 5–4 and Table 5–5 to determine what to order.

The tables below list the power supplies required for the example library.

Table 5–8 DC Supplies Required for Base Example

Configuration Option	DC Supplies Required	DC Supplies to Order (= Required - 2)
N+1 (240 VAC PDU)	3	1
2N (240 VAC PDU)	4	2
2N+1 (240 VAC PDU)	6	4

Table 5–9 DC Supplies Required for Drive Expansion Module - Example

Configuration Option	DC Supplies Required	DC Supplies to Order (= Required - 2)
N+1 (240VAC PDU)	2	0
2N (240VAC PDU)	2	0
2N+1 (240VAC PDU)	4	2

The number of drive DC supplies that must be ordered depends on the power configuration selected. For instance, if the example library had a 2N+1 configuration, it would require an order of six additional drive DC power supplies (4 supplies for the Base and 2 supplies for the DEM). The 2N+1 also requires an additional ECM 200W cPCI power supply. The ECM power supply is different than the tape drive and robot power supplies listed in this example. For ordering information, see "DC Power Supplies" on page 9-7.

AC Power Cables

The following table lists the cables required for each power configuration. You must order one power cord per PDU installed:

- N+1: One power cord for the Base and an additional power cord for the DEM (if installed)
- 2N or 2N+1: Two power cords for the Base and two additional power cords for the DEM (if installed)

Table 5–10 Power Cable Descriptions

Power Source	Description	Circuit Breaker	Wall Connector	Library Connector	Power Cord Length/Type
120 VAC/20A	US/Japan	20A	L5-20P	L5-20R	3.7 m (12 ft) 12 AWG
240 VAC/30A	US	30A	L6-30P	L6-30R	3.7 m (12 ft) 12 AWG
240 VAC/30A	International	30A	330P6W	L6-30R	4 m (13 ft) HAR

Power Consumption

For environmental or economical reasons, you may want to determine the total power consumption (watts), CO_2 emission values, and British Thermal Units (Btu/hr) for the SL3000 library and tape drives. The table below provides power consumption in watts.

Table 5–11 Power Consumption Values

Components	Quantity	Idle Watts	Max Watts
Base Library (required) Includes: 1 ECM, 1 robot, and 1 CAP	1	156	197
Redundant Electronics (optional)	1	100	100
Redundant Robotics (optional)	1	28	55
Operator Panel (optional)	1	29	37
Additional CAPs (optional)	Each	10	14
Access Expansion Module (optional, 1 or 2)	Each	8	30
T9840	Each	79	100
T10000A/B/C	Each	61	93
T10000D	Each	64	127
LTO	Each	30	46

Calculating Total Watts, CO_2 Emissions, and Btu/hr

To calculate the total power consumption in Watts for the library, add up all the applicable wattage values for the library configuration from Table 5–11.

To calculate kilograms of CO_2 emissions per day, multiply watts by the CO_2 emissions constant. Use the constant that is applicable for your country (0.02497 for US).

To convert electrical values to Btu/hr, multiply the number of watts by 3.412 (1 W =3.412 Btu/hr). Many manufacturers publish kW, kVA, and Btus for their equipment. Use the information provided by the manufacturer. Otherwise, use the formula below.

- 3.41214 x Watts =Btu/hr

Power Consumption Example 1

Using the maximum continuous values for the following components:

Table 5–12 Power Consumption Example

Quantity	Component Description	Watts
1	SL3000 Base (including one ECM, one robot, one CAP)	197
16	LTO4 Tape Drives	736
--	Total	933

- Emissions: 933W x 0.02497 = 23.3 Kg of CO_2
- Power consumption: 933W x 3.412 = 3,183 Btu/hr

Power Consumption Example 2

Using the maximum continuous values for the following components:

Table 5–13 Power Consumption Example

Quantity	Component Description	Watts
1	SL3000 Base (including one ECM, one robot, one CAP)	197
8	T9840D Tape Drives	800

Table 5–13 (Cont.) Power Consumption Example

Quantity	Component Description	Watts
1	Drive Expansion Module	--
8	T10000C Tape Drives	744
1	Cartridge Expansion Module	--
3	CAPs (3 at 10 Watts each)	30
--	Total	1,771

- Emissions: 1,771W x 0.02497 = 44.2 Kg of CO_2
- Power consumption: 1,771W x 3.412 = 6,043 Btu/hr

Cooling

Cooling within the SL3000 library is divided into three areas:

- Electronics control module
- Tape drives
- DC power supplies

Library Electronics Control Module

Two fans, located to the right of the electronics control module, provide cooling for the electronics in the library. Air is drawn from the sides of the library and flows through the fans to the rear of the library.

- The library controller card (HBCR) monitors these fans for proper operation.
- An amber Fault indicator is on the fan assembly to indicate a failure.

While there are two dedicated fans, one fan is sufficient to provide adequate cooling for the library and the electronics. The fans can be replaced without interfering with library operations. Therefore, replace a defective fan when it is detected.

Tape Drives

Each tape drive tray contains a fan for drive cooling. The tape drive's power converter card supplies power for the fans. Air is drawn from the front of the drive and flows through the fan to the rear of the drive/library.

DC Power Supplies

Each 1200 Watt DC power supply contains a fan that pulls air from the library, through the rear of the supply, and out the rear of the library.

6

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 SL3000 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 SL3000 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

Each individual engagement is different: different customers, different needs, and different requirements.

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. Sales personnel can provide a series of templates and checklists to assist with this 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 ensure that an SL3000 library is successfully installed.

Actions for Sales Personnel

Sales personnel should do the following:

- Introduce the team members to the customer, exchange contact information.
- Describe the SL3000 modular library, options, and features for the customer.
- See Chapter 1, "Introduction"for information and topics.
- Identify and define the customer's requirements.
- Understand the customer's expectations.
- Identify any additional items the customer might need:
  - Library management software and additional hardware activation files, media—data and cleaning cartridges, labels, media services, tape drives, drive tray conversions, encryption, network components and cables, and service delivery platform (SDP)
- Make sure the site is ready to receive the SL3000 library. Review the information in Chapter 7, "Site Planning" and Chapter 8, "Installation Planning".
- Review and complete the site survey, found at:
  `http://my.oracle.com/site/pd/sss/products/tape/index.html`
- Place an order, see Chapter 9, "Ordering".
- Install and implement that solution by providing qualified service and support.

7

Site Planning

This chapter provides planning information and requirements to consider before installation of the SL3000 library. 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
- *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*: space for additional modules

Physical Dimensions and Weights

Figure 7–1 Service Clearances and Dimensions with AEM

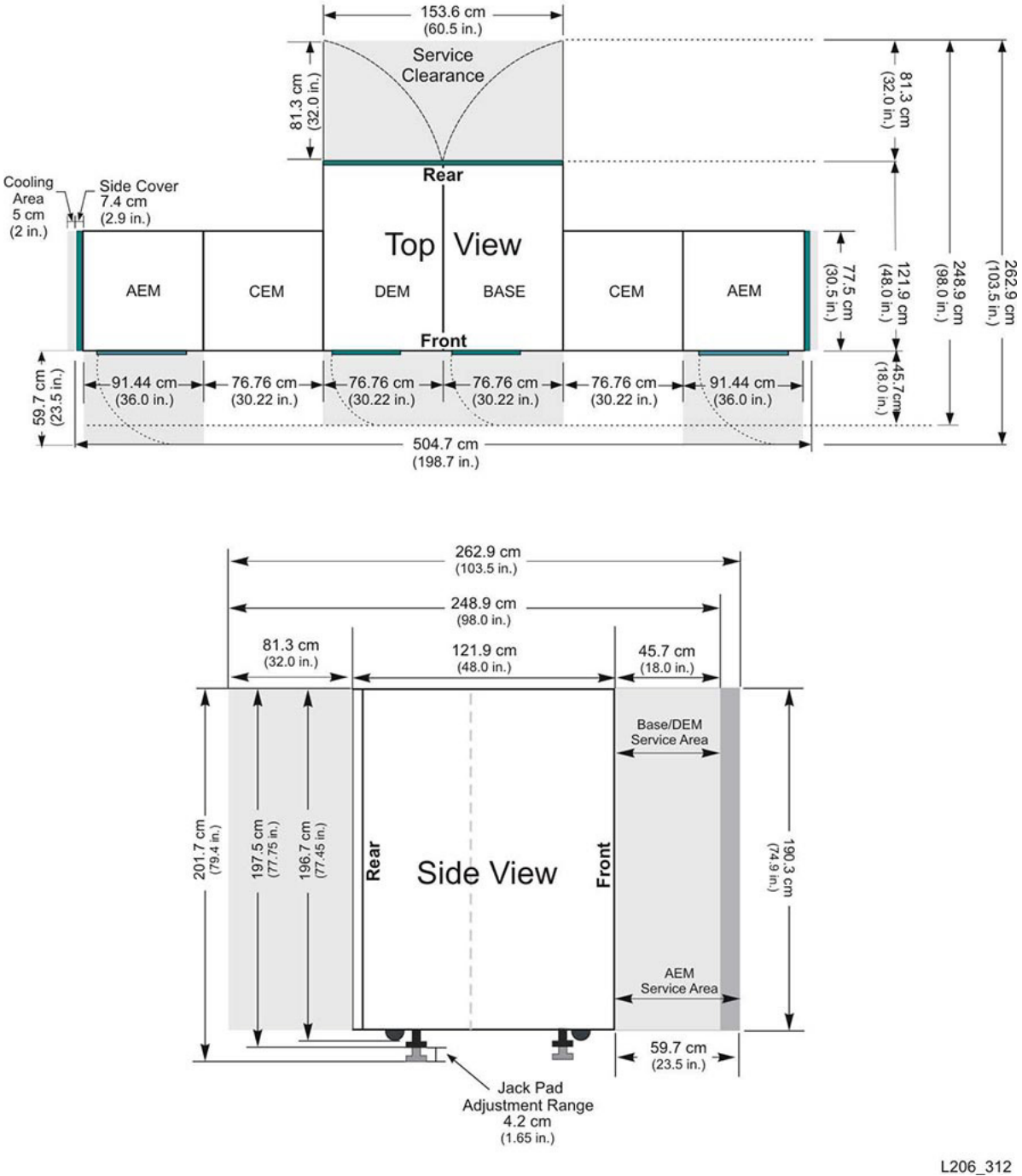
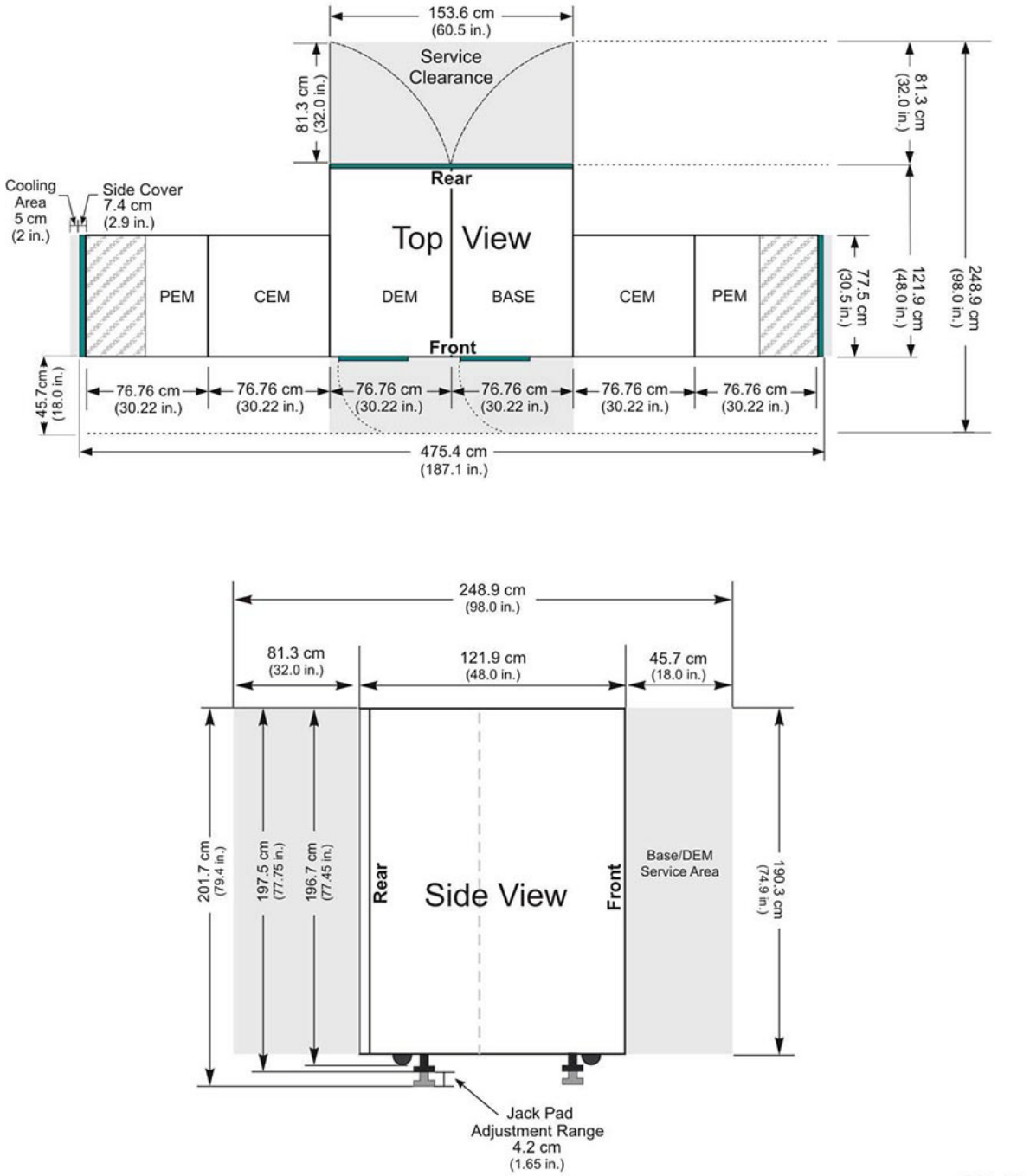


Figure 7–2 Service Clearances and Dimensions with PEM



Base Module

Table 7–1 Base Module Measurements

Dimension Type	Measurement
Height	196.7 cm (77.45 in.) on casters for transport
	197.5 cm (77.75 in.) to 201.68 cm (79.4 in.) on jack pads for permanent install

Table 7–1 (Cont.) Base Module Measurements

Dimension Type	Measurement
Width	76.8 cm (30.22 in.) when placed between modules
	81.3 cm (32 in.) transport width (no side covers) [1]
	91.5 cm (36 in.) standalone with side covers on both sides[2]
Depth	121.9 cm (48 in.)
Service Area	Front: 45.7 cm (18.0 in.)
	Rear: 81.3 cm (32.0 in.)
	Side Cooling Area: 5 cm (2 in.)
	Side Install Area: 45.7 cm (18.0 in.)
Weight	Frame only: 361 kg (796 lb), Shipping weight: 411 kg (905 lb)
	8 drives and media: 623 kg (1372 lb)
	16 drives and media: 661 kg (1457 lb)
	24 drives and media: 687 kg (1514 lb)
	Side Covers: 18.5 kg (41 lb) per side

[1] Minimum transportation clearance. There are alignment tabs on each side of the module, which add 4.5 cm to the 76.8 cm width of the module. Therefore, 81.3 cm is the minimum transportation width.

