SGI® Origin® 350 Server System User's Guide

007-4566-001

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Record of Revision

Version	Description
001	June 2003 Original publication

Contents

Figures

Tables

About This Guide

This guide provides an overview of the SGI Origin 350 server system components. It also describes how to set up and operate the Origin 350 server system.

The Origin 350 server system is either a standalone base compute module, or a base compute module connected and rackmounted with the following optional modules that expand the function of the system:

- A system expansion compute module, which is interconnected to the base compute module via a NUMAlink 3 cable, adds processors, memory, and PCI/PCI-X card slots, but may or may not have an IO9 card. (The new single system created by connecting the two modules together can include 4, 6, or 8 processors with local memory of up to 16 GB.)
- A 2U memory and PCI expansion (MPX) module provides extra memory and four PCI and PCI-X card slots to your system. See Chapter 4, "Memory and PCI Expansion (MPX) Module," for information about this module.
- The 4U PCI expansion module adds PCI slots, but no processors, no memory, and no IO9 card. There are two versions of the PCI expansion module: one module has 12 PCI slots that support 3.3-V or universal PCI cards, and the other module has 6 PCI slots that support 5-V or universal PCI cards and 6 slots that support 3.3-V or universal PCI cards. For information about this module, see *PCI Expansion Module User's Guide (5.0-V Support and/or 3.3-V Support)* (007-4499-00*x*).
- The SGI TP900 storage module provides additional storage to the system. For information about this module, see *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*). The Origin 350 server supports other storage modules. See "Storage Expansion" on page 89 for information.
- The NUMAlink module connects two or more compute modules in your server system. See Chapter 5, "NUMAlink Module," for information about this module.

This guide is written for owners, system administrators, and users of the Origin 350 server system. It is written with the assumption that the reader has a general knowledge of computers and computer operations.

Important Information

Your SGI system support engineer (SSE) should perform the addition or replacement of parts, cabling, and service of your Origin 350 server system, with the exception of the following tasks that you may perform yourself:

- Installing your system in a rack.
- Cabling the system modules to each other.
- Connecting a system console to your server system.
- Using your system console to enter commands and perform system functions such as powering on and powering off.
- Using the On/Off, reset, and non-maskable interrupt (NMI) switches on the front panel of your server system.
- Installing and removing PCI and PCI-X cards.

Caution: Exception: Because the installation and removal of an IO9 PCI card, which installs in the lowermost slot, is more complicated and can cause damage to your system if not performed properly, it can only be installed and removed by a trained SGI system support engineer.

- Installing and removing disk drives.
- Installing and removing power supplies.
- Installing and removing DIMMs.
- Installing and removing the L1 controller display.

Chapter Descriptions

The following topics are covered in this guide:

- Chapter 1, “Installation and Operation,” provides instructions for rack mounting, cabling, and operating the Origin 350 server system.
- Chapter 2, “System Overview,” provides a general overview of the Origin 350 server system, including a list of the system features. This chapter also includes a quick description of the various components and modules that can be part of an Origin 350 server system.

- Chapter 3, “Compute Module,” describes the Origin 350 base and system expansion compute modules and provides details about their internal and external components.
- Chapter 4, “Memory and PCI Expansion (MPX) Module,” describes the MPX module and provides details about its internal and external components.
- Chapter 5, “NUMAlink Module,” describes the NUMAlink module and provides details about its internal and external components.
- Chapter 6, “Installing and Removing Customer-replaceable Units,” describes how to install and remove the following customer-replaceable units (CRUs): PCI and PCI-X cards, disk drives, power supplies, memory (DIMMs), and the L1 system controller display.
- Chapter 7, “Troubleshooting,” describes how to troubleshoot your system by using the L1 controller and L1 controller messages, and by reading your system LEDs.
- Appendix A, “Technical Specifications,” contains environmental and physical specifications for the Origin 350 server system, as well as pin assignments for non-proprietary connectors for the various modules that can be part of an Origin 350 server system.
- Appendix B, “Regulatory Specifications and Safety Information,” contains regulatory specifications and safety information related to the Origin 350 server system.

An index completes this guide.

Related Publications

This section lists various information sources and explains how to access them. The following SGI publications relate to the Origin 350 server system:

- *SGI Origin 350 Server System User's Guide* (this manual) (hard copy shipped with the system and available online) (007-4566-00*x*). Use this guide to become acquainted with your server and to learn how to operate and monitor the server system. In addition, this guide contains information on installing the server system in a 19-inch rack, cabling the system, and replacing PCI and PCI-X cards, disk drives, power supplies, DIMMs, and an L1 display.

Warning: To ensure your safety and protect your system, do not add or replace any components that this guide does not designate as customer replaceable. Contact your SGI system support engineer (SSE) to install any hardware components that are not designated as customer replaceable in this guide.

- *IRIX Admin Software Installation and Licensing Guide* (hard copy shipped with system and available online) (007-1364-*xxx*). This is the complete reference guide on using the installation program, *inst*, to install software. For information on using the Software Manager to install software, see the online *Personal System Administration Guide*.
- *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) (hard copy shipped with system and available online). This guide describes the L1 and L2 controller functions, commands, and error messages that you may need to operate and maintain your system.
- *PCI Expansion Module User's Guide (5.0-V Support and/or 3.3-V Support)* (007-4499-00*x*). This guide describes the 4U PCI expansion module, which is an optional module that adds 12 PCI slots (but no processors, or memory, and no IO9 card) to your system.
- *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*). This guide describes the SGI TP900 storage module, which provides additional storage to the Origin 350 server system.
- *SGIconsole Hardware Connectivity Guide* (007-4340-00*x*) (optional). This guide describes how to connect an SGIconsole to your Origin 350 server system and other systems supported by the SGIconsole. You use the SGIconsole to manage and monitor your graphics systems.

You can obtain SGI documentation, release notes, or man pages in the following ways:

- See the SGI Technical Publications Library at http://docs.sgi.com. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.
- If it is installed on your SGI system, you can use InfoSearch, an online tool that provides a more limited set of online books, release notes, and man pages. With an IRIX system, select **Help** from the Toolchest, and then select **InfoSearch**. Or you can type **`infosearch`** on a command line.
- You can also view release notes by typing either **`grelnotes`** or **`relnotes`** on a command line.
- You can also view man pages by typing **`man`** <*title*> on a command line. The following paragraphs provide more information about man pages.

SGI systems include a set of IRIX man pages, formatted in the standard UNIX "man page" style. Important system configuration files and commands are documented on man pages. These are found online on the internal system disk (or CD-ROM) and are displayed using the `man` command. For example, to display the man page for the `Add_disk` command, type the following on a command line:

```
man Add_disk
```

References in the documentation to these pages include the name of the command and the section number in which the command is found. For example, "Add_disk(1)" refers to the `Add_disk` command and indicates that it is found in section 1 of the IRIX reference.

For additional information about displaying man pages using the `man` command, see `man(1)`.

In addition, the `apropos` command locates man pages based on keywords. For example, to display a list of man pages that describe disks, type the following on a command line:

```
apropos disk
```

For information about setting up and using `apropos`, see `apropos(1)` and `makewhatis(1M)`.

Conventions

The following conventions are used throughout this document:

Convention	Meaning
`Command`	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
variable	The italic typeface denotes variable entries and words or concepts being defined. Italic typeface is also used for book titles.
`user input`	This fixed-space font denotes literal items that the user enters in interactive sessions. Output is shown in nonbold, fixed-space font.
[ ]	Brackets enclose optional portions of a command or directive line.
...	Ellipses indicate that a preceding element can be repeated.
`man page`(*x*)	Man page section identifiers appear in parentheses after man page names.
GUI element	This font denotes the names of graphical user interface (GUI) elements such as windows, screens, dialog boxes, menus, toolbars, icons, buttons, boxes, fields, and lists.

Product Support

SGI provides a comprehensive product support and maintenance program for its products, as follows:

- If you are in North America, contact the Technical Assistance Center at 1 (800) 800 4SGI or contact your authorized service provider.
- If you are outside North America, contact the SGI subsidiary or authorized distributor in your country.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, contact SGI. Be sure to include the title and document number of the manual with your comments. (Online, the document number is located in the front matter of the manual. In printed manuals, the document number is located at the bottom of each page.)

You can contact SGI in any of the following ways:

- Send e-mail to the following address:

  techpubs@sgi.com

- Use the Feedback option on the Technical Publications Library website:

  http://docs.sgi.com

- Contact your customer service representative and ask that an incident be filed in the SGI incident tracking system.

- Send mail to the following address:

  Technical Publications
  SGI
  1600 Amphitheatre Pkwy., M/S 535
  Mountain View, California 94043-1351

- Send a fax to the attention of “Technical Publications” at +1 650 932 0801.

SGI values your comments and will respond to them promptly.

Installation and Operation

This chapter describes how to install and operate your SGI Origin 350 server system. Specifically, the following topics are covered:

Note: The rackmounting kit enables the module to be mounted in an SGI rack and in an industry-standard 19-inch wide rack.

System Installation Overview (the Road Map)

In this chapter, different installation instructions are provided for different types of system installations. Follow the instructions for your type of installation, as follows:

Note: It is assumed that you will be connecting a system console to your server system in each installation case.

- If you have ordered a server system that is already rackmounted, which means that the modules that compose your system are also already cabled together, follow the instructions in these sections:
  - "Safety Precautions" on page 3
  - "Installing a Rack" on page 5
  - "Cabling the Server System to a Power Source" on page 48
  - "Connecting the System Console" on page 51
- If you have ordered system modules and an empty rack or racks with the intention of rackmounting and cabling your own server system, follow the instructions in these sections:
  - "Safety Precautions" on page 3
  - "Installing a Rack" on page 5
  - "Unpacking and Inspecting Server System Modules" on page 23
  - "Installing the Server System in a Rack" on page 25
  - "Cabling the System Modules to Each Other" on page 45
  - "Cabling the Server System to a Power Source" on page 48
  - "Connecting the System Console" on page 51
- If you have ordered either a single- or dual-module server system that you intend to install on a table top, follow the instructions in these sections:
  - "Safety Precautions" on page 3
  - "Unpacking and Inspecting Server System Modules" on page 23
  - "Cabling the System Modules to Each Other" on page 45
  - "Cabling the Server System to a Power Source" on page 48

  - "Connecting the System Console" on page 51
- If you have your own rack, and have ordered server system modules with the intention of rackmounting and cabling your own server system, follow the instructions in these sections:
  - "Safety Precautions" on page 3
  - "Unpacking and Inspecting Server System Modules" on page 23
  - "Installing the Server System in a Rack" on page 25
  - "Cabling the System Modules to Each Other" on page 45
  - "Cabling the Server System to a Power Source" on page 48
  - "Connecting the System Console" on page 51

Safety Precautions

Before you install an Origin 350 server system, you should familiarize yourself with the safety precautions discussed in the following subsections:

- "Hazard Statements" on page 3
- "ESD Precautions" on page 4
- "Safety Measures" on page 4

Hazard Statements

During the installation of the computer system, be alert for hazard advisory statements with icons, which signify the following:

- **Caution** Indicates a potentially hazardous situation that, if not avoided, can result in minor or moderate injury. A caution statement also alerts you to unsafe practices that can result in equipment damage and/or data corruption. A caution message is accompanied by an icon as shown in the following example:

Caution:

- **Warning** indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury. A warning message is accompanied by icon as shown in the following example:

Warning:

- **Danger** indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. A danger message is accompanied by the same icon as a warning.

ESD Precautions

Observe electrostatic discharge (ESD) precautions during the entire installation process to eliminate possible ESD damage to the equipment. Wear an SGI-approved wrist strap when you handle an ESD-sensitive device. Connect the wrist strap cord directly to earth ground.

Caution: Observe all ESD precautions. Failure to do so can result in damage to the equipment.

Safety Measures

Observe the following safety measures when you install the system:

- Use caution when you remove the system from the shipping crate. Failure to handle the system carefully can result in personal injury or property damage.

Warning: Ensure that the shipping crate is positioned close to its destination before you unpack the crate.

Warning: Employ a minimum of two people to lift the system module or modules off the shipping pallet, to move the module(s) from one location to another, and to install the module(s) in a rack. Otherwise, someone could be seriously injured.

- Do not move the system while it is connected to power.

Danger: Keep fingers and conductive tools away from high-voltage areas. Failure to follow these precautions will result in serious injury or death. The high-voltage areas of the system are indicated with high-voltage warning labels.

- Ensure that a qualified electrician has properly installed the power receptacles.
- Set all circuit breakers to the OFF (**O**) position before you plug in the system power cord.

Warning: Use the following guidelines to prevent the rack from toppling over. Otherwise, people could be seriously injured and/or equipment could be damaged.

- Follow these guidelines to prevent the rack from toppling over:
- Make sure that only one module is extended out of the rack at one time.
- Install all equipment in the lowest available position in the rack.
- Ensure that the tip tray is bolted to the front of the rack.

Installing a Rack

This section describes how to install a rack at your site location, as follows:

- "Positioning and Leveling a Multiple-rack (Clustered) System" on page 20

Although these instructions are based on the assumption that you have ordered an empty rack or racks to rackmount your own modules, you can also use these instructions to install a rack that already has your server system modules rackmounted and cabled together. If this is the case, after you have completed installing your rack, proceed to "Cabling the Server System to a Power Source" on page 48 to continue your installation.

If your system will not be rackmounted, skip this section and proceed to "Unpacking and Inspecting Server System Modules" on page 23 to begin your installation.

Preinstallation Activities

Perform the following preinstallation activities days or weeks before you receive your system: perform site verifications, gather appropriate tools to complete the installation, and ensure that the correct power receptacle is installed and properly wired. These activities are explained in the following subsections:

- "Site Plan Verification" on page 6
- "Tools Required" on page 7
- "Power Receptacle Verification" on page 7

Site Plan Verification

Ensure that all site requirements are met before your system arrives. If you have questions about the site requirements or you would like to order full-size floor templates for your site, contact a site planning representative by e-mail (site@sgi.com) or by telephone (+1 715 726 2820).

Tools Required

Table 1-1 lists the tools that you need to complete the installation.

Table 1-1 Installation Tools

Tool	Part Number	Purpose
13-mm wrench	7260744	Adjust the leveling pads.
13-mm socket (3/8-in. drive)	7260726	Remove bracket bolts from tall rack shipping crate.
19-mm socket (3/8-in. drive)	9470618	Remove bolts from short rack shipping crate.
Extension, 6-in. (3/8-in. drive)	7260655	Used with ratchet and sockets.
Ratchet, reversible (3/8-in. drive)	7260755	Used with extension and sockets.
Level, 9-in.	9470556	Level the rack.

Power Receptacle Verification

Ensure that a qualified technician installs the correct power receptacles. The Origin 350 server system uses one or two single-phase power receptacles. For North American sites, the single-phase receptacle is a 30-amp, 200- to 240-volt receptacle that has two phase sockets and one ground socket. For international sites, the single-phase receptacle is a 32-amp, 200-volt receptacle that has one phase socket, one neutral socket, and one ground socket.

For North American sites, follow these steps to ensure that a single-phase power receptacle is properly wired:

1. Set the voltmeter to a high AC voltage range.
2. Check the voltage between socket X and socket Y (see Figure 1-1). The meter should read between 200 and 240 VAC.
3. Check the voltage between socket X and the ground socket. The meter should read approximately 120 VAC.
4. Check the voltage between socket Y and the ground socket. The meter should read approximately 120 VAC.
5. Check the voltage between the ground socket and an earth-ground location. The meter should read 0 VAC.

