Quantum

Planning Guide

Quantum Scalar i6000 Library

6-66882-02 Rev A

Scalar i6000 Planning Guide, 6-66882-02 Rev A, December 2011, Product of USA.

Contents

Chapter 1

About This Guide and Your Product

This guide contains information necessary for site planning prior to the installation of the Scalar i6000. This guide is intended for anyone interested in learning about or anyone that needs to know how plan for the installation of the Scalar i6000.

Caution: Be sure to read all operating instructions in this manual and in the *System, Safety, and Regulatory Information Guide* before operating this product.

This guide is intended to be used by system administrators, information technology professionals, and Quantum professional services and service personnel who will be involved with the installation of the library.

Product Safety Statements

This product is designed for data storage and retrieval using magnetic tape. Any other application is not considered the intended use. Quantum will not be held liable for damage arising from unauthorized use of the product. The user assumes all risk in this aspect.

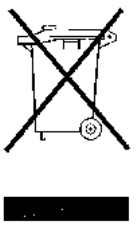
This unit is engineered and manufactured to meet all safety and regulatory requirements. Be aware that improper use may result in bodily injury, damage to the equipment, or interference with other equipment.

WARNING: Before powering on or using this equipment, read THE *System, Safety, and Regulatory Information Guide*. Keep the Guide for future reference.

Mercury Statement

Projectors, LCD displays, and some multifunction printers may use lamp(s) that contain a small amount of mercury for energy-efficient lighting purposes. Mercury lamps in these products are labeled accordingly. Please manage the lamp according to local, state, or federal laws. For more information, contact the Electronic Industries Alliance at www.eiae.org. For lamp-specific disposal information check www.lamprecycle.org.

Disposal of Electrical and Electronic Equipment



This symbol on the product or on its packaging indicates that this product should not be disposed of with your other waste. Instead, it should be handed over to a designated collection point for the recycling of electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please visit our Web site at: http://qcare.quantum.com or contact your local government authority, your household waste disposal service or the business from which you purchased the product.

Product Regulatory Model Number

The Scalar i6000 model number is: SCi2000

Explanation of Symbols and Notes

The following symbols appear throughout this document to highlight important information.

WARNING: INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR BODILY INJURY.

Caution: Indicates a situation that may cause possible damage to equipment, loss of data, or interference with other equipment.

Note: Indicates important information that helps you make better use of your system.

Other Documents You Might Need

The following documents are also available for this product. These documents can be found on the product CD or at www.quantum.com/support.

- *Scalar i6000 User's Guide* (6-66879-02)
- *Quantum Intelligent Libraries Basic SNMP Reference* (6-01159-04)
- *System, Safety, and Regulatory Information Guide* (6-00618-10)

Note: Release Notes are also available for this product. The Release Notes describe changes to your system or firmware since the last release, provide compatibility information, and discuss any known issues and workarounds. The Release Notes can be found in the product box or at www.quantum.com/support.

Contacts

Quantum Corporate Headquarters

Quantum Corporation Headquarters
1650 Technology Drive, Suite 700
San Jose, CA 95110-1382

Technical Publications

Provide documentation feedback at:
comments@quantum.com

Getting More Information or Help

More information about this product is available on the Service and Support Web site at www.quantum.com/support. The Service and Support Web site contains a collection of information, including answers to frequently asked questions (FAQs). You can also access software, firmware, and drivers through this site.

For further assistance, or if training is desired, contact Quantum:

Global Call Handling	1-800-284-5101
For additional contact information:	www.quantum.com/support
To open a Service Request:	www.quantum.com/osr
Quantum Corporation	www.quantum.com

Training

Important: Register for and complete the online training for the Scalar i6000 in order to make the best use of your product.

The online training is available at www.quantum.com/ServiceandSupport/StorageCareLearning/Index.aspx

Chapter 2
Description

The Scalar i6000 library automates the retrieval, storage, and control of cartridges. The cartridges are mounted and retrieved from tape drives using a robotic assembly that is driven by application software from the host without operator intervention. The library is designed for ease of installation, configuration, and field upgrades.

In December, 2011, the library robotics were redesigned. The redesign accommodates either a single robot or dual robotics. The original robot hardware is referred to as Gen 1; the new robot hardware is referred to as Gen 2.

Currently, the two robots work in an active/passive manner. One robot is the active robot and performs all move commands. If the active robot fails, the passive robot takes over operations. In addition, you can manually cause the active robot to fail over so that the passive robot becomes the active robot.

Dual robotics libraries require special modules on either end called parking modules, which house the robots when not in use. See Dual Robotics Configurations and Parking Modules on page 18 for more information.

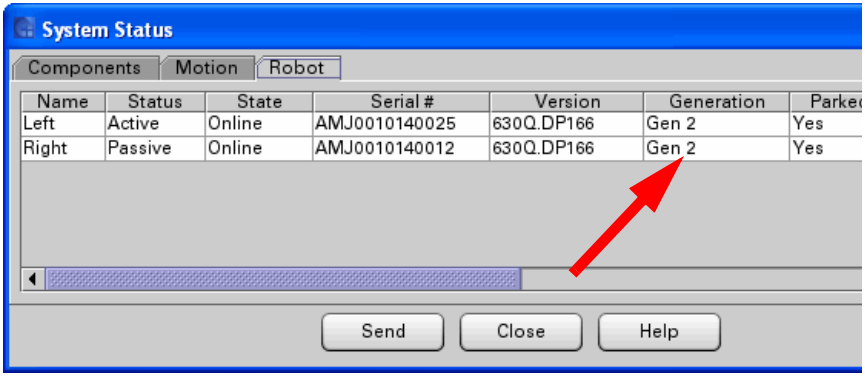
You can upgrade an existing single robotics library (Gen 1 or Gen 2) to a Gen 2 dual-robotics library. See Dual Robotics Upgrade Requirements on page 107 for specific upgrade requirements. You can also upgrade a Gen 1 library to a Gen 2 library (see Gen 2 Single Robotics Upgrade Requirements on page 108).

The library can be installed on a solid or a raised floor. The library has a standard 19-inch rack footprint and can be placed in a standard server rack space. Access is from the access and service doors so the library can be placed with either side against a wall, or between racks.

You can tell which generation robot you have via the library user interface. The library displays which generation of robot hardware is installed. Select **Monitor > System** from the menu, click the **Robot** tab, and look in the **Generation** column (see Figure 1).

Additionally, the main screen of the library user interface displays how many robots are installed (see Figure 17 on page 37). If you do not see this information displayed when viewing the physical library, you have a Gen 1 robot.

Figure 1 Robot Tab



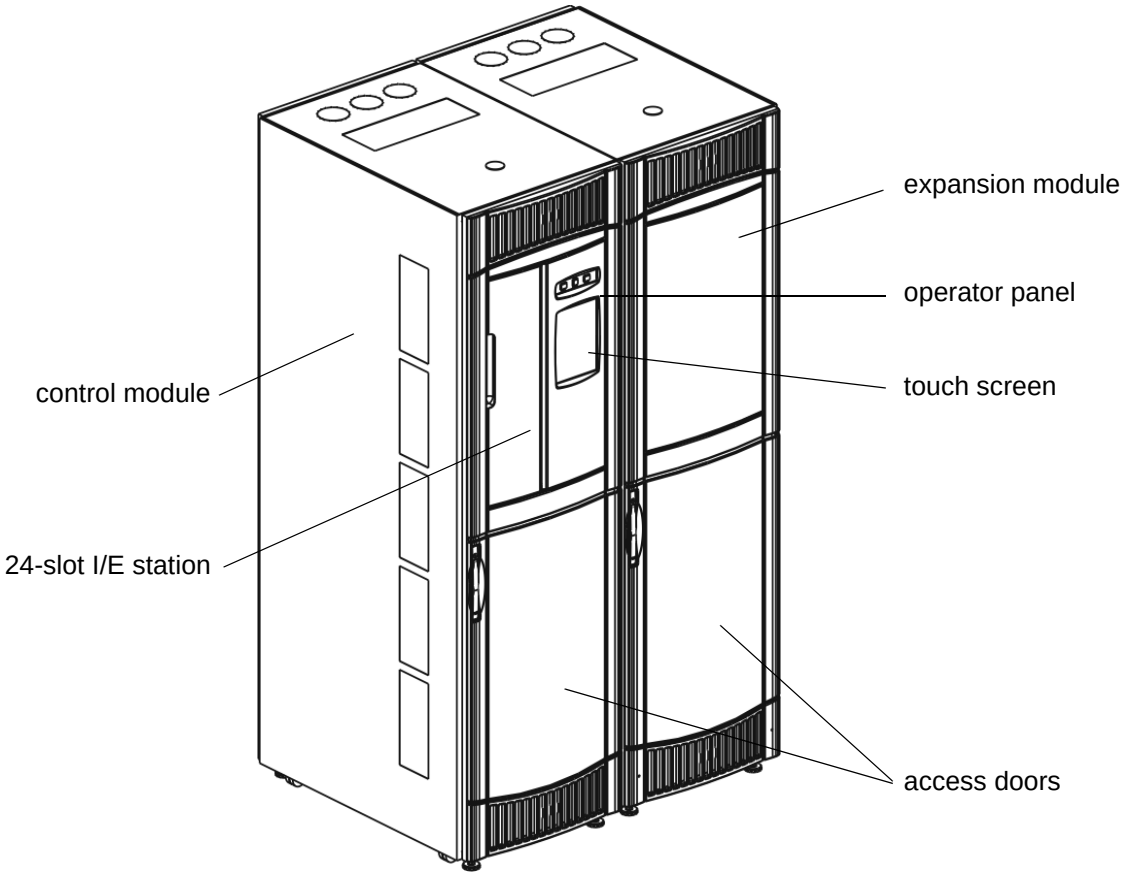
The maximum library can be configured to accommodate from 100 LTO cartridges to 5,322 LTO cartridges (for a single-robot library) or 5,376 LTO cartridges (for a dual-robot library).

This chapter provides a description of the following features and components:

Front View

The basic components on the front of the library are shown in Figure 2.

Figure 2 Front View of a Control Module and Expansion Module



Control Module

All libraries contain a control module. A single-frame library consists of a control module only. The control module manages library operations via the library management module and includes an operator panel touch screen for local operator use. For more information, see:

- Library Management Module on page 22
- Operator Panel on page 35

The control module also contains all of the other components common to expansion modules, including:

- Import/Export Station on page 27
- Tape Drives and Media on page 28
- Magazines on page 30
- Cartridges on page 31
- Power System on page 32

The control module always occupies module position 1 in the library. (In dual-robotics configurations, the left parking module is in position 0.)

Figure 3 Front and Back View of the Control Module

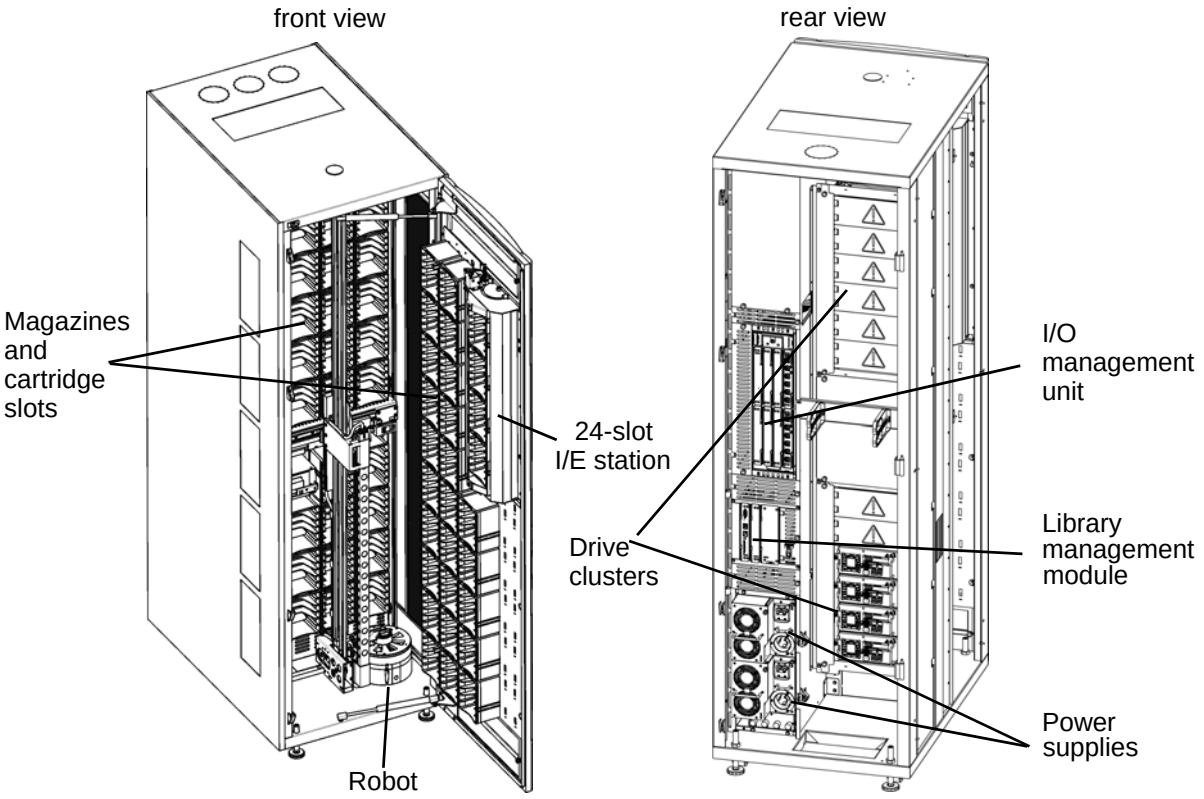


Figure 4 Magazine and Drive Location in the Single-Robotics Control Module

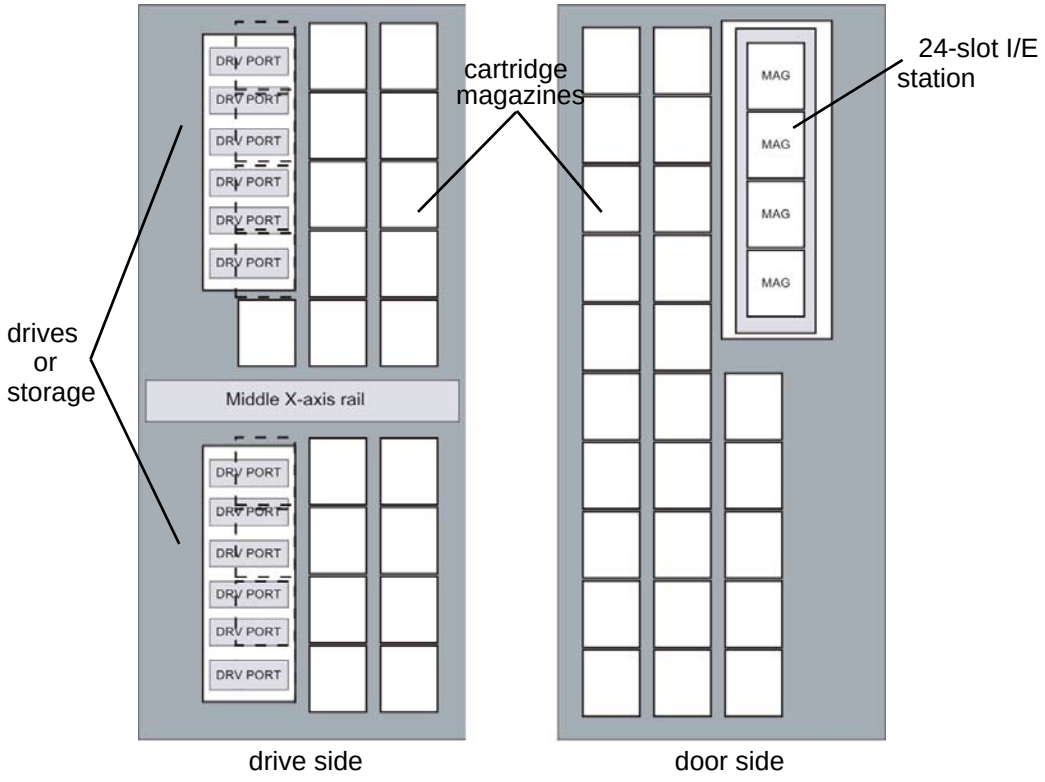
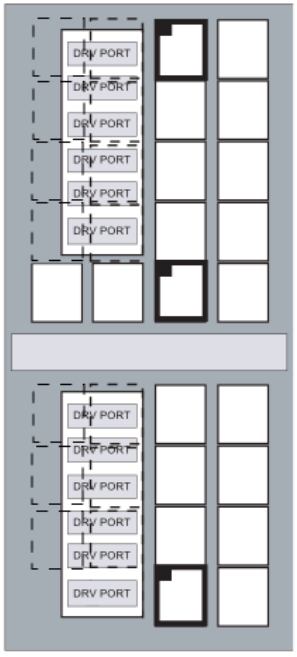
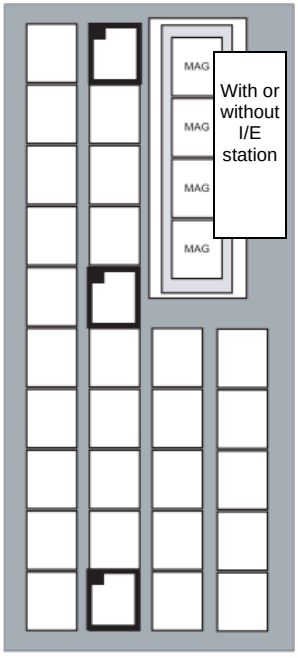


Figure 5 Magazine and Drive Location in the Dual-Robotics Control Module



Rack 1 (back)

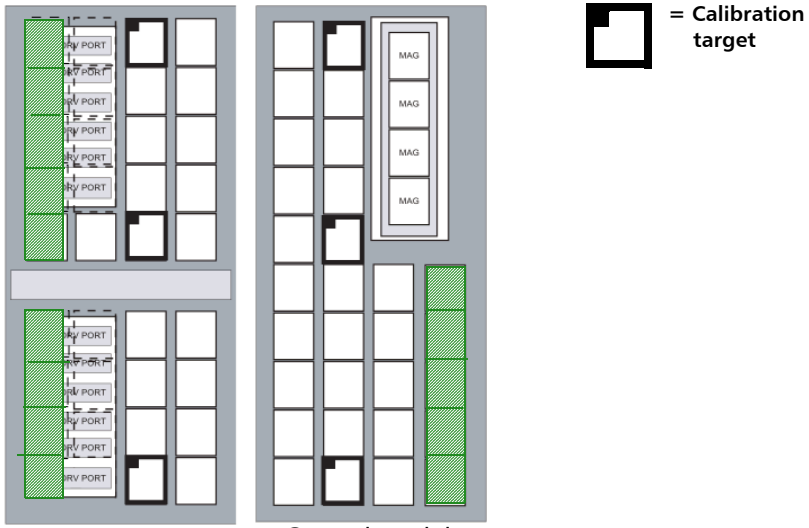


Rack 2 (door)
No I/E station or 24-slot I/E station installed

= Calibration target

Control modules in dual-robotics libraries can take advantage of two columns of storage (up to 14 additional magazines) that are unavailable in single-robotics configurations. Figure 6 shows where the additional magazines are located.

Figure 6 Additional Storage Available in Dual-Robotics Control Modules



Expansion Modules

Expansion modules enable the library to expand by adding space for tape drives, an I/E station, and storage. Each expansion module up to the seventh expansion module adds from 300 to 456 LTO cartridge slots depending on the number of tape drives installed and whether an I/E station is installed. See Figure 8 on page 16 for location information. The library's maximum configuration includes up to 11 expansion modules for a total of 12 modules in Gen 1 configurations and 13 modules in Gen 2 configurations. Expansion modules can be added only to the right of the control module.

Expansion modules in positions 9 through 12 are storage-only expansion modules. The first seven expansion modules can accommodate the following functional units:

- I/O Management Unit on page 24
  - Control Management Blade on page 24
  - Fibre Channel I/O Blades on page 25
  - Ethernet Expansion Blades on page 25
- Robot on page 27
- Import/Export Station on page 27 (optional)
- Tape Drives and Media on page 28 (drives are optional)
- Magazines on page 30
- Cartridges on page 31
- Power System on page 32 (required only if drives are installed; if an expansion module contains only cartridges, all power is derived from the control module).