[2] One side cover adds 7.4 cm (2.9 in.) to the width of the module. Only the ends of the library require side covers.

Drive Expansion Module

Table 7–2 Drive Expansion Module Measurements

Dimension	Measurement
Height	196.7 cm (77.45 in.) on casters for transport:
	197.5 cm (77.75 in.) to 201.68 cm (79.4 in.) on jack pads for permanent install
Width (module only)	76.8 cm (30.22 in.) when placed between modules
	81.3 cm (32 in.) transport width (no side covers) [1]
	83.8 cm (33 in.) with one side cover
Depth (doors closed)	121.9 cm (48 in.)
Service Area	Front: 45.7 cm (18.0 in.)
	Rear: 81.3 cm (32.0 in.)
	Side Cooling Area: 5 cm (2 in.)
	Side Install Area: 45.7 cm (18.0 in.)
Weight	Frame only, no CAP: 265 kg (584 lb)
	Shipping (frame only): 314 kg (693 lb), 321 kg (708 lb) with CAP
	8 drives and media: 540 kg (1190 lb), 582 kg (1284 lb) with CAP
	16 drives and media: 596 kg (1314 lb), 621 kg (1369 lb) with CAP
	24 drives and media: 647 kg (1426 lb), 660 kg (1456 lb) with CAP
	32 drives and media: 709 kg (1564 lb), 723 kg (1594 lb) with CAP

[1] Minimum transportation clearance. There are alignment tabs on each side of the module, which add 4.5 cm to the 76.8 cm width of the module. Therefore, 81.3 cm is the minimum transportation width.

Cartridge and Parking Expansion Modules

Table 7–3 Cartridge and Parking Expansion Module Measurements

Dimension	Measurements
Height	196.7 cm (77.45 in.) on casters for transport 197.5 cm (77.75 in.) to 201.68 cm (79.4 in.) on jack pads for permanent install
Width (module only)	76.8 cm (30.22 in.) when placed between modules/side cover 81.3 cm (32 in.) transport width (no side covers) [1] 83.8 cm (33 in.) with one side cover
Depth	77.5 cm (30.5 in.)
Weight (CEM)	Frame only: 175 kg (385 lb) Shipping: 213 kg (469 lb) Installed, with media: 340 kg (749 lb)
Weight (PEM)	Frame only: 122.5 kg (270 lb) Shipping: 213 kg (469 lb)

[1] Minimum transportation clearance. There are alignment tabs on each side of the module, which add 4.5 cm to the 76.8 cm width of the module. Therefore, 81.3 cm is the minimum transportation width.

Access Expansion Module

Table 7–4 Access Expansion Module Measurements

Dimension	Measurement
Height	196.7 cm (77.45 in.) on casters for transport 197.5 cm (77.75 in.) to 201.68 cm (79.4 in.) on jack pads for permanent install
Width	91.4 cm (36.0 in.) when placed between module and side cover 96 cm (37.8 in) transport width (no side covers) [1] 99.1 cm (39 in.) with one side cover
Depth	77.5 cm (30.5 in.)
Service Area	Front: 59.7 cm (23.5 in.)
Weight	Frame only: 204.2 kg (450 lb) Shipping: 260 kg (570 lb)

[1] Minimum transportation clearance. There are alignment tabs on each side of the module, which add 4.5 cm to the 91.5 cm width of the module. Therefore, 96 cm is the minimum transportation width.

Covers, Doors, and Service Clearances

Table 7–5 Covers, Doors, and Service Clearance Measurements

Dimension	Measurement
Height	190.3 cm (74.9 in.) frame only
Door thickness	Front: 1.9 cm (0.75 in.) Rear: 4.5 cm (1.75 in.)
Door latches	2.53 cm (0.9 in.)
Service clearance	Front: 45.7 cm (18 in.) for Base and DEM only, 59.7 cm (23.5 in.) for AEM Rear: 81 cm (32 in.) for Base and DEM only Side: 5 cm (2 in.) for cooling, 45.7 cm (18.0 in.) for install
Side cover	7.4 cm (2.9 in.) width 18.5 kg (41 lb) each

Floor Requirements

The SL3000 library can be installed on a raised, solid, or carpeted floor with a smooth surface. There must be adequate airflow and the floor must meet environmental specifications and weight requirements. If the floor is raised, there should not be ventilation panels directly below the library. If the floor is solid, route cables from the ceiling to avoid creating a tripping hazard. If the floor is carpeted, make sure the carpet is approved for computer-room equipment and provides protection from electrostatic discharge (ESD).

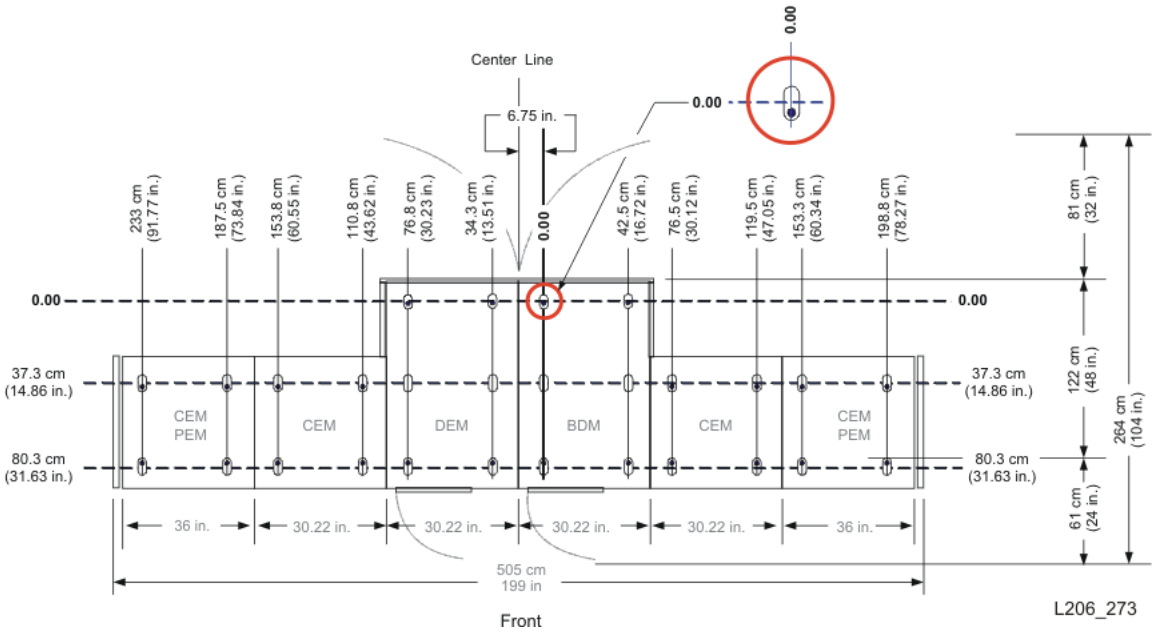
Weight

Ensure the site floor can support the weight of the library. If the equipment must be transported on elevators, the elevator cars must be capable of safely handling the weight. Depending on the library configuration the weight of the library can vary (see "Physical Dimensions and Weights" on page 7-2).

Weight Distribution Pads

The site floor must be capable of supporting 454 kg (1,000 lb) per weight distribution pad, which measure 4 by 8 inches. The distribution pads are represented by the dark grey boxes in the figure below.

Figure 7–3 Location of Weight Distribution Pads



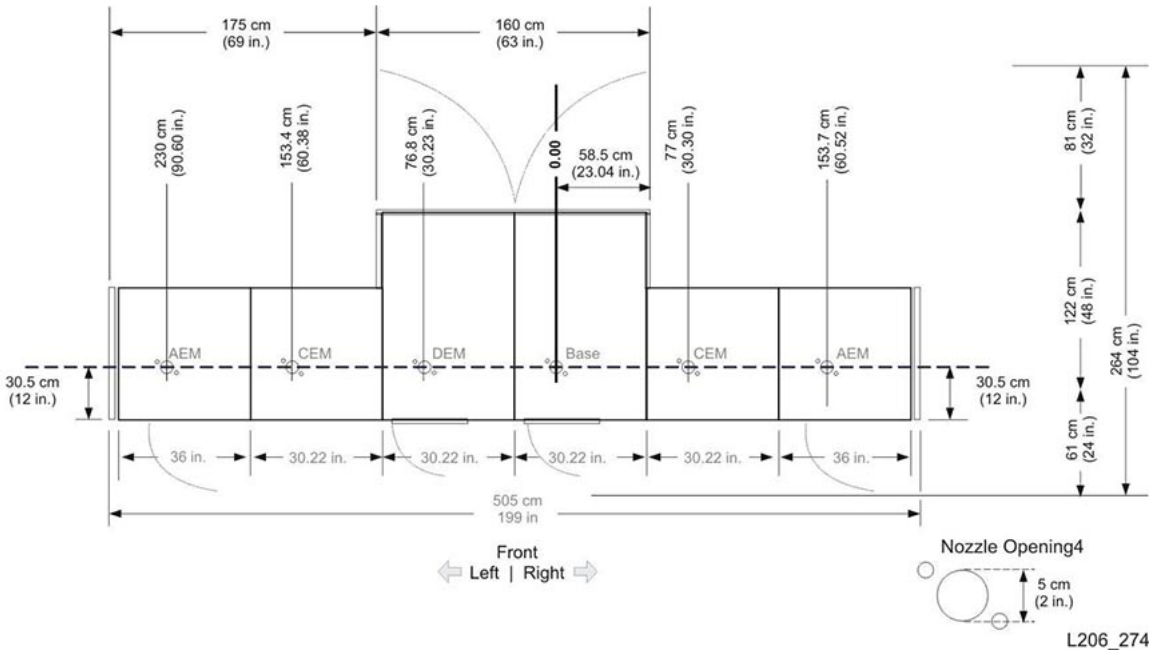
Floor Slope

TallBots must travel along a level plane throughout the library. Any excessive out-of-plane conditions could cause binding, premature wear, and damage to the TallBots. Use the jack pads to adjust the library on a sloped floor.

Fire Suppression Planning

The library does not ship with a fire suppression system, but features have been incorporated into the library to allow for one. Professional Services can assist with fire suppression planning.

Figure 7–4 Fire Suppression Ceiling Access (Viewed from the top of the library)



- Openings = One per module that measure 5 cm (2 inches) diameter. *Do not* cut/alter the provided opening without contacting Professional Services.
- Plates = Cover the openings and measure 7 cm (2.75 inches) square and 1 cm (0.48 inches) thick. These plates are what contractors can use to drill in to for a custom fit of the nozzles.
- Screws = Two T25 Torx screws
- Nozzle protrusion into the library to clear robotic operation =1 cm (0.4 inches) from the top of the library

Cable Routing

The SL3000 library has rear door cut-outs on both the top and bottom of the door to allow for cable routing. The cut-out is a 2.5cm (1 inches) opening that runs 73 cm (29 inches) along the length of the door with cable routing hardware and reliefs available.

Note: There are two square cut-outs on the rear door of the Base and DEM. These are not for cable routing.

When routing cables, make sure to include locations for power, drive interface, library control, and Ethernet cables. As a best practice, route power cables through one cut-out and signal cables through another cut-out.