6. Change the voltmeter to a low-resistance setting.
7. Measure between the ground socket and an appropriate earth-ground location and ensure that resistance is less than 1 ohm.
8. Repeat steps 1 through 7 for any additional single-phase power receptacles.

Caution: If a voltage reading is incorrect, or if the resistance measured in step 7 is more than 1 ohm, contact a site-approved electrician. Do not proceed with the installation.

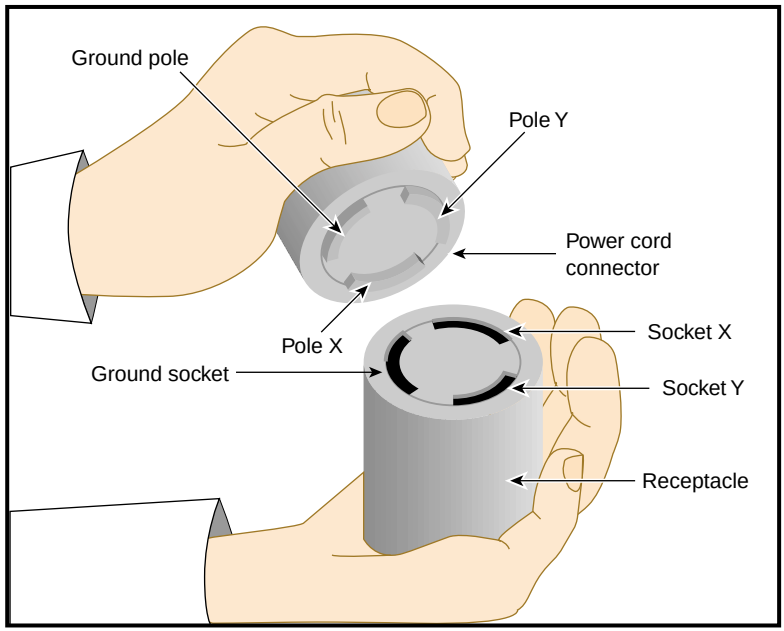


Figure 1-1 30-amp Single-phase Power Receptacle for North American Sites

For international sites, follow these steps to ensure that a single-phase power receptacle is properly wired:

1. Set the voltmeter to a high AC voltage range.
2. Check the voltage between socket 1 and socket 2 (see Figure 1-2). The meter should read between 200 and 240 VAC.

3. Check the voltage between socket 1 (line) and the ground socket. The meter should read between 200 and 240 VAC.
4. Check the voltage between socket 2 (neutral) and the ground socket. The meter should read approximately 0 VAC.
5. Check the voltage between the ground socket and an earth-ground location. The meter should read 0 VAC.
6. Change the voltmeter to a low-resistance setting.
7. Measure between the ground socket and an appropriate earth-ground location and ensure that resistance is less than 1 ohm.
8. Repeat steps 1 through 7 for any additional single-phase power receptacles.

Caution: If a voltage reading is incorrect, or if the resistance measured in step 7 is more than 1 ohm, contact a site-approved electrician. Do not proceed with the installation.

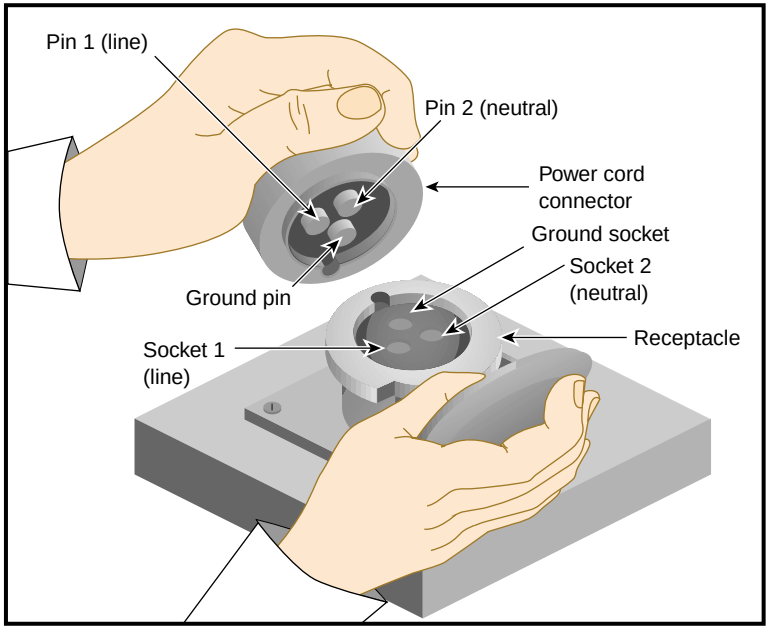


Figure 1-2 32-amp Single-phase Power Plug for International Sites

Unloading and Moving System Equipment

The Origin 350 server system arrives at the site in cardboard shipping crates.

For a short rack system, the documentation carton and the accessories carton are packed with the system. The documentation carton contains the system manuals as well as warranty and licensing information. The accessories carton contains the I/O, peripheral, and system cables, and any additional connectors or tools that are required for a specific configuration. The PC, workstation, or terminal is shipped in a separate carton.

For a tall rack system, the system documentation; accessories; and PC, workstation, or terminal arrive in separate cartons.

This section describes how to unload and transport the system to its designated location, as follows:

- "Unloading the Equipment from the Truck" on page 10
- "Inspecting the Shipping Crate" on page 12
- "Transporting the Shipping Crate" on page 13

Unloading the Equipment from the Truck

If your loading dock is the same height as the transportation vehicle, use a pallet jack to unload the system from the transportation vehicle. The pallet jack should have 48-in. tines or forks. Follow any instructions that are printed on the packing crates.

If the loading dock is not the same height as the vehicle, you must provide a forklift or another approved method to unload the system. You can use a platform or ramp to obtain the desired level as long as the ramp incline does not exceed a ratio of one unit vertical to six units horizontal. For more information on site requirements, contact site planning by e-mail (site@sgi.com) or by telephone (+1 715 726 2820).

Warning: Use two or more people to prevent computer equipment from rolling off the transportation vehicle. Failure to do so could result in serious damage to the computer equipment.

If your site does not have a loading dock, arrange for a forklift to unload the system from the transportation vehicle. Ensure that two or three people are available to help unload the equipment. Move all crates slowly and carefully.

Figure 1-3 shows the lift openings and dimensions of a tall rack shipping crate. This figure also shows where to position the pallet jack.

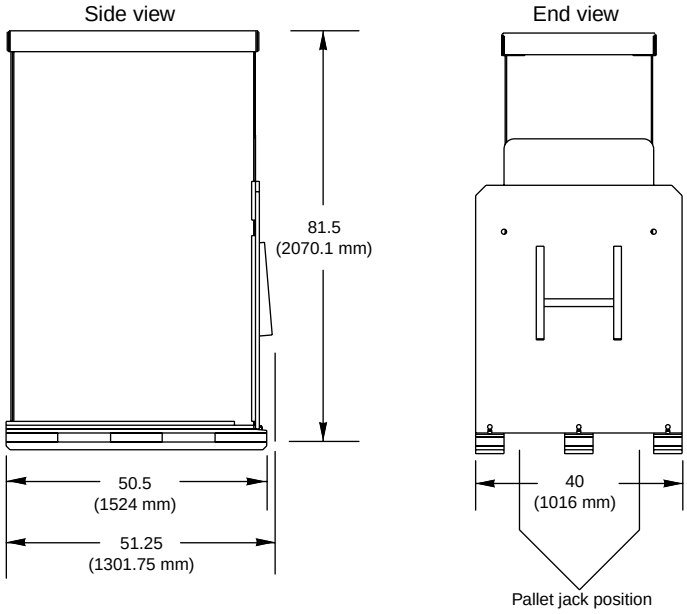


Figure 1-3 Dimensions of Tall Rack Shipping Crate

Figure 1-4 shows the lift openings and dimensions of a short rack shipping crate. This figure also shows where to position the pallet jack.

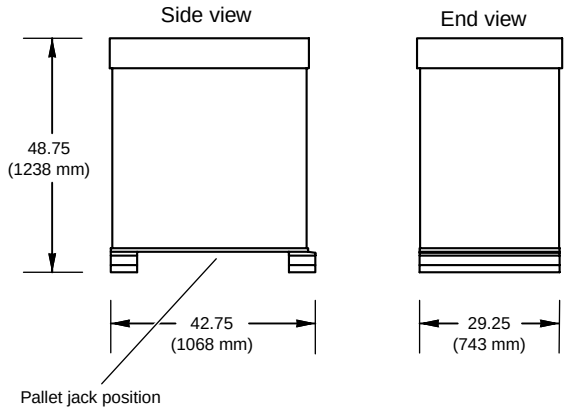


Figure 1-4 Dimensions of Short Rack Shipping Crate

Inspecting the Shipping Crate

After the system is unloaded from the truck, follow these steps before you unpack it:

1. Ensure that the crates and cartons arrive unopened.
2. Inspect the shipping crate for signs of external damage such as dents, holes, crushed corners, and water marks.
3. Ensure that the tilt watch has not been tripped.
4. If the crate is damaged, file a damage claim with the carrier immediately. In addition, notify your local Customer Support Center (CSC) for any missing, incorrect, or damaged items. For CSC contact information, see http://www.sgi.com/support/supportcenters.html.

Transporting the Shipping Crate

Use a pallet jack with forks that are 48 in. (122 cm) long or longer to transport the shipping crate to the designated location. See Figure 1-3 and Figure 1-4 for the crate dimensions and location to position the pallet jack. For system weight and dimensions, contact site planning by e-mail (site@sgi.com) or by telephone (+1 715 726 2820).

If the crate does not fit through all access doors, you may need to partially disassemble the crate.

Caution: If the system shipping or storage environment is significantly colder than the environment in which it will be installed [40 °F (22 °C) or greater disparity], leave the rack in its shipping crate for at least 24 hours at room temperature before you start the installation. This acclimation prevents damage to the equipment that could result from thermal shock and condensation.

Removing a Short Rack from the Shipping Crate

Warning: Be careful when you unpack and move the short rack system. Ensure that the rack remains on a level surface and that the rack weight remains evenly distributed across the four casters. If you must lift the casters over an obstacle, such as a door threshold, use proper lifting techniques and employ a minimum of two people.

Caution: Do not subject the rack to any unnecessary shocks or vibration while you unpack and install the system.

See Figure 1-5 as you follow these steps; the numbered illustrations correspond to the numbered steps.

1. Ensure that the temperature of the rack is acclimated to the environment in which you are installing it.
2. Remove the crate cover.
3. Lift the ramp out of the crate and set it aside.
4. Remove the documentation carton, accessories carton, and cardboard packing material.
5. Lift the sidewalls of the crate up and over the system.

6. Remove the four bolts that secure the rack to the crate. You must reach underneath the crate and feel for the bolts.
7. Align the holes in the edge of the ramp with the pegs in the base of the crate. Ensure that the ramp is secure.
8. Remove the gate pins from the left and right ends of the gate. Then remove the gate.
9. Pull the rack down the ramp.

Warning: The maximum weight of the short rack is 488 lb (221 kg). Use caution when you roll the rack down the ramp.

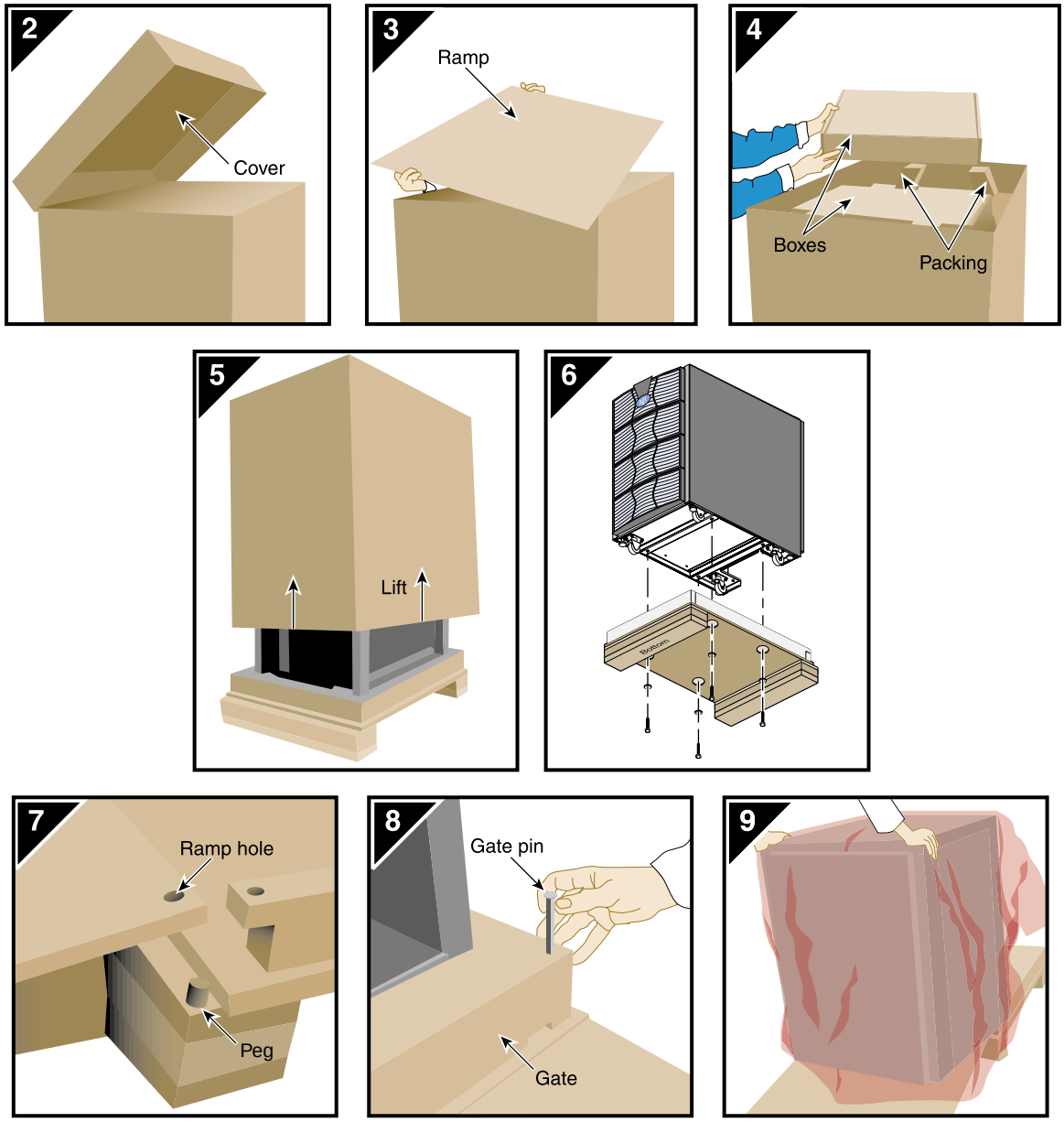


Figure 1-5 Removing a Short Rack from the Shipping Crate

Removing a Tall Rack from the Shipping Crate

Warning: In its maximum configuration, a tall rack system weighs approximately 1,110 lb (499 kg). Use caution when you unpack and move this rack. Ensure that the rack remains on a level surface and that the rack weight remains evenly distributed across the four casters.

To unpack a tall rack, you will need the following tools:

- Extension, 6-inch, 3/8-in. drive
- 13-mm standard 3/8-in. drive socket
- Ratchet, reversible, 3/8-in. drive

See Figure 1-6 as you follow these steps; the numbered illustrations correspond to the numbered steps.

1. Ensure that the temperature of the rack is acclimated to the environment in which you are installing it and that the system crate is in a stable, upright position.
2. Remove the bands that secure the crate.