Figure 7 Front and Internal Side View - Expansion Module with 72-slot I/E station

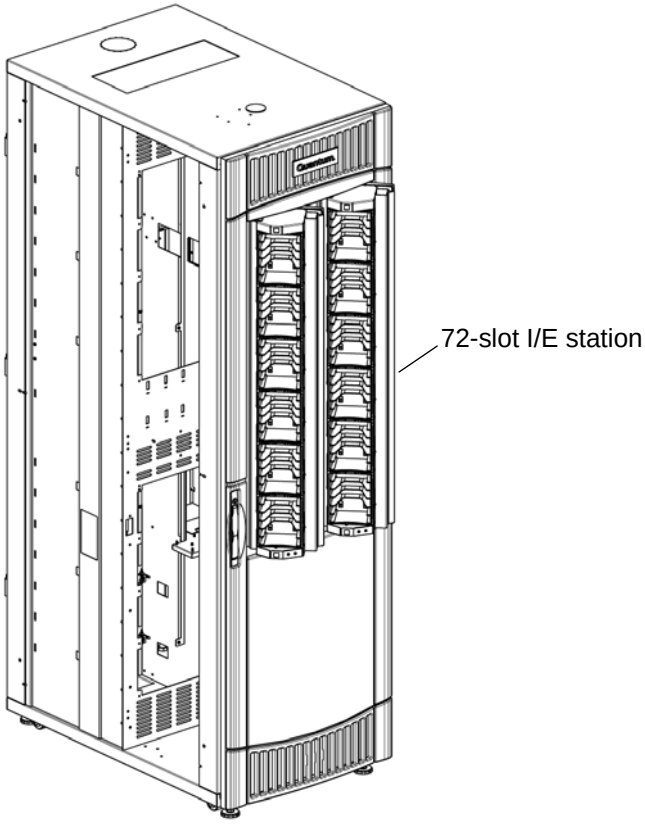


Figure 8 Magazine and Drive Locations in Expansion Modules with a 24-slot I/E Station

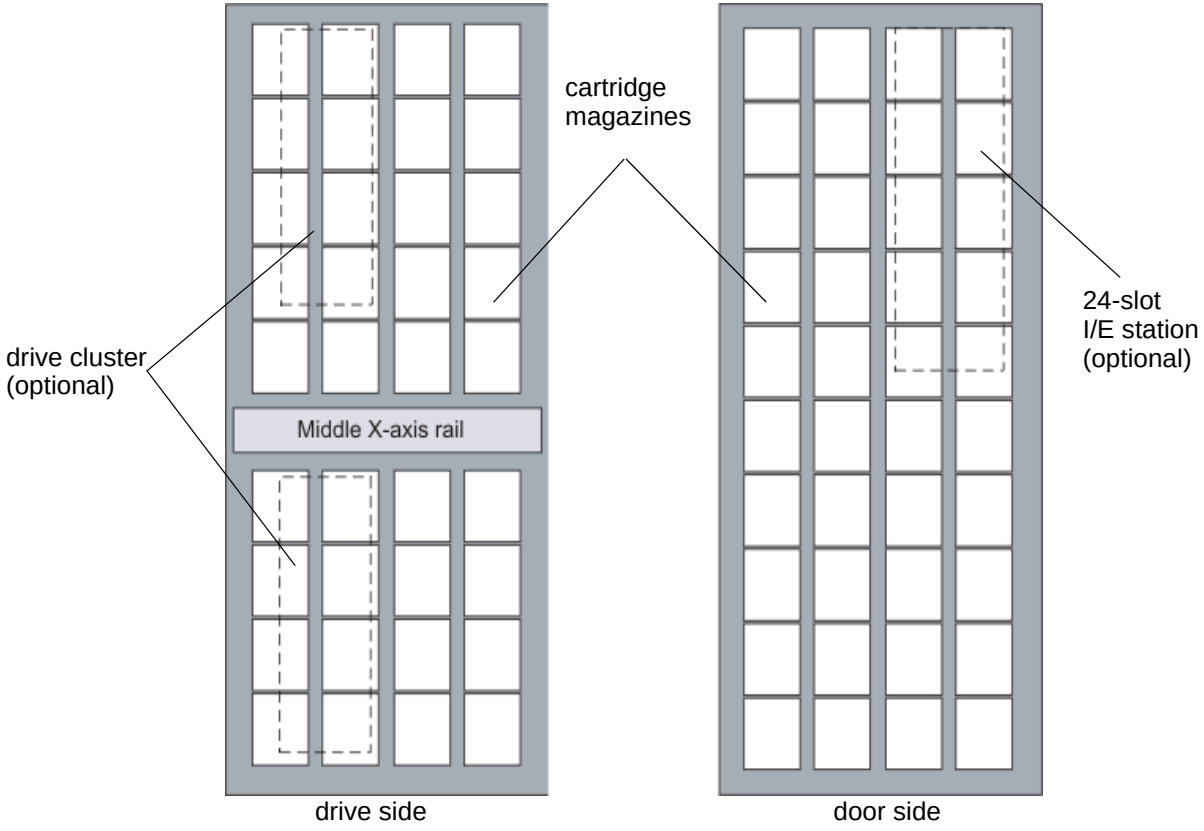
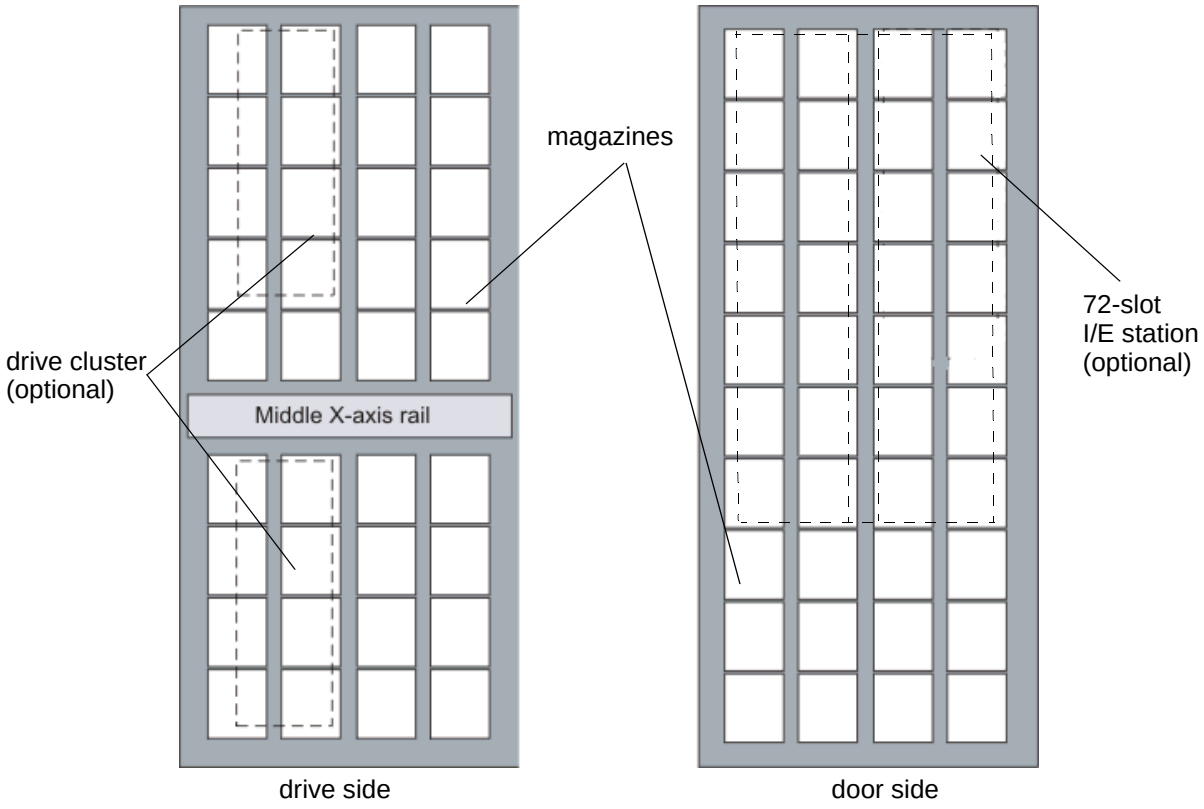


Figure 9 Magazine and Drive Locations in Expansion Modules with a 72-slot I/E Station



Dual Robotics Configurations and Parking Modules

A dual robotics library requires Gen 2 robotics hardware. A dual robotics library requires, at a minimum, a control module, a left parking module, and a right parking module. See Figure 10.

The left and right parking modules have the same size and appearance as expansion modules, but they function differently. Each parking module contains a “parking space” in which the respective left or right robot resides when not in use. The “parking space” occupies four magazine columns which cannot be used for storage.

The left parking module is located to the left of the control module in position zero. It is referred to in the user interface as “module 0.” The left parking module does not contain tape drives, I/E stations, or power supplies. The control module supplies its power. If you are upgrading to dual robotics, you will receive a left parking module to add onto your existing system. This increases your system size, so you must take this into account when planning for an upgrade.

The right parking module is the right-most module in the system. As with standard expansion modules, if the right parking module is in positions 2 – 8, it may contain drives, power supplies, and up to one 24-slot I/E station. If it is in positions 9 through 12, it cannot contain drives, power supplies, or I/E stations. Right parking modules may not contain 72-slot I/E stations.

If you are upgrading a single-robotics library to a dual-robotics library, the existing right-most expansion module can, in most cases, be converted into a right parking module. However, if the existing right-most expansion module contains a 72-slot I/E station, you may need another module to be added to the right of your system which will become the right parking module. If space considerations prohibit the addition of another module, then the right-most module will be swapped with another module in the library that does not contain a 72-slot I/E station. For more information on upgrading an existing library to dual robotics, see Dual Robotics Upgrade Requirements on page 107.

Figure 10 Dual Robotics Library

Side panels, doors, and door posts have been removed for clarity.

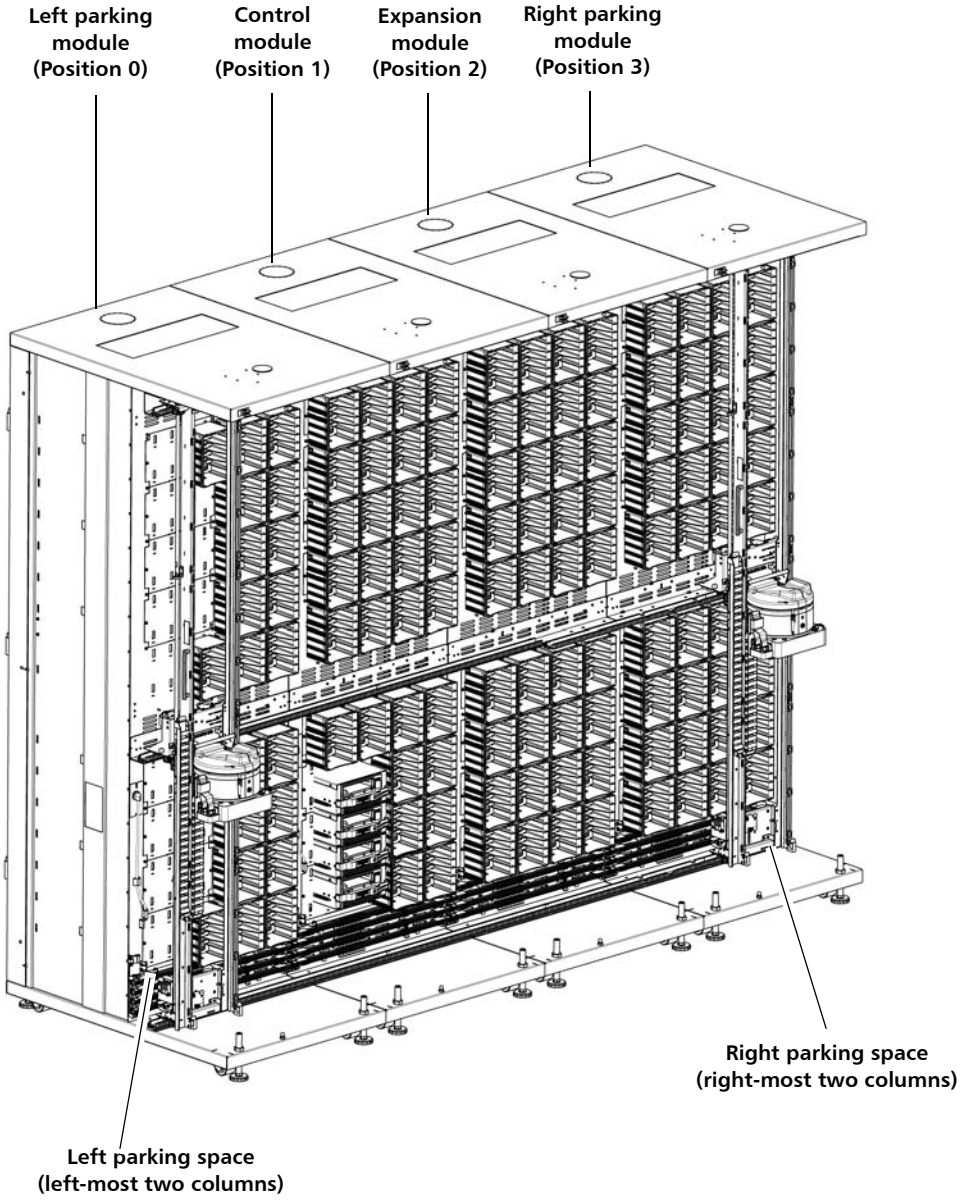


Figure 11 Left Parking Module Slot Configuration (Dual Robotics Only)

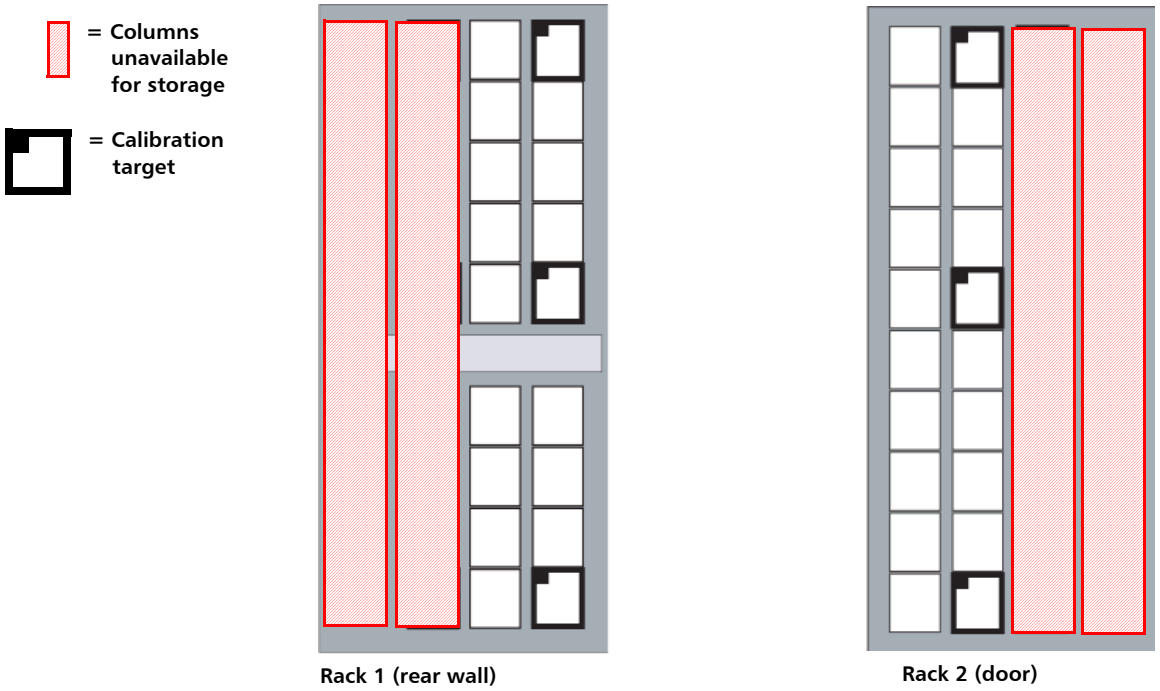
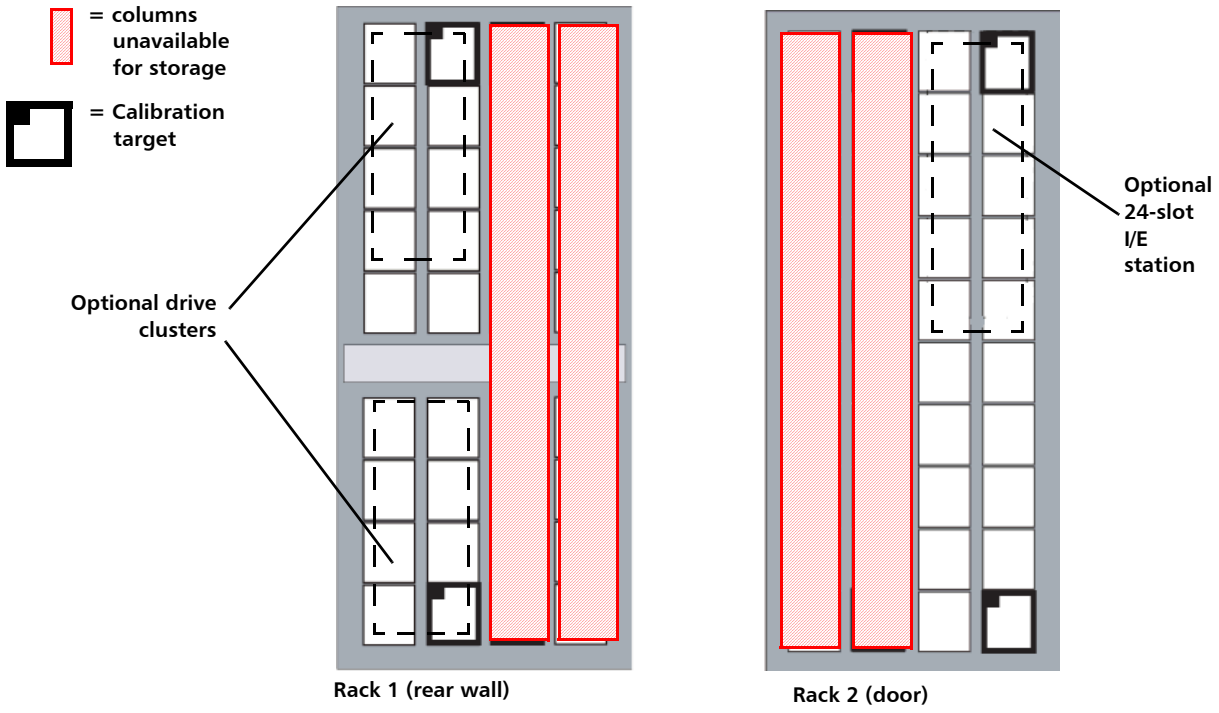


Figure 12 Right Parking Module Slot Configuration (Dual Robotics Only)

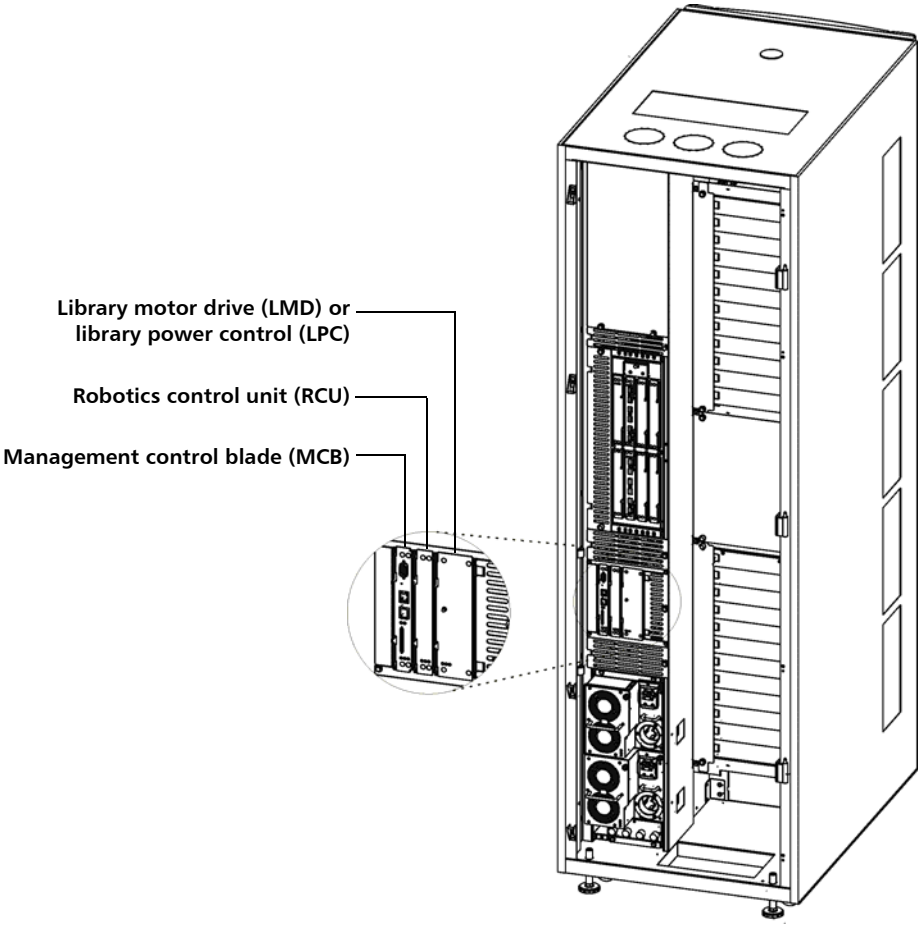


Library Management Module

The library management module is located in the control module. It controls system hardware and enables external devices to perform configuration and obtain system status. The library management module contains the following boards:

- Management control blade (MCB) - Manages the library, passing commands to and from the robotics control unit as well as the storage area network (SAN) components.
- Robotics control unit (RCU) - Controls the picker and accessor functionality.
- Library motor drive (LMD) (Gen 1 libraries only) - Distributes power to the picker along with the X and Y-axis circuits. It also distributes power to the touch screen.
- Library power control (LPC) (Gen 2 libraries only) - Distributes power to the robot through the power rails. It also distributes power to the touch screen.

Figure 13 Library Management Module Boards


Library motor drive (LMD) or library power control (LPC)
Robotics control unit (RCU)
Management control blade (MCB)

I/O Management Unit

The I/O management unit is an optional component that provides connectivity and data path management to a SAN fabric and the hosts. The I/O management unit houses up to four FC I/O blades, which provide FC connections for the Fibre Channel drives in the module. The I/O management unit also houses up to two Ethernet Expansion blades, which handle internal Ethernet communication between the MCB and HP LTO-5 drives. (The control module and each of the expansion modules can contain up to 12 FC drives.) The I/O management unit performs all tape drive and library host communication functions in a library that is attached to a SAN.

I/O management units may be installed in the control module and expansion modules. The I/O management unit supports the following blades:

- Control Management Blade
- Fibre Channel I/O Blades
- Ethernet Expansion Blades

When FC I/O blades or Ethernet Expansion blades are installed in the library, the following rules regarding control management blades (CMBs) apply:

- Any module (including the control module) that contains FC I/O blades or Ethernet Expansion blades must also contain a CMB.
- A CMB must be installed in the control module and all modules between the control module and the module containing the FC I/O blade or Ethernet Expansion blade. The CMB provides daisy-chained Ethernet communication between the Management Control Blade (MCB) located in the control module and the FC I/O blades and Ethernet Expansion blades.