Figure 7–5 Door Cable Routing Cutouts

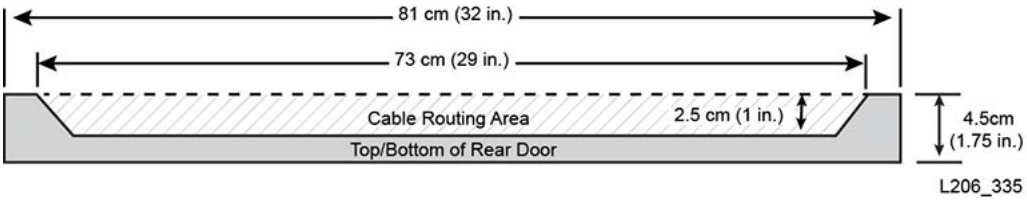
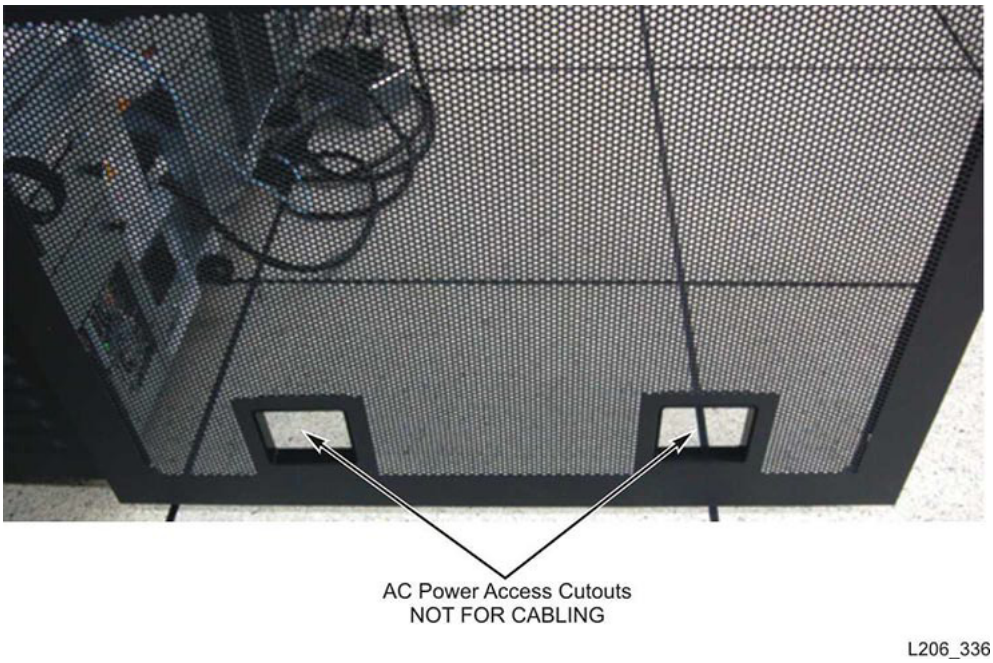


Figure 7–6 Rear Door AC PDU Access - Not for Cable Routing



AC Power Configurations and Cables

SL3000 libraries require that the customer select one of the following single phase AC power options for the base and drive expansion modules:

- 110 VAC, 50/60 Hz, at 20 Amps (range: 100–127 VAC, 50–60 Hz, 16 Amps)
- 240 VAC, 50/60 Hz, at 30 Amps (range: 200–240 VAC, 50–60 Hz, 24 Amps)

Make sure to plan for the locations of power cables and list the locations for their associated circuit breakers. Cables *must* be ordered for the appropriate power configuration. Keep in mind that you must order one power cord per PDU installed:

- N+1: One power cord for the Base and an additional power cord for the DEM (if installed).
- 2N or 2N+1: Two power cords for the Base and two additional power cords for the DEM (if installed).

Library Network Cables

The maximum distances that the SL3000 Tape Library supports on a Fibre Channel link is determined by the link speed, the type of fiber (50 or 62.5 micron), and the device to which the library is attached.

The library can be used in a 62.5-micron-cable Storage Area Network (SAN). However, the cable that connects the library to the network must be a 50-micron cable because the library uses 50-micron cables internally.

Refer to your switch vendor to determine what is supported in the customers storage area network. The typical support distances for the cables are:

- 4 Gbps = up to 70 m (230 ft) for 62.5-micron, 150 m (492 ft) for 50-micron
- 2 Gbps = up to 150 m (492 ft) for 62.5-micron, 300 m (984 ft) for 50-micron
- 1 Gbps = up to 175 m (574 ft) for 62.5-micron, 500 m (1640 ft) for 50-micron

If your library attaches to a host bus adapter (HBA), refer to the documentation for the HBA for the supported cable distances. A list of cables is supplied in "Cables - Fibre Channel, ESCON, and Ethernet" on page 9-11.

Tape Drive Cables

A list of cables is supplied in "Cables - Fibre Channel, ESCON, and Ethernet" on page 9-11. If the drives are connected to the optional Ethernet switches (see "Encryption Switches and Cabling" on page 9-9) to connect to the drives, the cable connections between each drive and the switch are at the rear of the base or drive expansion modules.

Environmental Requirements

Although the SL3000 library will function over a full range of environmental variables as specified below, for optimal reliability maintain the environment between the recommended ranges. Although this equipment is designed to operate in environmental conditions of 20% to 80% humidity, a recommended industry best practice is to maintain a relative humidity of 40% to 50%.

Table 7–6 Environmental Specifications

Description	Temperature	Relative Humidity (non-condensing)	Wet Bulb Maximum	Maximum Altitude
Operating	15 to 32°C (60 to 90°F) dry bulb	20% to 80%	29.2°C (84.5°F)	3.05 km (10,000 ft)
Storage	10 to 40°C (50 to 104°F)	10% to 95%	35.0°C (95.0°F)	3.05 km (10,000 ft)
Shipping	-40 to 60°C (-40 to 140°F)	10% to 95%	35.0°C (95.0°F)	15.24 km (50,000 ft)

Power Consumption

For information on power requirements, heat output, and power consumption, refer to Chapter 5, "Power and Cooling".

Seismic or Earthquake Ratings

The requirements for seismic compatibility vary dramatically throughout the world. Therefore, Oracle does not offer a standard "seismic" feature for the SL3000 library. 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.

Caution: *Bodily injury and equipment damage:* A qualified seismic engineer must be consulted to verify seismic zone exposures and adequate site preparation.

For sites in areas of seismic activity, the customer may wish to permanently fix the library position for added stability. The SL3000 library provides mounting holes in the floor of each module where half-inch carriage bolts (mounting studs) can be used to permanently fix the library's position.

Airborne Contaminants

Control over contaminant levels in a computer room is an extremely important consideration when evaluating an environment. 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 refer to 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 ensure safe levels of airborne chlorine when chlorinated water is used for humidification.

Table 7–7 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)

8

Installation Planning

This chapter outlines requirements and considerations when planning for an SL3000 library installation.

Physical Space

A successful installation of the SL3000 library requires an adequate physical space. For dimensions of the library modules, refer to "Physical Dimensions and Weights" on page 7-2. If modules will be added in the future, ensure there is enough room to expand the library.

Floor

Several requirements exist for the customer's floor, review the section "Floor Requirements" on page 7-6. 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 Measures" on page 8-2 for more information.

Construction Area

The minimum working area (not including the space required for the pallets) is approximately 19 m^2 (200 ft^2).

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.

Time and Personnel

The table below shows the estimated times for the installation of modules and components. **At least two qualified service representatives should install the library**. The times listed below **do not** include library initialization, testing, audits, and feature upgrades. Installation services are required with the purchase of the SL3000 library. Contact an Oracle sales representative for more information.

Table 8–1 Installation Time Estimates

Module/Component	Time Estimate (hours)	Personnel Required	Total Person Hours
Base Module with 8 drives (standard)	3	2	6
Base Module and Drive Expansion Module	5	2	10
Base Module and Cartridge Expansion Module	4	2	8
Each additional Cartridge Expansion Module	2	2	4
Two Parking Expansion Modules	2	2	4
Access Expansion Modules (each)	2	2	4
CAPs	1	2	2
Tape Drive (each drive)	0.5	1	0.5
Operator Panel or Window	0.75	1	0.75
Firmware	0.2	1	0.2
Integration (cables, hubs, switches, connections)	8	1	8
Media install (each)	0.02	1	variable

Shipping Weights and Measures

The SL3000 library modules and other components are shipped on pallets. The table below lists each module and its shipping specifications. If equipment on a pallet must be transported on elevators, the elevator cars must be capable of safely handling the weight.

Table 8–2 Module and Tape Drive Shipping Information

Module	Height	Width	Depth	Weight
Base Drive	216 cm (85 in.)	97 cm (38.3 in.)	134 cm (53 in.)	410 kg (905 lb)
Drive Expansion	216 cm (85 in.)	97 cm (38.3 in.)	134 cm (53 in.)	321 kg (708 lb)
Cartridge Expansion	216 cm (85 in.)	97 cm (38.3 in.)	96 cm (38 in.)	213 kg (469 lb)
Parking Expansion	216 cm (85 in.)	97 cm (38.3 in.)	96 cm (38 in.)	213 kg (469 lb)
Access Expansion	216 cm (85 in.)	97 cm (38.3 in.)	148 cm (58 in.)	260 kg (570 lb)
LTO	32 cm (12.6 in.)	31 cm (12.2 in.)	66 cm (26 in.)	9.5 kg (20.9 lbs)
T10000	34 cm (13.4 in.)	31 cm (12.2 in.)	66 cm (26 in.)	10.5 kg (23.1 lbs)

Either a split-pallet or pallet-ramp design is used to ship and provide safe removal of the module at the customer site. SL3000 library modules are shipped with wheels (casters) already attached to allow for easy positioning within the data center. Once positioned, the modules must be raised from their wheel-base to rest upon load plates for stability and/or leveling purposes.

The suggested library adjustment height is 200 cm (77.6 in.). Therefore, make sure that the top of the library does not interfere with ceiling fixtures in the data center..

Pallet Double Stacking

WARNING: ***Possible Physical Injury*. Many SL3000 modules are being delivered stacked, unsecured, on a second pallet by the shipping companies due to the narrow pallet design. Only use a forklift to remove the second pallet.**

Use a forklift operated by a qualified operator to safely remove a library module pallet that is stacked on another pallet. *Do not* attempt to remove an SL3000 module from a second pallet without the proper equipment. Field personnel *should not* try to remove the modules by tilting and sliding the palleted module off the second pallet underneath.

In the event that a forklift is unavailable to safely remove the module, please notify the install coordinator. Inform them that the library may need to be picked up from the site by the delivery company, taken off the second pallet, and re-delivered.

Delivery personnel are not authorized to remove the modules from the second pallet without the proper equipment.

Installation Tools

The table below lists the installation tools required for the SL3000 library. There are no special installation toolkits required.

Note: Some of the standard tools may be obtained from an SL8500 installation kit if available.

Table 8–3 Standard Installation Tools

Standard Tools	Part Number	Use
Torx screwdriver with T8, T10, T15, T25 bits	Obtain Locally	**T8:** Removal and replacement of the PUK card. **T10:** PUO, PUW, PUN, PUF, PUZ cards. Track stops. **T15:** Operator panel, window, blank plate, arrays **T25:** Removal/replacement of shipping brace, rails, and CAP screws.
3/8-in. drive ratchet wrench	Obtain Locally or from SL8500 Kit	Module height adjustment, joining modules
5/16-in. hex Allen on 3/8-in. drive	Obtain Locally or from SL8500 Kit	Module height adjustment, joining modules
9/16-in. socket on 3/8-in.-drive	Obtain Locally or from SL8500 Kit	Module removal from pallet
Wire side cutters	Obtain Locally	Cutting shipping straps

Table 8–4 Special Installation Tools

Special Tools	Part Number	Use
Copper rail connector extraction tool	313921001	Track terminator removal (supplied with Base module installation kit)
Rail separator/joiner	4199410xx	Release or join extrusions (supplied with Base module installation kit)
Serial cable for laptop	24100134	CLI access to library (obtain from iProcurement/Zones)
Crossover cable for laptop	24100163	Ethernet access to library (obtain from iProcurement/Zones)
Drive tray power-on tool	314831204	See "Drive Tray Power-on Tool" on page 8-4 below (obtain from iProcurement/Zones)

Additional tools that must be obtained locally:

- Flashlight
- Step stool
- Multimeter
- Phillips screwdriver and flat blade screwdriver
- Adjustable wrench (must accept 7/8-in. nut) to lock weight distribution pads
- Pallet jack

Drive Tray Power-on Tool

A tool is available to assist in removing a stuck tape within a library tape drive. This tool turns on a drive *outside* the library for the primary function of removing a cartridge stuck within a library drive.

The drive tray toolkit part number is 314831204, which contains the instructions for its use (document 102084) and a drive power cable (part 419632401).

An AC power cord is required to use this tool. You must obtain a cord that is appropriate for your region. The Drive Tray Power-on Tool is available from iProcurement under the Zones online tool crib.

Optional Power Drill

While the amount of fastening hardware is minimal, you may also use a power drill to speed up the process of tightening nuts and screws. If a power drill is used, you must adjust the torque setting to:

- 2.8 Nm (25 in.-lb) for T-25 screws
- 0.6 Nm (5 in.-lb) for T-10 screws

Installation Kits

Installation kits are supplied with each module. These contain the hardware required to install each module. Kit part numbers are:

- 419838301—Base module
- 419844301—Drive expansion and cartridge expansion modules

9

Ordering

This chapter provides information for ordering the SL30000 library modules, additional components, tape drives, media, and external cables. Contact Sales Assistance at +1.888.672.2534 for more information.

The tables throughout this chapter provide the part numbers for library components and upgrade options. For most components, two part numbers are provided, ATO and PTO. The ATO number is for initial orders and PTO is for orders after the initial purchase of an SL3000 modular library.

Ordering Process

1. Select a physical configuration.
   a. Choose modules: Base (required), DEM, CEMs (up to eight), PEMs, or AEMs.

      Identify the number of physical slots currently needed, then add additional capacity to meet the needs for future growth (see Chapter 4, "Capacity").
   b. Select module add-ons for each module selected, such as CAPs, window arrays, operator panel, and tape drive arrays.
2. Determine the active capacity.
   a. Order largest quantities first, add smaller quantities to get the total desired active capacity. Quantity options include: +25, +100, +200, +500, +700, +1000.
   b. Refer to Chapter 4, "Capacity" and "Hardware Activation Files" on page 9-2.
3. Select the number and type of tape drives.
   a. Select the number of supported drives: T9840, T10000, and LTO.
   b. Order tape cartridges and labels.
4. Select the power options.
   a. Choose a power redundancy option: N+1, 2N, or 2N+1.
   b. Calculate the number of power supplies and input power source needed (see Chapter 5, "Power and Cooling").
   c. Order the required number of power supplies, AC power cords, and PDUs.
5. Select the software options.
   a. Options include: dual TCP/IP, dual fibre channel, partitioning, redundant electronics, library management software, and network connectivity.
6. Select required cables (see "Cables - Fibre Channel, ESCON, and Ethernet" on page 9-11)

7. Determine the required services.
   a. Select maintenance options and professional service options.
   b. Determine if the library will be installed during normal working hours, or if it will require after-hours installation.