   Note: Brace the wooden ramp as you remove the horizontal band that surrounds the crate and the wooden ramp. The ramp moves freely after you remove this band.

3. Place the ramp so that the three holes in the edge of the ramp align with the pegs in the base of the pallet deck.
4. Remove the cardboard cover, the two cardboard sidewalls, and the foam cushion.
5. Remove the bolts that secure the rack to the pallet deck, as follows:
   a. Remove the top four bolts from the rear mounting bracket; do not remove the bottom bolts.
   b. Remove the four bolts that secure the front mounting bracket and tip tray to the bottom of the pallet deck. Set the tip tray aside.
   c. Remove the top four bolts from the front mounting bracket. Set the mounting bracket aside.

6. Use two people to roll the rack out of the crate and down the ramp.

Warning: Use extreme caution when you roll the tall rack down the ramp. Personal injury and system damage could result if the rack becomes unbalanced or gains too much momentum when it rolls down the ramp.

7. Bolt the tip tray to the front of the rack before you move the rack to its designated location. This tray prevents the rack from tipping while you move the rack.

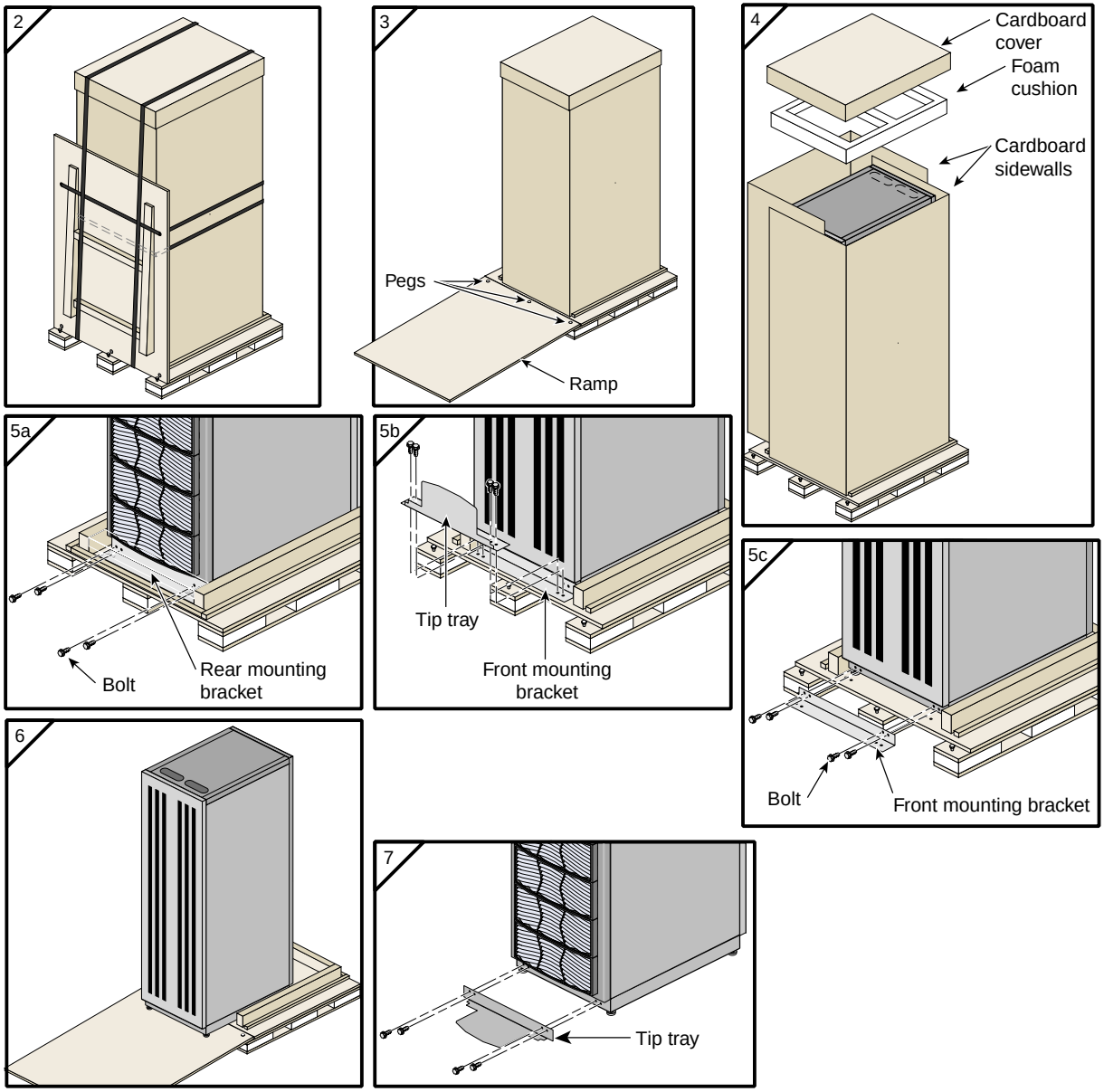


Figure 1-6 Removing a Tall Rack from the Shipping Crate

Positioning and Leveling a Single-rack System

Caution: To avoid ESD damage to the electronic components, be sure to position the rack before you remove the ESD bag that covers the rack assembly.

To position and level a single-rack system, follow these steps:

1. Grasp the rear of the rack and roll the rack to its designated location.
2. Remove the ESD bag.
3. If you are installing a tall rack, adjust the leveling bolts, as shown in Figure 1-7, until the rack is level.

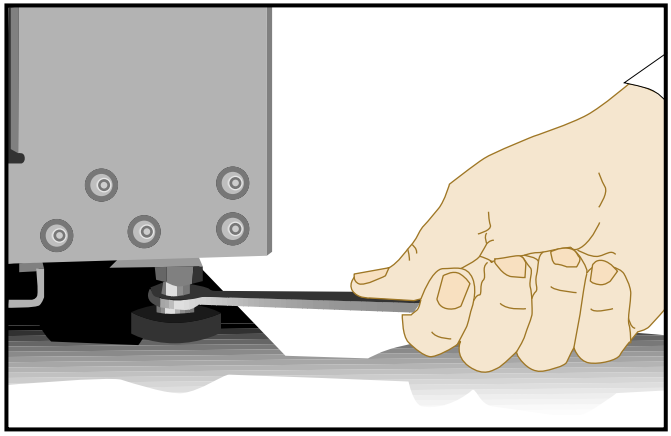


Figure 1-7 Leveling Bolts

4. Ensure that the circuit breaker on the power distribution unit is in the OFF (**O**) position. Then connect the power cord to a grounded power outlet. Plugging in the power cord grounds the rack.

5. Secure the rack with seismic tie-downs if you are installing the system in an earthquake zone.

Note: Tall and short racks have four threaded holes that are located at the bottom of the rack (see Figure 1-8). Use these holes to secure the seismic tie-downs. SGI does not supply the seismic tie-downs.

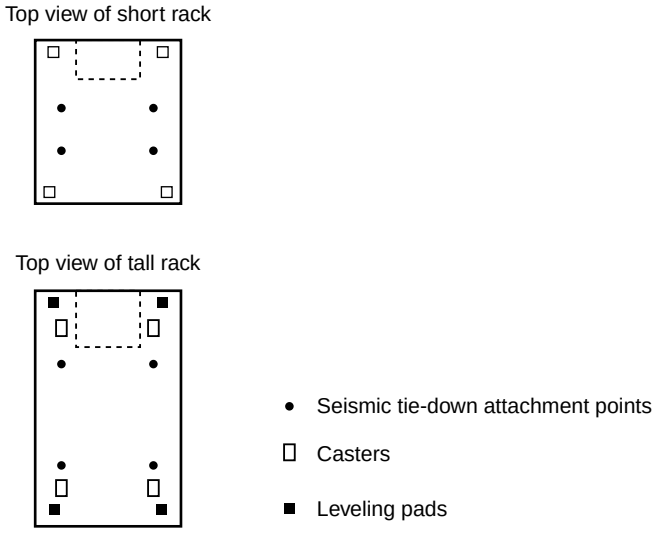


Figure 1-8 Seismic Tie-down Attachment Points

Positioning and Leveling a Multiple-rack (Clustered) System

Caution: To avoid ESD damage to the electronic components, be sure to position the racks before you remove the ESD bags that cover the rack assemblies.

To position and level a multiple-rack (clustered) system, follow these steps:

1. Grasp the rear of each rack and roll the rack to its designated location.
2. Remove the ESD bags.

3. Adjust the leveling bolts of rack 001, as shown in Figure 1-9, until the rack is level.

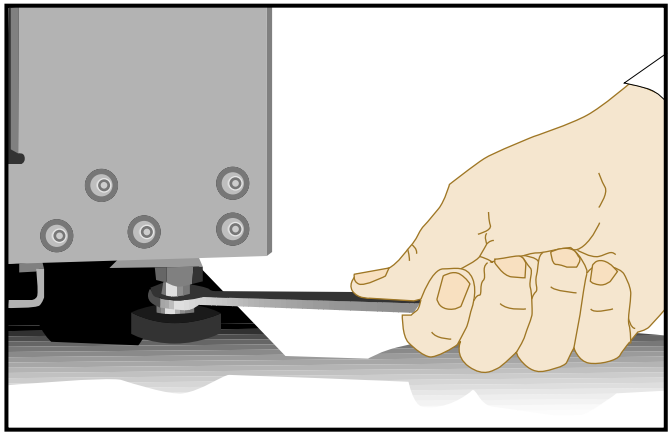


Figure 1-9 Leveling Bolts

4. Using the leveling bolts of rack 002, adjust rack 002 so that the joining holes of rack 002 align with the joining holes of rack 001. See Figure 1-10.
5. Using the provided straps, screws, and washers, bolt the racks together in the four designated locations shown in Figure 1-10.
6. If your system has additional racks, repeat steps 4 and 5 until all of the racks are bolted together.
7. Ensure that the circuit breakers on the power distribution units are in the OFF (**O**) position. Then connect the power cords to grounded power outlets. Plugging in the power cords grounds the racks.
8. Secure the racks with seismic tie-downs if you are installing the system in an earthquake zone.

Note: Tall racks have four threaded holes that are located at the bottom of the rack (see Figure 1-8 on page 20). Use these holes to secure the seismic tie-downs. SGI does not supply the seismic tie-downs.

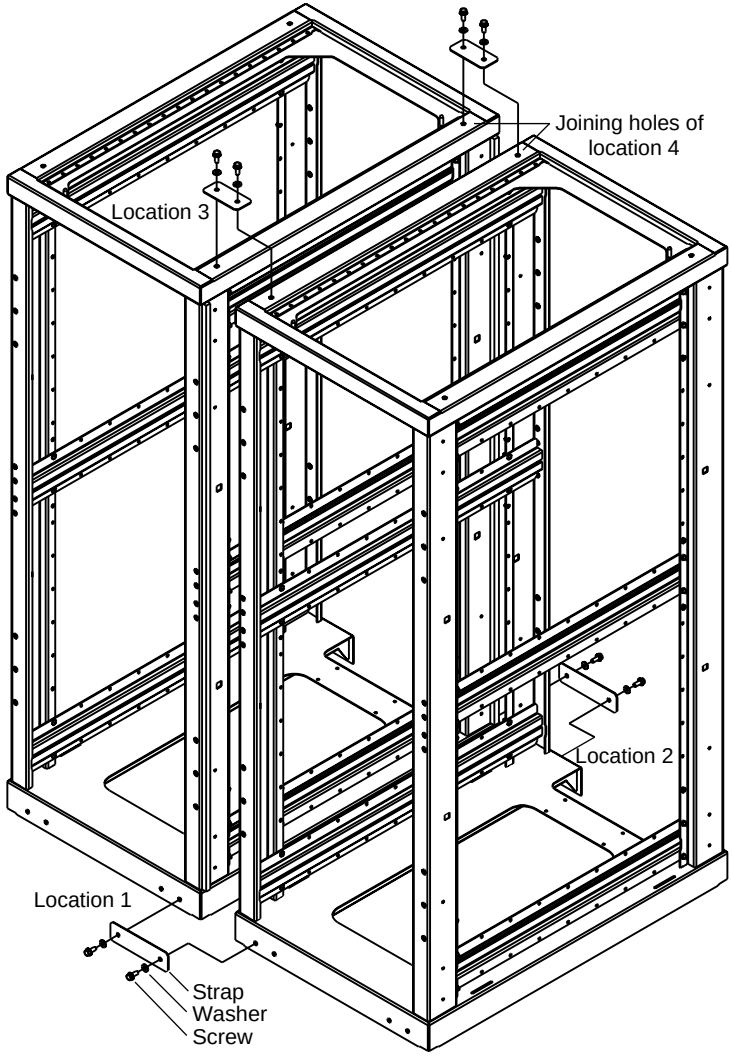


Figure 1-10 Joining Locations

Unpacking and Inspecting Server System Modules

This section is written for the person who wants to install his or her own individual server system modules either on a rack or on a tabletop. It describes how to unpack and inspect individual server system modules.

Before unpacking your modules, inspect the packaging container for evidence of mishandling during transit. If the packaging container is damaged, photograph it for reference. After you remove the contents, keep the damaged container and the packing materials.

Remove the module or modules from the packaging container and ensure that all accessories are included. Inspect the module(s) and accessories for damage. If the contents appear damaged, file a damage claim with the carrier immediately. In addition, notify your local Customer Support Center (CSC) for any missing, incorrect, or damaged items. For CSC contact information, see http://www.sgi.com/support/supportcenters.html.

Setting the Server System on a Table Top

If your server system is a single module (the base compute module) system or a dual-module (a base compute module cabled to an MPX module, for example) system, and you choose to operate it on a table top, you need to install five self-adhesive feet that are supplied with the module(s). To install the feet, follow these steps:

1. Place the module upside down on a flat, stable surface.
2. Peel off the protective film from the feet and place them on the five circular marks, as shown in Figure 1-11.
3. If you have a dual-module system, repeat steps 1 and 2 to put feet on the second module. (If you have a dual-module system, it is recommended that you place the base compute module on the bottom, and that you place the other module on top.)

Note: If you mount the system in a rack at a later date, you will need to remove the feet.

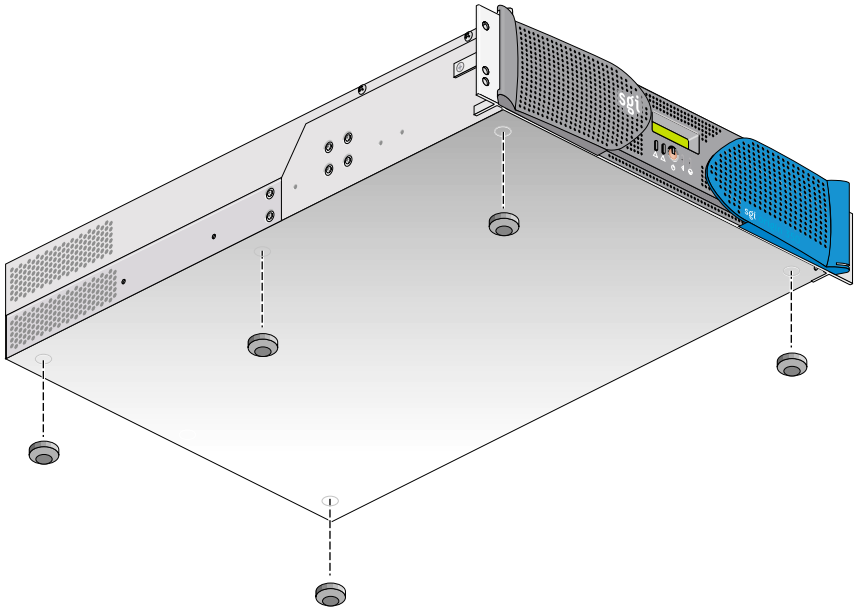


Figure 1-11 Location of Table-mounting Feet

Installing the Server System in a Rack

This section describes how to install the modules that compose an Origin 350 server system on a rack with either a slide rail assembly or with a shelf rail assembly (also known as a fixed rail assembly). It also describes how to remove these modules from these racks.