Control Management Blade

The control management blade (CMB) performs unit status monitoring including power and I/O present conditions, and internal network switch functions connecting I/O blades with the library management module.

Fibre Channel I/O Blades

There are two different Fibre Channel (FC) I/O blade types: 6404 that auto-negotiates up to 2 Gbps and 7404 that auto-negotiates up to 4 Gbps. Each FC I/O blade has an embedded controller that provides connectivity and features that enhance the performance and reliability of tape operations. Each blade provides two host communication ports and four connection ports to drives.)

- Fibre Channel LTO-1, LTO-2, LTO-3, LTO-4, LTO-5 DLT-S4, and SDLT-600 drives can be connected to drive-aggregating Fibre Channel I/O blades or directly attached to a host, so these drives do not require an external SNC.

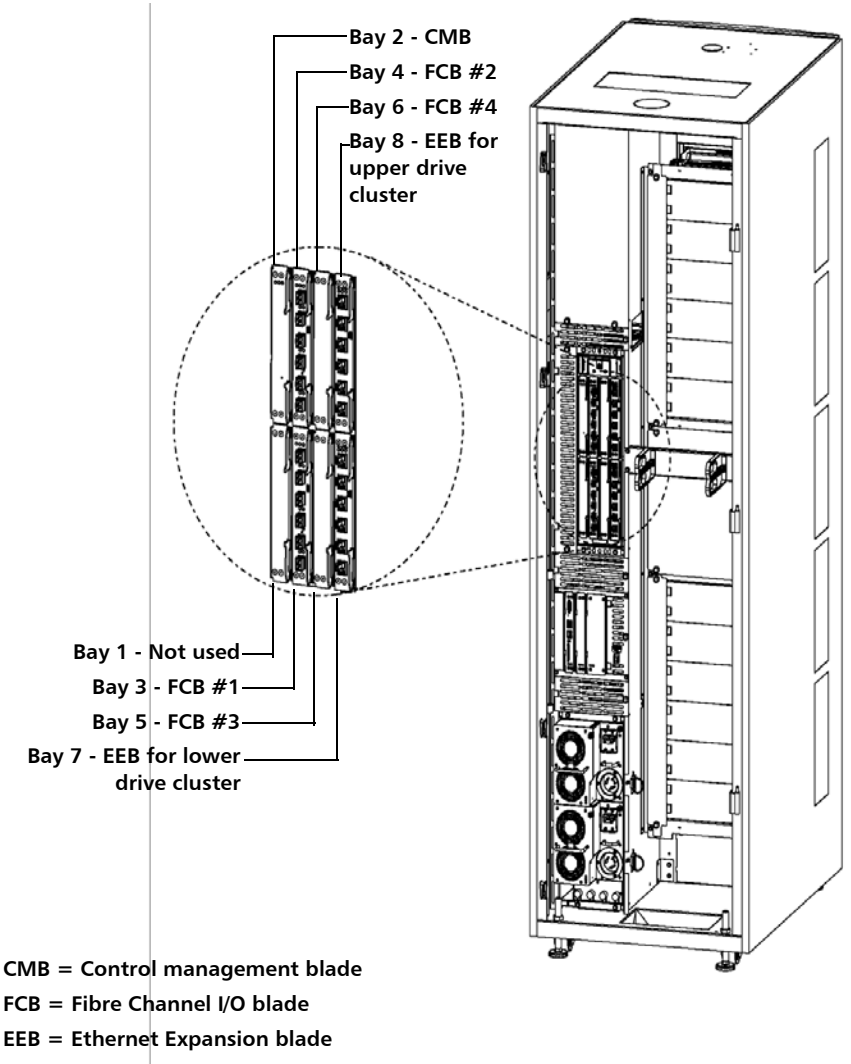
  Note: If library firmware is at level 630Q or later, DLT tape drives are no longer supported.

- We recommend that you do not connect an LTO-5 drive to an FC I/O blade. The drive supports speeds of 8 Gbps, but the FC I/O blade supports only 4 Gbps.

Ethernet Expansion Blades

The Ethernet Expansion Blade (EEB) provides the option for Ethernet connectivity to each LTO-5 drive (for MCB-to-drive communication purposes only). The connection is at T100. The EEB provides a control path to the drive for commands as well as facilitates taking drive logs and downloading drive firmware. Each EEB has 6 Ethernet ports to allow attachment to 6 LTO-5 drives. The EEB provides Ethernet connectivity to the library's internal Ethernet only and should not be connected to an external Ethernet source.

Figure 14 I/O Management Unit



Robot

The robot moves cartridges between storage cells, tape drives, and the I/E station. A picker is used to get or put cartridges in a storage cell or a tape drive slot. The picker moves along an X and Y axis and can pivot 180°. A barcode scanner on the picker assembly identifies cartridges located in storage cells.

The library can be configured for either one or two robots. See Dual Robotics Configurations and Parking Modules on page 18 for more information.

Import/Export Station

I/E stations enable you to import and export cartridges without interrupting normal library operation. There are two types of I/E stations: 24-slot I/E stations and 72-slot I/E stations.

Each 24-slot I/E station has a capacity of 24 LTO cartridges that are located in four removable magazines. The 72-slot I/E station consists of two side-by-side 36-slot I/E stations that can operate independently or as a single 72-slot I/E station. Each 36-slot I/E station provides I/E capacity of 36 LTO cartridges in six removable magazines.

The I/E station is installed on the front of the control module or any of the first seven expansion modules. It can be installed in a right parking module if the right parking module is in position 2 through 8. Expansion modules (and the right parking module) in positions nine through twelve are storage-only modules and do not contain I/E stations or drives. See Figure 2 on page 8 and Figure 3 on page 10 to see the location of the I/E station.

Note: The I/E station cannot be configured as a storage location, but can be part of a a logical division of library resources known as partitions.

Note: The maximum number of I/E element addresses in any partition is 240. This includes both physical slots and Extended I/E virtual slots.

Tape Drives and Media

Note: Library firmware versions 630Q (i10) and later do not support DLT tape drives, media, or magazines. If you upgrade to these library firmware versions, make arrangements to remove and/or replace all DLT tape drives, media, and magazines in your library. If you want to continue to use DLT tape drives and media, your library firmware must be at version 615G.GS00501 (i8.3) or earlier.

The tape drives are enclosed in a universal drive sled. The library supports the following tape drives types:

- IBM LTO-1 or LTO-2 LVD–SCSI
- IBM LTO-1, LTO-2, LTO-3, LTO-4, and LTO-5 FC Multi-mode
- HP LTO-3, HP LTO-4, and LTO-5 FC Multi-mode

The control module and first seven expansion modules (including a right parking module, in a dual-robotics system) have upper and lower drive clusters. Each library must have at least one tape drive. Each drive cluster can house up to six tape drives for a total of 12 drives per module. Additional drives can be added to each of the first seven expansion modules in the configuration. This enables you to have a total of 96 drives. Expansion modules in positions 9 through 12 are storage-only expansion modules.

In dual robotics systems, the left parking module cannot contain drives.

Note: The term *drive cluster* defines a grouping of up to six tape drives below or above the middle X-axis rail. See Figure 3 on page 10 for the locations of drive clusters.

Tape drives should be installed in bottom-to-top order in the control module before any are added to the first expansion module. Once the control module has 12 drives installed from bottom to top, you should move to bottom drive position of the first expansion module. Refer to LTO Drive Requirements and Compatibility on page 91 for LTO drive requirements.

Note: When you add drives, you lose storage slots.

WORM Support

The Scalar i6000 library supports WORM (write once, read many) technology in LTO-3, LTO-4, and LTO-5 tape drives. WORM requirements include:

- Cartridges
- Firmware
- WORM-supported LTO-3 tape drives
- WORM-supported LTO-4 tape drives
- WORM-supported LTO-5 tape drives

WORM allows non-erasable data to be written once and provides extra data security by prohibiting accidental data erasure. When the library firmware and WORM-supported LTO-3 or, LTO-4, or LTO-5 tape drive code are installed on a library with LTO-3 or, LTO-4, or LTO-5 tape drives, the WORM feature is supported whenever the operator uses WORM cartridges.

Magazines

The magazine is a storage assembly that installs on the drive side or door side of the control module, expansion module, or parking module. It contains the cartridge slots and provides flexibility when adding storage cartridges to a module. The LTO magazines hold six cartridges. Magazines are removable and may have moved during shipment; make sure they are seated.

Table 1 LTO Cartridge Capacities in Library Modules

Type	Magazine Capacity	Cartridge Capacity
Magazine (LTO)	--	6
Control module (single robotics)[a]	44 min/51 max	264 min/306 max
Control module (dual robotics)[a]	50 min/64 max	300 min/384 max
Expansion module[b]	32 min/76 max	192 min/456 max
Left parking module (dual robotics)[c]	38	228
Right parking module (dual robotics)[d]	12 min/38 max	72 min/228 max

a Control module: The minimum is based on having 12 drives and one 24-slot I/E station installed. The maximum is based on having one drive and one 24-slot I/E station installed.

b Expansion module: The minimum is based on having 12 drives and one 72-slot I/E station and 12 drives installed. The maximum is based on having no drives or an I/E station installed.

c Left parking module: No drives or I/E stations are allowed. The left parking space takes up 4 columns of storage. There are six empty magazines located in the unusable 4 columns which are used for calibration only. These six magazines are not counted toward the total capacity.

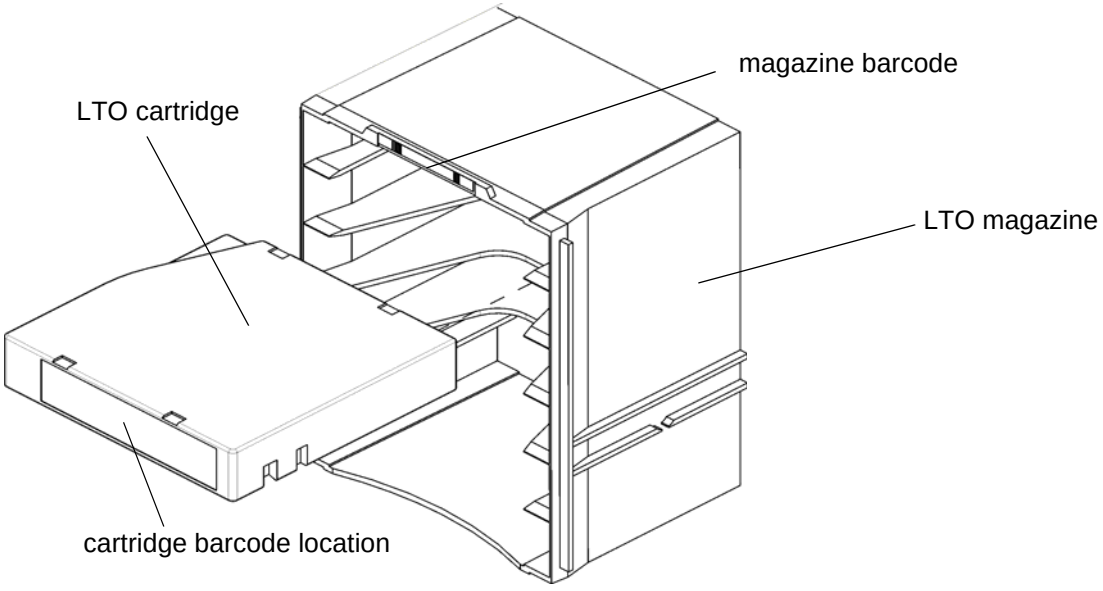
d Right parking module: The minimum is based on having 12 drives and one 24-slot I/E station installed. The maximum is based on no drives or I/E station installed. The right parking space takes up 4 columns of storage.

Each magazine has a barcode label that the scanner reads for identification and inventory. An optional, snap-on dust cover is available for the magazines to be used for external storage. The magazines with the dust cover have interlocked stacking that enables easier storage of the media when they are removed from the library.

Cartridges

Cartridges are stored in magazines within the library and identified by an operator-attached, machine-readable barcode label. See Barcode Requirements on page 93 for additional information.

Figure 15 Example of LTO Cartridge Insertion into a Magazine



Power System

The library supports single and redundant power configurations. The single configuration has a single AC line input and single DC power supply. The redundant configuration has dual AC line input and dual DC power supplies. You can hot swap a power supply if you have a redundant power supply. You can hot add a second power supply.

The power system consists of the following:

- Power supply
- Power distribution unit
- AC power cord

A single power switch, located on the front door of the control module, turns on and off all power for the control module and attached expansion modules. Each power distribution unit has a second circuit breaker, located in the rear of the module, that controls the module power supply output. The power supply has three LEDs that provide status information. The power system also has four fuses for system protection.

The control module and all expansion modules or right parking modules that contain drives must contain a power system. If an expansion module or right parking module contains only cartridges, its power is derived from the control module and a power system is not needed.

Host Attachment

Hosts can be attached to the library in the following ways:

- Library Control Path on page 33
- Data Path on page 34
- Network on page 34

Library Control Path

The library control path is used to send SCSI commands to the library. The Scalar i6000 offers several different control path options:

- **HP LTO-5 Native Fibre Channel (Ethernet Expansion Blade Attached)** — A tape drive hosts the library control path and forwards media changer commands to the library controller. Commands for both the tape drive and the library are received by the drive. This shared SCSI connection uses the Fibre Channel connection on the drive so a dedicated port for library control is not needed. You must have at least one HP LTO-5 FC drive installed in the library. The drive must be attached to an Ethernet Expansion blade. For more information, see the *Scalar i6000 User's Guide*.
- **Native Storage Networking (nSNW) (Ethernet Expansion Blade Attached)** — A tape drive hosts the library control path and forwards media changer commands to the library controller. Commands for both the tape drive and the library are received by the drive. This shared SCSI connection uses the Fibre Channel connection on the drive so a dedicated port for library control is not needed. The control path can be configured for failover with another drive. Drives must be nSNW HP LTO-5 FC drives and attached to an Ethernet Expansion blade. For more information, see the *Scalar i6000 User's Guide*.
- **Storage Networking (SNW) (Fibre Channel I/O Blade Attached)** — The host connects to the library through a dedicated 4 Gb FC port on an FC I/O blade. A second, dedicated 4 Gb FC port on the FC I/O blade can be used for control path failover. Drives must be SNW tape drives and attached to an FC I/O blade. For more information, see the *Scalar i6000 User's Guide*.

- **Library MCB Port** — The MCB has one dedicated 1 Gb FC port that can be used for host connectivity. This port can be used even if the nSNW or SNW options are purchased.

Data Path

The data paths are used to send commands and data to tape drives. The Scalar i6000 offers three different data path options:

- **Native Storage Networking (nSNW) (Ethernet Expansion Blade Attached)** — Applies to nSNW HP LTO-5 FC drives connected to an Ethernet Expansion blade only. The native 8 Gb FC port on the drive is used. These drives also support data path failover using a second FC port on the tape drive, so if you want to use data path failover, two ports per drive are required.
- **Storage Networking (SNW) (Fibre Channel I/O Blade Attached)** — The data paths connect to the library through a dedicated 4 Gb FC port on an FC I/O blade. Drives must be SNW tape drives and attached to an FC I/O blade. Up to four tape drives can be supported per port on the FC I/O blade.
- **Native Fibre Channel (nFC) (Direct Attach)** — Drives use a single FC port per LTO tape drive. The FC interfaces vary by LTO generation:
  - LTO-5 uses 8 Gb
  - LTO-4 uses 4 Gb
  - LTO-3 uses 2 Gb and 4 Gb
  - LTO-2 uses 1 Gb and 2 Gb
  - LTO-1 uses 1 Gb

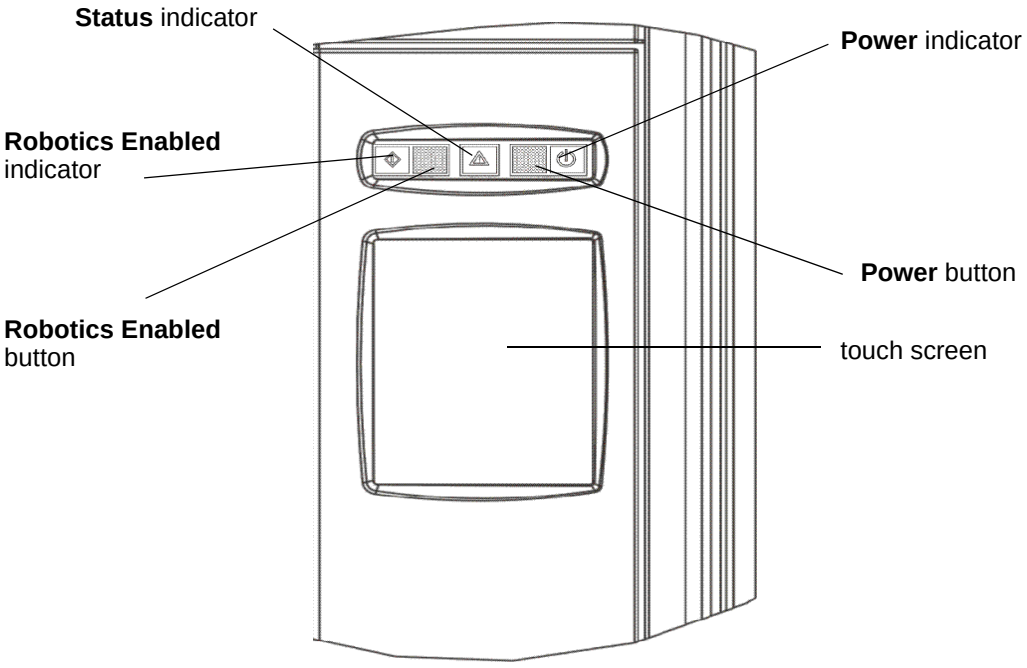
Network

The library management interface uses an 10/100 Ethernet port on the MCB for network connectivity. This port is shared for connectivity of the remote user interface and any encryption key management solution used for library managed encryption.

Operator Panel

The operator panel is located on the front of the control module and consists of indicators and a touch screen (see Figure 16). The buttons are for library control and power while the indicators provide library status.

Figure 16 Operator Panel

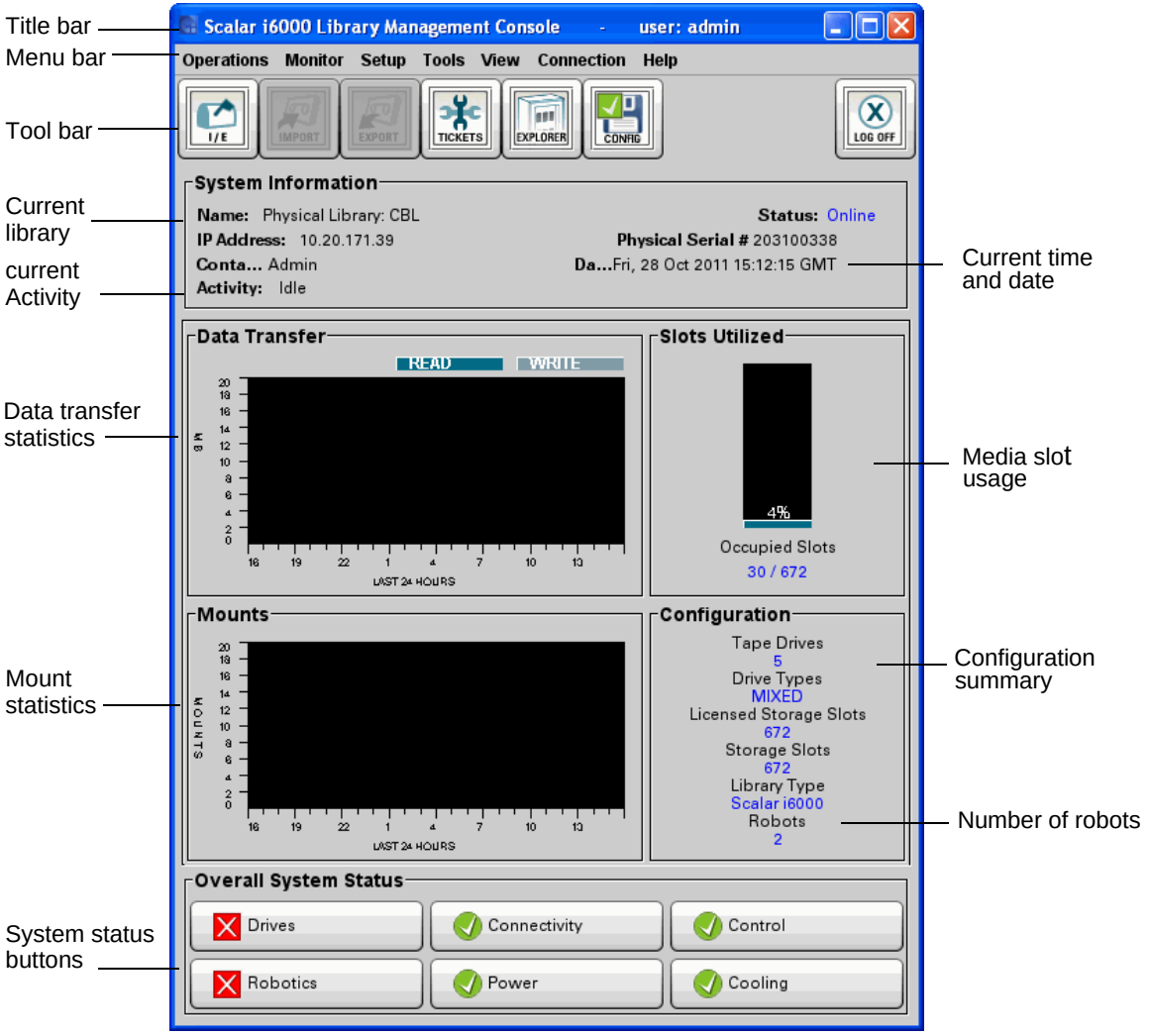


The touch screen is the library navigation point and provides access to the Library Management Console (LMC), which is shown in Figure 17 on page 37. The LMC consists of five primary areas:

- Title bar–provides the library name

- Menu bar–provides menu access to all library management commands
- Tool bar–provides quick access to the most commonly executed functions
- Library information panel–provides real-time library information
- Overall system status–provides real-time status information for the six subsystems of the physical library

Figure 17 Library Management Console



For additional information on the touch screen and the LMC, refer to the *Scalar i6000 User's Guide*.