Hardware Activation Files

Hardware Activation Files are required to enable certain features purchased for the SL3000 library. The following features are controlled by activation files:

- Capacity on Demand (active capacity)
- Partitioning
- Dual TCP/IP Port or Dual Fibre Channel (FC)
- Redundant Electronics

Hardware activation files are typically delivered to the customer through Oracle's Software Delivery Cloud. This is a digitally signed Java Archive (.jar) file that contains one activation permit for the purchased feature. These activation files can be added and removed from the library using the StorageTek Library Console. To download the appropriate hardware activation files, go to Oracle's Software Delivery Cloud at: https://edelivery.oracle.com/

1. Choose a language, and enter your information.
2. Read and agree to terms and conditions.
3. Under select a product pack, choose Oracle StorageTek Products. Under platform select "Generic Platform".
4. Select the StorageTek SL3000 Modular Library System.
5. Download the purchased features.

Physical Configuration

The physical configuration of the library includes selecting the modules that will make up the SL3000 library. Be sure to read the options and requirements for each module carefully.

Base Module (required)

A base module is required with every initial order. A standalone base module is the smallest library configuration.

Table 9–1 Base Module Part Number

Description	ATO
Base module, no active slots, one drive array (eight drive slots), CAP	SL3000-BASE-Z
Base module for non-European Union countries, no active slots, one drive array (eight drive slots), CAP	7105811

Options:

- 8 (standard), 16, or 24 drive slots. To order additional drive arrays, see "Tape Drive Arrays" on page 9-5.

- Perforated window (standard), window storage array, or operator panel. To order, see "Module Add-on Options" on page 9-5.

Requirements:

- A minimum of 200 activated slots must be purchased. Activation permits must be purchased to activate storage capacity in this module, see "Activating Capacity" on page 9-6.

Drive Expansion Module - Additional Drive Capacity

Order a drive expansion module for additional drive capacity.

Table 9–2 Drive Expansion Module Part Numbers

Description	ATO	PTO
DEM, 200 active slots, one drive array (eight drive slots)	SL3000K-DEM200-Z	XSL3000-DEM200-F

Options:

- 8 (standard), 16, 24, or 32 drive slots. To order additional drive arrays, see "Tape Drive Arrays" on page 9-5.
- Perforated window (standard), window storage array, operator panel, or CAP. To order, see "Module Add-on Options" on page 9-5.

Requirements:

- One DEM maximum per library.
- Activation file for 200 slots included. However, additional activation permits may be purchased to activate storage capacity in this module, see "Activating Capacity" on page 9-6.

Cartridge Expansion Module - Additional Storage Capacity

Order up to eight cartridge expansion modules for additional tape cartridge storage capacity.

Table 9–3 Cartridge Expansion Module Part Numbers

Description	ATO	PTO
CEM, no active slots (438 to 620 cartridge slots)	SL3000-1CEM-Z	XSL3000-CEM-Z-N

Options:

- One CAP per module. To order, see "Cartridge Access Port" on page 9-5.
- Two CEMs may be converted to PEMs at any time, if the dual robotics option is selected.

> **Note:** There is a loss of capacity when converting a CEM to a PEM. Ensure that the library has the required capacity.

Requirements:

- Maximum of eight CEMs per library.
- Activation permits may be purchased to activate storage capacity in this module, see "Activating Capacity" on page 9-6.

Dual Robotics Support

Dual robotics require either two PEMs or two AEMs and a minimum 2N power with 240 VAC.

Parking Expansion Module

A PEM provides dual robotics support. A PEM is a converted CEM.

Table 9–4 Parking Expansion Module Part Numbers

Description	ATO	PTO
PEM, no active slots (230 to 312 cartridge slots)	SL3000-1CEM-Z	XSL3000-CEM-Z-N

Options:

- PEM on left side may have a CAP (a CAP on the right PEM is not supported). To order, see "Cartridge Access Port" on page 9-5.

Requirements:

- If AEMs are not installed, two PEMs (one on each end of the library) are required to support dual robotics.
- The library requires a minimum 2N power with 240 VAC to support dual robotics.
- The library must have two TallBots. To order an additional TallBot, see "Dual TallBots" on page 9-4.

Access Expansion Module

AEMs can provide bulk loading and dual robotics support. AEMs can only be placed at the ends of the library.

Table 9–5 Access Expansion Module Part Numbers

Description	ATO	PTO
AEM for Left Side, 234 bulk loading CAP	SL3000-LEFTAEM-Z	XSL3000-AEM-LFT-N
AEM for Right Side, 234 bulk loading CAP	SL3000-RIGHTAEM-Z	XSL3000-AEM-RT-Z-N

Options:

- One AEM supports bulk loading capability only, dual robotics is not supported. It is recommended to install a single AEM on the left for maximum storage slot capacity.
- Two AEMs support bulk loading and dual robotics.

Requirements for Dual Robotics:

- If two PEMs are not installed, two AEMs are required to support dual robotics.
- The library requires a minimum 2N power with 240 VAC to support dual robotics.
- The library must have two TallBots for dual robotics. To order an additional TallBot, see "Dual TallBots" on page 9-4 below.

Dual TallBots

Dual TallBots increase efficiency and provide redundancy if a robot becomes inactive.

Table 9–6 Dual TallBots Part Numbers

Description	ATO	PTO
Dual TallBot	SL3000-DUALBOT-Z	XSL3000K-DUALBOT-N

Requirements:

- Two AEMs or two PEMs are required to support dual robotics.
- The library requires a minimum 2N power with 240 VAC to support dual robotics.

Module Add-on Options

Module add-on options include tape drive arrays, CAPs, window arrays, and an operator panel which can be added to a module. Some options are only compatible with a specific module, read the options and requirements carefully.

Tape Drive Arrays

Tape drive arrays may be ordered for the Base or DEM.

Table 9–7 Tape Drive Array Part Numbers

Description	ATO	PTO
Tape Drive Array (eight drive slots)	SL3000-DRVARRAY-Z	XSL3000-DRVARY-Z-N

Options:

- The Base holds a maximum of three drive arrays. One array comes standard with the module. Therefore, up to two additional arrays may be ordered for the Base to support up to 24 tape drives.
- The DEM holds a maximum of four drive arrays. One array comes standard with the module. Therefore, up to three additional arrays may be ordered for the DEM to support up to 32 tape drives (56 total in the library).

Cartridge Access Port

Order cartridge access ports (CAPs) to increase the import and export capacity of the library.

Note: Bulk cartridge loading is available with an AEM, see "Access Expansion Module" on page 9-4.

Rotational CAP

The cartridge access port (CAP) is a vertically-mounted, rotating cylinder with two removable 13-slot magazines.

Table 9–8 Rotational Cartridge Access Ports - Part Numbers

Description	ATO	PTO
Cartridge Access Port (26 slots)	SL3000-1CAP-Z	XSL3000-CAP-Z-N
Spare CAP Magazine (13 slots)	SL3000-CAPMAG-Z	XSL3000-CAP-MAG-N

Options:

- Spare CAP magazines can be ordered.
- There can only be one CAP per CEM or DEM module.

Requirements:

- The Base comes standard with one CAP. A maximum of nine additional CAPs can be ordered for a maximum-sized library.

Window Cartridge Array

The window array can be used to increase cartridge capacity in the Base and DEM. The window array replaces the perforated window with 23 storage slots.

Table 9–9 Window Array Part Numbers

Description	ATO	PTO
Cartridge Window Array (+23 slots)	SL3000-WARRAY-Z	XSL3000-W-ARRAY-N

Requirements:

- Only for Base and DEM. Replaces perforated window.

Operations Panel

The operations panel provides local touch screen operator panel for the library.

Table 9–10 Operations Panel Part Numbers

Description	ATO	PTO
Operations Panel	SL3000-OPPANL-Z	XSL3000-OP-PANL-N

Requirements:

- Only for Base or DEM, one per library. Replaces perforated window.

Redundant Electronics

Redundant electronics provide failover protection if a library controller card fails.

Table 9–11 Redundant Electronics Part Numbers

Description	ATO	PTO
Redundant Electronics	SL3000-REDELCT-Z	XSL3000-REDELCT-Z

Activating Capacity

Physical capacity in the library must be activated before it can be accessed by the host. Capacity upgrades can be purchased at any time. Order larger quantities first and add smaller quantities to get the total desired active capacity. For more information on capacity, refer to Chapter 4, "Capacity".

Active Capacity Permits

Capacity can be activated in quantities of: +25, +100, +200, +500, +700, +1000. However, the 700 slot upgrade is only available for an initial purchase.

Table 9–12 Activate Capacity Permit Part Numbers

Description	ATO	PTO
1000 Cartridge Slot Upgrade	SL3000K-1000SLOT	XSL3000-1000SLOT-F
700 Cartridge Slot Upgrade	SL3000K-700-SLOT	
500 Cartridge Slot Upgrade	SL3000K-500-SLOT	XSL3000-500-SLOT-F
200 Cartridge Slot Upgrade	SL3000K-200-SLOT	XSL3000-200-SLOT-F
100 Cartridge Slot Upgrade	SL3000K-100-SLOT	XSL3000-100-SLOT-F
25 Cartridge Slot Upgrade	SL3000K-25SLOT	XSL3000-25-SLOT-F

Power Options

Refer to Chapter 5, "Power and Cooling" for details on the power configurations, as well as how to calculate power requirements for the SL3000 library.

There are three possible power configurations for the library N+1, 2N, and 2N+1. There are two AC power source options for the Base and Drive Expansion modules. Both are *single phase*:

- **120 VAC**, 50/60 Hz, at 20 Amps (range: 100–127 VAC, 47–63 Hz, 16 Amps) limited support for T9840 and T10000 drives; no redundant TallBot support
- **240 VAC**, 50/60 Hz, at 30 Amps (range: 200–240 VAC, 47–63 Hz, 24 Amps)—full featured

DC Power Supplies

The number of powers supplies required depends on the power redundancy option selected (N+1, 2N, or 2N+1) and the number of tape drives. To calculate the number of DC power supplies to order for the tape drives, refer to "Calculating Tape Drive Power Supply Quantities" on page 5-3.

If the **2N+1** power options is selected, order one additional 1200W DC supply to power the robotics, and two additional 200W cPCI power supplies for the electronics control module. These are in addition to the DC supplies required for the tape drives. For more information, refer to "DC Power Supplies" on page 5-2.

Table 9–13 DC Power Supply Part Numbers

Description	ATO	PTO
1200W DC power supply (for tape drives and robotics)	SL3000-1DCPWR-Z	XSL3000-DCPWR-Z-N
200W cPCI power supply (for ECM)	SL3000-EMDCPWR-Z	XSL3000-EM-DCPWR-N

AC Power Distribution Units (PDU)

One PDU is required per Base or DEM. The same PDU type must be installed in both the base and the DEM. There can be a maximum of four PDUs in the library depending on the configuration selected. To determine the number and type of PDUs to order, refer to Chapter 5, "Power and Cooling".

Table 9–14 AC Power Distribution Unit Part Numbers

Description	ATO	PTO
100 - 127 VAC 20 Amp PDU	SL3000-PDU110-Z	XSL3000-PDU-110-N
200 - 240 VAC 30 Amp PDU	SL3000-PDU240-Z	XSL3000-PDU-240-N

AC Power Cords

You must order one power cord per PDU installed:

- N+1: One power cord for the Base and an additional power cord for the DEM (if installed).
- 2N or 2N+1: Two power cords for the Base and two additional power cords for the DEM (if installed)

Table 9–15 AC Power Cord Part Numbers

Description	ATO	PTO
US Power Cord 20A/110V, 3.7 meter	SL3000-PWCD20110	XSL3000-PC20110-N
US Power Cord 30A/220V, 3.7 meters	SL3000-PWCD30220	XSL3000-PC30220-N
International Power Cord, 30A/220V, 4 meters	SL3000-IPWCD30220	XSL3000-IPC30220-N

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.

Some tape drives used in other StorageTek modular libraries can be converted to operate in an SL3000 library, refer to "Drive Tray Conversions Kits" on page 9-9. To order tape drive arrays for a module, refer to "Tape Drive Arrays" on page 9-5.

T-Series Drives

The SL3000 library is compatible with T9840(C,D) and T10000(A,B,C,D). However, Oracle only currently sells the T9840D, T10000C, and T10000D.

Table 9–16 T-series Tape Drive Part Numbers

Description	Part Number
T10000D tape drive: 16 Gb FC	7105799
T10000C tape drive: 4 Gb FC	T10C-4FC-SW-30Z
T10000C tape drive: 4 Gb FICON	T10C-4FI-LW-30Z
T9840D tape drive: FC, dual port, short wave	9840D-FC-S30-2PS-N
T9840D tape drive: FICON, dual port, long wave	9840D-FI-S30-2PL-N

LTO Drives

The SL3000 library is compatible with LTO drives generation 3, 4, 5, and 6. However, not all drive models are currently sold. Check the corporate web site listed above for the most current sales information. All currently sold LTO drives listed below are encryption capable.

Table 9–17 LTO Tape Drive Part Numbers

Description	Part Number
HP LTO6 8 Gb FC	7104452

Table 9–17 (Cont.) LTO Tape Drive Part Numbers

Description	Part Number
IBM LTO6 8 Gb FC	7104436
HP LTO5 8 Gb FC	LTO5-HP8FC-SL3000Z
IBM LTO5 8 Gb FC	LTO5-IB8FC-SL3000Z

Encryption Switches and Cabling

Ethernet switches and cables are required if tape drive encryption is selected. The number of required parts depends on the number and location of the encrypted drives. The "Harness number" below correspond to the drive array location. Therefore, "Harness 1" supports the first drive array in a module and "Harness 2" supports the second drive array in a module and so on.

Table 9–18 Drive E-Switch Harness Part Numbers

Description	Part Number
Drive E-Switch Harness 1 (supports 1-8 drives) - includes switch	XSL3000-ETHRNT1-N
Drive E-Switch Harness 2 (supports 9-16 drives) - cables only	XSL3000-ETHRNT2-N
Drive E-Switch Harness 3 (supports 17-24 drives) - includes switch	XSL3000-ETHRNT3-N
Drive E-Switch Harness 4 (supports 25-32 drives, DEM only) - cables only	XSL3000-ETHRNT4-N

Drive Tray Conversions Kits

A drive tray conversion kit converts tape drives used in other StorageTek modular libraries to the SL3000 library tray.