The base compute module, the system expansion compute module, and the MPX module are rackmounted with slide rails. The NUMAlink module, the PCI expansion module, and the SGI TP900 storage system are rackmounted with shelf rails.

This rackmounting information is found in the following sections:

Rackmounting Modules with Slide Rails

This section describes how to rackmount modules with slide rail assemblies. You can use the instructions to rackmount base compute modules, system expansion compute modules, and MPX modules. This section includes the following topics:

Determining Space Requirements

Table 1-2 specifies the space requirements when rackmounting either a base compute module, a system expansion compute module, or an MPX module in a 19-inch rack.

Table 1-2 Module Space Requirements

Height	3.44 inches (8.74 cm)
Width	17.06 inches (43.33 cm)
Depth	27 inches (68.58 cm) (with bezel)
Weight	37.80 lb (17.18 kg) minimum configuration; 44.50 lb (20.23 kg) maximum configuration[a]
Required front clearance for module	8.25 in. (20.96 cm)
Required rear clearance for module	10 in. (25.40 cm)
Required side clearance for module	6 in. (15.24 cm) (right side) No clearance requirement for left side.
Required front clearance for rack	36 in. (91 cm)
Required rear clearance for rack	36 in. (91 cm)

a. Weight will vary depending on whether the system has one or two power supplies, on the amount of DIMMs installed, and on whether you have one or two disk drives in your system.

Checking the Slide Rail Hardware

Table 1-3 lists the hardware that you will use to mount the module in a 19-inch rack.

Table 1-3 Rackmounting Hardware

Hardware Type	Qty	Usage
Slide rail assembly (includes chassis rail)	2	Allows the module to slide in and out of rack. (The left and right slides are identical.)
2-in. rear mounting bracket	2	Mounts the slide rails to the rear rack rails. (The left and right brackets are identical.)
10-24 x 1/4-in. Phillips screw	10	Secures the chassis rails to the module.

Table 1-3 Rackmounting Hardware **(continued)**

Hardware Type	Qty	Usage
10-32 x 1/2-in. Phillips screw Shoulder washer Barnut	8 8 4	Secures the slide rails to the rack rails.
10-32 x 1/2-in. Phillips screw Barnut	4 2	Secures the slide rails to their mounting brackets.
10-32 clip nut	2	Provides a threaded hole for fastening the module front panel to the rack rails.
10-32 x 1/2-in. Phillips screw	2	Fastens the module front panel to the clip nut.

Preparing the Slide Rail Assemblies

The slide rail assembly consists of a chassis rail and a slide rail. You need to remove the chassis rail from the slide rail so that you can install a mounting bracket to the slide rail and attach the chassis rail to the module (see “Preparing the Module” on page 30). To remove the chassis rail from the slide rail, follow these steps:

1. Remove the two slide rail assemblies and the rear mounting brackets from the shipping container.
2. Extend each slide rail assembly until the safety latch snaps into place.
3. Press the safety latch and remove the chassis rail from the slide rail, as shown in Figure 1-12.

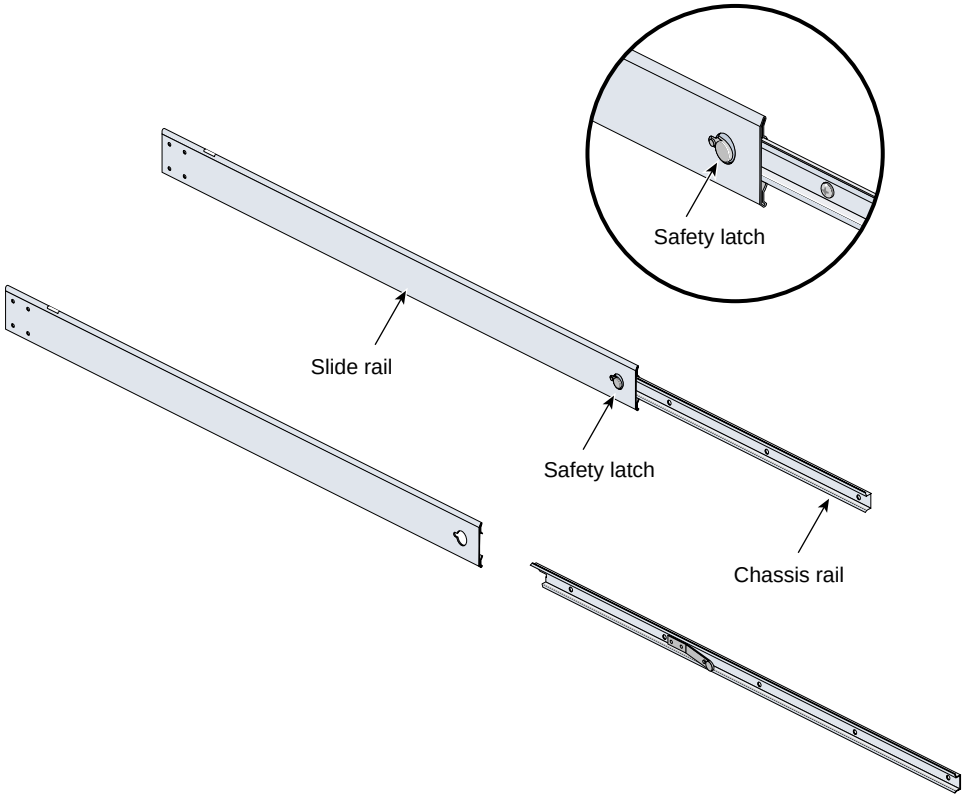


Figure 1-12 Removing the Chassis Rail from the Slide Rail

4. Place one of the mounting brackets on the back of the slide rail, as shown in Figure 1-13. Adjust the position of the mounting bracket on the slide rail according to the depth of the rack.
5. Place a barnut next to the mounting bracket. Secure the mounting bracket to the slide rail by inserting two 10-32 x 1/2-in. screws through the assembly and into the barnut, as shown in Figure 1-13.
6. Repeat steps 4 and 5 to attach a mounting bracket to the other slide rail.

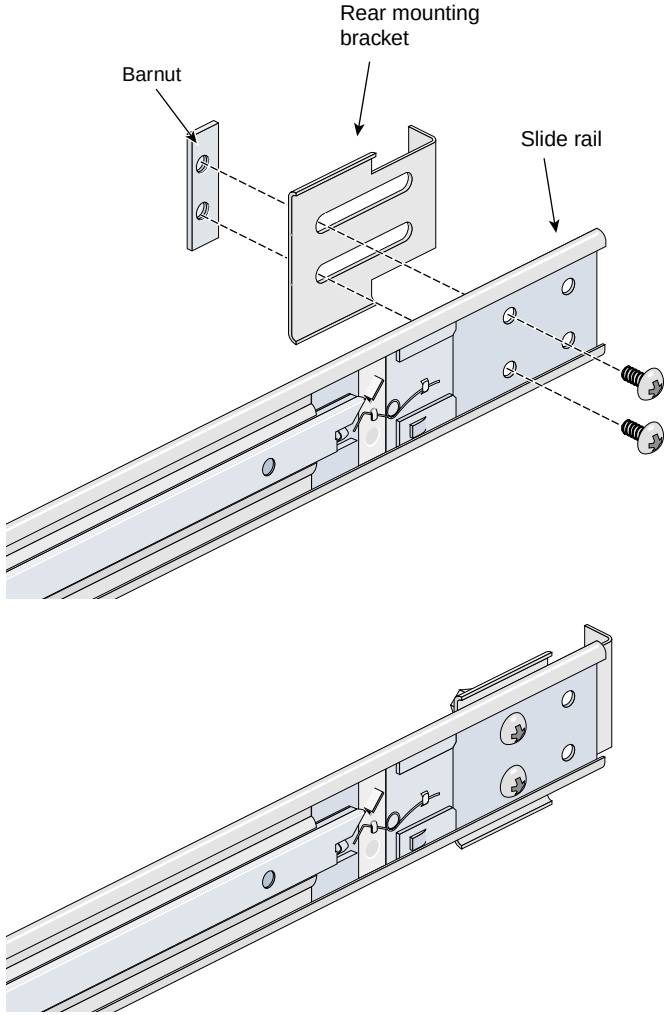


Figure 1-13 Attaching the Rear Mounting Bracket to the Slide Rail

Preparing the Module

To attach the chassis rails to the module, follow these steps:

1. Place the module on a flat, stable surface.
2. Using four 10-24 x 1/4-in. screws, attach one of the chassis rails to the right side of the module chassis. Ensure that the rail is installed in the correct direction (see Figure 1-14).

Caution: Use only the 1/4-in. (0.64 cm) length screws. Longer screws damage internal components in the module.

3. Using five 10-24 x 1/4-in. screws, attach the second rail to the left side of the module chassis. Again, ensure that the rail is installed in the correct direction.

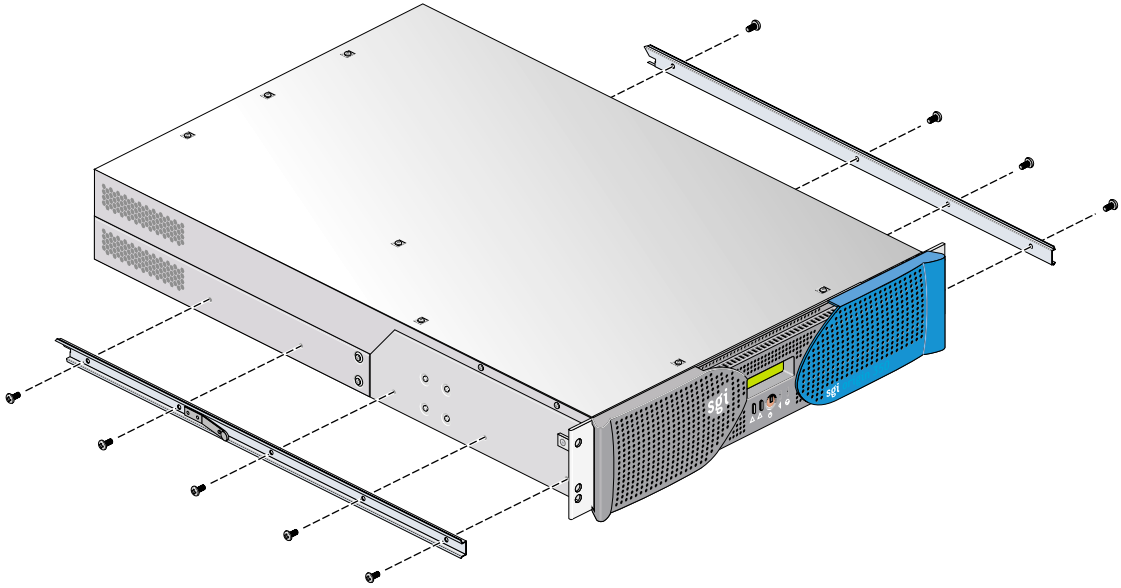


Figure 1-14 Attaching Chassis Rails to the Module Chassis

Determining Where to Attach the Slide Rail in the Rack

The module requires two units (2U) of space within the rack (one unit is equivalent to 1.75 inches [44.5 cm]). To determine where you should install the slide rails in the rack, you must count mounting holes. Each U contains three mounting holes; therefore, in the 2U of space that the module occupies, there are six mounting holes. The bottom hole of the 2U space is hole 1. The top mounting hole in the 2U space is hole 6. See Figure 1-15.

Note: A module in the rack is identified by the lowest U number that it occupies. For example, in Figure 1-15 the module resides in U5 (the fifth unit within the rack).

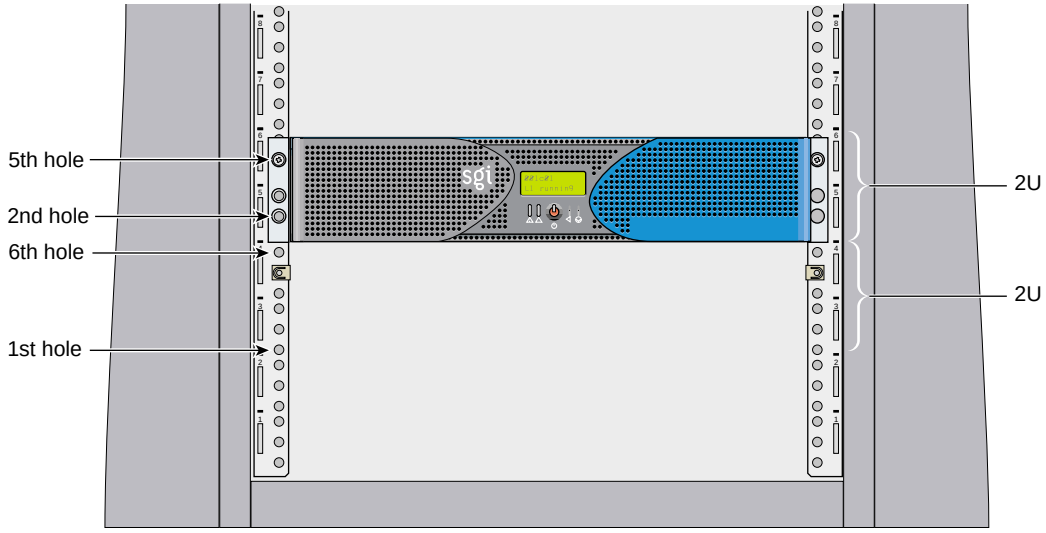


Figure 1-15 Mounting Hole Pattern of Rack Vertical Rails

To determine how many mounting holes you must count, use the following formula: **3 x (the lowest U number that the module will occupy) - 2**. For example, when you want to install the module in locations U9 and U10, count 25 mounting holes (3 x 9 - 2) starting from the bottom of the rack. The 25th hole is the first mounting hole of U9.

Attaching the Slide Rail to the Rack

To attach the slide rail to the rack, follow these steps:

Tip: The slide rails must be level in the rack. To ensure that you install the slide rails correctly, carefully count the mounting holes on all of the rack rails (two front rails and two rear rails).

1. Locate eight 10-32 x 1/2-in. Phillips screws, eight shoulder washers, and four barnuts.
2. Place one of the barnuts inside the rack and align it with the second and third holes of the selected 2U of space (see Figure 1-16).

   Note: The holes in the barnuts are not centered. The barnuts need to be placed in such a way that the holes are closest to the inside edge of the rack rails. See Figure 1-16.

3. Insert two screws with shoulder washers through the rack rail to hold the barnut in place. The screws should not be tightened at this point.
4. Repeat steps 2 and 3 to install the remaining three barnuts on the other three rack rails (front and rear of rack).