Managing Your Library Remotely

The library can be managed locally or remotely using the Library Management Console (LMC). Locally, the LMC is displayed on the touch screen (operator panel) on the front of the library. Remotely, the LMC is accessed through a Web browser. The interface is identical to the front panel interface, using Java RMI communications. This enables the library to provide end-users with status changes and events as they occur.

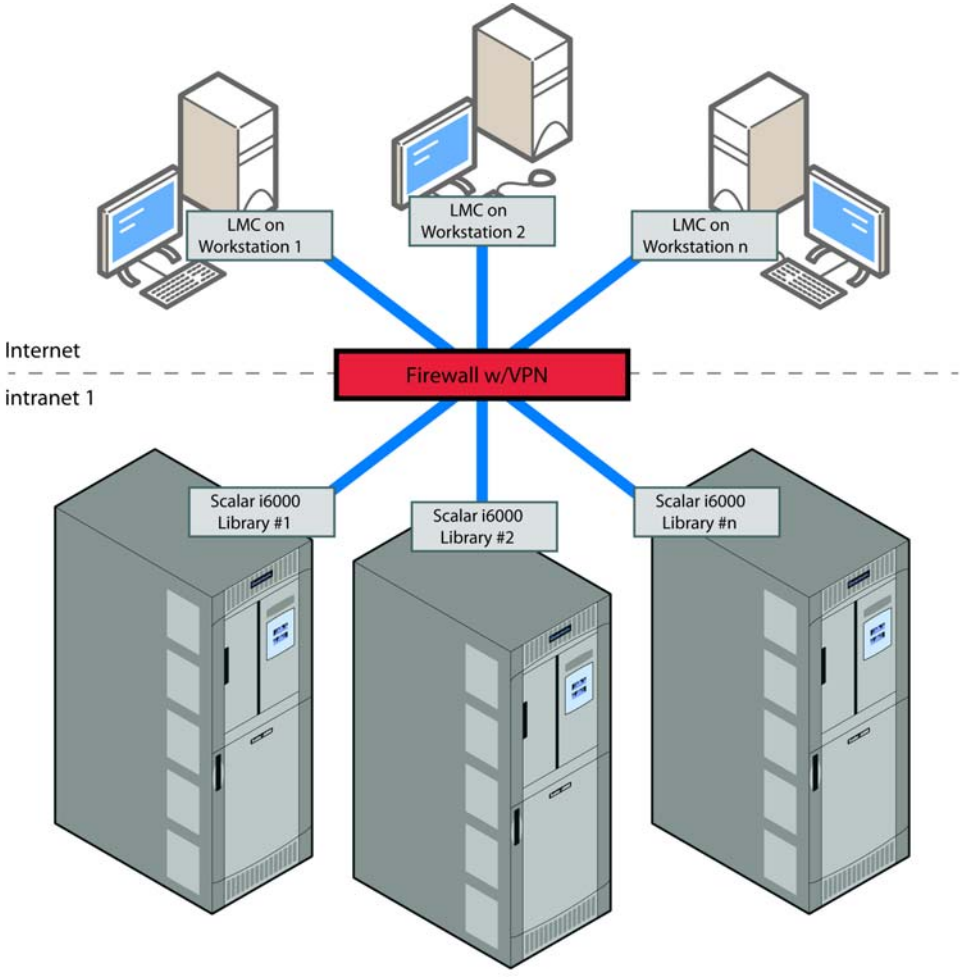
At a high level, remote access can be managed using security functions embedded within the Scalar i6000. This includes authentication via individual user names/passwords and access control settings which enable or disable specific access protocols to limit what type of remote management is possible.

In addition to this, most customers should have one or more firewalls in place to govern remote access. As with any Internet accessible service, the LMC requires a communication path so that data can be transmitted between clients and the Scalar i6000. How this communication path is managed depends on the user's configuration.The following three scenarios describe typical configurations.

Scenario 1: Internet-based clients managing multiple internal Scalar i6000s

For most organizations, a single administrator will not be managing all storage resources. In this instance, as shown in Figure 18, multiple administrators and even Quantum service personnel may be asked to remotely access Scalar i6000s.

Figure 18 Multiple Libraries, Firewall with VPN



In the scenario shown in Figure 18, Quantum highly recommends using virtual private network (VPN) software to control access to the Scalar i6000. VPNs offer authentication and encryption services to protect data transmissions and determine who can access a corporate network. By using VPN, the LMC client appears to be inside the firewall and have unrestricted access when communicating with the library.

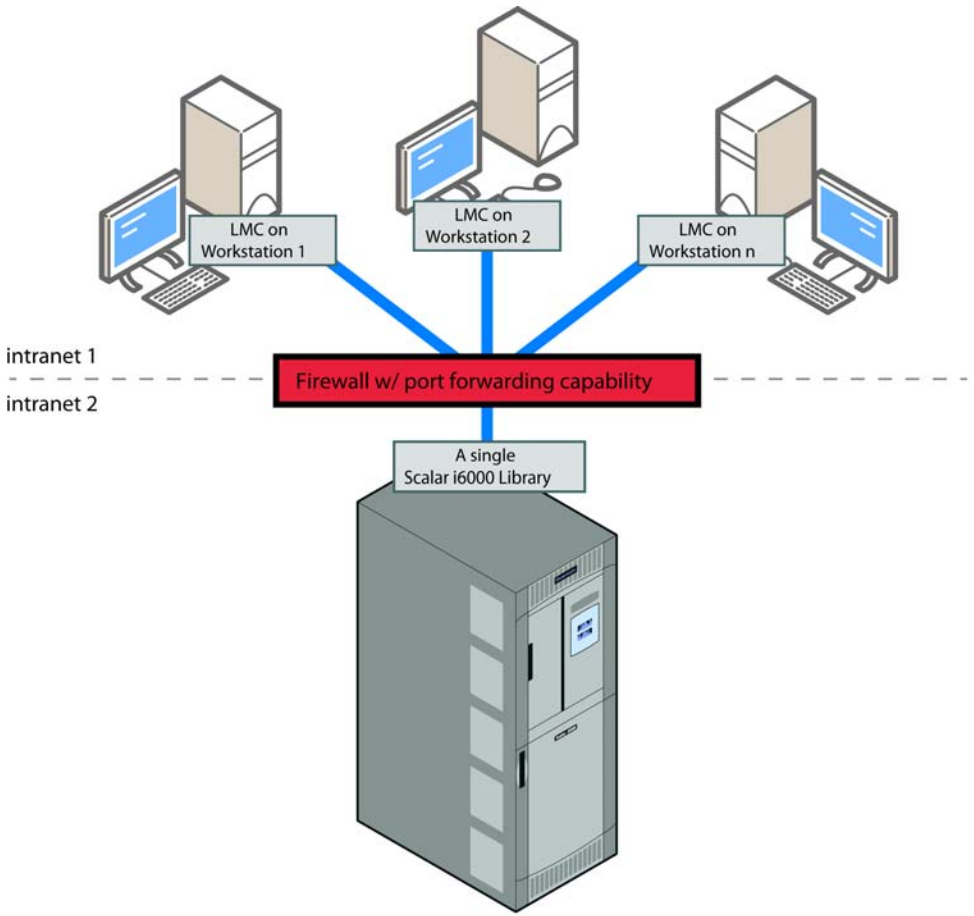
While a VPN is recommended, customers could use port blocking to provide access. In this instance, the following firewall requirements must exist:

- Inbound access to port 1099 (Java RMI server port)
- Stateful access control — used with most Web technologies (for example, Web mail) to enable a server to communicate with the client that started the connection

Scenario 2: Internal clients accessing a single library across an internal firewall

Another common configuration is one in which multiple internal clients manage a single Scalar i6000. For example, Figure 19 shows network operation/data center staff providing monitoring services of specific resources. Administrators are inside the corporate firewall, but security considerations necessitate an additional firewall between administrators and the resources they manage.

Figure 19 Single Library, Firewall with Port Forwarding



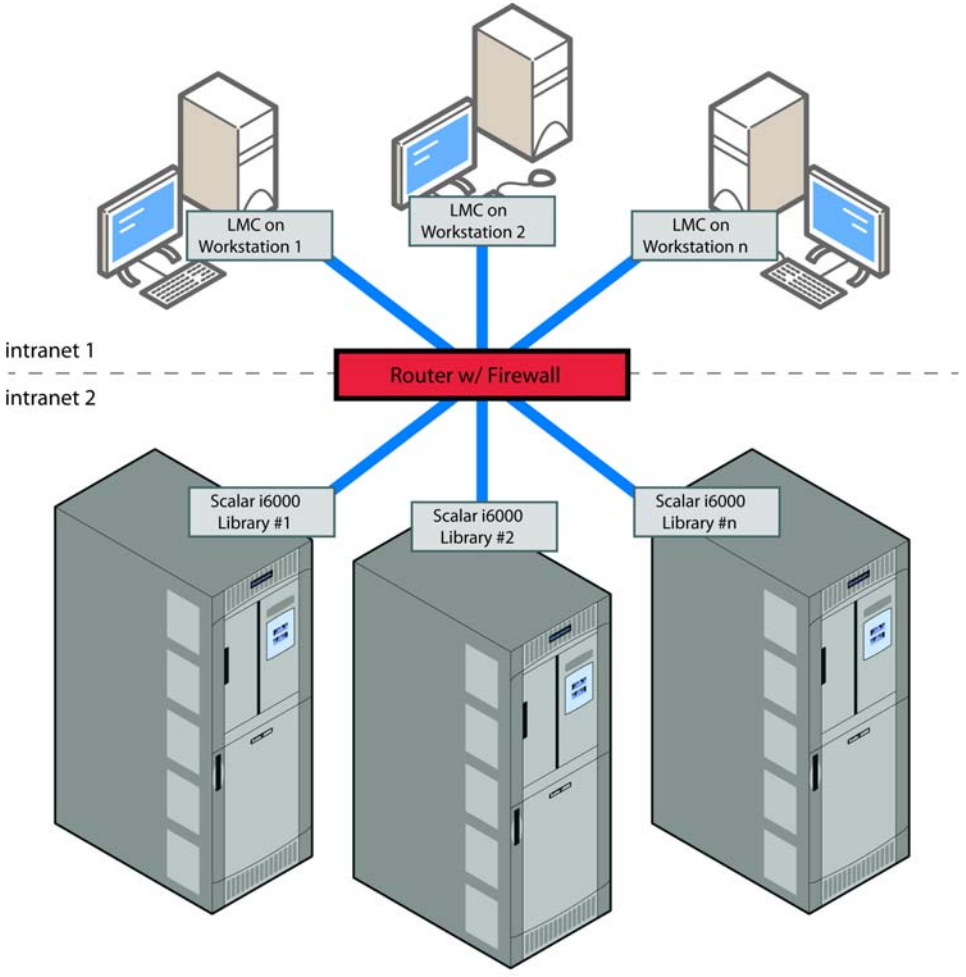
In the scenario shown in Figure 19, customers can utilize port forwarding functionality to enable specific access to a Scalar i6000. Port forwarding works by taking all host communications directed to a specific port and forwarding them to a single IP device. In this case, port forwarding would be configured so that all communications to the Java RMI server port (1099) would be directed to the IP address of the Scalar i6000.

The benefit of this solution is that all traffic is forced to a single library and prevents any other traffic using port 1099 from going to other devices. This does mean that only a single Scalar i6000 can be accessed. Multiple Scalar i6000 libraries cannot be accessed.

Scenario 3: Internal clients accessing multiple libraries across an internal firewall

Many customers use a layered system of firewalls to safeguard resources. In the scenario shown in Figure 20, a customer may have multiple Scalar i6000s which need to be administered by internal staff (for example, data center/network operations staff), with a firewall between the administrators and the libraries.

Figure 20 Multiple Libraries, Internal Firewall



To enable LMC access between firewall zones, two solutions are possible depending on the customer configuration. If the two zones are on the same IP subnet, then the firewall will provide IP address and port blocking functionality and should follow these rules:

- Inbound access to port 1099 (Java RMI server port) by client IP addresses
- Stateful access control – used with most Web technologies (for example, Web mail) to enable a server to communicate with the client that started the connection

If the two zones are on different subnets, or an IP address translation is performed to mask the library's true IP address, then the firewall must provide routing rules that allow the client IP addresses to access specific library IP addresses.

Slot Capacity

Capacity on Demand

The library is initially licensed for a default configuration of 100 storage slots.

Capacity on Demand allows you to purchase additional storage capacity for your library as needed. As your storage needs change, you can add storage in blocks of 100 cartridges, without being required to purchase additional hardware. Capacity on demand begins at 100 cartridges and can be increased to as many as 5,322 LTO cartridges (for a single-robot library) or 5,376 LTO cartridges (for a dual-robot library).

Note: Maximum numbers assume only one drive and one 24-slot I/E station in the control module.

To gain the use of additional storage slots, you must purchase a Capacity on Demand license for the desired number of slots.

Your library ships with enough modules to meet your Capacity on Demand needs. If you require additional physical capacity to be physically prepared for non-disruptive future expansion, you can order one or more Unlicensed Expansion Modules.

Unlicensed Slots

Active Vault and Extended Data Lifecycle Management (EDLM) features do not require the use of licensed slots. You may purchase additional Unlicensed Expansion Modules to accommodate these features without the need to increase your COD license. For more information, refer to the *Scalar i6000 User's Guide*.

Encryption and Key Management Solutions

The Scalar i6000 supports library managed encryption systems. These encryption systems use a centralized key manager application to generate, protect, store, and manage encryption keys. These keys are used by HP or IBM LTO-4 and LTO-5 tape drives to encrypt information being written to, and decrypt information being read from, tape media. Policy control and keys pass through the library-to-drive interface; therefore encryption is transparent to the host application software.

You must have an Encryption Key Management (EKM) license installed on the library to encrypting data using library managed encryption.

The Scalar i6000 supports the following encryption key management systems. For more information, see the *Scalar i6000 User's Guide*.

Note: The library does not support using more than one encryption key management system on a single library.

Encryption System	Supported Tape Drives
Quantum Encryption Key Manager (Q-EKM)	IBM LTO-4 Fibre Channel IBM LTO-5 Fibre Channel
Scalar Key Manager (SKM)	HP LTO-4 Fibre Channel HP LTO-5 Fibre Channel
RSA Key Manager (RKM)	HP LTO-4 Fibre Channel HP LTO-5 Fibre Channel
KMIP-compliant key management	HP LTO-4 Fibre Channel HP LTO-5 Fibre Channel

Chapter 3
System Specifications

This section provides performance, environmental, electrical, and physical specifications for modules in the library. The major sections include:

Performance Specifications

The performance of the library is 53 cartridge exchanges per hour (EPH) for a twelve module system, 130 cartridge EPH for an eight-module system, with a maximum EPH of 265.

Environmental Specifications

Table 2 lists the key environmental information for the library.

Table 2 Environmental Specifications

Temperature	Humidity	Altitude	BTU/Heat Dissipation	
			Minimum[a]	Maximum[b]
LTO:50°F - 95°F (10°C - 35°C)[c] SDLT: 64 ℉ - 82 ℉ (18 ℃ - 28 ℃)[d]	15 - 75%	10,000 ft	.375 kwh 1280 BTU/hour	5.98 kwh 28175 BTU/hour

a. Configuration includes a control module with one drive.
b. Configuration includes a control module and 11 expansion modules (or, for Gen 2 configurations, a left parking module, control module, 10 expansion modules, and a right parking module) with a total of 96 drives and four I/O management units with a total of 12 I/O blades (three blades in each of the four I/O management units).
c. Contingent on using LTO tapes that are qualified for use at 35°C.
d. Once an SDLT cartridge is used for archival storage these temperature ranges apply.

Electrical Specifications

Although each system is configured with a single AC power source, redundant power is an option. If redundant power is chosen, the control module and the first seven expansion modules that contain tape drives require two independent AC power sources. Expansion modules in positions 9 – 12 are storage-only. In dual-robotics systems, the left parking module does not require a power source, and the right parking module requires a power source if it is in position 2 through 8.

Caution: You must install your library with two independent power sources to have redundant power. You will not have redundant power if you use only one AC power source.

The power cable length for each of these inputs is 14 feet (4.26 m). See Table 3.

For North America, the NEMA L6 - 30 power cord ships by default.

Module Electrical Specifications

The typical power consumption for each module is listed in Table 3.

Note: Gen 1 robotics libraries, Gen 2 single-robotics libraries, and Gen 2 dual-robotics libraries have nearly identical readings and fall under these specifications.

Table 3 Electrical Specifications for Control and Expansion Modules

Location	Voltage (Single Phase, 50 - 60 Hz)	Required Protective Service	Delivered Power Connector	AMPs
North America	110	30	NEMA L5 - 30	30
North America	208	30	NEMA L6 - 30[a]	30
North America	208	20	NEMA L6-20	20

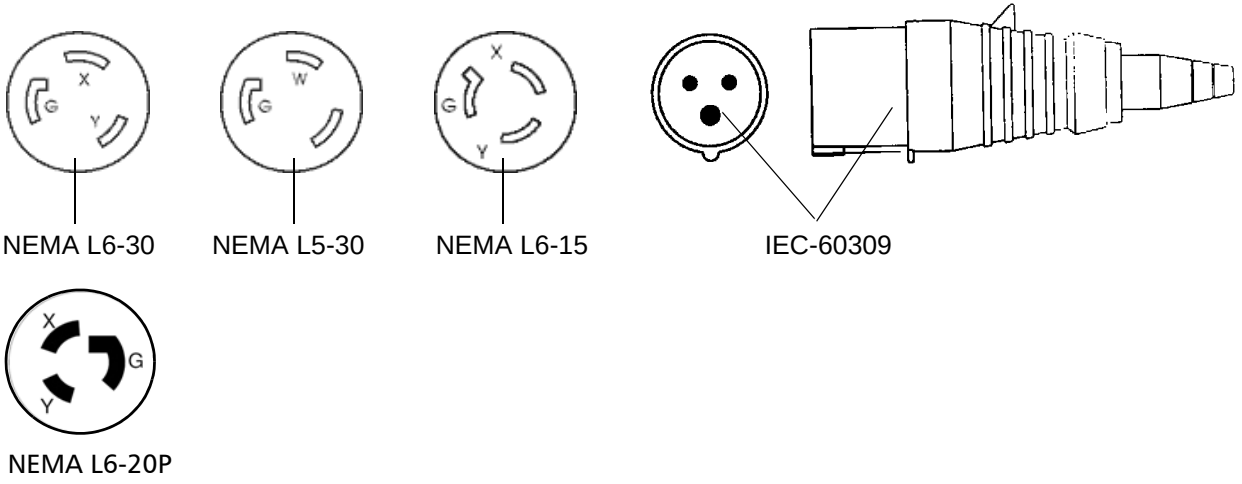
North America	208	15	NEMA L6 - 15	15
International	240	16	IEC60309 2P+E	20[b] or 16[c]

a.For North America, the NEMA L6 - 30 power cord ships by default.
b.20 amps in North America
c.16 amps international.

Supported Power Connectors

The supported power connectors are shown in Figure 21.

Figure 21 Supported Power Connectors



Module Power Consumption

The typical power consumption for each module is listed in Table 4.

Note: Gen 1 robotics libraries, Gen 2 single-robotics libraries, and Gen 2 dual-robotics libraries have nearly identical readings and fall under these specifications.

Table 4 Typical Module Power Consumption

Module	AMP @ 110 V	AMP @ 220 V	kW	BTU/hr
Control Module				
Minimum (1 drive)	3.4	1.7	.375	1280
Each additional drive	0.446	0.223	.050	167
Maximum (12 drives)	8.31	4.2	0.92	3121
I/O management unit	0.69	0.35	0.075	258
Each FC I/O blade	1.0	0.5	0.110	376
Ethernet Expansion Blade (EEB)	0.091	0.045	0.010	34
Maximum (12 drives, 1 I/O management unit, and 3 I/O blades)	12	6	1.32	4508
Expansion Module and Right Parking Module (Expansion modules and right parking modules only have power consumption if in positions 2 - 8) (Left parking module has no power supply, gets power from CM)				
Minimum (no drives)	0	0	0	0
Each additional drive	0.446	0.223	.050	167
Maximum (12 drives)	5.31	2.7	0.58	1990
I/O management unit	0.69	0.35	0.075	258
Each FC I/O blade	1.0	0.5	0.110	376
Ethernet Expansion Blade (EEB)	0.091	0.045	0.010	34
Maximum (12 drives, 1 I/O management unit, and 3 I/O blades)	9	4.5	.99	3381

Table 5 Scalar i6000 Power Consumption Characteristics

230V / 50 Hz / 1 pH.

Robot Operating								
Total Number Drives	12	12	12	12	6	3	1	0
Operational Drives	12	6	3	1	6	3	1	0
KW	0.77	0.76	0.75	0.74	0.54	0.48	0.35	0.31
KVA	0.82	0.8	0.79	0.79	0.58	0.52	0.38	0.35
KVAR (capacitive)	0.28	0.26	0.26	0.26	0.22	0.21	0.16	0.16
Power Factor	0.94	0.94	0.94	0.95	0.93	0.92	0.9	0.89
Crest Factor	1.85	1.85	1.82	1.82	1.87	1.8	1.68	1.6
Amps (RMS)	3.63	3.54	3.53	3.55	2.58	2.15	1.85	1.6
Amps (Peak)	7.097	7.214	7.063	6.983	5.532	4.714	3.924	2.588

208 v / 60 Hz / 1 pH.