Table 9–19 T-Series Drive Tray Conversion Kit Part Numbers

Description	Part Number
T9840C/D Escon from 9310, L5500, L700, L1400, L180, 9740 to SL3000	9840CD-ES-SL3-Z-N
T10000A/B (FI/FC) from 9310, L5500, L700, L1400, or L180 to SL3000	T10AB-FCFI-SL3-Z-N
T10000A/B from SL8500 to SL3000	T10K-S85/S30CKIT-N
T10000C from SL8500 to SL3000	T10C-S85/S30-CKITZ

Table 9–20 LTO Series Drive Tray Conversion Kit Part Numbers

Description	Part Number
IBM/HP LTO3 from SL8500 to SL3000	LTO-3F-S8S30-CKZ-N
HP LTO3 or LTO4 from L180, L700, L1400, SL500 to SL3000	7103000
IBM LTO3 or LTO4 from L180, L700, L1400, L5500, 9310 to SL3000	LTO-IBF-L7S30-CK-N
IBM LTO3 or LTO4 from SL500 to SL3000	LTO-IBF-S5S30-CK-N
IBM/HP LTO4 from SL8500 to SL3000	LTO-4F-S8S30-CKZ-N
HP LTO5 from SL500 or SL8500 to SL3000	7103006
IBM LTO5 from SL500 or SL8500 to SL3000	7103003

Port Conversions Kits

Port conversion kits convert the port type installed on the tape drive or install an additional ports on tape drive. For single port to dual port upgrades and long to short wave conversions, order two kits for dual port drives.

Table 9–21 T-Series Port Conversion Kit Part Numbers

Description	Part Number
T10000C FC to FICON conversion kit	T10C-FC/FI-CKITZ
T10000A/B 4GB FC and FICON single 4GB long wave SFP	XT10K-4GB-LW-Z-N
T10000A/B 4GB FC and FICON single 4GB short wave SFP	XT10K-4GB-SW-Z-N
T9840C/D and T10000A 2GB FC and FICON single 2GB long wave SFP	X984/T10K-2GB-LW-N
T9840C/D and T10000A 2GB FC and FICON single 2GB short wave SFP	X984/T10K-2GB-SW-N

Table 9–22 LTO Dual-Port Conversion Kit Part Numbers

Description	Part Number
HP LTO4 FC dual-port conversion kit for installation of a second data port	XL4-HF-SL30-DPCK-N
IBM LTO4 FC dual-port conversion kit for installation of a second data port	XL4-IF-SL30-DPCK-N
LTO5 FC dual-port conversion kit for installation of a second data port	XL5-SL85-SL30-DPCK

Cartridges and Labels

Tape cartridges are not shipped as part of the SL3000 modular library system and must be ordered separately.

The customer can use their existing cartridges as long as they are compatible with the supported tape drives and still within their warranty period. Professional Services and Data Center Services offer transition support and services to help migrate media and drives. The sales representative should make sure that the customer orders the proper cartridge tape labels before the installation.

- 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

Label kits are available in either 60 or 200 piece quantities. The 60 piece kit has 60 data and 6 cleaning cartridge labels. The 200 piece kit has 200 data and 20 cleaning cartridge labels. The end-user will affix the labels to the cartridges. The label ranges are sequentially numbered, non-repeating and cannot be customized.

Refer to the T-Series *Systems Assurance Guides* for information about the media part numbers for the T9840 and T10000 tape drives. Refer to the *Barcode Technical Brief* for more details about media labels.

Software Options

Hardware activation files for these software options are downloaded through Oracle's Software Delivery Cloud at: `https://edelivery.oracle.com/`

For additional information about these options, refer to the *SL3000 User's Guide* or *SL3000 Host Connectivity Guide*.

Table 9–23 Software Options Part Numbers

Description	ATO	PTO
Partitioning	SL3000K-PART	XSL3000-PART-F
Dual TCP/IP	SL3000-2TCPIP	XSL3000-2TCPIP-F
Dual Fibre Channel Card	—	XSL3000-2FCCARD
Dual Fibre Channel Port	SL3000K-2FCPORT	XSL3000-2FCPORT-F

Cables - Fibre Channel, ESCON, and Ethernet

The following tables list the cables available for the SL3000 library and tape drives. The cables are either **Riser** or **Plenum**. Plenum-rated cables have a higher flammability rating and are used for under-the-floor applications. SL3000 drive trays accept only LC fiber cable connectors. If you are using cables with SC connectors, you must add an adapter.

Fiber Optic Cables

LC connectors are the industry standard for all 2 Gb-capable or higher Fibre Channel devices. SL3000 drive trays accept only LC fiber cable connectors.

Table 9–24 LC-to-LC, 50/125 Micron, Multimode Cable Part Numbers

Description	ATO	PTO
50 m (164 ft) FC cable OM4, 50/125 duplex riser	7106951	7106952
50 m (164 ft) FC cable OM4, 50/125 duplex plenum	7106953	7106954
3 m (9.8 ft) FC cable, duplex riser	CABLE10800340-Z-A	CABLE10800340-Z-N
5 m (16.4 ft) FC cable, duplex riser	CABLE10800341-Z-A	CABLE10800341-Z-N
10 m (32.8 ft) FC cable, duplex riser	CABLE10800310-Z-A	CABLE10800310-Z-N
10 m (32.8 ft) FC cable, duplex plenum	CABLE10800313-Z-A	CABLE10800313-Z-N

Table 9–25 LC-to-LC, 9/125 Micron, Single Mode Cable Part Numbers

Description	Part Number
3 m (9.8 ft) Optical Cable, LC-to-LC Duplex, Riser	CABLE10800302-Z-A
10 m (32.8 ft) Optical Cable, LC-to-LC Duplex, Riser	CABLE10800331-Z-A
50 m (164 ft) Optical Cable, LC-to-LC Duplex, Riser	CABLE10800333-Z-A
100 m (328 ft) Optical Cable, LC-to-LC Duplex, Riser	CABLE10800306-Z-A
10 m (32.8 ft) Optical Cable, LC-to-LC Duplex, Plenum	CABLE10800330-Z-A
50 m (164 ft) Optical Cable, LC-to-LC Duplex, Plenum	CABLE10800332-Z-A
100 m (328 ft) Optical Cable, LC-to-LC Duplex, Plenum	CABLE10800305-Z-A

Table 9–26 LC-to-SC, 9/125 Micron Cable Part Numbers

Description	Part Number
10 m (32.8 ft) Optical Cable, LC-to-SC Duplex, Riser	CABLE10800335-Z
50 m (164 ft) Optical Cable, LC-to-SC Duplex, Riser	CABLE10800337-Z
100 m (328 ft) Optical Cable, LC-to-SC Duplex, Riser	CABLE10800304-Z
10 m (32.8 ft) Optical Cable, LC-to-SC Duplex, Plenum	CABLE10800334-Z
50 m (164 ft) Optical Cable, LC-to-SC Duplex, Plenum	CABLE10800336-Z
100 m (328 ft) Optical Cable, LC-to-SC Duplex, Plenum	CABLE10800303-Z

Table 9–27 ESCON Cable Part Numbers

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

Table 9–27 (Cont.) ESCON Cable Part Numbers

Description	Part Number
107 m (350 ft) Plenum	CABLE10800288-Z

Ethernet Cables

These cables provide the interface connection for TCP/IP (HLI-PRC).

Table 9–28 Ethernet Cable Part Numbers

Description	Part Number
2.4 m (8 ft), 24 AWG, CAT5, Shielded	CABLE10187033-Z-A
10.7 m (35 ft), 24 AWG, CAT5, Shielded	CABLE10187034-Z-A

Support

Service and support representatives are available to assist with hardware and software problem resolution. During the initial order and installation planning, the customer should contact local and remote support with any questions.

Service Delivery Platform

The Service Delivery Platform (SDP) is a support enhancement solution that provides faster problem resolution, analysis and trending, and improved diagnostic capabilities. The SDP consists of a smart appliance placed at the customer site that connects to the library and any StorageTek T-series tape drives. The SDP collects device events and alerts support analysts, providing remote diagnosis and auto service requests (ASR).

For more information, customers should contact an Oracle representative, or visit: http://www.oracle.com/technetwork/systems/asr/documentation/oracle-installed-storage-330027.html

Oracle sales representatives should work with the customer to complete an SDP Systems Assurance Guide. Sales or service representatives can find the SDP Systems Assurance Guide and other SDP information at: https://stbeehive.oracle.com/teamcollab/overview/Service+Delivery+Platform

Oracle Premier Support for Systems

Oracle Premier Support is a fully integrated support solution which features:

- Complete system coverage and unlimited 24/7 access to Oracle system specialists
- Essential product updates, such as firmware
- Personalized, proactive IT support and rapid-response hardware service

For more information visit: http://www.oracle.com/us/support/index.html

Contacting Support

The Oracle Global Customer Support Contacts Directory can be found at: http://www.oracle.com/us/support/contact-068555.html

To purchase support call United States Support Sales: +1.800.833.3536. If support has been purchased call United States Technical Support: +1.800.223.1711

To submit, update, or review service requests, go to My Oracle Support at: https://support.oracle.com/

A

Best Practices

This appendix provides best practices and fundamentals of operation for the SL3000 library to optimize library performance. The key practices include library configuration planning, content management, partitioning, and networking.

Library Configuration Planning

When selecting modules and features of the SL3000 library, there are fundamental guidelines that should be followed to maximize library performance. This section describes best practices to optimize library performance when adding expansion modules, dual robotics, cartridge access ports, and tape drives.

Cartridge Expansion Module

The initial CEM should be installed to the right of a Base, then a second to the left of the drive expansion module, a third to the right, and the fourth one to the left, and so on. This alternating method provides the best usage of the cartridge slots.

A balance of CEMs—to the left and to the right—provides for the most efficient operation. Cartridge expansion modules can be installed with up to four to the right and up to four to the left. Installing four CEMS only on one side increases the amount of robotic travel, resulting in a decrease of overall library performance.

Parking Expansion Module

The inaccessible arrays in a PEM do not need to be removed. This allows the customer to restore this module to a CEM at anytime. However, any data cartridges in the inaccessible arrays cannot be accessed by the client.

Access Expansion Module

When entering and ejecting cartridges in smaller quantities, use the smaller rotational CAPs to complete the job. These CAPs are easier to use and take less time to audit than the larger AEM bulk load CAPs.

Robotic Rails and TallBots

The robotic units in an SL3000 library are called TallBots. Each library can have either one (standard) or two (redundant) TallBots that are driven along two extrusions, called rails, on the rear wall of the library.

Rails are continuous and allow the TallBots to travel the length of the library from end-to-end. However, in a dual TallBot configuration, there is a robotic safety zone that

prevents collisions. When using redundant TallBots, Access or Parking Expansion Modules must be installed at both ends of the library string.

- Parking Expansion Modules (PEMs) have an area of inaccessible cartridge slots in the event of a TallBot failure. The defective TallBot either moves into or is pushed into this area while the other—redundant—TallBot continues library operations.
- Access Expansion Modules provide an area or "garage" where the defective TallBot is parked. A service representative can then replace this TallBot without interrupting library operations.

Using redundant TallBots for content management offers:

- Increased speed for library operations—two robotic units working in parallel
- Redundant operations should one unit fail

Cartridge Access Ports

When planning the workloads, place applications that require significant enters and ejects adjacent to the CAP magazines.

CAP control is split down the centerline. Make sure there is a left- and right-side CAP to support the library. If a CAP encounters a failure, all CAPs to the outside of the failed CAP, will be unusable until the defective CAP is serviced. Therefore, install CAPs in a balanced fashion around the centerline.

- If a redundant CAP is required and no DEM is installed, install the CEM with a CAP on the left. If a DEM is installed, then place the CEM on the right and install a CAP on the DEM.

If partitioning, the recommendation is to install enough CAPs to provide at least one CAP for each partition. This allows each partition to contain a *dedicated* CAP. CAPs can be shared between similar hosts. For example, FC SCSI hosts can share CAP resources and HLI hosts can share those resources (CAPs).

Place labels outside on the library wall indicating which CAP and which magazine gets what type of cartridge. Labels are provided for the customer to identify the cartridge access ports.

Insert cartridges with the correct orientation:

- Fully seated and laying flat within the slots
- Parallel to the floor, hub-side down
- Barcode label pointing out and below the readable characters.

Tape Drives

During the installation, logically grouping tape drives can improve performance. Strategies to use when determining where to install the tape drives include:

- Install tape drives that use the same media types closer to those slots. For example, place T9840 drives on the left side of the drive bay with their cartridges to the left and LTO drives on the right side with their matching media to the right.
- Install enough tape drives to adequately handle peak workloads.
- Configure heavy tape applications so they do not exceed the performance limits of the library configuration.
- Use a tool such as QuickLine or a Tape Library Configurator to determine the optimal drive configurations.

- In a dual-robotics library, performance can be improved by separating drives with a blank column down the center of the drive arrays.

Content Management

Proper content management can maximize the performance of the library. When planning for content it is important to consider the best way to manage cartridges, effects of adding active capacity, and the effects of partitioning.

Managing Cartridges

Managing cartridges in the library can have an affect on performance. Use a library management application such as LCM with ELS to keep active volumes and compatible drives closer together and to migrate less active volumes farther away from the drives. Use the watch_vols utility for ACSLS.

Use a float option to help with performance. When float is on, the management software can automatically select a new home slot for a cartridge on a dismount. Make sure the library contains enough free slots to allow the selection of a new home slot during the dismount.

Cluster frequently used cartridges close together and as near to the tape drives as possible. Group or partition the cartridges by workload with enough tape drives to support the maximum, peak activity.

Enter cartridges through the CAP.