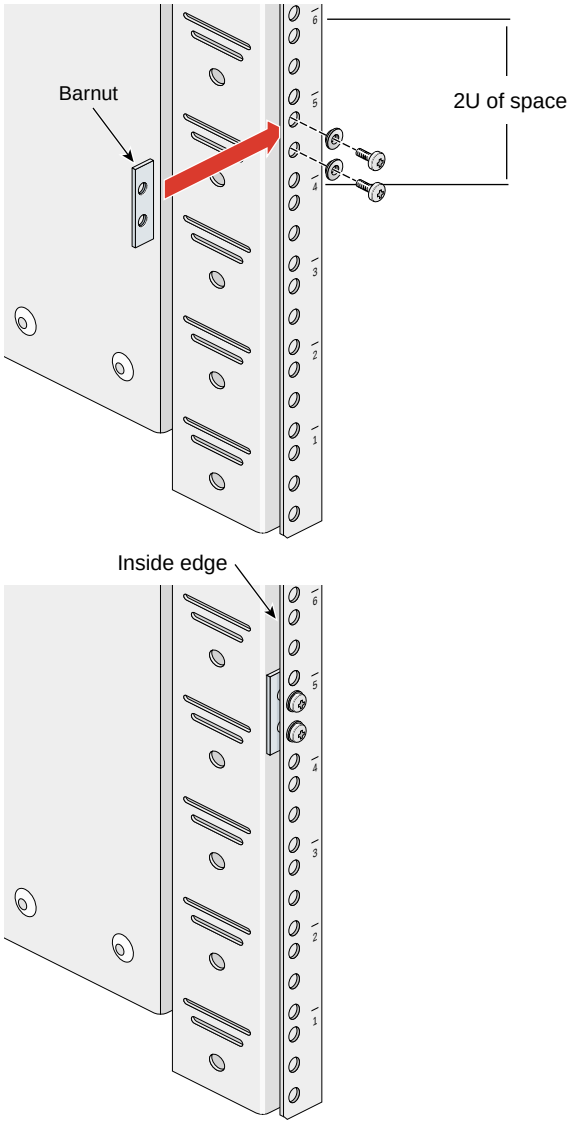


Figure 1-16 Placing the Barnuts on the Rack Rails

5. Insert the front and rear brackets of one of the slide rails between the rack rails and the barnuts, as shown in Figure 1-17.
6. Tighten the screws on the front- and rear-end of the rails. Do not tighten firmly at this point, because all screws will be firmly tightened once the module is installed in the rack.
7. Repeat steps 5 and 6 to attach the second slide rail to the other side of the rack.

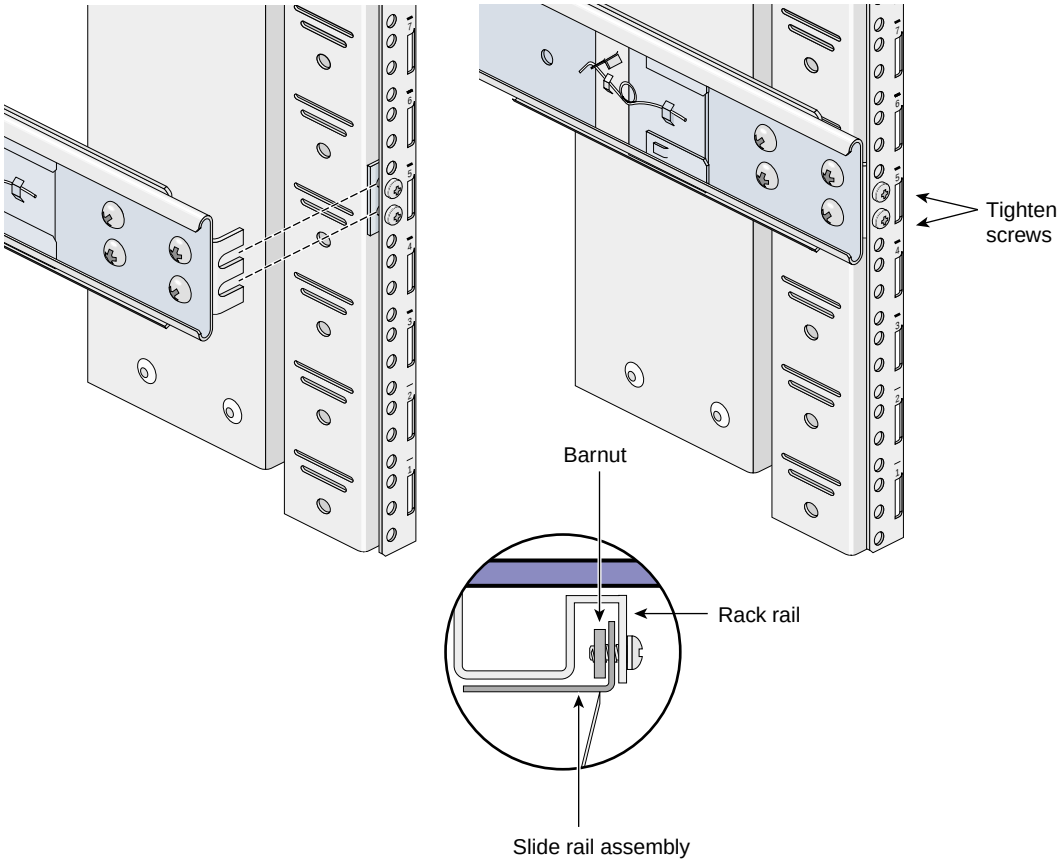


Figure 1-17 Attaching the Slide Rail to the Rack

Installing Clip Nuts in Rack Rails

Clip nuts secure the modules to the rack. To install the clip nuts, slide the clip nuts over the fifth hole of the selected 2U of space on each of the front rails. See Figure 1-18 for details.

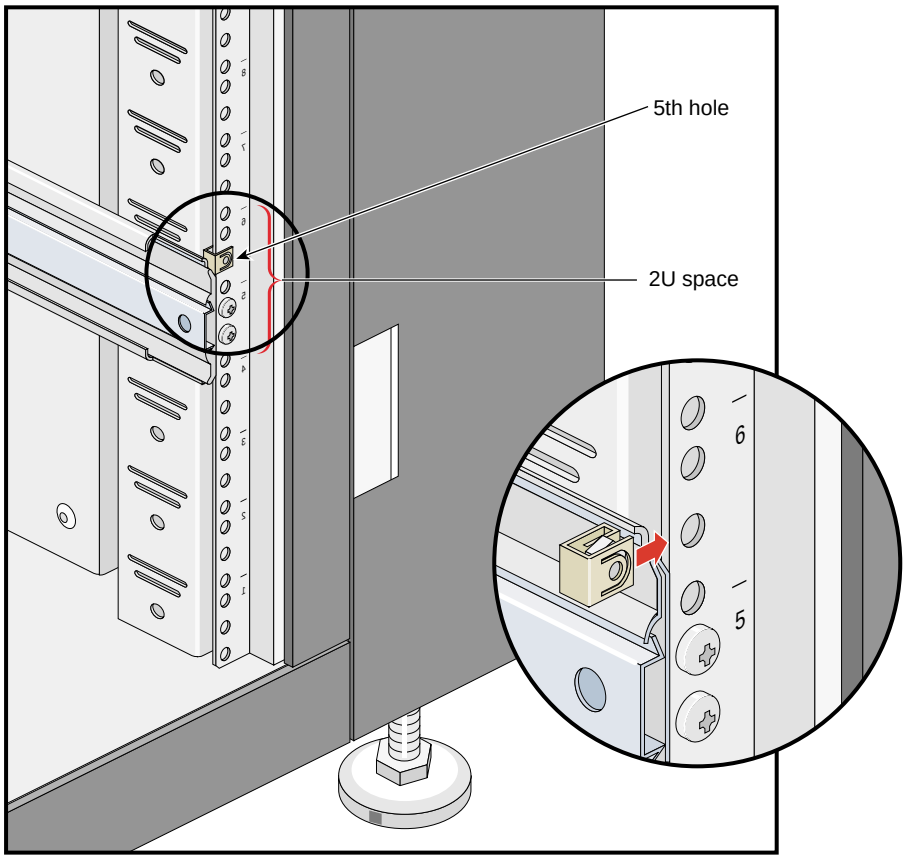


Figure 1-18 Installing Clip Nuts in Rack Rails

Installing the Module in the Rack

To install the module in the rack, follow these steps:

Note: Step 2 requires two people.

1. Fully extend the left and right slide rails from the rack until they lock into place.
2. With one person holding each side of the module, align the chassis rails of the module with the slide rails of the rack.
3. Slide the chassis rails into the slide rails until the chassis rails are stopped by the safety latches.
4. Press the safety latches on both sides of the module to fully seat the chassis rails into the slide rails (see Figure 1-19).
5. Firmly tighten all screws (the eight screws that secure the slide rails to the rack rails).

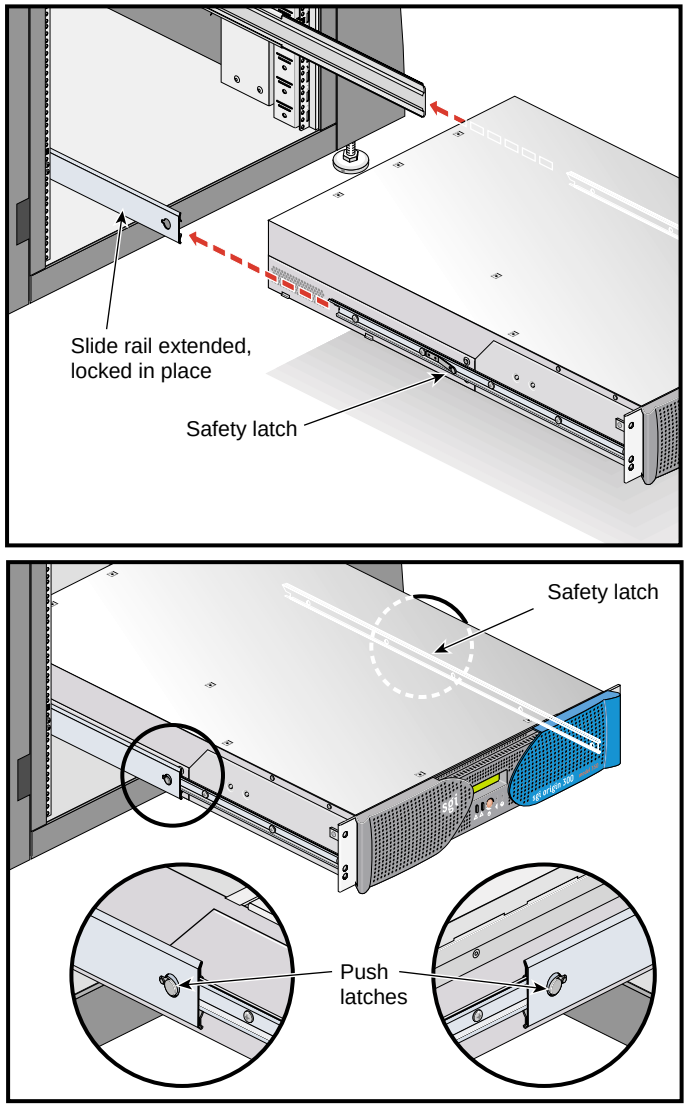


Figure 1-19 Pressing the Safety Latches

6. Secure the module to the rack by inserting a 10-32 x 1/2-in. Phillips screw in the top hole of each chassis ear (see Figure 1-20).

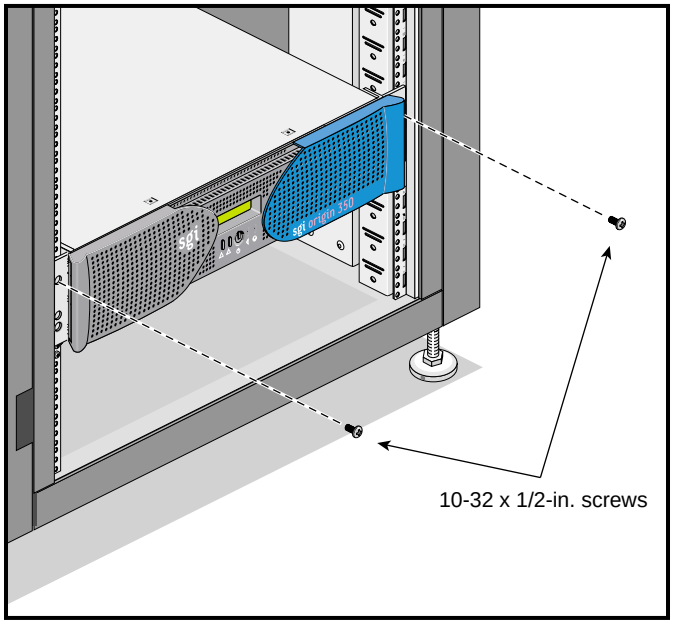


Figure 1-20 Securing the Module to the Rack

Adjusting the Position of the Rackmounted Module

Once the module is installed in the rack, you can adjust the position of the module in the rack (upward and sideways). To adjust the position of the module, loosen the front mounting screws, adjust the module to the desired position, and then tighten the mounting screws.

Caution: Do not lift the module by its bezel; it is not designed to handle the weight of the module. Instead, use the chassis ears to move the module (see Figure 1-20).

Removing a Module on Slide Rails from a Rack

To remove the module that is on slide rails on a rack, follow these steps:

1. Power off the module. For instructions on how to power off the module, see "Powering the Server System On and Off" on page 53.
2. Disconnect all of the cables at the rear of the module.

Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. Remove the two screws that secure the module to the front rails of the rack.
4. Carefully pull the module from the rack until it is stopped by the safety latches.
5. With one person holding each side, release the safety latches on both sides of the module and pull the module out of the slide rail (see Figure 1-21).
6. Place the module on a flat, stable surface.

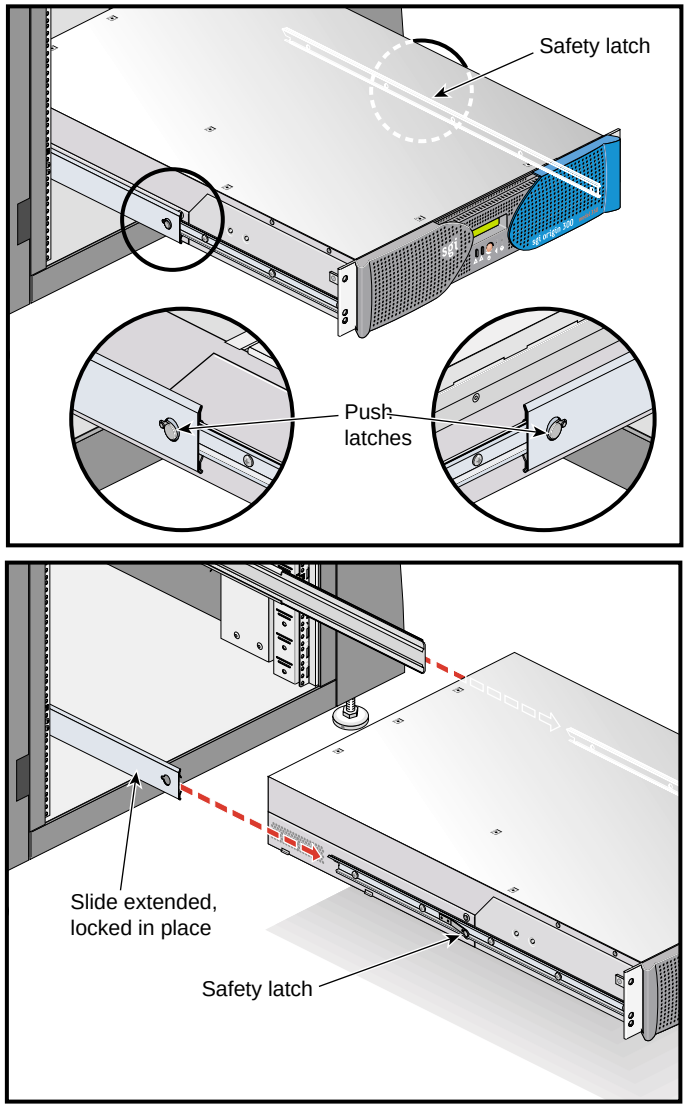


Figure 1-21 Releasing the Safety Latches

7. To slide the slide rails back into the rack, push down on the slide latches as shown in Figure 1-22.

Note: Before you can reinstall a module into the rack, fully extend the slide rails from the rack until they lock into place.