Robot Operating								
Total Number Drives	12	12	12	12	6	3	1	0
Operational Drive	12	6	3	1	6	3	1	0
KW	0.77	0.76	0.76	0.75	0.54	0.43	0.35	0.31
KVA	0.82	0.81	0.8	0.8	0.57	0.46	0.38	0.34
KVAR (capacitive)	0.28	0.27	0.27	0.27	0.18	0.17	0.15	0.14
Power Factor	0.94	0.94	0.94	0.94	0.95	0.93	0.92	0.91
Crest Factor	1.68	1.69	1.7	1.7	1.69	1.61	1.56	1.58
Amps (RMS)	4.06	3.92	4.04	3.91	2.78	2.31	1.93	1.75
Amps (Peak)	7.227	7.244	7.078	7.122	7.045	4.422	3.975	2.787

Library Connection Types and Speeds

Table 6 lists the library connection types and speeds.

Table 6 Library Connection Types and Speeds

Connection[a]	Connector	Speed
Fibre Channel drive (control path bridging; HP LTO-5 only)	LC	8 Gbps
Fibre Channel on FC I/O Blade	LC	2 Gbps (6404) 4 Gbps (7404)
Fibre Channel on management control blade	LC	1 Gbps
Ethernet on management control blade	RJ45	10/100 Base-T

a.The DB-9 serial connection on the management control blade is not intended for customer use.

Physical Specifications – Pallet

Pallet Specifications

The library control modules, expansion modules, and parking modules are each shipped on the same type of specially designed pallet. The pallet's dimensions are listed in Table 7.

Table 7 Pallet Dimensions – Module Only

Height	Width	Length
87 in. 2209.8 mm	42.5 in. 1079.5 mm	47 in. 1193.8 mm

For dual-robot new installs or upgrades, the robots may not come installed in a module, but will instead be shipped in their own boxes on the same pallet with the left parking module. This pallet's dimensions are listed in Table 8.

Table 8 Pallet Dimensions – Module with Two Robots

Height	Width	Length
87 in. 2209.8 mm	42.5 in. 1079.5 mm	61 in. 1549.4mm

Physical Specifications – Library

This section contains the physical specifications for all possible library configurations.

The maximum weight, distributed load, and point load figures provided in the sections below were calculated using the heaviest configurations for a given frame count. Where differences between Gen 1/Gen 2 or single robotics/dual robotics exist, the heaviest number was used.

Note: If the library is installed on a raised floor, the raised floor should be stabilized to prevent any horizontal movement. The library has four point loads each on the control and expansion modules.

This section covers:

Configuration Rules

The following are rules for configuring a library.

- A single-robot library can consist of 1 to 12 frames.
- A dual-robot library can consist of 3 to 13 frames.
- In dual-robot systems, the left parking module is installed to the left of the control module in position 0.
- Upgrading from a single robot to a dual robot library requires at least one additional module (the left parking module, installed to the left of the control module).
- Left parking modules can never contain tape drives, I/E stations, or power supplies. The control module provides power to the left parking module.

- Expansion modules in positions 2 – 8 can contain drives, power supplies, and either a 24-slot I/E station or a 72-slot I/E station.
- Right parking modules in positions 2 – 8 can contain drives, power supplies, and a 24-slot I/E station. Right parking modules can never contain a 72-slot I/E station.
- Expansion modules and right parking modules in positions 9 – 12 are storage-only modules and do not contain I/E stations, drives, or power supplies.
- The left and right parking modules contain only four columns of storage (the other four columns are taken up by their respective robot parking spaces).
- Redundant power is allowed in the control module and the first seven expansion modules that contain tape drives. For more details on power, see Electrical Specifications on page 49.
- LBX2 0 OHM cards must be installed in all expansion modules (or a right parking module in a dual-robot configuration) located in positions 9 through 12. If your library configuration contains expansion modules or a right parking module in positions 9 or higher, the LBX2 0 OHM card must also be installed in the expansion module in position 8.
- LBX cards are not installed in the left parking module of dual-robotics libraries.

Basic "Building Blocks"

Table 9 provides specifications for certain common "building blocks" so to help you calculate your specific configuration.

Table 9 Basic "Building Blocks"

Components	Weight	Point Load	Height	Width	Depth
Details specific to single-robot configuration					
CM – fully loaded: robot, drives, redundant power, 24-slot I/E, media	899 lb 408.6 kg	71.5 lb/in.^{2} 5 kg/cm^2	77.4 in	24.3 in	38.3 in
Details Specific to Dual-Robot Configuration					
CM – Fully loaded: no robot, drives, redundant power, 24-slot I/E, media	897 lb 407.7 kg	71.4 lb/in.^{2} 5 kg/cm^2	77.4 in	24.3 in	38.3 in
LPM – Fully loaded: robot, media	623 lb 283.2 kg	49.6 lb/in^2 3.5 kg/cm^2	77.4 in	23.6 in	38.3 in
RPM – Fully loaded: drives, redundant power	820 lb 372.7 kg	65.2 lb/in^2 4.6 kg/cm^2	77.4 in	23.6 in	38.3 in
RPM – Fully loaded: drives, redundant power, 24-slot I/E, media	820 lb 372.7 kg	65.2 lb/in^2 4.6 kg/cm^2	77.4 in	23.6 in	38.3 in
RPM – Media only	723 lb 328.6 kg	57.5 lb/in^2 4.1 kg/cm^2	77.4 in	23.6 in	38.3 in

Components	Weight	Point Load	Height	Width	Depth
Details common to both configurations					
EM – Empty	586 lb 266.4 kg	46.6 lb/in^2 3.3 kg/cm^2	77.4 in	23.6 in	38.3 in
EM – Media only	820 lb 372.7 kg	65.2 lb/in^2 4.5 kg/cm^2	77.4 in	23.6 in	38.3 in
EM – Fully loaded: drives, redundant power, media	882 lb 400.9 kg	70.2 lb/in^2 4.9 kg/cm^2	77.4 in	23.6 in	38.3 in
EM – Fully loaded: drives, redundant power, 24-slot I/E, media	882 lb 400.9 kg	70.2 lb/in^2 4.9 kg/cm^2	77.4 in	23.6 in	38.3 in
EM – Fully loaded: dries, redundant power, 72-slot I/E, media	894 lb 406.4 kg	71.1 lb/in^2 5.0 kg/cm^2	77.4 in	23.6 in	38.3 in

Examples of Common Configurations

Table 10 provides examples of some common single-robotics configurations.

Table 11 provides examples of some common dual-robotics configurations.

Table 10 Examples of Common Single-Robot Configurations

Components	Max Weight	Max Distributed Load	Max Point Load	Height	Width	Depth
CM – Fully loaded: robot, 12 drives, redundant power, 24-slot I/E, media	899 lb 408.6 kg	139.1 lb/ft^2 680.6 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	24.3 in 61.7 cm	38.3 in 97.3 cm
CM + 1x EM – Fully loaded, 24 drives, redundant power, 2x 24-slot I/E, media	1781 lb 809.5 kg	139.8 lb/ft^2 684 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	47.9 in 121.7 cm	38.3 in 97.3 cm
CM + 1x EM – Fully loaded, 24 drives, redundant power, 1x 24-slot IE, 1x 72-slot I/E, media	1793 lb 815 kg	140.7 lb/ft^2 688.6 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	47.9 in 121.7 cm	38.3 in 97.3 cm
Maximum Single-Robot configuration: CM + 11x EM – Fully loaded, 96 drives, redundant power, 1x 24-slot IE, 7x 72-slot I/E, media	10437 lb 4744.1 kg	138.2 lb/ft^2 676.3 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	283.9 in 721.1 cm	38.3 in 97.3 cm

Table 11 Examples of Dual-Robot Configurations

Components	Max Weight	Max Distributed Load	Max Point Load	Height	Width	Depth
CM + LPM + RPM – Fully loaded: 12 drives, redundant power, 1x 24-slot I/E, media	2243 lb 1019.5 kg	117.9 lb/ft^2 577.1 kg/m^2	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	71.5 in 181.6 cm	38.3 in 97.3 cm
CM + LPM + RPM – Fully loaded: 24 drives, redundant power, 1x 24-slot I/E, media	2340 lb 1063.6 kg	123 lb/ft^2 602 kg/m^2	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	71.5 in 181.6 cm	38.3 in 97.3 cm
CM + LPM + RPM + 1 EM: 36 drives, redundant power, 1x 24-slot I/E, 1x 72-slot I/E, media	3234 lb 1470 kg	127.9 lb/ft^2 625.6 kg/m^2	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	95.1 in 241.5 cm	38.3 in 97.3 cm
Maximum dual-robot configuration CM + LPM + RPM + 10x EM – Fully loaded, 96 drives, redundant power, 1x 24-slot I/E, 7x 72-slot I/E, media	11183 lb 5083.2 kg	136.7 lb/ft^2 669 kg/m^2	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	307.5 in 781.1 cm	38.3 in 97.3 cm

Maximum Single Robot Configurations

Table 12 provides maximum specifications for every size of single-robotics configuration (one frame to twelve frames).

Table 12 Maximum Single-Robot Configurations

Components	Max Weight	Max Distributed Load	Max Point Load	Height	Width	Depth
One Frame: CM – Fully loaded: robot, 12 drives, redundant power, 24-slot I/E, media	899 lb 408.5 kg	139.1 lb/ft 680.6 kg/m	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	24.3 in 61.7 cm	38.3 in 97.3 cm
Two Frames: CM + 1 EM: 1x 24-slot I/E, 1x 72-slot I/E, 24 drives, redundant power, media	1793 lb 815 kg	140.7 lb/ft 688.6 kg/m	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	47.9 in 121.7 cm	38.3 in 97.3 cm
Three Frames: CM + 2 EM: 1x 24-slot I/E, 2x 72-slot I/E, 36 drives, redundant power, media	2687 lb 1221.4 kg	141.3 lb/ft 691.3 kg/m	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	71.5 in 181.6 cm	38.3 in 97.3 cm
Four Frames: CM + 3 EM: 1x 24-slot I/E, 3x 72-slot I/E, 48 drives, redundant power, media	3581 lb 1627.7 kg	141.6 lb/ft^2 692.7 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	95.1 in 241.6 cm	38.3 in 97.3 cm
Five Frames: CM + 4 EM: 1x 24-slot I/E, 4x 72-slot I/E, 60 drives, redundant power, media	4475 lb 2034.1 kg	141.7 lb/ft^2 693.5 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	118.7 in 301.5 cm	38.3 in 97.3 cm
Six Frames: CM + 5 EM: 1x 24-slot I/E, 5x 72-slot I/E, 72 drives, redundant power, media	5369 lb 2440.5 kg	141.9 lb/ft^2 694.1 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	142.3 in 361.4 cm	38.3 in 97.3 cm

Components	Max Weight	Max Distributed Load	Max Point Load	Height	Width	Depth
Seven Frames: CM + 6 EM: 1x 24-slot I/E, 6x 72-slot I/E, 84 drives, redundant power, media	6263 lb 2846.8 kg	141.9 lb/ft^2 694.5 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	165.9 in 421.4 cm	38.3 in 97.3 cm
Eight Frames: CM + 7 EM: 1x 24-slot I/E, 7x 72-slot I/E, 96 drives, redundant power, media	7157 lb 3253.2 kg	142 lb/ft^2 694.8 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	189.5 in 481.3 cm	38.3 in 97.3 cm
Nine Frames: CM + 8 EM: 1x 24-slot I/E, 7x 72-slot I/E, 96 drives, redundant power, media	7977 lb 3625.9 kg	140.7 lb/ft^2 688.6 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	213.1 in 541.3 cm	38.3 in 97.3 cm
Ten Frames: CM + 9 EM: 1x 24-slot I/E, 7x 72-slot I/E, 96 drives, redundant power, media	8797 lb 3998.6 kg	139.7 lb/ft^2 683.7 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	236.7 in 601.2 cm	38.3 in 97.3 cm
Eleven Frames: CM + 10 EM: 1x 24-slot I/E, 7x 72-slot I/E, 96 drives, redundant power, media	9617 lb 4371.4 kg	138.9 lb/ft^2 679.6 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	260.3 in 661.2 cm	38.3 in 97.3 cm
Twelve Frames: CM + 11 EM: 1x 24-slot I/E, 7x 72-slot I/E, 96 drives, redundant power, media	10437 lb 4744.1 kg	138.2 lb/in^2 676.3 kg/m^2	71.5 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	283.9 in 721.1 cm	38.3 in 97.3 cm

Maximum Dual Robot Configurations

Table 13 provides maximum specifications for every size of dual-robotics configuration (one frame to twelve frames).

Table 13 Maximum Dual-Robot Configurations

Components	Max Weight	Max Distributed Load	Max Point Load	Height	Width	Depth
Three Frames: CM + LPM + RPM - fully loaded: 12 drives, redundant power, 1x 24-slot I/E, media	2243 lb 1019.5 kg	117.9 lb/ft	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	71.5 in 181.6 cm	38.3 in 97.3 cm
Three Frames: CM + LPM + RPM - fully loaded: 24 drives, redundant power, 1x 24-slot I/E, media	2340 lb 1063.6 kg	123 lb/ft 602 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	71.5 in 181.6 cm	38.3 in 97.3 cm
Four Frames: CM + LPM + RPM + 1 EM: 36 drives, redundant power, 1x 24-slot I/E, 1x 72-slot I/E, media	3234 lb 1470 kg	127.9 lb/ft 625.6 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	95.1 in 241.6 cm	38.3 in 97.3 cm
Five Frames: CM + LPM + RPM + 2 EM: 48 drives, redundant power, 1x 24-slot I/E, 2x 72-slot I/E, media	4128 lb 1876.4 kg	130.8 lb/ft 639.7 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	118.7 in 301.5 cm	38.3 in 97.3 cm
Six Frames: CM + LPM + RPM + 3 EM: 60 drives, redundant power, 1x 24-slot I/E, 3x 72-slot I/E, media	5022 lb 2282.7 kg	132.7 lb/ft 649.2 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	142.3 in 361.4 in	38.3 in 97.3 cm

Components	Max Weight	Max Distributed Load	Max Point Load	Height	Width	Depth
Seven Frames: CM + LPM + RPM + 4 EM: 72 drives, redundant power, 1x 24-slot I/E, 4x 72-slot I/E, media	5916 lb 2689.1 kg	134.1 lb/ft 656 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	165.9 in 421.4 cm	38.3 in 97.3 cm
Eight Frames: CM + LPM + RPM + 5 EM: 84 drives, redundant power, 1x 24-slot I/E, 5x 72-slot I/E, media	6810 lb 3095.5 kg	135.1 lb/ft 661.1 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	189.5 in 481.3 cm	38.3 in 97.3 cm
Nine Frames: CM + LPM + RPM + 6 EM: 96 drives, redundant power, 1x 24-slot I/E, 6x 72-slot I/E, media	7704 lb 3501.8 kg	135.9 lb/ft 665 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	213.1 in 541.3 cm	38.3 in 97.3 cm
Ten Frames: CM + LPM + RPM + 7 EM: 96 drives, redundant power, 1x 24-slot I/E, 7x 72-slot I/E, media	8501 lb 3864.1 kg	135 lb/ft 660.7 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	236.7 in 601.2 cm	38.3 in 97.3 cm
Eleven Frames: CM + LPM + RPM + 8 EM: 96 drives, redundant power, 1x 24-slot I/E, 7x 72-slot I/E, media	9395 lb 4270.5 kg	135.7 lb/ft 663.9 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	260.3 in 661.2 cm	38.3 in 97.3 cm
Twelve Frames: CM + LPM + RPM + 9 EM: 96 drives, redundant power, 1x 24-slot I/E, 7x 72-slot I/E, media	10289 lb 4676.8 kg	136.3 lb/ft 666.7 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	283.9 in 721.1 cm	38.3 in 97.3 cm

Components	Max Weight	Max Distributed Load	Max Point Load	Height	Width	Depth
Thirteen Frames: CM + LPM + RPM + 10 EM: 96 drives, redundant power, 1x 24-slot I/E, 7x 72-slot I/E, media	11183 lb 5083 kg	136.7 lb/ft 669 kg/m	71.4 lb/in^2 5 kg/cm^2	77.4 in 196.6 cm	307.5 in 781.1 cm	38.3 in 97.3 cm

Diagrams of Module Configurations

This section contains diagrams of all module configurations, from one frame to thirteen frames, and includes both single- and dual-robotics configurations.

This section covers:

One-Frame Configuration

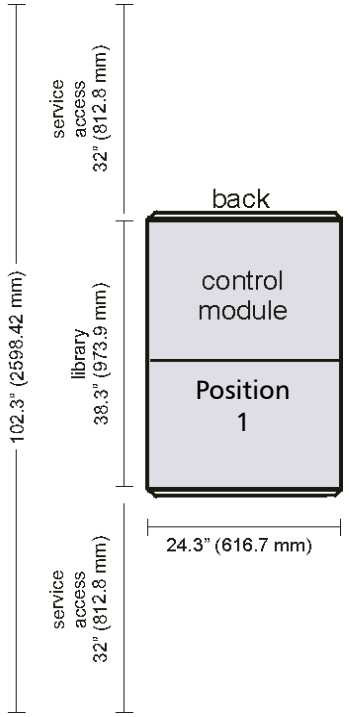
The smallest library configuration consists of the control module only. The minimal configuration contains one I/E station and one drive.

Note: This configuration applies to single-robot systems only.

See Configuration Rules on page 55 for specific module configuration information.

The single robotics two-frame configuration is shown in Figure 22 on page 66.

Figure 22 One-Frame Configuration Diagram (Single Robotics)



Two-Frame Configuration

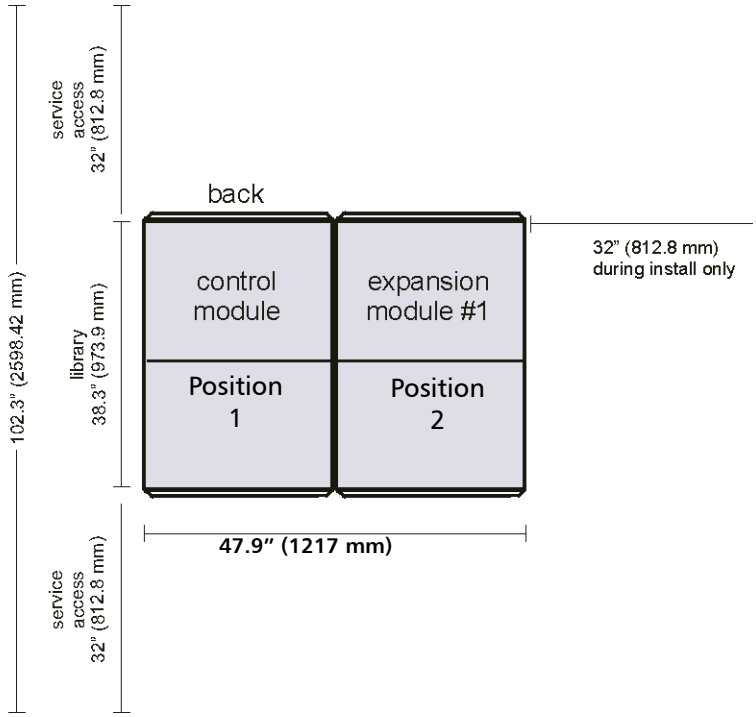
The single robotics two-frame configuration consists of the control module and one expansion module.

Note: This configuration applies to single-robot systems only.

See Configuration Rules on page 55 for specific module configuration information.

The single robotics two-frame configuration is shown in Figure 23 on page 67.

Figure 23 Single Robotics Two-Frame Configuration Diagram



Three-Frame Configuration

The single robotics three-frame configuration consists of one control module and two expansion modules.

The smallest dual-robotics library configuration is a three-frame system. It consists of one control module, a left parking module, and a right parking module.

See Configuration Rules on page 55 for specific module configuration information.

The single robotics three-frame configuration is shown in Figure 24 on page 68. The dual robotics three-frame configuration is shown in Figure 25 on page 69.