- When manually placing cartridges in the library with the front door open, library operations cease and the library management software must perform a full audit to update the library database to match the actual contents.
- When entering cartridges through the CAP, the library stays online so that mounts can continue and the library automatically updates the database.

Eject cartridges efficiently. There are two ways (host functions) to eject cartridges: ordered and unordered.

- When the host specifies an ordered eject, the library places the cartridges in a specific sequence. This operation is significantly slower than unordered ejects. Ordered ejects are used for vaulting, which simplifies the external operations.
- When the host specifies an unordered eject, the library ejects cartridges as it can, often in a random order.

Manage the available space in the library:

- Plan for times of peak activity.
- Keep an adequate supply of scratch cartridges in the library.
- Move inactive cartridges out of the library to ensure there is adequate space for active cartridges.

Capacity on Demand

Capacity on Demand is a non-disruptive optional feature that allows the customer to add active capacity to the libraries.

Non-disruptive Capacity Changes

Changes to active capacity result in minimal disruptions to library operations. The specific library behavior depends on the type of host connection, HLI or FC-SCSI.

> **Note:** Although changes to active capacity are not disruptive to library hosts, it is recommended that you make the library unavailable to other users before committing the active storage region changes.

You can increase active capacity without stopping host jobs or having host connections go offline. When you decrease capacity, the library goes offline only momentarily and then comes back online automatically.

With FC-SCSI libraries, whenever you make any of the following changes, the library goes offline temporarily with a Unit Attention condition:

- Activate or deactivate a storage cell.
- Add, change, or remove a host connection.
- Remove an empty drive slot.

Multiple error messages may be generated, and all hosts must issue the appropriate commands to update their library configuration information. See the appropriate tape management software documentation for detailed procedures and commands. In the case of adding or removing drives, the device SCSI numbering is updated as well.

Partitioning

The benefits of a partitioned library include:

- More than one operating system and application managing the library
- An improvement in the protection or isolation of files
- An increase in system and library performance
- An increase in user efficiency

Partitions allow for a customized fit, such as:

- Giving multiple departments, organizations, and companies access to the resources of the library
- Isolating clients at service centers
- Separating different encryption key groups
- Dedicating partitions for special tasks

Partitions are defined by assigning rectangular boundaries. Currently the SL3000 supports up to 60 rectangular boundaries per partition within the library.

Any slots added to a partition are considered active. Therefore, adding to a partition increases the total number of active slots in the library. Ensure that the library has enough active capacity when adding to a partition. If more active capacity is required, purchase additional activation permits.

Note: If a partition contains slots that are being displaced because an optional CAP is being installed, the customer *must remove all these slots from any partition definitions before shutting down the library*. Failure to do this will result in a service call and engineering assistance to recover partition definitions.

Non-Disruptive Partitioning

The non-disruptive partitioning (NDP) feature minimizes the number of host interruptions that occur when partitions are modified. The library does not need to be taken offline for every partition change. Hosts that are not connected to the changed partition are not disrupted.

The specific functions of the NDP feature vary, depending on the type of host-partition connection. For details, refer to the SL3000 User's Guide.

Rectangular Boundaries

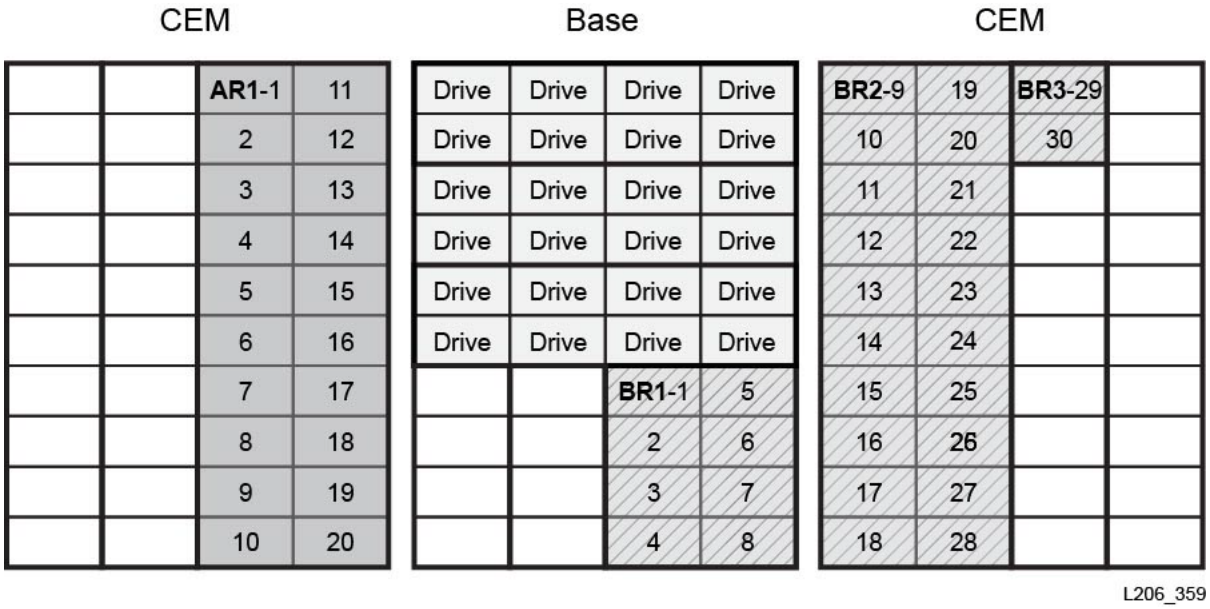
Rectangular boundaries provide the customer with a resource to better optimize cartridge placement within the library. To do this, the customer selects boundaries within the library by using the same method as defining a partition. This rectangular boundary can be just one or two slots, a row, a column, or an entire module.

Available slots use the same numbering scheme of the library within the boundaries—starting in the upper left, then counting to the lower right—for the activated capacity of the library. The figures that follow provide an example of partitioning with rectangular boundaries. The figures are simplified and do not represent the actual physical layout of the library.

The Figure A–1 below shows a sample library where the customer has defined:

- Two selected partitions (A and B)
- Four Rectangular boundaries called AR1, BR1, BR2, and BR3
- A library activated for 50 slots: AR1-1 through 20, BR1-1 through 8, BR2-9 through 28, and BR3-29 through 30

Figure A–1 Adding Capacity to Partitions - Adding 50 Slots

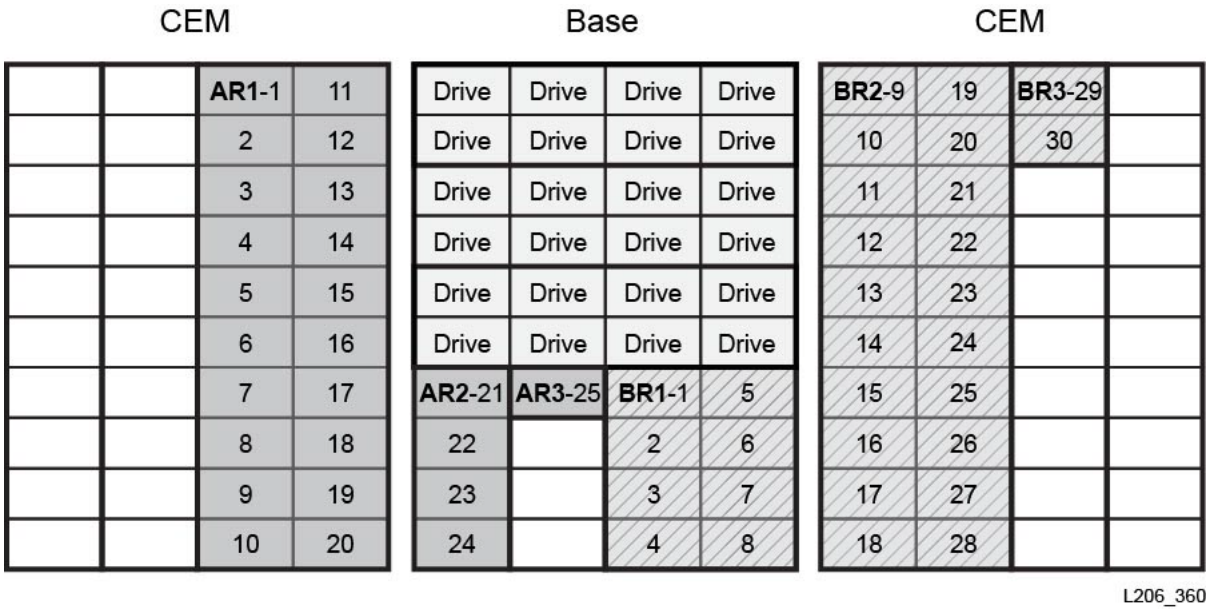


In Figure A–2 below, the customer has added five more slots to partition A by creating two more rectangular boundaries: AR2 and AR3.

- AR2 slots 21-24 and AR3 slots 25

Because there are no more slots under AR2-24, the customer must go to the right and create a boundary for the fifth slot AR3-25, an example of a single slot rectangular boundary.

Figure A–2 Adding Capacity to Partitions - Adding 5 More Slots

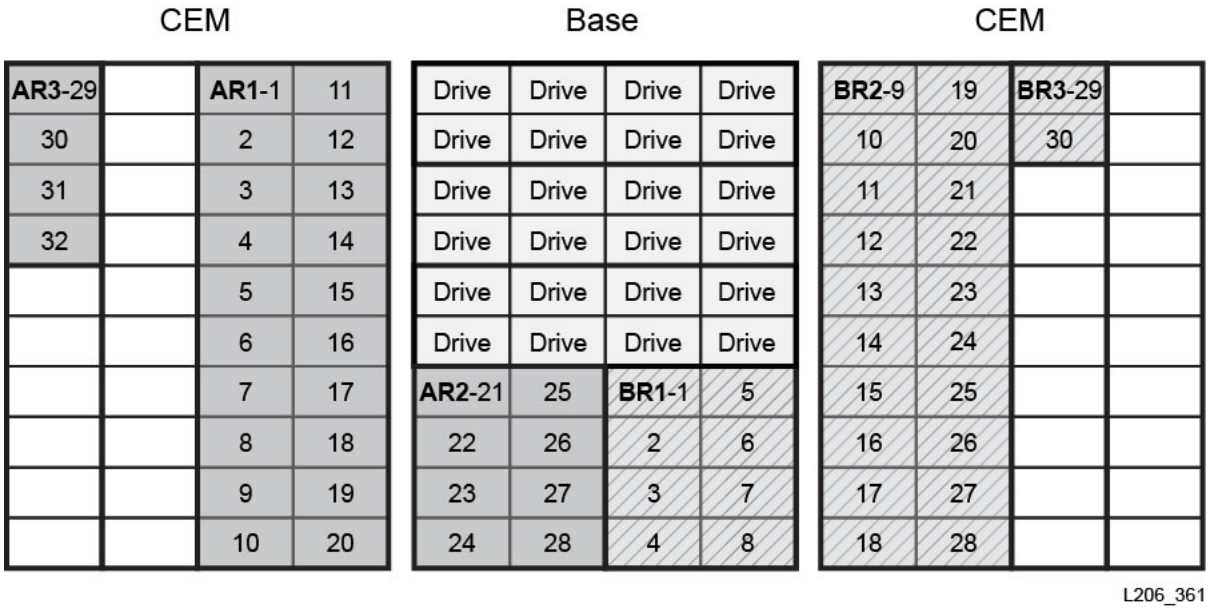


In Figure A–3 below, the customer has added 12 more slots to partition A.

- AR2 slots 21-28 and AR3 slots 29-32

Because there are no more slots to the right of AR2-28, the customer must go to another area of the library with installed, yet inactive, slots to continue with the addition. To do this, the boundary AR3 was created to the left of boundary AR1.

Figure A–3 Adding Capacity to Partitions - Adding 12 More Slots



Guidelines for Partitioning

The SL3000 library can support up to eight partitions using a variety of interface types: only Ethernet partitions, only SCSI partitions, or combinations of both.

Essential guidelines for understanding partitions are:

- Clear communication between the system programmers, network administrators, library software representatives and administrators, and service representatives.
- Customers must be current on maintenance levels of their library management software.
- A clearly written and drawn out plan for partitioning must be completed and agreed upon by all partition members.
- One partition will not recognize another partition within the library. Other partitions are either not reported or marked as inaccessible.
- CAPs may be allocated to one or more partitions. *However:*
  - Sharing a CAP between HLI and SCSI partitions is *not* permitted.
  - CAP sharing among SCSI partitions is *not recommended*.
- Since CAPs can be either shared or dedicated among partitions:
  - Automatic mode for shared CAP operations is not supported.
  - Automatic mode for dedicated CAP operations is supported.
- If a host has a CAP reserved for enter or eject operations for a partition, no other hosts or partitions can have access to the CAP.

The SL3000 library has an optional feature to add cartridge access ports to the drive expansion and cartridge expansion modules for a total of up to 10 rotational CAPs.

Note: For SCSI hosts, automatic CAP mode is supported for one partition at a time *if the shared CAP is associated with that partition*. A shared CAP that has been associated with a partition acts as a dedicated CAP until the association changes.

- Duplicate VOLSERs are supported by the library; however, the library management software may not support this unless the duplicate VOLSERs are in different partitions.
  - With ELS/HCS-managed partitions, the duplicate VOLSERs must be in different control data sets.
  - With ACSLS-managed partitions, the duplicate VOLSERs must be on different ACSLS servers.

Planning the Data Path for Partitions

When planning for partitions, you also need to be aware of the location, quantity, type, and need for the tape drives and media.

Likewise, a clear understanding about how to logically group and install the tape drives and locate media for the different hosts, control data sets, and interface types is necessary.

When planing for partitions:

- Make sure the tape drive interface supports that operating system.
  - Open system platforms do *not* support ESCON or FICON interfaces.
  - Not all mainframes support Fibre Channel or LTO tape drives.
- Make sure the media types match the application.
- Install tape drives that use the same media types in the same partition.