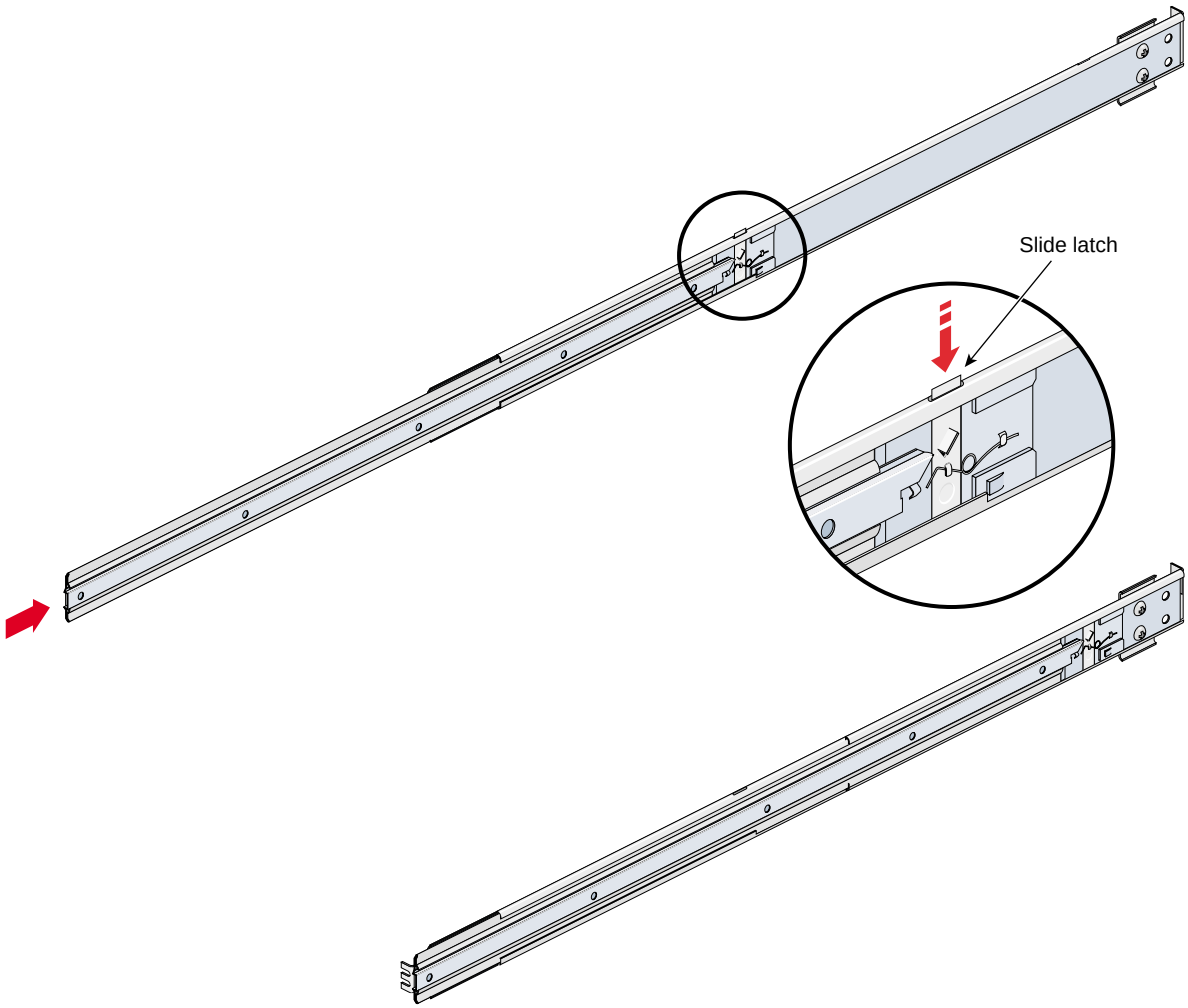


Figure 1-22 Releasing the Slide Latches

Rackmounting Modules with Shelf Rails

This section describes how to rackmount a module using shelf rails. The NUMAlink module, the 4U PCI expansion module, and the TP900 storage module are rackmounted with shelf rails (also known as fixed rails).

The module ships with shelf rails that must be mounted in the rack. The shelf rails support the module within the rack.

To attach the shelf rails to the rack, follow these steps:

1. Locate the slot location in the rack in which you will install the module.
2. In the slot location from step 1, position the left shelf rail at a 90-degree angle to the front and rear rack rails (see Figure 1-23).
3. Insert the top-front bracket tab into one of the narrow slots in the front rack rail.
4. Insert the top-rear bracket tab into the narrow slot in the rear rack rail.

Note: Verify that the tabs are the same height to ensure that the module is level in the rack.

---

5. Lower the bottom of the shelf rail until its two lower tabs engage with the wide slots in the front and rear rack rails.
6. Install the two push-in fasteners that secure the shelf rail to the front and rear rack rails.
7. Place the EMI gasket bracket on the rear rack rail. Then install the two screws that secure the bracket and the shelf to the rear rack rail.
8. Repeat steps 2 through 7 for the right shelf rail.

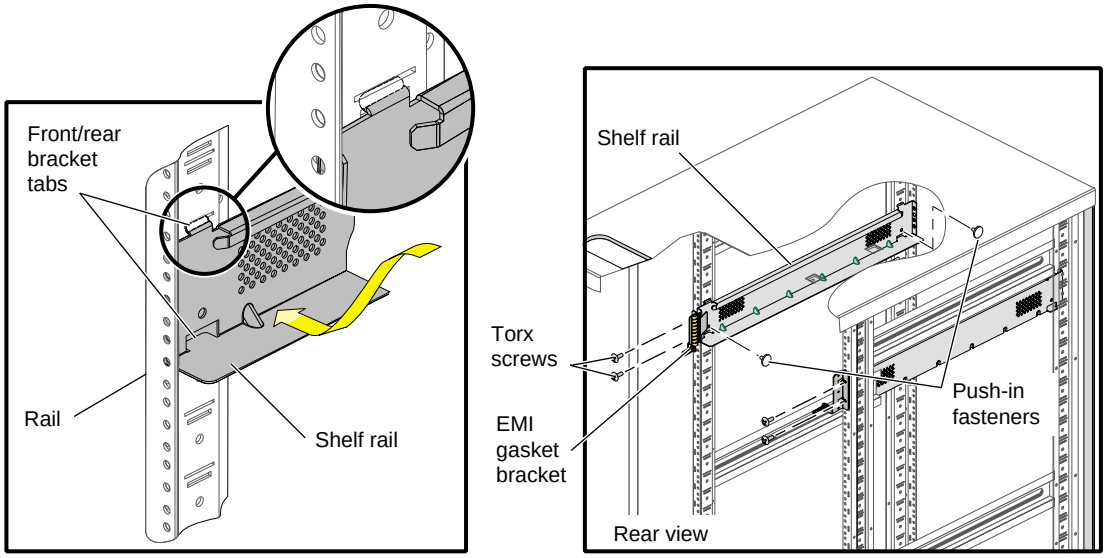


Figure 1-23 Installing the Shelf Rails in the Rack

9. Set the rear edge of the module on the shelf rails. Then slide the module into the rack until the module ears are snug against the rack rails. See Figure 1-24.
10. Fasten the module to the front rails of the rack with the screws and clip nuts provided. See Figure 1-24.
11. Fasten the module to the rear rails of the rack with the screws and clip nuts provided.

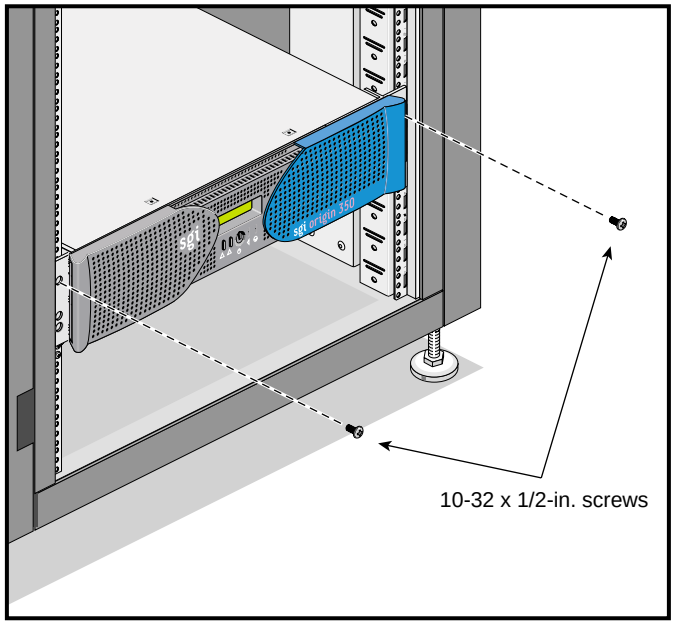


Figure 1-24 Securing the Module to the Rack

Removing a Module on Shelf Rails from a Rack

To remove the module that is on shelf rails on a rack, follow these steps:

1. Power off the module. For instructions on how to power off the module, see "Powering the Server System On and Off" on page 53.
2. Disconnect all of the cables at the rear of the module.

Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. Remove the two screws and clip nuts that secure the module to the front rails of the rack.
4. Remove the two screws and clip nuts that secure the module to the rear rails of the rack.

5. Carefully and slowly slide out the module by holding and pulling on one of the module ears with one hand, while placing the other hand securely under the module so that it supports the weight of the module as it clears the rack.
6. Place the module on a flat, stable surface.

Cabling the System Modules to Each Other

Some configurations of an Origin 350 server system will consist of either two or more modules. This section describes how to cable together these multiple modules.

Note: If your server system is made up of a single module, you can skip this section and proceed to "Cabling the Server System to a Power Source" on page 48 for instructions to connect your system to power.

Cabling two modules to each other that consist of a base compute module and a module to expand the server system's functionality, such as a system expansion compute module, entails connecting a cable from base compute module's NUMAlink connector to the NUMAlink connector of the added module.

Figure 1-25 shows the cabling of a base compute module to a system expansion compute module, which can add up to 8 GB of local memory, four PCI/PCI-X slots, and an IO9 card to a server system. (The IO9 card adds real time interrupt input [RTI] and output [RTO] connectors, an Ethernet port, and a SCSI port to the system.)

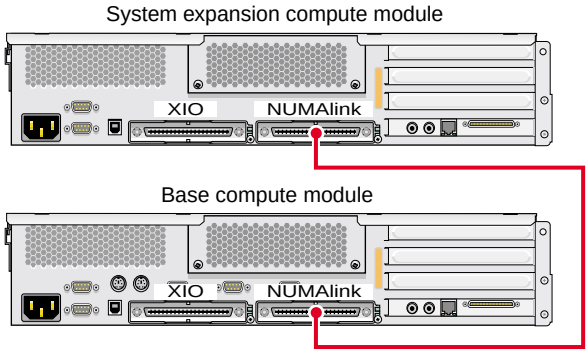


Figure 1-25 Cabling a Base Compute Module to a System Expansion Compute Module

Figure 1-26 shows the cabling of the following server system modules (and other items) to each other in a 39U rack:

- SGIconsole (system console) to monitor and manage your system. (The LAN2 port connects to the L2 controller's Ethernet port with an RJ-45 twisted-pair cable.)
- L2 controller. (Using an RJ-45 twisted-pair cable, the L2 controller's L1 port connects to the NUMAlink module's L1 port.)
- Two 4U PCI expansion modules. (Using a NUMAlink 3 cable, the NUMAlink port of the top PCI expansion module connects to the NUMAlink module's 2-B port. Using another NUMAlink 3 cable, the NUMAlink port of the lower PCI expansion module connects to the NUMAlink module's 3-C port.
- NUMAlink module. (Using a NUMAlink 3 cable, the NUMAlink module's G-7 port connects to the system expansion compute module's NUMAlink port. Using another NUMAlink 3 cable, the NUMAlink module's F-6 port connects to the base compute module's NUMAlink port connector.
- System expansion compute module.
- Base compute module. (Using a SCSI cable, the SCSI port on the base compute module connects to the TP900 module's SCSI port.)
- TP900 storage module.

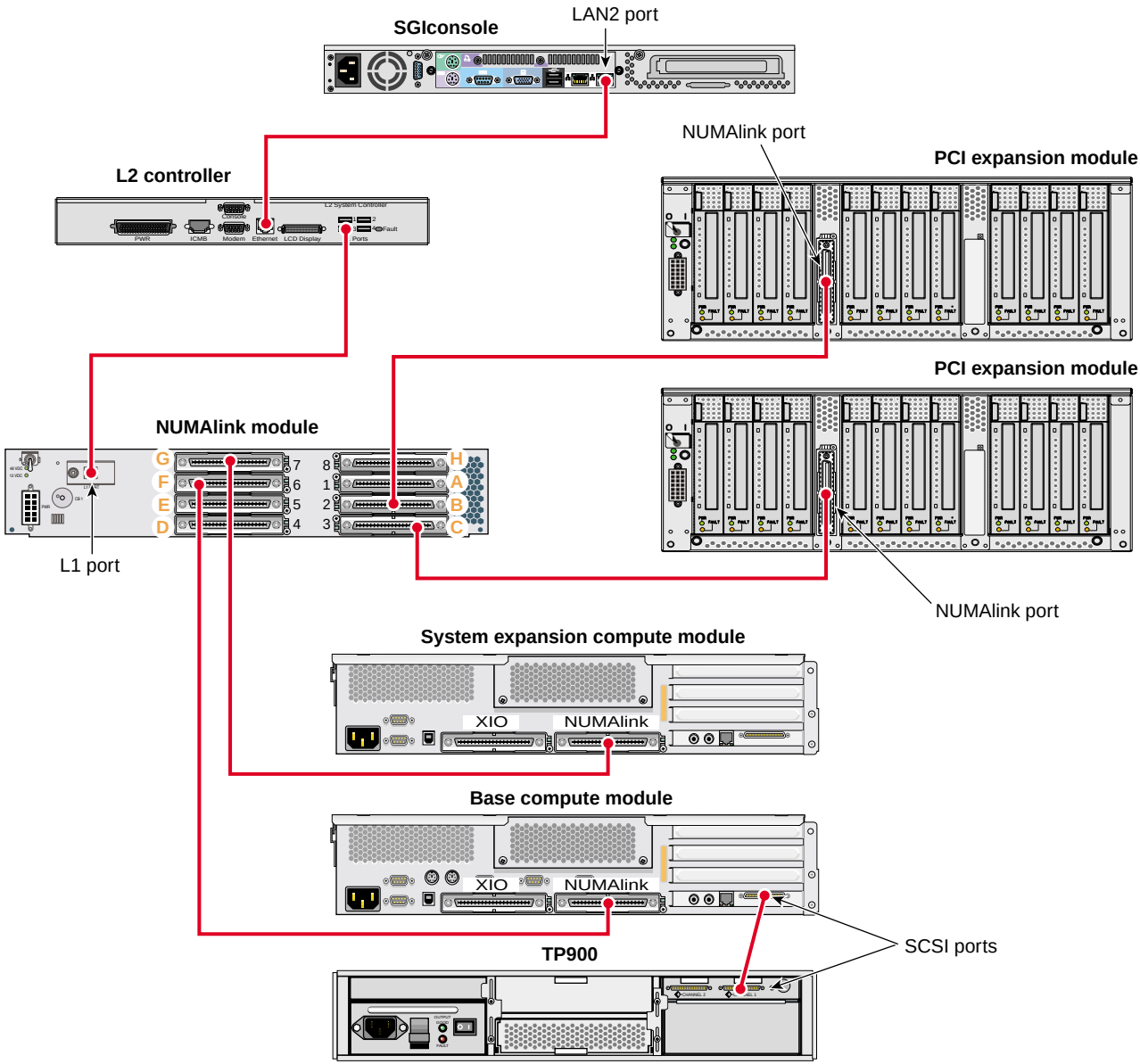


Figure 1-26 Cabling Multiple Modules to Each Other

Cabling the Server System to a Power Source

This section describes how to make the following connections to a power source:

- "Connecting a Single-module or Dual-module Server System to a Power Source" on page 48
- "Connecting a Multiple-module Server System to a Power Source" on page 49

Connecting a Single-module or Dual-module Server System to a Power Source

If you are operating your server system on a table top, connect the base compute module to a wall power receptacle. If your module resides in a rack, connect the module to a power distribution unit (PDU) or a power strip. See Figure 1-27 for the location of the module's power connector.