Figure 24 Single Robotics Three-Frame Configuration Diagram

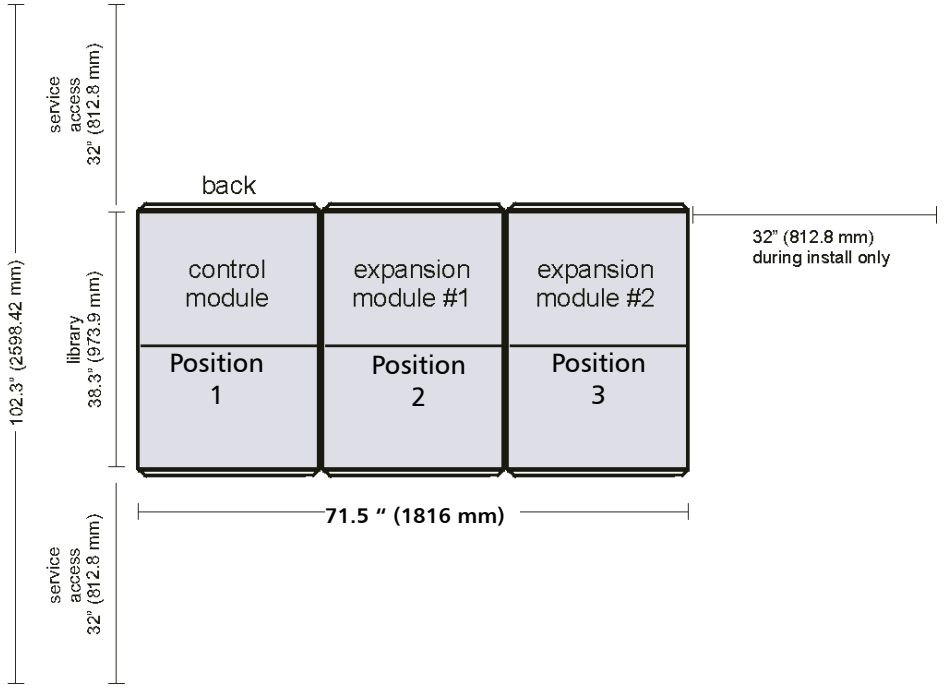
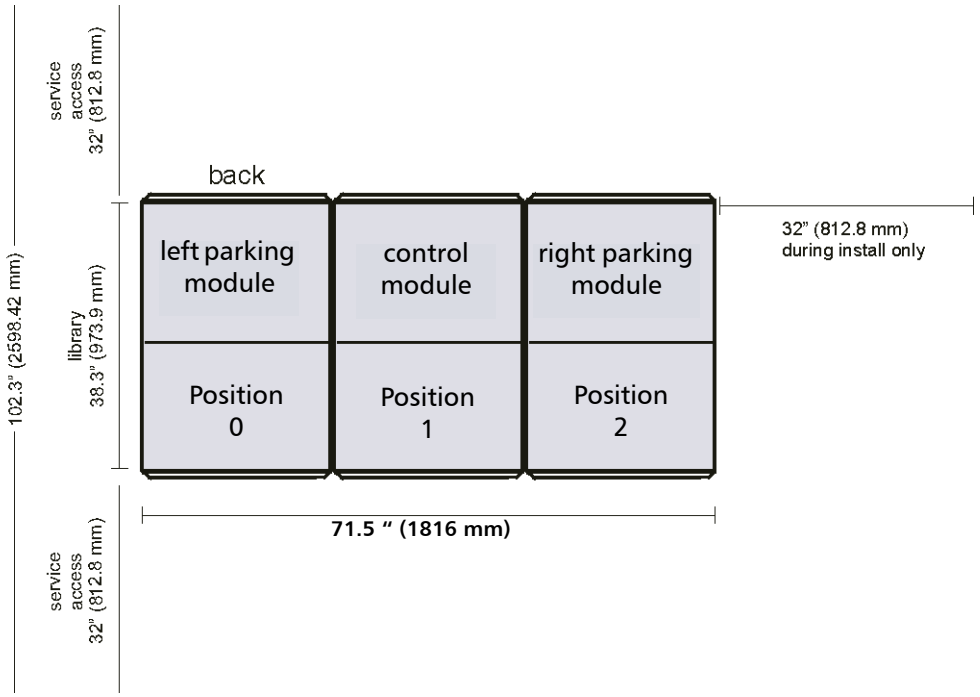


Figure 25 Dual-Robotics Three-Frame Configuration Diagram



Four-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics four-frame configuration is shown in Figure 26 on page 70. The dual robotics four-frame configuration is shown in Figure 27 on page 71.

Figure 26 Single Robotics Four-Frame Configuration Diagram

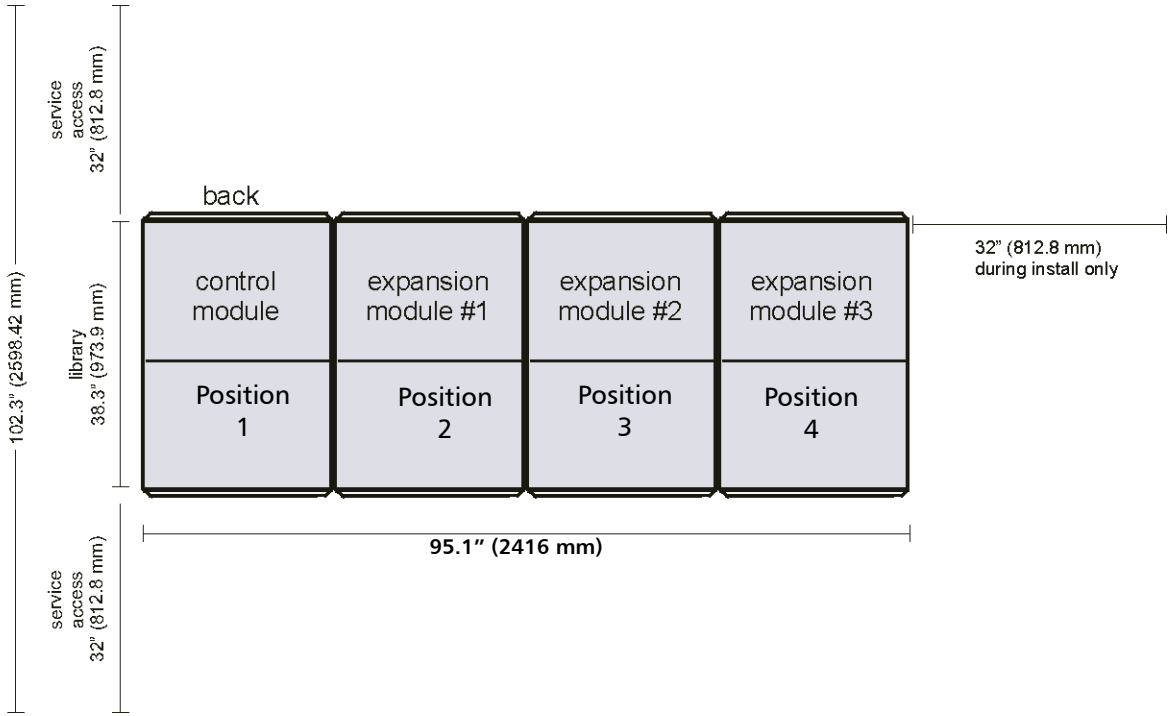
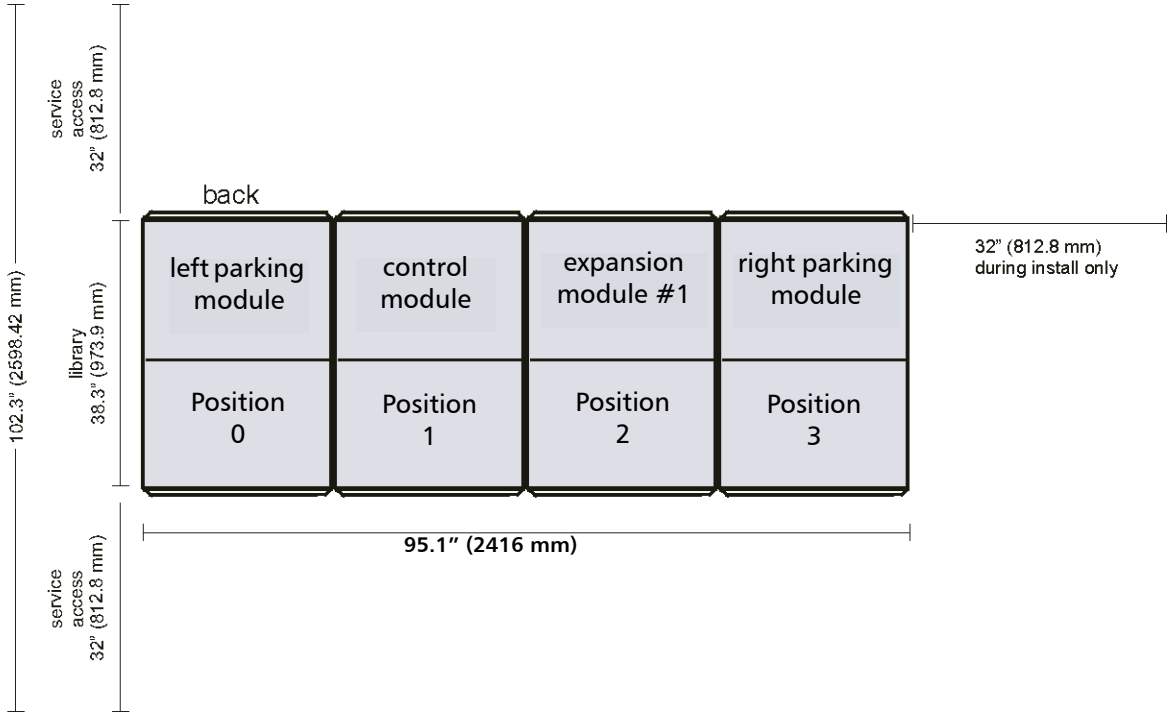


Figure 27 Dual Robotics Four-Frame Configuration Diagram



Five-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics five-frame configuration is shown in Figure 28 on page 72. The dual robotics five-frame configuration is shown in Figure 29 on page 73.

Figure 28 Single Robotics Five-Frame Configuration Diagram

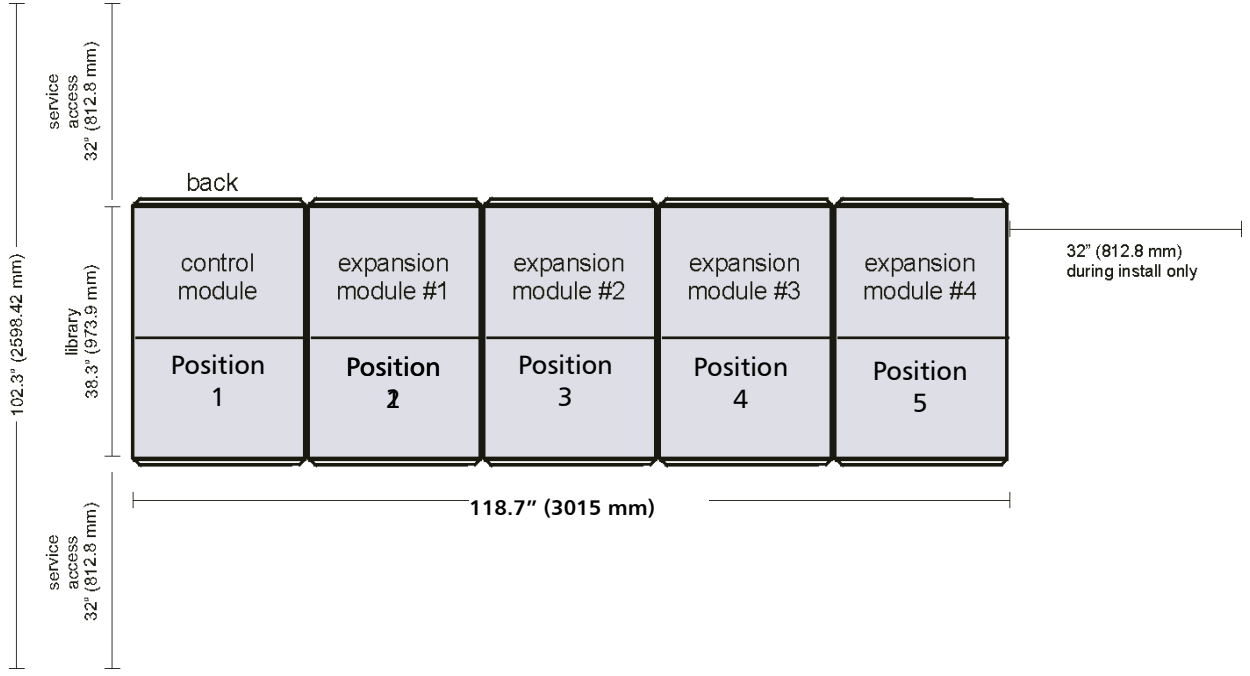
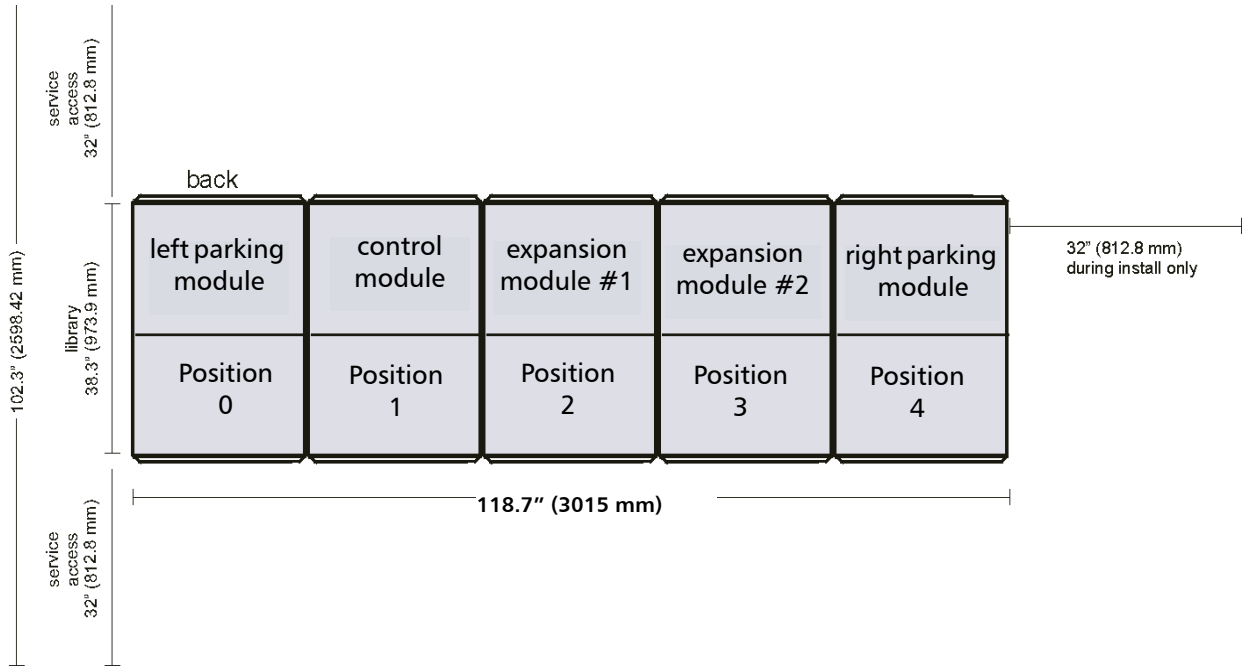


Figure 29 Dual Robotics Five-Frame Configuration Diagram



Six-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics six-frame configuration is shown in Figure 30 on page 74. The dual robotics six-frame configuration is shown in Figure 31 on page 75.

Figure 30 Single Robotics Six-Frame Configuration Diagram

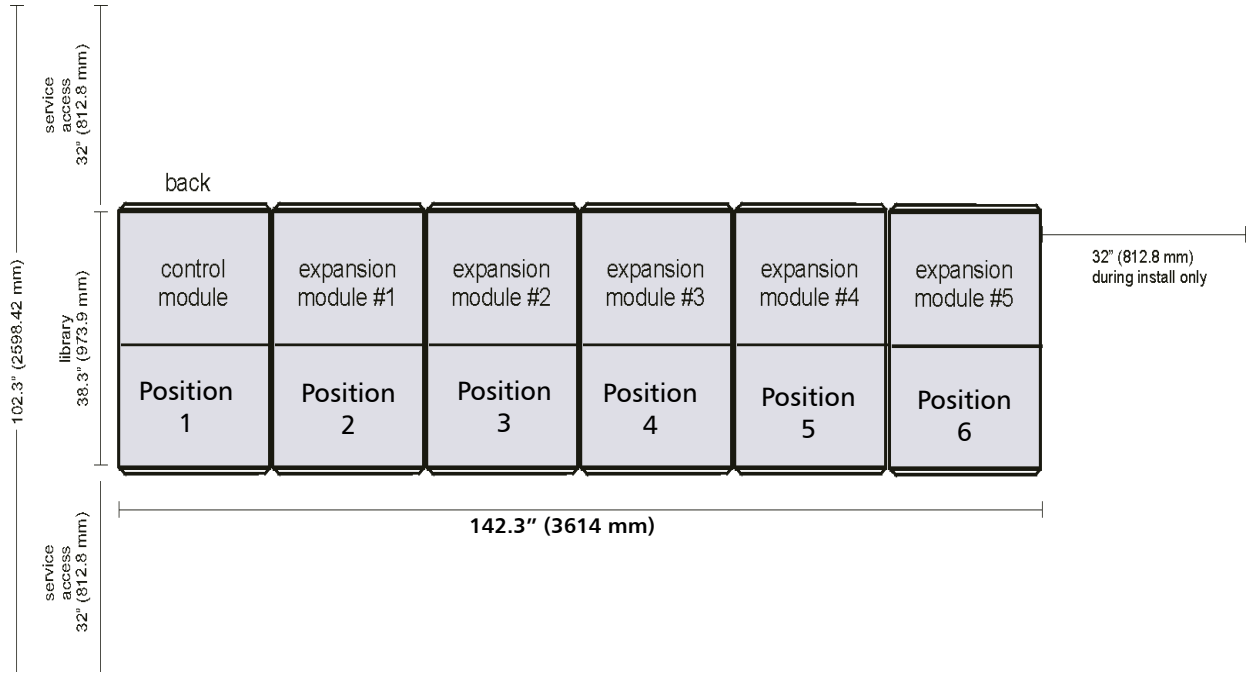
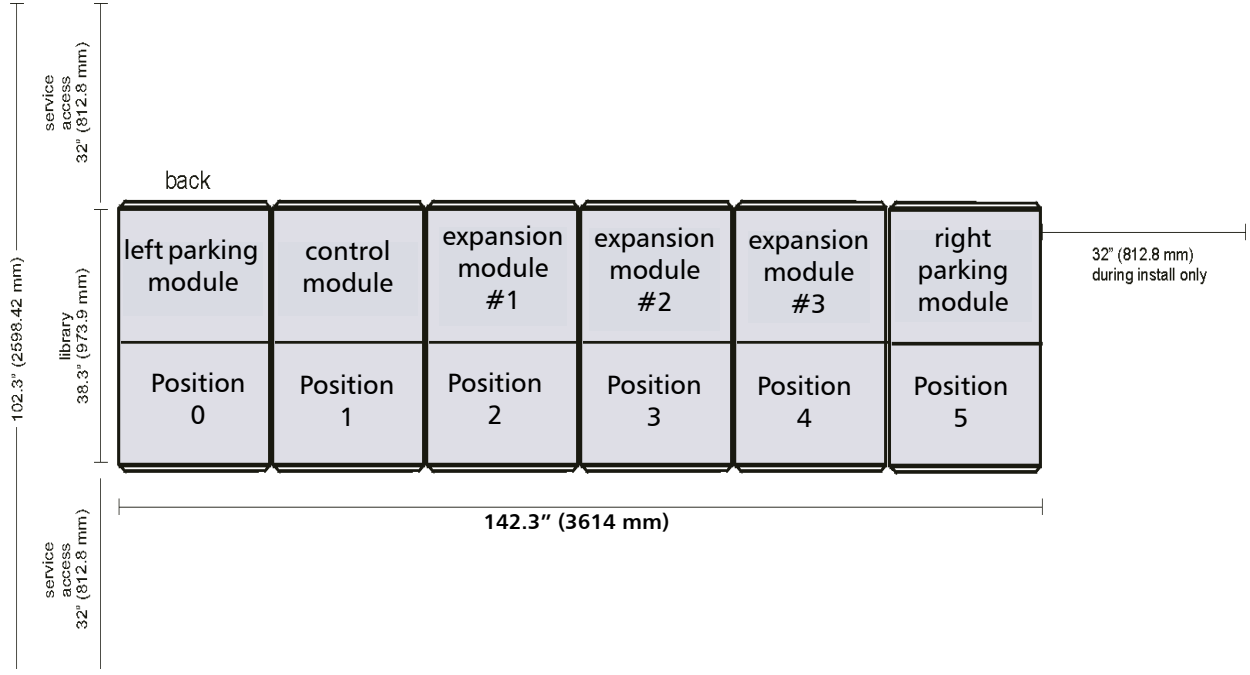


Figure 31 Dual Robotics Six-Frame Configuration Diagram



Seven-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics seven-frame configuration is shown in Figure 32 on page 76. The dual robotics seven-frame configuration is shown in Figure 33 on page 77.