Host Software Precautions when Partitioning

When you partition or re-partition a library, you do not have to reboot or IPL the library. However, when you remove resources from a partition, the library will take the affected partition offline temporarily. For this reason, it is best to minimize any disruptions to the operating systems and library management software before you partition.

The amount of time the affected partition goes offline is minimal, from 10 to 15 seconds, unless work is in the queue. The library will wait for queued jobs to complete before taking the partition offline. This action affects only the changed partition, not the entire library. Anytime resources are removed from a partition, the change is disruptive only to the host(s) connected to the altered partition.

An example of a procedure that all hosts (ACSLS or ELS/HSC) should follow when partitioning or changing partitions is:

1. Plan the distribution of cartridges, such as enters, ejects, and moves.
2. Use the remote SLC software to change the partitioning configuration.

3. The host(s) will get a configuration change message, and should audit the library with the host software to update the accessible cartridges and storage slots in the host software's database. SCSI hosts will need to re-learn the library if anything has changed on their partition.

Partitioning in the Performance Zone

The performance zone is an area within the SL3000 library that is closest to the tape drives. Because of the physical location, volumes in this zone have faster access and response times to the tape drives.

Selection of the volumes that reside in this zone is critical to obtain the best performance. Volumes that benefit the most from the performance zone are:

- Applications such as VSM, HSM, and ABARS
- Volumes that tend to be recalled regularly
- Most recently created volumes
- Volumes that need fast access time
- Volumes that require very few ejects

Volumes that do not meet any of the above criteria should be moved out of this area. Once this zone is full, volumes would extend into the regular storage area.

Networking

Whenever possible, use a dedicated, secure private network for communication between the library and host management software. A secure private network connection using an Ethernet hub or switch is required for maximum throughput and minimum resource contention.

If a shared network is used or required by the customer, these actions can help with the communication between the host and the library:

- Directly connect the library to a switch.
- Place the library on its own subnet.
- Use a managed switch that can:
  - Set priorities on ports to give the host and library higher priority.
  - Provide dedicated bandwidth between the host and the library.
  - Create a VLAN between the host and the library.

Use a virtual private network (VPN) to insulate host to library traffic.

Using World Wide Names

The SL3000 library assigns World Wide Name (WWN) addresses to drives. The WWN does not change when the drive is swapped or replaced and host parameters do not need to be changed or re-configured.

Normally, blocks of World Wide Name (WWN) addresses are assigned to manufacturers by the IEEE Standards Committee and are built into devices during manufacture. In the case of the SL3000 Tape Library, however, the library assigns World Wide Node Names and World Wide Port Names to the drives. This technique is referred to as "library-centric world wide names." Potential drive slots are each assigned a WWN which does not change when a drive is swapped or replaced.

In the SL3000 library, a WWN for a drive is implemented through an algorithm that uses the frame serial number of the library and the drive's position within the library. Only the last two digits change within the library. The second-to-the-last digit represents the frame number (starting at 0 for Frame 1) and the last digit is the drive row (starting at 1). The WWN of the drive is location-dependent and not device-dependent. That is, each time a drive is reset or turned on, the library re-establishes the WWN so that a drive in frame x, row y always retains the same WWN—host parameters do not need to be changed or re-configured. The library's configuration can also easily survive a reboot. The following sections describe methods that involve World Wide Names in resolving these issues.

Tape Drive Dynamic World Wide Name

Each connection (port) in a Fibre Channel environment must have a unique ID called the World Wide Name (WWN). The WWN is a 64-bit address that identifies each individual device.

When a tape drive logs-in to a Fibre Channel network, the WWN is validated for access by comparing Port Name, Node Name, and Port ID. All three of these identifiers must match or this indicates the configuration has changed and the port is blocked from access.

The dynamic World Wide Name (dWWN) feature assigns world wide names to the library drive slots rather than the drives themselves. This allows you to swap or replace devices, such as tape drives, without bringing down the entire operating system.

Using Persistent Binding

When a server is booted, devices are discovered and assigned SCSI target and LUN IDs. It is possible for these SCSI assignments to change between boots. Some operating systems do not guarantee that devices will always be allocated the same SCSI target ID after rebooting. Also, some software depends on this association, so you do not want it to change. The issue of SCSI ID assignment is addressed by persistent binding.

Persistent binding is a host bus adapter (HBA) function that allows a subset of discovered targets to be bound between a server and device.

Implemented by a World Wide Node Name (WWNN) or World Wide Port Name (WWPN), persistent binding causes a tape drive's World Wide Name to be bound to a specific SCSI target ID.

After a configuration has been set, it survives reboots and any hardware configuration changes because the information is preserved. If a drive needs to be replaced, the new drive assumes the WWNN of the old drive because the WWNN for the drive is location-dependent within the library. Because the WWNN does not change, persistent binding does not need to be changed, which would otherwise cause an outage.

Using Zoning to Isolate Devices and Enhance Security

For security reasons, it is important to limit the devices that a server or servers can recognize or access. Also, some performance configurations and Storage Area Network (SAN) configurations can result in a device being seen multiple times from the same server. For example, if you have two host bus adapters (HBAs) from the same server connected to a tape drive in the SL3000 Tape Library, the drive will be detected and appear as two logical devices. That is, there will be two special files for one physical device. Zoning can address these issues.

Zoning allows you to partition your SAN into logical groupings of devices so that each group is isolated from the other and can only access the devices in its own group. Two types of zoning exist: hardware zoning and software zoning. Hardware zoning is based on physical fabric port number. Software zoning is defined with the World Wide Node Name (WWNN) or World Wide Port Name (WWPN).

While zoning can be re-configured without causing an outage, some zoning configurations can become complicated. The advantage of the library's WWNN implementation is that you can avoid the exposure of introducing zoning errors because there is no need to change the zoning configuration if a drive needs service or replacement.

B

Tape Drives and Media

This appendix provides basic information about the tape drives and media supported by the SL3000 library. For more information about currently available tape drives, see the tape drive section on the corporate website:
http://www.oracle.com/us/products/servers-storage/storage/tape-storage/overview/index.html

Additionally, 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

Tape Drives

The SL3000 library supports three families of tape drives and media:

- StorageTek T-Series (T9840C and D)
- StorageTek T-Series (T10000A, B, C, and D)
- Linear Tape-Open (LTO) Ultrium generations 3, 4, 5, and 6

> **Note:** Tape drives must support the dynamic World Wide Name feature for them to be placed online by the SL3000 library.

T9840

The T9840 tape drive is an *access-centric* tape drive that use a unique dual-reel cartridge design with mid-point load technology. This design enables fast access and reduces latency by positioning the read/write head in the middle of the tape when the cartridge is loaded. With the dual-reel design, the entire tape path is contained within the cartridge, which reduces contamination and enables the drive's fast access capabilities.

T9840C and T9840D drives are:

- Backward read compatible to the first generation (T9840A) written cartridges
- Not backward write compatible

T10000

The T10000 tape drive is a *capacity-centric* tape drive that is capable of storing a native capacity of up to: 8 TB (T10000D). There are two generations of cartridges: the T10000 for A and B drives and the T10000 T2 for C and D drives. The T10000C and D drives are capable of reading T10000A or T10000B media. The T10000C and D drives only write to StorageTek T10000 T2 media. In addition to the standard data cartridge, there is a sport cartridge for faster access, but with less capacity.

LTO Ultrium

The LTO Ultrium is a *capacity-centric* tape drive that conforms to an open standard that provides media compatibility across all brands and manufacturers of LTO Ultrium products. Check the corporate web site listed above for the most current sales information.

LTO tape drives are:

- Read compatible backward two generations
- Write compatible backward one generation

Encryption Capable Tape Drives

The following drive models have encryption capabilities:

- StorageTek =T10000A, B, C, D and T9840 Model D only
- HP and IBM =LTO Generations 4, 5, 6

For more information, refer to the tape drive specific documentation and Oracle Key Manager documentation on the Oracle Technical Network.

Tape Drive Comparisons

The table below provides a quick comparison of tape drives compatible with the SL3000 library.

Table B–1 Tape Drive Comparisons

Specification	T10000 C	T10000 D	T9840D	LTO5	LTO6
Capacity (native)	5 TB 1TB (sport)	8 TB 1.6 TB (sport)	75 GB	1.5 TB	2.5 TB
Transfer rates (native)	252 MB/s	252 MB/s	30 MB/s	140 MB/s	160 MB/s
Buffer size	2 GB	2 GB	64 MB	256 MB	—
Load Time (sec)	13.1	13	8.5	19	22
Access (sec)	57 17.5 (sport)	50 14 (sport)	8	52	50
Maximum Rewind time (sec)	115 32.5 (sport)	97 26 (sport)	16	96	98
Unload Time (sec)	26	23	12.5	19	19
Length–usable	1,107 m (3,632 ft)	1,107 m (3,632 ft)	251 m (889 ft)	850 m (2789 ft)	—

Table B–1 (Cont.) Tape Drive Comparisons

Specification	T10000 C	T10000 D	T9840D	LTO5	LTO6
Fibre Channel	4 Gb/s FCP	16 Gb/s FCP 10 Gb/s FCoE	2 Gb/s FCP	8 Gb/s FCP	8 Gb/s FCP
SCSI /SAS	—	—	—	6 Gb SAS	6 Gb SAS
FICON	4 Gb/s	8 Gb/s	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 SL3000 library 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

Media Comparisons

The table below provides a comparison of compatible media.

Table B–2 Tape Drive Media Comparisons

Specifications	T10000 C	T10000 D	9840 D	LTO5	LTO6
Capacity, native	5 TB	8 TB	75 GB	1.5 TB	2.5 TB
Transfer rate (MB/s)	252	252	30	140	160
Number of tracks	3584	4608	576	1280	2176
Total length	1147 m (3763.1 ft)	1147 m (3763.1 ft)	271 m (889 ft)	846m (2776 ft)	846m (2776 ft)
Archival life (years)	30	30+	15–30	15–30	—
Load/unloads	25,000	>150,000	10,000	5,000	—
Uncorrected bit error rate	$1x10^{-19}$	$1x10^{-19}$	$1x10^{-18}$	$1x10^{-17}$	$1x10^{-17}$

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

Standards of Conformance

The tables below list the standards to which the SL3000 library complies.

Table D–1 Standards of Conformance - Country

Country	Standard
U.S.A.	Federal Communications Commission (FCC). Title 47, Part 15, Subpart B, and as an Unintentional Radiators Class A
Japan	Voluntary Control Council for Interference(VCCI), Class A(CISPR22)
European Union (CE mark)	Electromagnetic Compatibility Directive 89/336/EEC and 2004/108/EC (including EN55022, EN55024, EN61000-3-2, EN61000-3-3 and amendments)
Australia/New Zealand	EMC Framework AS/NZS 3548
Taiwan	Bureau of Standards, Metrology and Inspection (BSMI) Law, Taiwan CNS13438
Canada	Canadian EMC Law ICES-003
Korea	Korean EMC Law

Table D–2 Standards of Conformance - Emissions

Emissions	European Union Test Requirements
HF Radiated	EN55022 Class A
HF Conducted	EN55022 Class A
Harmonic Current	EN61000-3-2
Voltage Fluctuations/Flicker	EN61000-3-3

Table D–3 Standards of Conformance - Directives

Directive	Description
RoHS	Reduction of Hazardous Substances
WEEE	Waste Electrical and Electronic Equipment (e-waste)

Table D–4 Standards of Conformance

Standard	Description
EDS 3-3	AC Powerline

Table D–4 (Cont.) Standards of Conformance

Standard	Description
EDS 5-6	Product Safety Requirements
EDS 6-3	Electrostatic Discharge (ESD) Immunity
CP-7-1-2	Product Safety

Glossary

This glossary defines terms and abbreviations used in this and other product-related publications.

2N

A power configuration that gives the SL3000 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 the base module or drive expansion module through which service personnel can enter the library. A standard CAP is installed on a base module's access door; an optional CAP may be installed on a drive expansion module's access door.

access expansion module (AEM)

An optional module that can be installed on one or both ends of a library. If only one access expansion module is installed, it must be used as a bulk loading CAP (no storage slots).

If two access expansion modules are installed:

- They must be on the ends of the library—this is required if the dual TallBot option is installed.
- They are used as bulk loading CAPs only (no storage slots).
- They contain a service safety door for non-disruptive replacement of a defective TallBot.
- Access expansion and parking expansion modules *cannot* be mixed within a library.

accessory rack

Areas of the base module and the drive expansion module that are used for electronic equipment and for other standard 19-inch rack-mount equipment. Two racks are supplied in each base module and drive expansion module.

Rack mount equipment must be compatible with the power and cooling specifications of the racks.

ACSLS

See **Automated Cartridge System Library Software (ACSLS)**.

addressing schemes

See the following:

- **SL3000 address**
- **SL3000 drive bay**
- **HLI-PRC address**
- **SCSI elements**

alias

An alternate name for an entity that is more easily human-readable. Aliases are sometimes used for grouping purposes. *See* also **alias identifier**.

alias identifier

One or more address identifiers that may be recognized by an N_Port in addition to its N_Port identifier. Alias address numbers are used to form groups of N_Ports so that frames may be addressed to a group rather than to individual N_Ports.)

Any Cartridge Any Slot technology

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

archive

(1) The process of making a copy of one or more files or databases that is saved for future reference and readily accessed if needed for restoration. Archive ensures a chance of recovery and is used for long-term retention.

(2) A copy of files that are saved for future recovery purposes in case the original data is lost or corrupted.

array

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

(2) A molded unit that holds multiple cartridges.

asynchronous (ASYNC)

Not synchronized; not occurring at regular, predetermined intervals. Asynchronous transmissions send one data character at a time, at irregular intervals, rather than in one steady stream; a start bit and a stop bit notify the receiver when the transmission begins and ends. Contrast with synchronous.

audit

See **host audit** *and* **security audit**.