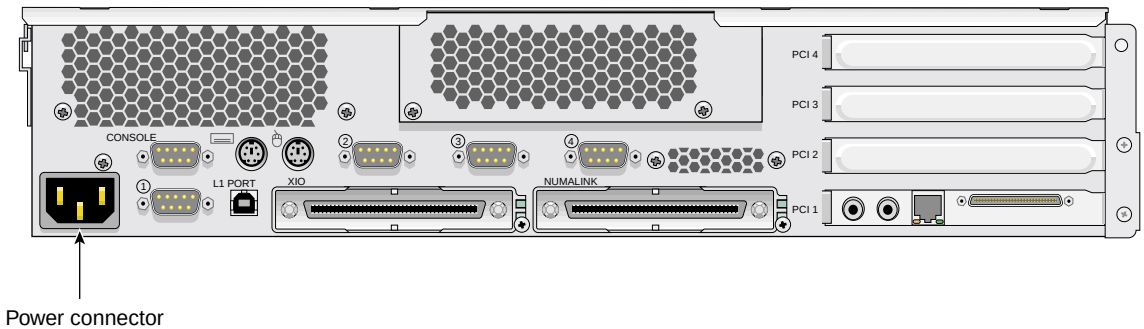


Figure 1-27 Power Connector on the Rear of the Base Compute Module

Figure 1-28 shows the connecting of a dual-module server system (an MPX module and a base compute module), located on either a tabletop or desktop, to a power source.

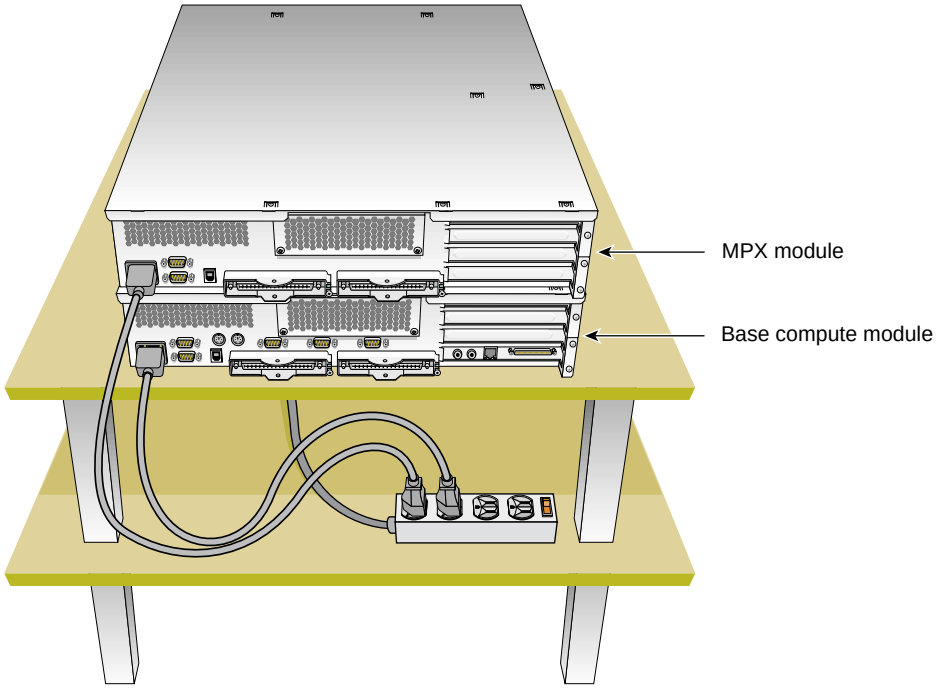


Figure 1-28 Connecting a Dual-module System to a Power Source

Connecting a Multiple-module Server System to a Power Source

This section describes how to cable the multiple modules that make up a multiple-module server system to a power source. Figure 1-29 shows a sample of a multiple-module server system that includes the following modules (and other items):

- L2 controller
- Two PCI expansion modules
- NUMAlink module
- System expansion compute module
- Base compute module
- TP900 storage module

- Power bay
- Power distribution unit (PDU), Power adapter, and USB hub

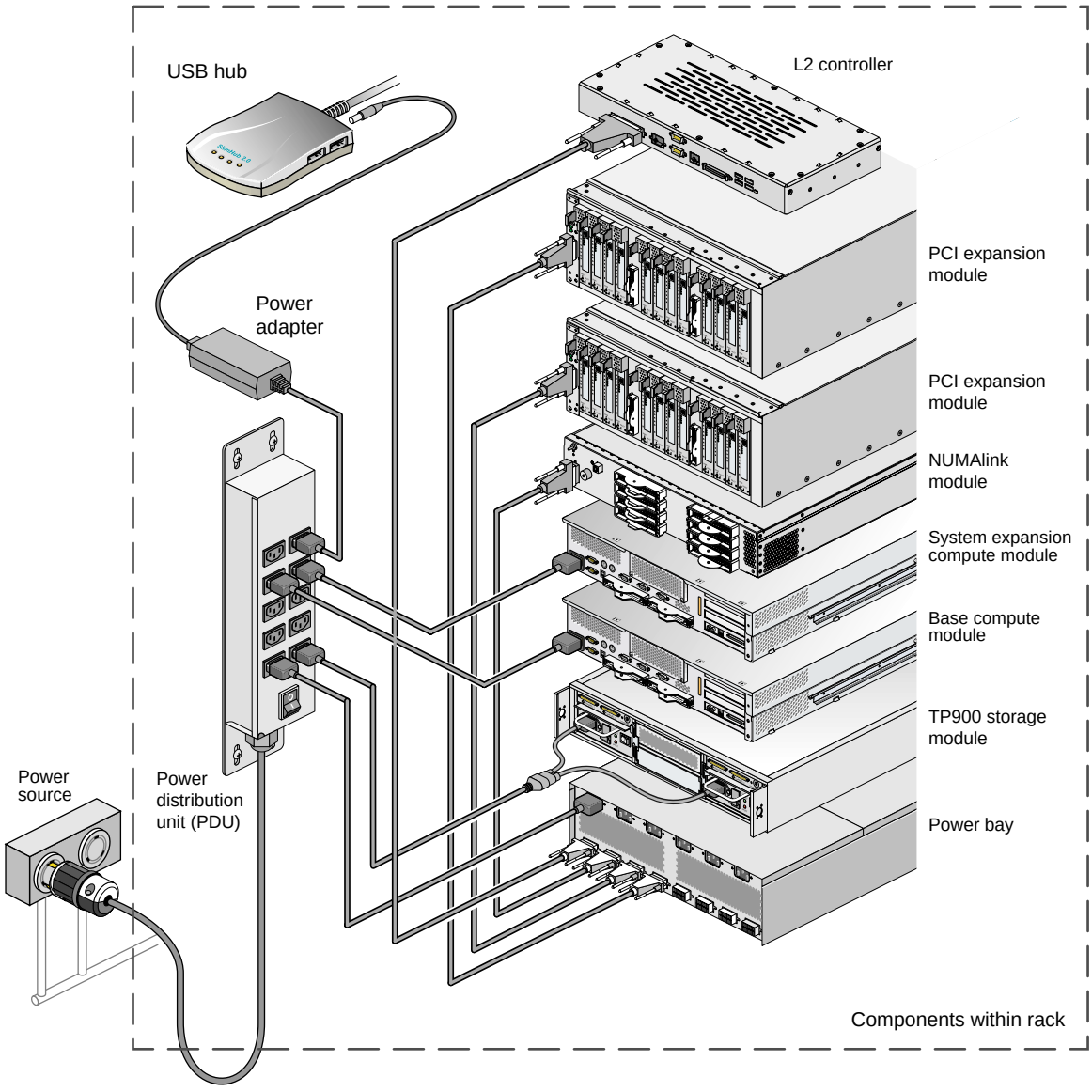


Figure 1-29 Connecting Multiple Modules to a Power Source

Connecting the System Console

This section explains how to attach and establish a connection between a system console and an Origin 350 server system. The system console enables you to perform the following activities:

- Start an IRIX console session to set up networking and other configuration parameters.
- Monitor your system by reading the status and error message information that the L1 controller generates.
- Enter L1 controller commands to monitor or change particular system functions. You can, for example, monitor the speed of fans for a particular module. See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for descriptions of the L1 controller commands that you can use.
- Power on or power off your server system.

The system console can be a server that runs the SGIconsole remote multiserver management system or a personal computer (PC). SGIconsole provides a central server control environment that has the following features:

- Support for SGI clusters, partitioned systems, and large single-system-image servers.
- Expandable to support additional servers.
- Rackmountable, space-efficient platform.
- Software applications and tools for installation and configuration, for console functionality, and for monitoring and managing system-level performance.
- Web-based user interface.

For instructions on how to attach a system console that runs SGIconsole software to your server system, see the *SGIconsole Hardware Connectivity Guide* (007-4340-00*x*).

To attach a PC to your server system, connect a null modem serial cable between the PC and the CONSOLE port of the base compute module of your server system (see Figure 1-30). To establish a connection between your server system and the system console (PC), follow these steps:

1. Ensure that the L1 controller of the base compute module is powered on. When the base compute module is connected to a power source, the L1 controller should be powered on.

   Note: When powered on, the L1 controller displays `L1 running`. If it does not display `L1 running`, check the connection between the base compute module and the power source. In addition, ensure that the circuit breaker of the power source is on.

2. Power on the system console.
3. Ensure that the system console has the following network settings:
   - Baud 38400
   - No parity
   - 8 data bits
   - 1 stop bit
   - Hardware flow control on (RTS/CTS)
4. Type **`cu -l ttyd2`** for an IRIX-based console, or **`cu -l ttys0 -S38400`** for a Linux-based console, and then press **Enter** to display the L1 prompt. If the console uses another operating system, start a terminal emulation program as instructed in the console's user documentation.

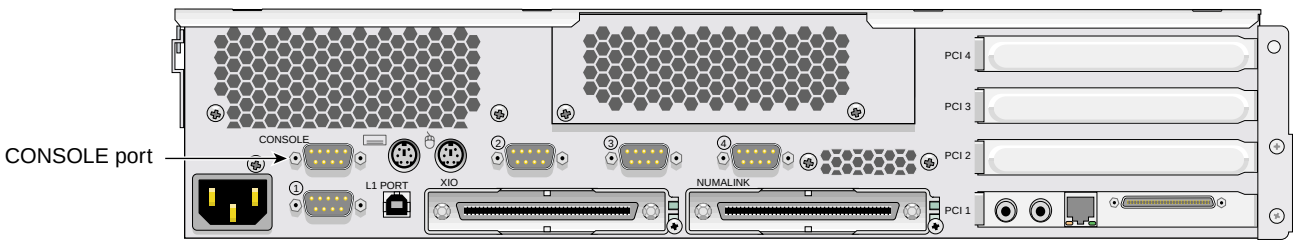


Figure 1-30 Location of the Console Port

Operating the Server System

This section describes how to operate an Origin 350 server system, as follows:

Powering the Server System On and Off

This section describes how to power on and power off your server system (or an individual module) at a system console, or manually, as follows:

Preparing to Power On

To prepare to power on your system, follow these steps:

1. Confirm that all the modules and other system items are plugged in securely. If necessary, see "Cabling the System Modules to Each Other" on page 45 for information.
2. Confirm that all the server system power cables are plugged in securely to a power source. If necessary, see "Cabling the Server System to a Power Source" on page 48 for information.

3. Ensure that the power switch on the rear panel of each DC-powered NUMAlink and PCI expansion module that you want to power on is set to the ON (**I**) position. This switch enables the L1 controllers of the NUMAlink module and PCI expansion modules to power on after you turn on the circuit breaker of the PDU.

Note: The Origin 350 base and AC-powered NUMAlink modules do not have a power switch; when the PDU circuit breaker is on, their L1 controllers are on.

Powering On at the System Console

To power on and boot your system using the system console, follow these steps:

Note: You must manually power on the TP900 storage module by placing the power switch(es) in the ON (**I**) position. You must turn this module on before rebooting the system.

1. If not yet done so, connect a system console to the server system as described in "Connecting the System Console" on page 51.
2. If the monitors and other peripherals are equipped with voltage select switches, verify that they are set for the appropriate AC voltage and plug them in. Note that they are normally plugged into sources outside the rack system.
3. Turn on the circuit breaker switch of the PDU as shown in Figure 1-31.

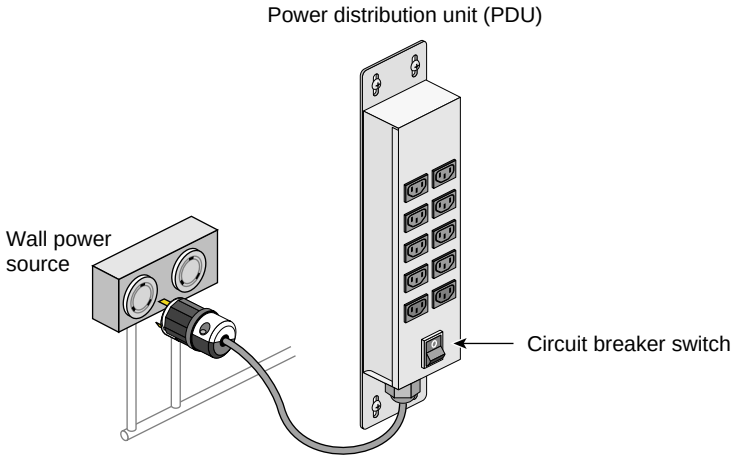


Figure 1-31 PDU Circuit Breaker

4. Verify that all of the L1 controllers display "L1 running." If any L1 controllers are not running, contact your SGI system support engineer (SSE).
5. At the system console, access the L2 controller by entering the following command:

   ```
   $> /stand/sysco/bin/l2term
   ```

6. From the L2 prompt, display the system configuration by entering the following command:

   ```
   L2> cfg
   ```

   This command lists the modules that the L2 controller detects in the system and their system controller addresses. If a module that you want to power on does not appear in the list, it will not power on. Ensure that the module's L1 controller is running and that the module is cabled properly.

7. From the L2 prompt (L2>), power on an individual module by entering the following command. (If you want to power on the entire system, proceed to Step 8.)

   ```
   L2> r <rack#> s <slot#> pwr u
   ```

   For example, to power on an Origin 350 base compute module in rack 1, slot 18, enter the following command:

   ```
   L2> r 1 s 18 pwr u
   ```

   The slot number is the unit number of the module within the rack.