Figure 32 Single Robotics Seven-Frame Configuration Diagram

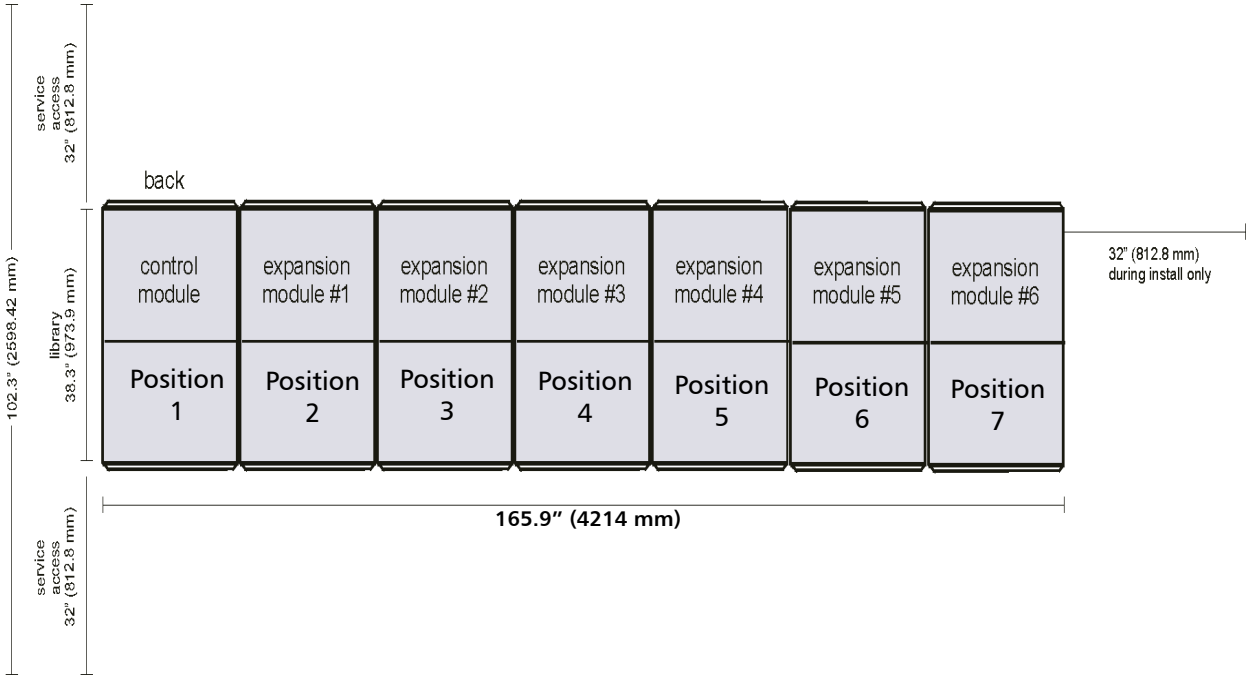
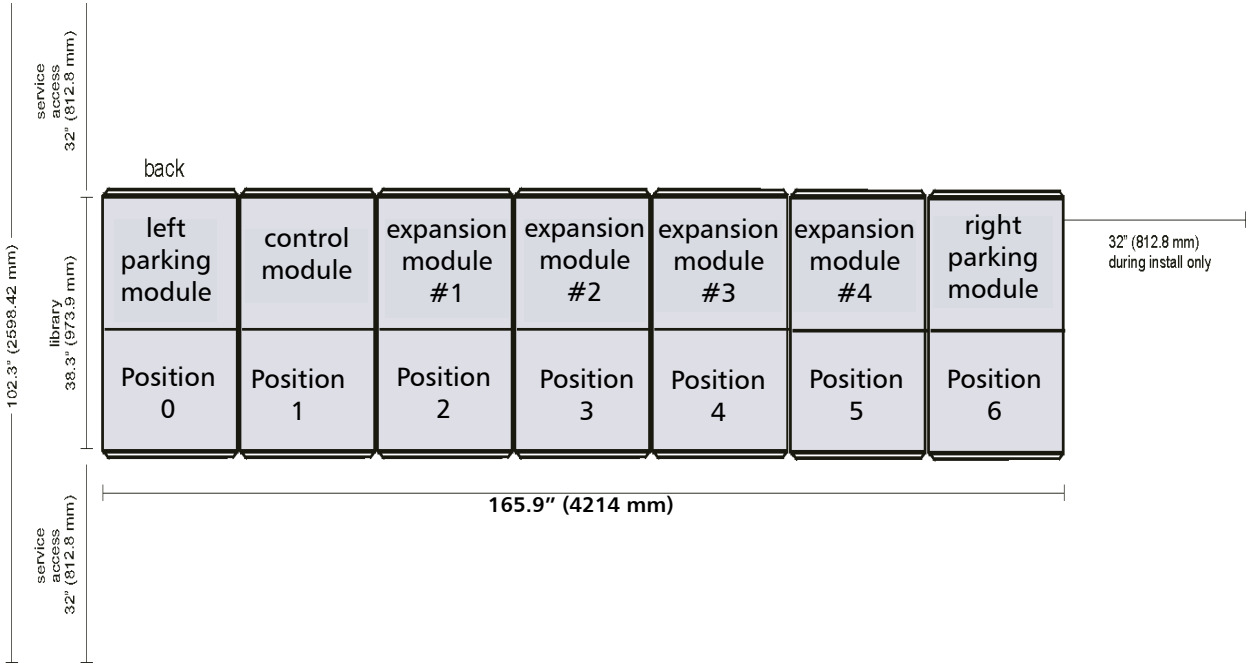


Figure 33 Dual Robotics Seven-Frame Configuration Diagram



Eight-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics eight-frame configuration is shown in Figure 34 on page 78. The dual robotics eight-frame configuration is shown in Figure 35 on page 79.

Figure 34 Single Robotics Eight-Frame Configuration Diagram

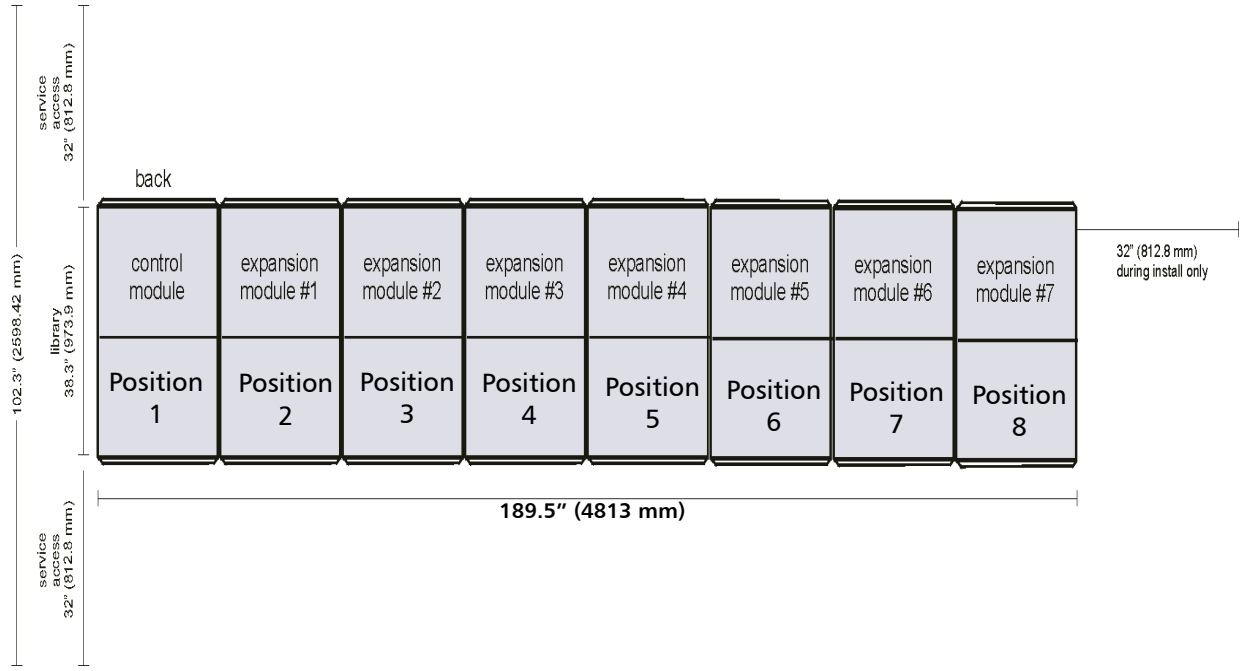
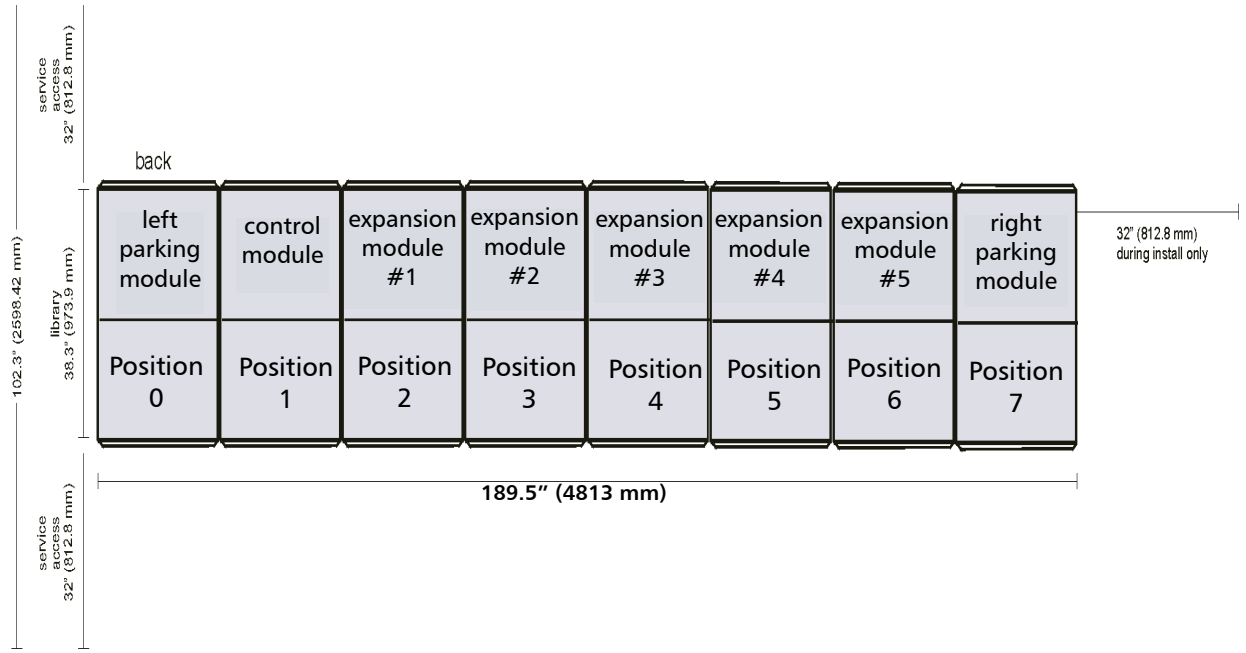


Figure 35 Dual Robotics Eight-Frame Configuration Diagram



Nine-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics nine-frame configuration is shown in Figure 36 on page 80. The dual-robotics nine-frame configuration is shown in Figure 37 on page 81.

Figure 36 Single Robotics Nine-Frame Configuration Diagram

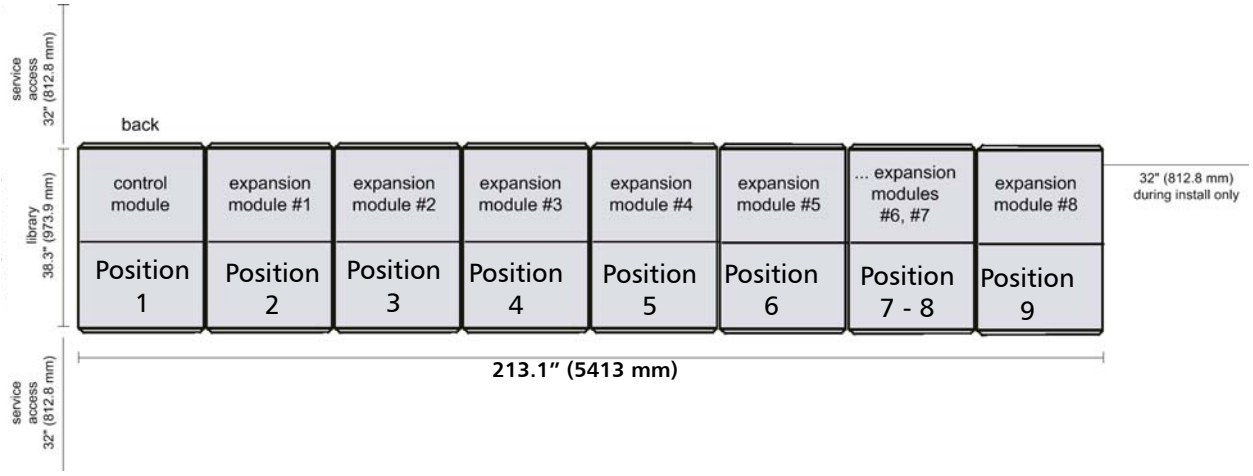
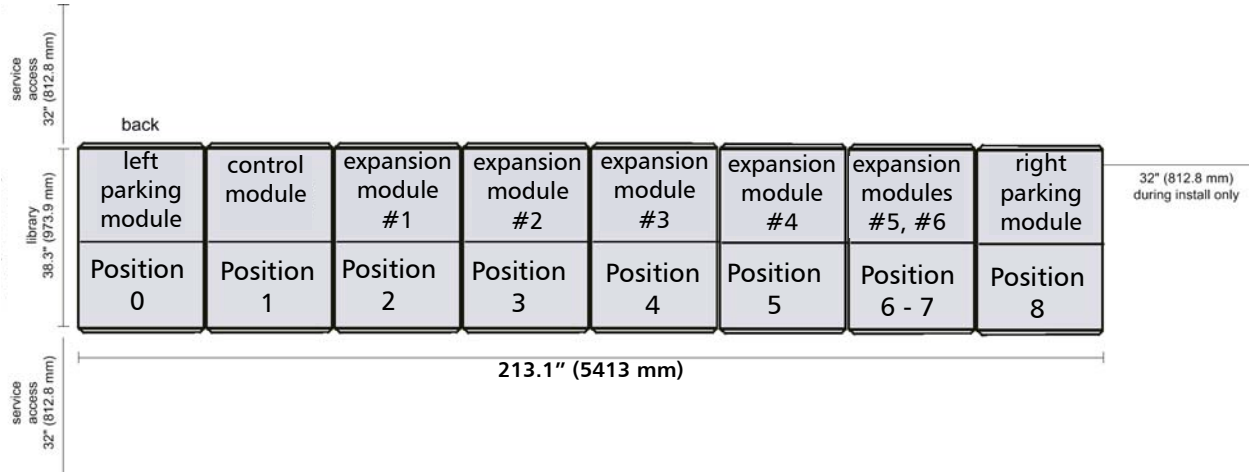


Figure 37 Dual Robotics Nine-Frame Configuration Diagram



Ten-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics ten-frame configuration is shown in Figure 38 on page 82. The dual robotics ten-frame configuration is shown in Figure 39 on page 83.

Figure 38 Single Robotics Ten-Frame Configuration Diagram

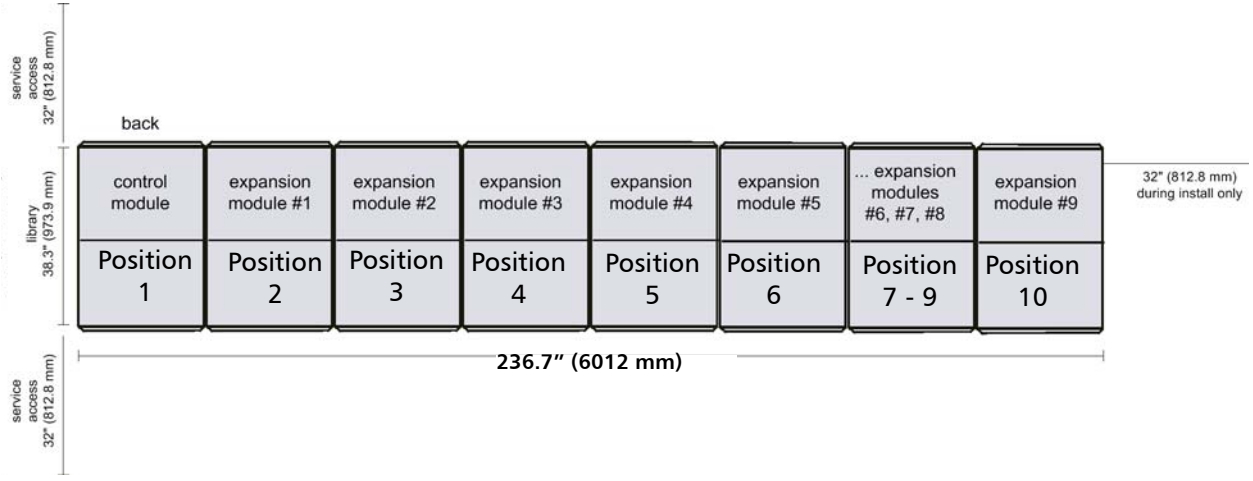
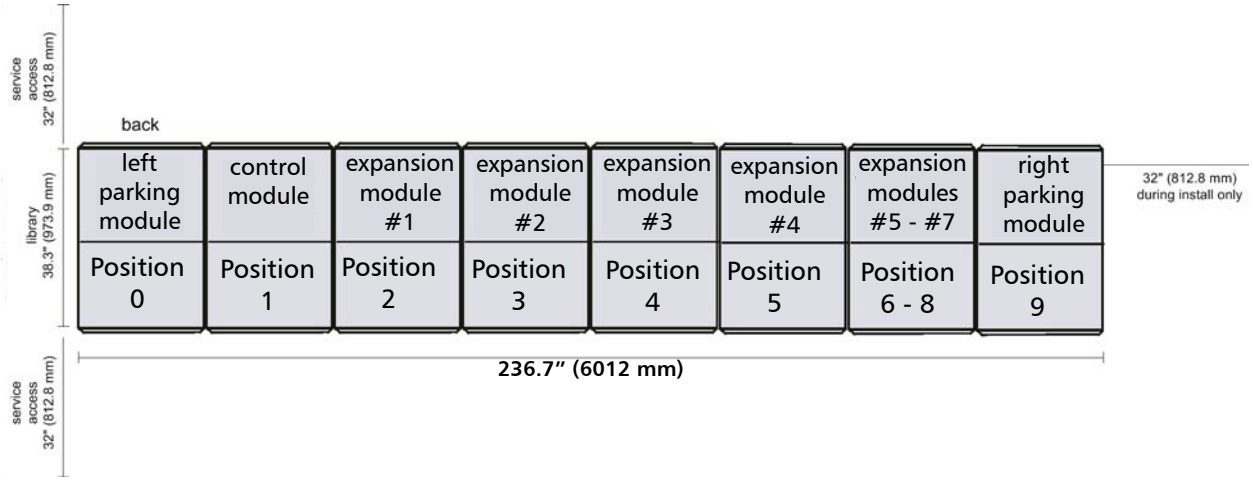


Figure 39 Dual Robotics Ten-Frame Configuration Diagram



Eleven-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics eleven-frame configuration is shown in Figure 40 on page 84. The dual robotics eleven-frame configuration is shown in Figure 41 on page 85.

Figure 40 Single Robotics Eleven-Frame Configuration Diagram

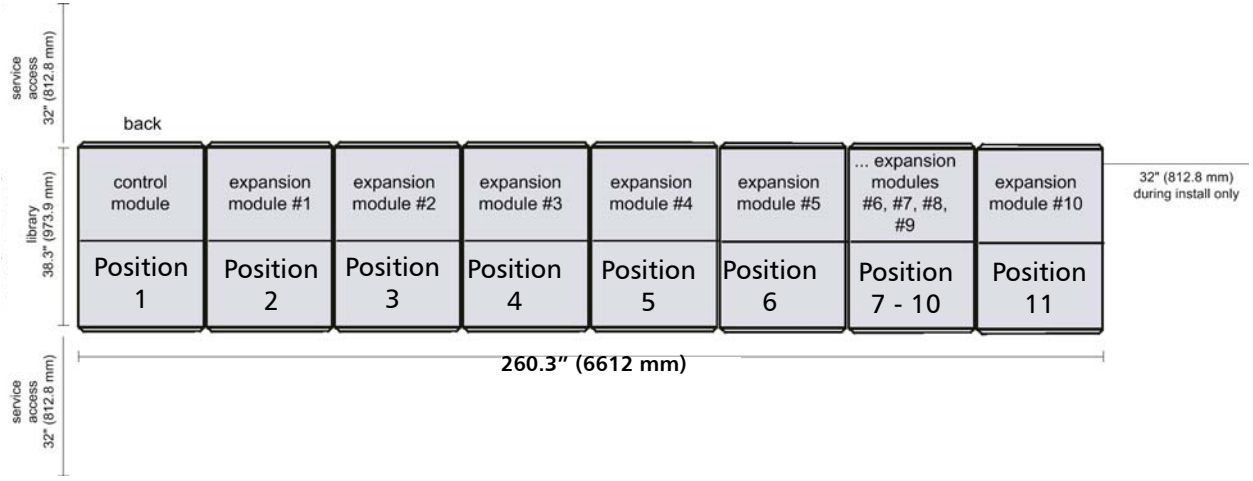
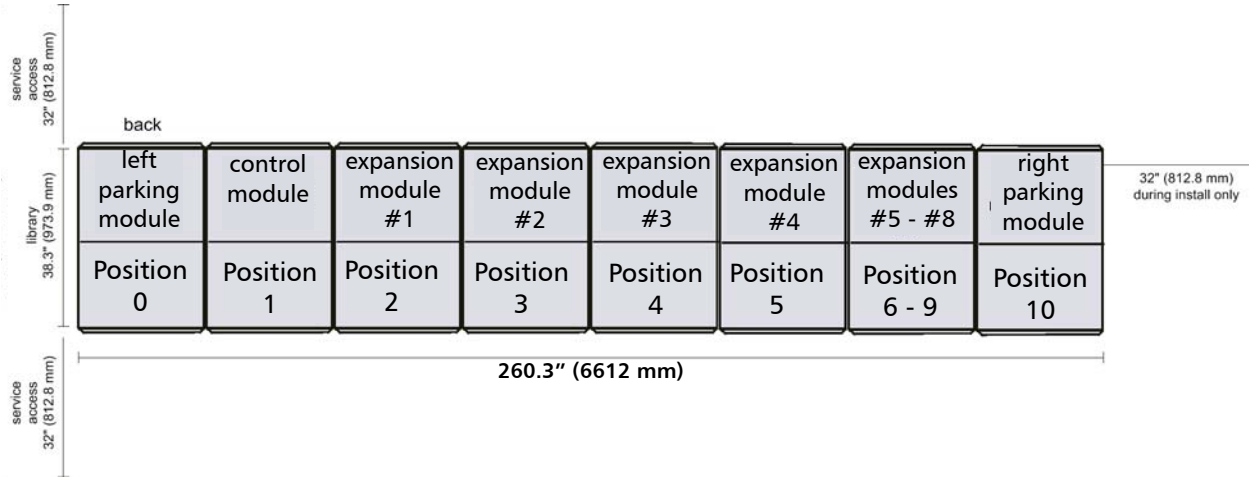


Figure 41 Dual Robotics Eleven-Frame Configuration Diagram



Twelve-Frame Configuration

See Configuration Rules on page 55 for specific module configuration information.

The single robotics twelve-frame configuration is shown in Figure 42 on page 86. The dual robotics twelve-frame configuration is shown in Figure 43 on page 87.