Automated Cartridge System Library Software (ACSLS)

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

automation bezel

A tape drive attachment with a locator target for positioning gets and puts to the tape drive.

backplane

The main circuit board inside electronic equipment that contains the central processing unit, the bus, memory sockets, expansion slots, and other components.

barcode camera

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

blind mate connector

A connector that allows hot plugging instead of manually placing a cable between two fixed connectors.

British thermal units (Btu)

A measure of the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit. British thermal units are most commonly associated with power over a unit of time—Btu per hour (Btu/hr).

bulk load

Manually loading cartridges into the library, for example, during library installation.

camera

A device attached to a robot that reads volume serial number labels on cartridges, instead of scanning the labels with a laser. A camera performs faster and more accurately than a laser scanner.

CAP

See **cartridge access port**.

Capacity on Demand

A process by which a customer purchases additional slots and enlarges the library's capacity with minimal impact to host applications.

card

Synonymous with printed wire assembly.

cartridge access port

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

Synonymous with import/export mail slot in SCSI and open system libraries. *See also* **unlocked**.

cartridge array

An array that holds multiple cartridges. *See also* array. SL3000 arrays contain 3, 4, 8, 9, 11, or 13 slots, depending on their location.

cartridge bias

Left or right justification of a cartridge within a storage slot, CAP, or tape drive.

cartridge mover

See **robot**.

cartridge proximity detector

A component that determines if a slot is empty or contains an unlabeled cartridge during a label reading error recovery procedure. Synonymous with empty slot detector.

CCD

(1) Charge couple device.

(2) Slot contents database.

cleaning cartridge

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

CLI

Command line interface.

cold swap

To remove and replace a system component (typically one such as a logic board that has no redundant backup) after system operations have been stopped and system power has been disabled. Contrast with **hot swap**.

CompactPCI (cPCI)

*See **cPCI**.*

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

conversion bill

An optional feature ordered by a customer for the library. This contains conversion instructions for installing the feature. *See also* **X-option**.

cPCI

Compact peripheral component interconnect. Industry standard bus used for card-to-card bus expansion. The electronics control module uses 200W cPCI power supplies.

CSSC

See **Customer Services Support Center (CSSC)**.

Customer Services Support Center (CSSC)

StorageTek's customer services organization. Customers with StorageTek maintenance contracts may contact the CSSC.

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.

data error rate

The number of errors that occur per a measurable amount of data on a tape.

destination

The drive or slot location in an adjacent library where a cartridge will be mounted or stored. *See also* **source**.

diagnostic cartridge

A data cartridge with a "DG" label that is used for diagnostic routines.

base module

The base module in an SL3000 library that houses the electronics module assembly, power distribution units (PDUs), power supplies, accessory racks and equipment, and tape drives for the module.

drive array assembly

An array that is installed in the base drive or drive expansion module for inserting tape drive tray assemblies. The base module holds up to three array assemblies; the drive expansion module can contain four array assemblies, and each array holds up to 8 tape drive tray assemblies.

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.

dWWN

See **dynamic World Wide Name**.

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.

electronic mail (e-mail)

Correspondence in the form of messages transmitted between user terminals over a computer network.

electronics control module

The assembly that:

- Processes commands from a host system
- Coordinates the activities of TallBots, CAPs, and tape drives
- Monitors status inputs from sensors and switches

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.

Enterprise Library Software (ELS)

Enterprise Library Software (ELS) incorporates the StorageTek Nearline Control Solutions (NCS) products, VTCS products, and provides customers with a single, integrated software suite.

Enterprise Systems Connection (ESCON)

(1) 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.

(2) A set of IBM products and services that provide a dynamically-connected environment within an enterprise.

environmental monitors

A collective term for the sensors that track temperatures, fan speeds, and the status of various other mechanisms within a library.

EPO

See **emergency power-off (EPO)**.

ESCON

See **Enterprise Systems Connection (ESCON)**.

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.

export

The action in which the library places a cartridge into the cartridge access port so that the operator can remove the cartridge from the library. Synonymous with eject.

failover

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

FFC

Flat flexible cable.

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 up to 200 MB per second. Fibre Channel operates over distances of up to 100 m over copper media or up to 10 km over optical links.

fibre connection (FICON)

An IBM S/390-based channel architecture that provides up to 256 channels in a single connection, each having a capacity of 100 MB per second.

FICON

See **fibre connection (FICON)**.

firmware

An ordered set of instructions and data stored in a way that is functionally independent of main storage; for example, microprograms stored in a ROM.

flash memory

A nonvolatile semiconductor storage device that can be reprogrammed electronically without removal from the circuit. Flash must be erased in fixed blocks rather than single bytes. *Synonymous with* flash erasable programmable read-only memory (FEPROM).

gateway

(1) A 32-bit, or 4-byte number, in dotted decimal format (typically written as four numbers separated by periods, such as 107.4.1.3 or 84.2.1.111) that is applied to an IP Address to identify router interface.

(2) Specialized hardware that connects two otherwise incompatible systems, using different protocols and media, operating locally or over wide areas.

get

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

gripper

(1) The portion of the hand assembly that grasps the cartridge.

(2) The part of the hand assembly that grasps and holds a cartridge during transport.

hand assembly

(1) The robotic element that includes a motor, a gripper for grasping cartridges, and a camera for reading volume serial number labels and targets.

(2) A part of the library robot whose function is to grasp cartridges and move them between storage slots and drives. A camera on the hand assembly reads volume serial number labels and targets.

(3) 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.

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 ELS/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)

A host-resident software package, implemented on operating systems, that influences device allocation and intercepts mount and dismount requests to automate these requests. HSC has been replaced, see **Enterprise Library Software (ELS)**.

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**.

hot swap

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

Synonymous with **online replacement**.

hot-swappable

(1) A component that can be replaced while the system remains online. *Contrast with* **hot-pluggable**.

(2) The capability that allows a component to be replaced while power to the component is maintained. This feature allows hardware maintenance actions and hardware upgrades to proceed without disrupting subsystem availability.

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.

initial program load (IPL)

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

(2) The initialization procedure that activates a machine reset, initiates wake-up diagnostics (from EPROMs) and loads functional code.

interlock switch

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

IPL

See **initial program load (IPL)**.

Java

An object-oriented computer programming language created by Sun Microsystems.

keypad interface

A keypad mounted on the front access door of a base module, used to monitor the status of the SL3000 library and to operate the CAPs.

label

An identifier associated with a removable media or cartridge. Labels are humanly readable, machine readable, or both. *Synonymous with* VOLSER and volume serial number.

library console

(1) *See* StorageTek Library Console.

(2) The customer's operator console that interfaces with the library. *See also* security software layer.

library controller (LC)

The HBCR card within the SL3000 library that controls operations and communicates with the operator console and other modules.

library operator console

See **local operator console**.

local operator console

An optional feature consisting of a flat-panel display with a touch screen interface and a panel mount computer.

This feature is attached to the front door of the base module (or, alternately if desired, the drive expansion module's door). *See also* **touch panel operator control panel**.

magazine

(1) A removable array that holds cartridges in the cells provided and is inserted into the cartridge access port (CAP).

(2) A removable container hat holds cartridges and is placed into the cartridge access port (CAP).

(3) A removable array that holds cartridges and is placed into the cartridge access port (CAP). Each SL3000 CAP holds two magazines, each of which holds up to13 cartridges.

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**.

network gateway

A four-byte notation that makes a library accessible to a large network, which consists of two or more subnets, through a gateway connection.

online replacement

Replacement or service of a module while the library remains operational. The service person may be required to power off the module before removing or replacing it. Synonymous with hot swap.

operator console

(1) A panel that enables a user to configure and diagnose the library or drive. *See also* local operator console.

(2) The user interface for libraries or drives. *Synonymous with* operator control panel.

(3) A touch screen panel that enables users to configure, diagnose, or receive status information about the library or drive.

parking expansion module

Modules that can be installed on the ends of a library configuration. These modules (or access expansion modules) are required for dual TallBot operation.

Parking expansion modules must be installed in pairs and customers lose storage slots to allow space for a defective TallBot. If a defective TallBot is moved into this module,

time must be scheduled for its replacement. (*Contrast with* **access expansion module (AEM)**.)

partition

A subset or portion of an entire library that presents itself to a host client as an independent library. Slots and tape drives included in one partition cannot be seen by another partition. CAPs cannot be shared.

PCI

Peripheral component interconnect.

PDU

See **power distribution unit (PDU)**.

peer to peer

A form of cooperative processing in which either of the programs involved can initiate communication with another. In a peer network every station can function as both a client and a server.

physical capacity

The number of data cartridge slots in the library (excludes reserved slots for cleaning cartridges, diagnostic cartridges, and the module identification block).

physical library

A single SL3000 library consisting of up to 8 modules. See also logical library.

PLC

Power line communications.

PLI

See **primary library interface (PLI)**.

Port Addressing

In Fibre Channel, Port Addressing is used for login validation, and includes the Port Name, Node Name, and N_Port ID.

power distribution unit (PDU)

A device for the distribution of AC line power from one inlet to multiple outlets. Multiple PDUs provide higher availability because the power continues if one PDU (or its alternating current [AC] source if the PDUs use separate AC sources) loses power.

power grid

A power circuit that minimizes power failures that cause the library to cease operations.

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 console and the library controller (the HBCR 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.

PWA

Printed wiring assembly.

RaceTrack architecture

The design and implementation of the SL3000 library's multiple high-performance robotics.

rack unit (u)

A standard unit of measurement of vertical space inside a rack mount cabinet. One u equals 44.5 mm (1.75 in.).

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.

ready

A library that has been powered on and has completed its initialization and initial program load (IPL). It is ready to accept user requests.

RealTime Growth capability

The capability to add pass-thru ports dynamically while the library is operating.

Relative Humidity

A measure of water vapor in the air.

Remote Diagnostic Center (RDC)

See **Customer Services Support Center (CSSC)**.

remote operator console

The customer's operator console that interfaces with the PLI. See also security software layer.

reserved slots

Cartridge slots that are used only for cleaning and diagnostic cartridges and as drop-off slots.

robot

(1) An electromechanical device that moves tape cartridges among the cartridge access ports, storage slots, and drives.

(2) A mechanism that moves horizontally along a track in the SL3000 to transport tape cartridges to and from other locations in the library.

Also called a **TallBot**.

SCSI elements

A four-digit number that represents the addressing scheme used by hosts operating on a Fibre Channel interface. *See also* **Fibre Channel**.

security audit

The process of reading and storing in SL3000 library memory the VOLIDs and locations of all cartridges in the library. See also **host audit**.

security software layer (SSL)

The communication path between the PLI and the remote operator console.

service area

An area between the access expansion module and the library for service representatives to perform replacement of a defective TallBot.

servo power interrupt (SPI)

A signal that removes voltage to a motor if overtravel is detected in the motor or a safety condition exists (for example, an access door to the library module is open). When the sensor or switch is made, the drive current to the motor disables and an error posts.

The SPI prevents a servo runaway condition for an out-of-range motor; it also prevents motors from starting up while an access door is open.

SL3000 address

A four-digit, comma-separated value (L,R,C,S,W) that represents Library, Rail, Column, Side, and Row. This addressing scheme is used by the SL3000 firmware and internal communications to represent all devices and locations within the library.

SL3000 drive bay

A two-digit integer (01–56) that represents the physical locations into which drive tray assemblies are inserted.

slot

The location in the library in which a tape cartridge is stored. *Synonymous with* cell.

source

The home slot location containing the cartridge that will be passed through to an adjacent library. *See also* **destination**.

SPI

See **servo power interrupt (SPI)**.

SSi

System Server infrastructure.

storage cell

See **slot**.

StorageTek Library Console

The operator console software application used for the SL3000.

TallBot

High capacity tall robot. One or two TallBots are used in an SL3000 library. See also **robot**.

tape cartridge

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.

tape drive

An electromechanical device that moves magnetic tape and includes mechanisms for writing and reading data to and from the tape.

tape drive tray assembly

The mechanical structure that houses a tape drive, fan assembly, power and logic cards, cables, and connectors for data and logic cables. Synonymous with drive tray assembly.

tape storage area

The area in the SL3000 library where cartridges are stored.

tape transport interface (TTI)

An interface to control/monitor tape movement.

temperature

The measurement of hot and cold to specific scales, such as Celsius (also called centigrade) and Fahrenheit. The Celsius temperature scale uses 0° for the freezing point of water and 100° for the boiling point of water. The Fahrenheit temperature scale uses 32° for the freezing point and 212° for the boiling point.

touch panel operator control panel

An optional feature consisting of a flat-panel display with a touch screen interface and a panel mounted computer.

track

The horizontal path upon which a robot travels.

track drive mechanism

The component that moves the robot along the track between the slot arrays, CAPs, and tape drives.

TTI

See **tape transport interface (TTI)**.

U

See **rack unit (u)**.

unlocked

In the SL3000 library, status indicating that software has made a CAP available for operator use. An LED is lit when a CAP is unlocked.

UART

Universal asynchronous receiver/transmitter.

vacancy plate

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

volume serial number (VOLSER or VOLID)

(1) An alphanumeric label that the host software uses to identify a volume. It attaches to the spine of a cartridge and is both human- and machine-readable.

(2) A six-character alphanumeric label used to identify a physical volume.

Watt

A watt is a unit of power or the amount of energy per unit of time. Often the term watt is used for expressing energy consumption as kW (kilo-Watts).

Wet bulb

The difference in temperature between wet bulb (humidity) and dry bulb (temperature) provides a measure of atmospheric humidity.

World Wide Name (WWN)

A 64-bit integer that identifies a Fibre Channel port. *See also* **dynamic World Wide Name**.

World Wide Node Name (WWNN)

A globally unique 64-bit identifier assigned to each Fibre Channel node process.

World Wide Port Name (WWPN)

(1) A 64-bit network address that identifies the port name.

(2) A globally unique 64-bit identifier assigned to each Fibre Channel port.

WORM

See **write once read many**.

write once read many

A storage classification for media that can be written only once but read many times.

wrist

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

(2) A component of the hand assembly that rotates the hand horizontally.

X-option

An optional feature ordered by a customer for the library. This contains conversion instructions for installing the feature.

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