Figure 42 Single Robotics Twelve-Frame Configuration Diagram

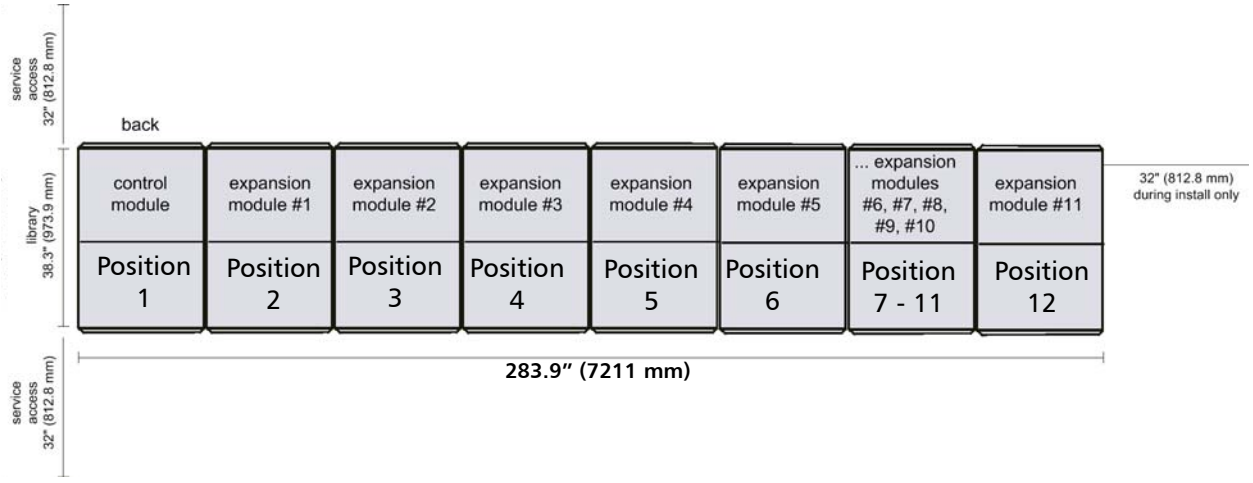
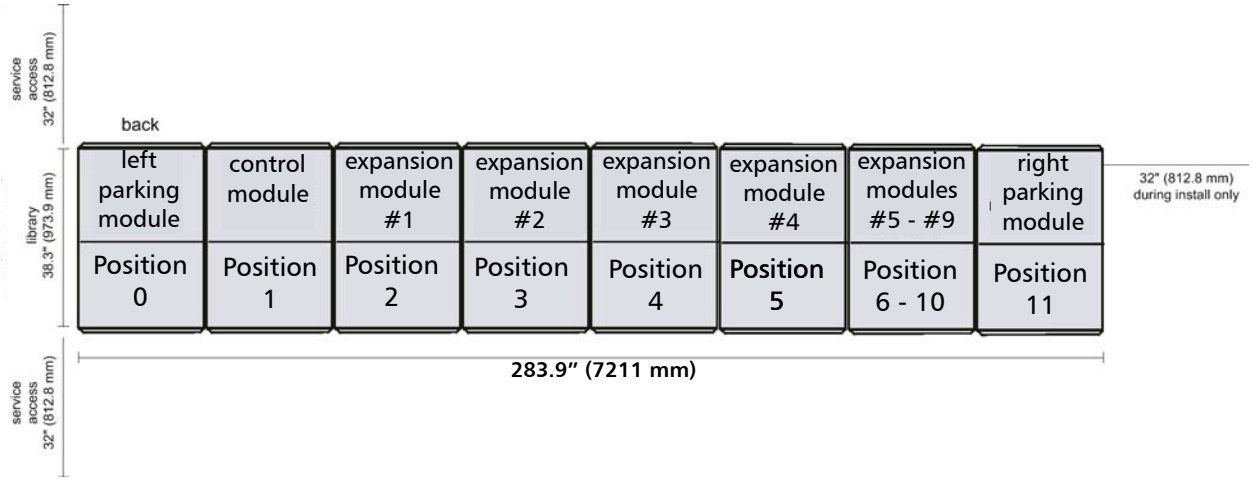


Figure 43 Dual Robotics Twelve-Frame Configuration Diagram



Thirteen-Frame Configuration

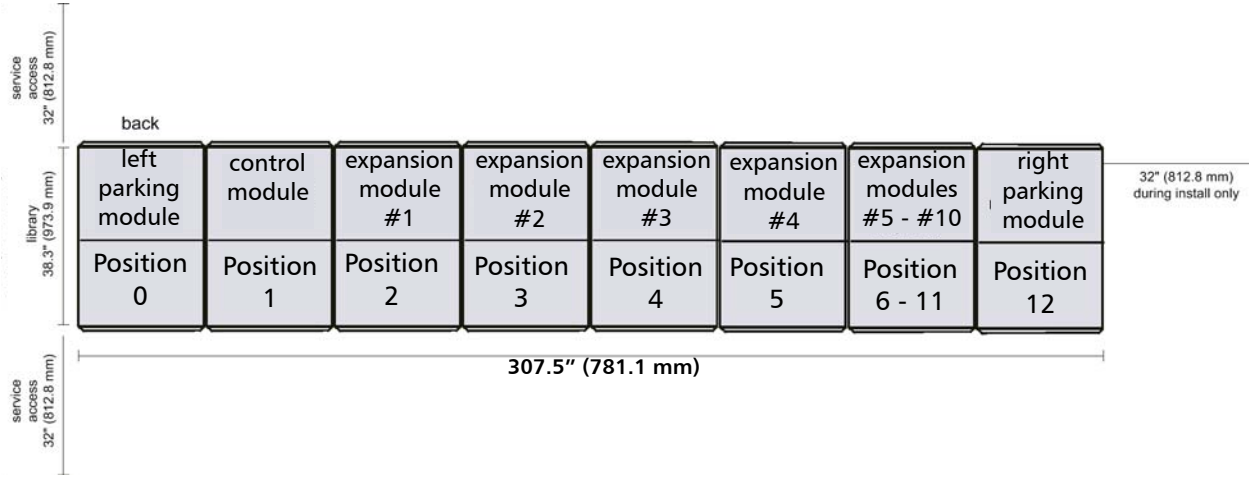
The maximum library configuration is 13 frames. A dual robotics thirteen-frame configuration consists of the control module, left parking module, right parking module, and ten standard expansion modules.

Note: This configuration applies to dual-robot systems only.

See Configuration Rules on page 55 for specific module configuration information.

The dual robotics thirteen-frame configuration is shown in Figure 44 on page 88.

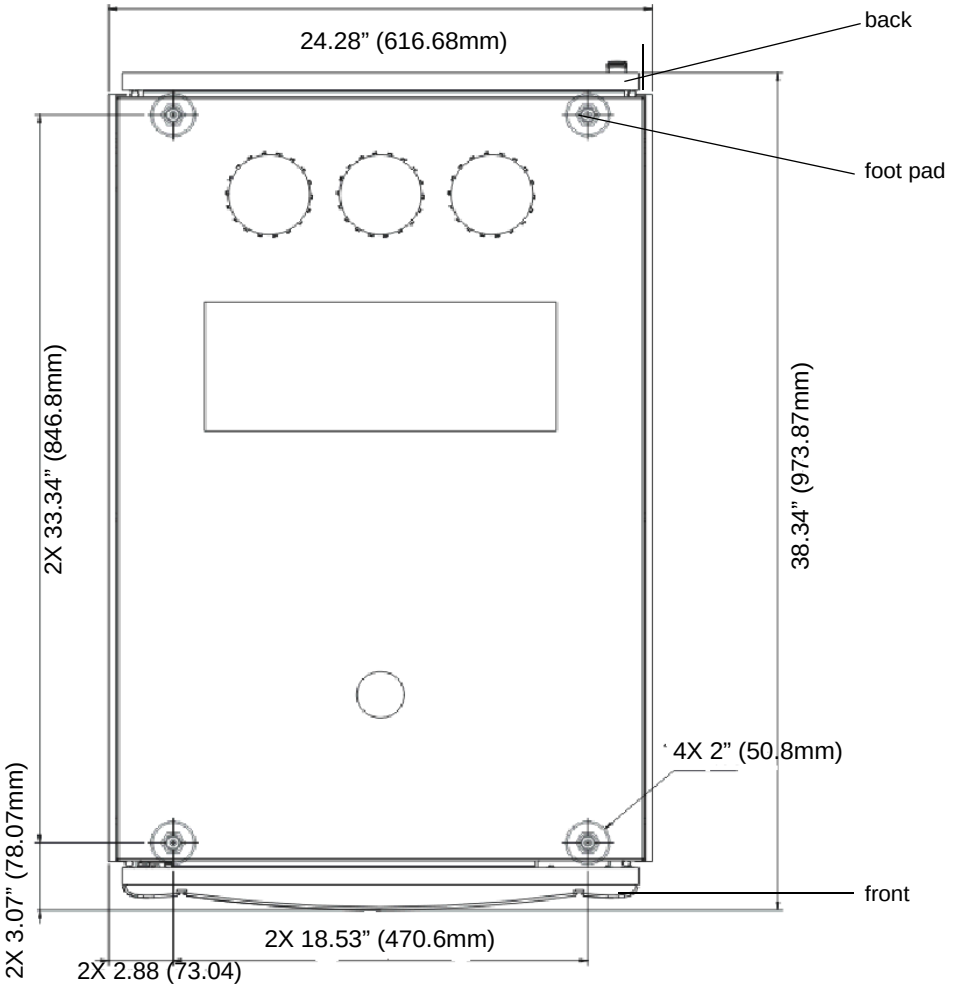
Figure 44 Dual Robotics Thirteen-Frame Configuration Diagram



Module Foot Pad Positions

The library foot pad positions looking down from the top are shown in Figure 45 on page 89. The foot pad positions are the same for the control module, expansion modules, and parking modules.

Figure 45 Library Module Foot Pad Positions



Module Floor Cutout

The foot pad positions are shown from underneath the library in Figure 46. The module floor cutouts are the same for the control module, expansion modules, and parking modules.

Figure 46 Module Floor Cutout (Bottom View)

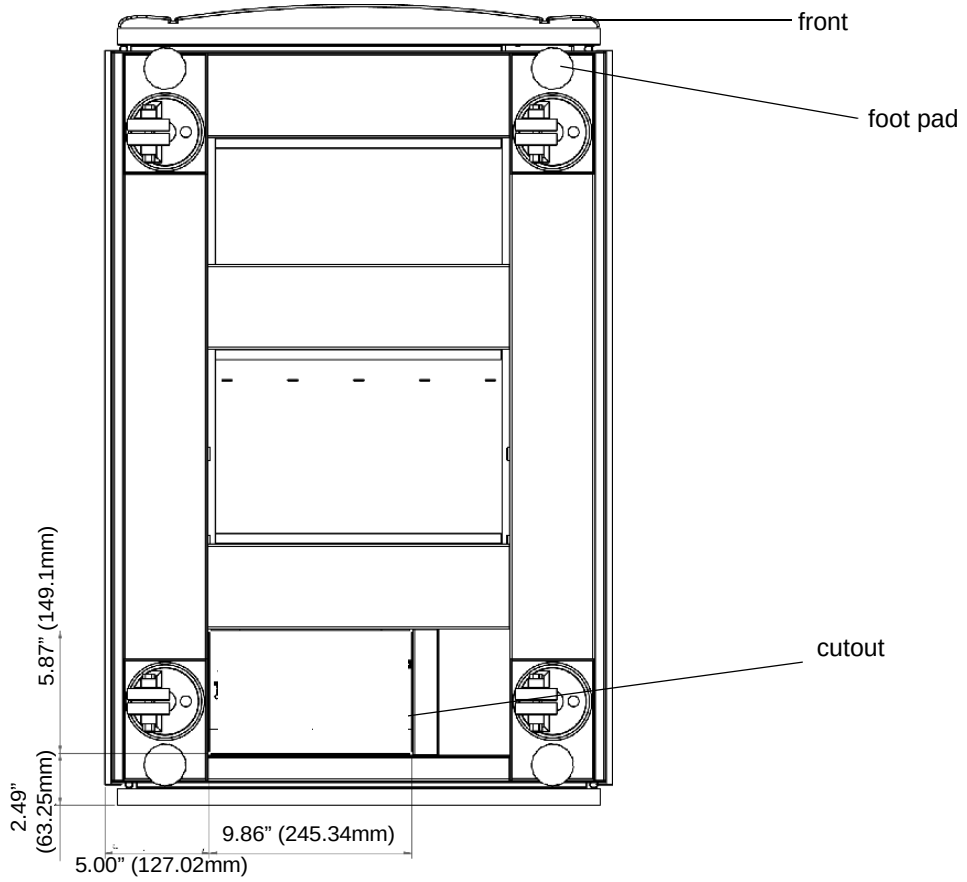
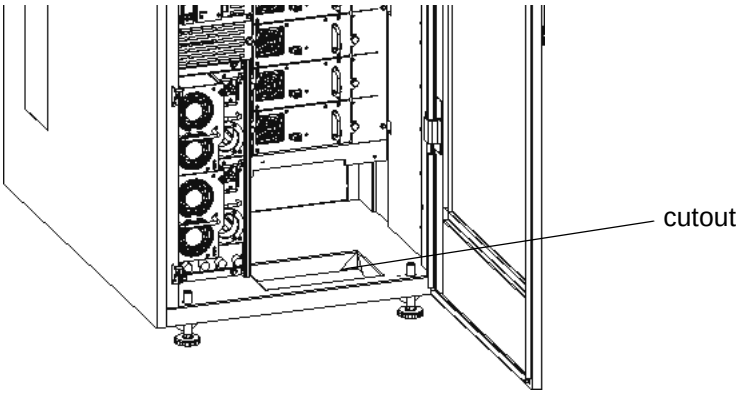


Figure 47 Module Floor Cutout (Front View)



LTO Drive Requirements and Compatibility

The control module and first seven expansion modules (including the right parking module in dual-robot configurations) can each contain up to 12 full-height FC linear tape-open format tape drives (LTO-1, LTO-2, LTO-3, LTO-4, and LTO-5).

Although all five generations of LTO drives are supported in the library, the drives are not fully compatible (both read/write) as shown in Table 14 on page 92.

Table 14 LTO Drive and Cartridge Compatibility

	LTO-1 Cartridge	LTO-2 Cartridge	LTO-3 Cartridge	LTO-3 WORM	LTO-4 Cartridge	LTO-4 WORM	LTO-5 Cartridge	LTO-5 WORM
LTO-1 Drive	Reads/ Writes	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible
LTO-2 Drive	Reads/ Writes[a]	Reads/ Writes	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible
LTO-3 Drive	Reads[b]	Reads/ Writes[c]	Reads/ Writes	Write Once, Read Many[d]	Not compatible	Not compatible	Not compatible	Not compatible
LTO-4 Drive	Not compatible	Reads	Reads/ Writes	Write Once/ Read Many	Reads/ Writes	Write Once, Read Many[e]	Not compatible	Not compatible
LTO-5 Drive	Not compatible	Not compatible	Read	Read Many	Reads/ Writes	Write Once, Read Many	Reads/ Writes	Write Once/ Read Many[f]

a.LTO-2 drives do not reformat LTO-1 cartridges. The drives will write to the cartridges in the LTO-1 format (100 GB capacity).

b.LTO-3 drives only read LTO-1, they do not write to the LTO-1.

c.LTO-3 drives do not reformat LTO-2 cartridges to contain the same density as the LTO-3 cartridges (400 GB). The LTO-3 drives will write to the LTO-2 cartridges in the LTO-2 format (200 GB capacity).

d.LTO-3 WORM requires the installation of library firmware and WORM-supported LTO-3 tape drive code

e. LTO-4 WORM requires the installation of the library firmware and WORM-supported LTO-4 tape drive code.

f.LTO-5 WORM requires the installation of the library firmware and WORM-supported LTO-5 tape drive code.

All LTO cartridges are the same size, which means they use the same magazines in the library. LTO drives can be directly attached to hosts, attached to the storage area network (SAN), or connected to FC I/O blades in the I/O management unit.

Barcode Requirements

Cartridges must have an external barcode label that is machine-readable to identify the volume serial number. A barcode must use only uppercase letters A to Z and/or numeric values 0 to 9. The library supports Code 39 (3 of 9) type barcode labels.

For LTO media barcodes, the library dynamically supports 1 to 14 characters for volume serial number plus a two-character media type identifier. The image below is an example of a supported LTO barcode label.

Note: A 14-character barcode label length may not be printable according to the Code 39 label specifications for the tape cartridge area to which the label is attached. The effective tape cartridge barcode label length, including any media ID, may be limited to a maximum of 12 characters.

two-character media identifier (“L1”, “L2”, “L3”, “L4”, or “L5”, “LT”, “LU”, “LV”)

Quantum-supplied barcode labels will provide the best results. Barcode labels from other sources can be used, but they must meet the following requirements:

- ANSI MH10.8M-1983 Standard
- Number of characters: 6+2 (LTO)
- Background reflection: greater than 25 percent
- Print contrast: greater than 75 percent
- Ratio: greater than 2.2
- Module: >= .254 mm
- Print tolerance: ± 57 mm

Additional Requirements:

- Height of the visible portion of the barcode: 10 mm ±2 mm
- Length of the rest zones: 5.25 mm ± 0.25 mm

- No black marks should be present in the intermediate spaces or rest zones
- No white areas should be present on the bars

Chapter 4
Site Preparations

This chapter provides a structure for the collection of all necessary information concerning the delivery site. Record all requested information in the forms provided or create additional sheets as needed. This chapter provides the following information:

General Information

Place any additional information in Additional Comments on page 108.

Customer name

Mailing address

Shipping address

Sales contact

Telephone _____

Quantum sales rep. _____

Quantum account manager _____

Installation contact _____

_____

Telephone _____

Target installation date _____

Target operational date _____

Physical Environment

Place any additional information in Additional Comments on page 108.

Room dimension

Ceiling projection

Floor type

Floor load capacity

Fire protection	
Seismic bracing - If seismic bracing is being used, verify that the seismic bracing solution is supported prior to installation.	
Type of power connector required	

Access Conditions

Access to the library room (elevator, stairs, door widths, etc.)

Dimensions and location of the smallest door or opening

Loading dock specifications (dock height, type of ramps, weather protection, etc.)

Semitrailer accessibility (Y or N)

Preferred/required local carrier company

Where is the trailer location for staging?

Availability of material handling equipment

Location for uncrating

Preferred time of day for unloading and moving materials

Off hours/weekends accessibility for installation team

Procedure for obtaining building passes

Procedure for scheduling the elevator, loading dock

Waste disposal considerations

Bargaining unit considerations

Other considerations

Required Configuration Information

The following is some of the information that will be needed during installation of the library. Place any additional information in Additional Comments on page 108.

Library name:

License string:	
IP address (internal)	
IP addresses of the two network time protocol (NTP) servers:	1. 2.
SNMP server:	
SNMP account:	
SNMP sender address	
Subnet mask:	
Default gateway:	
SMTP server IP address:	

If your mail server requires a user name and password you can enable this on the library and enter these for e-mail authentication.

E-mail addresses of local administrators to be notified if issues arise with the library: _____

_____

_____

_____

Operating system and version running off the remote servers that will connect to the library: _____

_____

_____

_____

SAN Readiness

All servers or appliances intended to communicate with the Scalar i6000 robotic controller or tape drives must be already installed on the SAN before configuring the library for fiber channel SAN connectivity. Additionally, the World Wide Names (WWNs) of the associated fiber channel HBAs should be visible on the SAN. This is necessary because the Scalar i6000 "Extended Virtual Private SAN" (eVPS) feature can only grant LUN access to WWNs it discovers on the SAN at the time of configuration.

Are all necessary servers or appliances visible on the SAN? (Y or N):

_____

Dual Robotics Upgrade Requirements

If you are upgrading your library from a single robot system to a dual robot system (whether from Gen 1 or Gen 2), please understand and address the following requirements before Service arrives to do the upgrade:

☑	Requirement
☐	**Scalar i6000** — Scalar i2000 libraries must be upgraded to Scalar i6000 before upgrading to dual robotics.
☐	**Gen 2** — Dual robotics libraries use the Gen 2 robot. If you are upgrading from a Gen 1 system, the hardware and robots need to be upgraded to Gen 2. You cannot add a second robot to a Gen 1 system.
☐	**No DLT tape drives, media, or magazines** — Dual robotics libraries do not support DLT tape drives or media. Remove these from the library before the upgrade.
☐	**Sufficient physical space** — The dual robotics library upgrade requires a left parking module to be installed to the left of the control module. Make sure you have sufficient space for the additional module. If this will require moving the library, ensure the new space is prepared, ready, and level prior to the upgrade. **Note:** The minimum dual-robot configuration consists of three modules (left parking module, control module, and right parking module).
☐	**No 72-slot I/E station in right-most module** — The right-most module of a dual-robotics system cannot have a 72-slot I/E station. If your current right-most expansion module contains a 72-slot I/E station, notify your Sales representative so that an additional module can shipped and installed on the right end of the system. (If you do not have space for an additional module, then Service will swap your right-most module with an existing module in the library that does not contain a 72-slot I/E station.)

Gen 2 Single Robotics Upgrade Requirements

If you are upgrading a Gen 1 library to a Gen 2 single-robotics library, please understand and address the following requirements before Service arrives to do the upgrade:

☑	**Requirement**
☐	**Scalar i6000** — Scalar i2000 libraries must be upgraded to Scalar i6000 before upgrading to Gen 2 robotics.
☐	**No DLT tape drives, media, or magazines** — Gen 2 robotics libraries do not support DLT tape drives or media. Remove these from the library before the upgrade.

Additional Comments

Record any additional information from other pages. For reference purposes, note the page number with the information. Add and number additional sheets as necessary.

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