If you want to power on several selected modules of a rack at the same time, you must enter the rack number followed by the slot numbers of the modules that you want to power on. For example, to power on the modules in slots 18, 20, and 22, enter the following command:

```
L2> r 1 s 18,20,22 pwr u
```

8. If you want to power on the entire system, enter the following command:

   ```
   L2> pwr u
   ```

   (The default setting for the `pwr u` command is all racks and slots.)

9. When the L2 prompt appears, you will not see the output that is produced during the power-on procedure unless you redirect the keyboard input from the L2 controller to the normal console by typing control d.

   ```
   L2> ctrl d
   ```

10. When the power-on procedure completes, the following System Maintenance Menu appears on the system console.

    ```
    System Maintenance Menu
    1) Start System
    2) Install System Software
    3) Run Diagnostics
    4) Recover System
    5) Enter Command Monitor
    Option?
    ```

11. Select option 1 “Start System” to boot the IRIX operating system.

Powering On Manually

To power on your system or an individual module manually, follow these steps:

1. If the monitors and other peripherals are equipped with voltage select switches, verify that they are set for the appropriate AC voltage and plug them in. Note that they are normally plugged into power sources outside the rack system.
2. Turn on the circuit breaker switch of the PDU as shown in Figure 1-31 on page 55.

3. Press the power buttons or power switches on each of the modules that you want to power on in the following order:

   a. For the PCI expansion module or a NUMAlink module, press the power switch on the module's rear panel to the ON (**I**) position to start the module's L1 controller. Then, push in the On/Off switch with LED in the front of the module to power on the rest of the module's internal components.

   Note: The Origin 350 base and AC-powered NUMAlink modules do not have a power switch. To power on their L1 controllers, plug the modules to the PDU.

   b. For the TP900 storage module, press the power button on its rear panel to ON (**I**).

   c. For the MPX module, the base compute module, and the system expansion compute module, press the power button with the LED on the front panel of each module (see Figure 1-32).

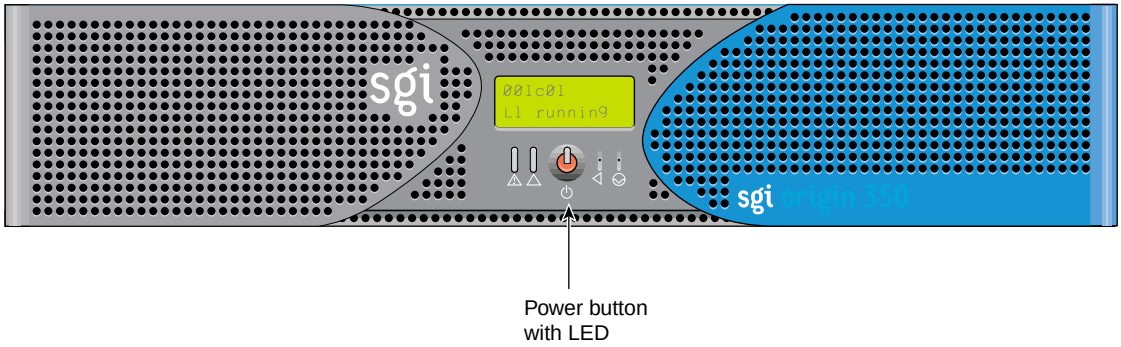


Figure 1-32 Location of the Power Button

Powering Off at the System Console

To power off your system using the system console, follow these steps:

Caution: If you power off the system before you halt the operating system, you can lose data.

1. Shut down the IRIX operating system by entering the following command:

   ```
   # init 0
   ```

2. To access the L2 prompt, direct the keyboard input to the L2 controller by entering **Ctrl+T**.

   ```
   $> ctrl t
   ```

3. From the L2 prompt (L2>), power off an individual module by entering the following command. (If you want to power off the entire system, proceed to Step 4.)

   ```
   L2> r <rack#> s <slot#> pwr d
   ```

   For example, to power off an Origin 350 base compute module in rack 1, slot 18, enter the following command:

   ```
   L2> r 1 s 18 pwr d
   ```

   The slot number is the unit number of the module within the rack.

   If you want to power off several selected modules from the rack at the same time, enter the rack number followed by the slot numbers of the modules that you want to power off. For example, to power off the modules in slots 18, 20, and 22, enter the following command:

   ```
   L2> r 1 s 18,20,22 pwr d
   ```

4. If you want to power off all of the modules within the rack, enter the following command:

   ```
   L2> pwr d
   ```

   (The default setting for the `pwr d` command is all racks and slots.)

   "Powered Down" appears on the L1 display when the module is powered off. The L1 controller is still powered on.

5. To power down an L1 controller of a DC-powered NUMAlink or PCI expansion module, set the power switch to the Off (**O**) position. The power switch of the NUMAlink or PCI expansion module is located in the upper-left corner of the rear of the module.

Note: The Origin 350 base and AC-powered NUMAlink modules do not have a power switch. To power down their L1 controllers, unplug the modules from the PDU.

Powering Off Manually

To power off your system manually, follow these steps:

Caution: If you power off the system before you halt the operating system, you can lose data.

1. Shut down the IRIX operating system by entering the following command:

```
# init 0
```

2. Press the power buttons or power switches on each of the modules that you want to power off. You may power off the modules in any order:
   - For the PCI expansion module or DC NUMAlink module, press the power switch on the module's rear panel to the OFF (**O**) position to turn off the module's L1 controller. Then, push on the On/Off switch with LED in the front of the module to power off the rest of the module's internal components. The green LED on the On/Off switch turns off when the module is powered off.

     Note: The Origin 350 base and AC-powered NUMAlink modules do not have a power switch. To power off their L1 controllers, unplug the modules from the PDU.

   - To power off the TP900 storage module, press the power button on its rear panel to the OFF (**O**) position.
   - To power off the base compute module, the system expansion compute module, and the MPX module, press the power button with the LED on the front panel of each module (see Figure 1-32 on page 57).

Connecting Two Server Systems

Before connecting two Origin 350 server systems to each other, you must assign unique system ID numbers to the servers, as follows:

1. Designate one of the servers as the master server and the other server as the slave.
2. Connect a console to the slave server (see "Connecting the System Console" on page 51), and power on the server (see "Powering the Server System On and Off" on page 53).
3. Use the `brick slot` <*slotnumber*> L1 command to set the slave system ID number to a higher number than the master system ID number. For example, if the master server's L1 prompt indicates that its ID number is `01` (`001c01-L1>`), then the slave system ID number should be 02 or higher (`001c02-L1>`).

   ```
   001c01-L1>brick slot 02
   brick slot set to 02.
   ```

   See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on L1 commands.

To connect two Origin 350 server systems to each other with a NUMAlink 3 cable, follow these steps:

1. Power off both servers (see "Powering the Server System On and Off" on page 53).
2. Connect the NUMAlink 3 cable to the NUMAlink connectors on both servers.
3. Connect a system console to the master server, as described in "Connecting the System Console" on page 51.
4. Power on both servers as described in "Powering the Server System On and Off" on page 53.

The console output should indicate that the processors and memory on both servers have been discovered. If the slave server has not been discovered, use the `reset` L1 command to perform a reset of the system.

Note: For server-to-server communication to work correctly, the network mode on the server must be set to 422 (when connecting a PC [system console] to a serial port). Use the `network` L1 command to set the network mode. (See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on L1 commands.)

Operating the Server System Modules via Front Panel Controls

The front panel of the base compute module, the system expansion compute module, and the MPX module provides the following control features, as shown in Figure 1-33:

Note: If your server system includes other modules such as the TP900 and the PCI expansion module, see the operating instructions provided for those modules.

- **Status LEDs.** The front panel has the following LEDs:
  - Power button LED. This LED illuminates green when the internal components are on.
  - Service-required LED. This LED illuminates yellow to indicate that an item is not functioning properly (for example, a fan is off), but the server is still operating.
  - Failure LED. This LED illuminates red to indicate that a failure has occurred and the server is down.
- **Power button.** Press this button to power on the server. Alternatively, you can power on the server system at a system console.
- **Reset button.** Press this button to reset the internal processors and ASICs. The reset will cause a memory loss. (To perform a reset without losing memory, see the NMI button information that follows.)
- **NMI button**. Press the NMI (non-maskable interrupt) button to reset the internal processors and ASICs without losing memory. Register data and memory are stored in a `/var/adm/crash` file.

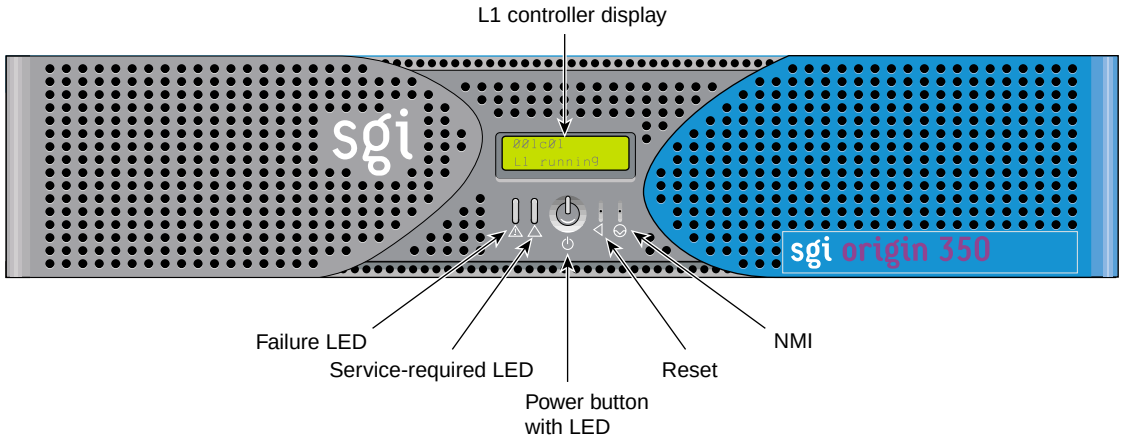


Figure 1-33 Front Panel Functions

Operating the L1 Controller

The L1 controller operates in one of the two following modes:

- **L1** mode. The L1 prompt (`001c01-L1>`) is visible and all input is directed to the L1 command processor.
- **Console mode from L1**. Output from the system is visible and all input is directed to the system.

The L1 controller is ready to accept commands when you see a prompt of the following form:

```
001c01-L1>
```

See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for a detailed list of L1 commands.

To enter console mode, press **Ctrl+D** at the L1 prompt, as follows:

```
001c01-L1> Ctrl+D
entering console mode 001c01 console, <CTRL-T> to escape to L1
.
<system output appears here>
.
```

To return to L1 mode, press **Ctrl+T**, as follows:

```
Ctrl+T
escaping to L1 system controller
001c01-L1>
```

At this point, you can enter any L1 command. When the command completes execution, the L1 returns to console mode:

```
re-entering console mode 001c01 console, <CTRL-T> to escape to L1
```

To permanently engage the L1 mode, press **Ctrl+T** and then enter the **l1** command, as follows:

```
Ctrl+T
escaping to L1 system controller
001c01-L1> l1
L1 command processor engaged, <CTRL-D> for console mode.
001c01-L1>
```

System Overview

This chapter provides an overview of the physical and architectural aspects of your SGI Origin 350 server system. System configurations and components are described and illustrated. This chapter includes the following sections:

Physical Features

The Origin 350 server system is the latest advancement in the SGI NUMAflex approach to modular computing. It is designed to deliver maximum sustained performance in a compact system footprint. Independent scaling of computational power, I/O bandwidth, and in-rack storage lets you configure a system to meet your unique computational needs. The small footprint and highly modular design of the Origin 350 server system makes it ideal for computational throughput, media streaming, or complex data management.

The Origin 350 server system can be expanded from a standalone 2 processor server system to a high-performance server system with 32 processors, 64 GB of memory, and 62 PCI/PCI-X slots. For most configurations, the Origin 350 server system is housed in one 17U rack or one 39U rack as shown in Figure 2-1; however, for small system configurations, the Origin 350 server system can be placed on a table top.

Systems that are housed in 17U racks have a maximum weight of approximately 488 lb (221 kg). The maximum weight of systems that are housed in 39U racks is approximately 1,100 lb (499 kg). The racks have casters that enable you to remove the system from the shipping container and roll it to its placement at your site.

See Chapter 1, "Installation and Operation," for more information about installing your system. Your *Site Planning Guide for SGI Origin 350 and SGI Onyx 350 Rack Systems* (007-4649-00*x*) also provides additional physical planning information.

For more information about the technical specifications of your system, see Appendix A, "Technical Specifications," in this manual.

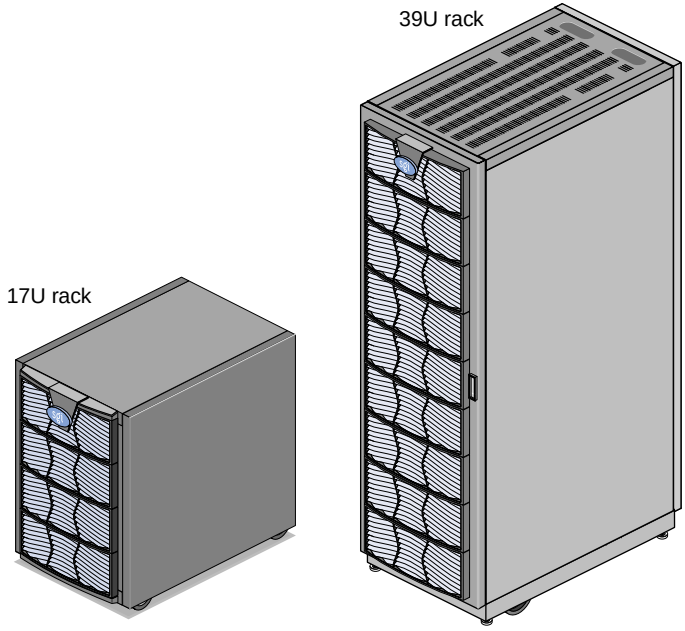


Figure 2-1 Example of SGI Origin 350 Server Systems

Functional Architecture

The Origin 350 server system is based on the SGI NUMAflex architecture, which is the third-generation shared-memory system architecture that is the basis of SGI HPC servers and supercomputers. The NUMAflex architecture is specifically engineered to provide technical professionals with superior performance and scalability in a design that is easy to deploy, program, and manage. It has the following features:

Shared access of processors, memory, and I/O. The Bedrock ASICs and the NUMAlink interconnect functions of the NUMAflex architecture enable applications to share processors, memory, and I/O devices.

- Each Bedrock ASIC in the system is an 8-input by 6-output crossbar that acts as the memory controller between processors and memory in the system for both local and remote memory accesses.
- The NUMAlink interconnect channels information between all the modules in the system to create a single contiguous memory in the system of up to 64 GB and enables every processor in a system direct access to every I/O slot in the system.

Together, the Bedrock ASICs and the NUMAlink interconnect enable efficient access to processors, local and remote memory, and I/O devices without the bottlenecks associated with switches, backplanes, and other commodity interconnect technologies.

System scalability. The NUMAflex architecture incorporates a low-latency, high-bandwidth interconnect that is designed to maintain performance as you scale system computing, I/O, and storage functions. For example, the computing dimension in some system configurations can range from 4 to 32 processors in a single system image (SSI). To increase the number of processors beyond 32, you can cluster Origin 350 server systems together. The maximum number of processors in a clustered configuration is 128.

Efficient resource management. The NUMAflex architecture is designed to run complex models and, because the entire memory space is shared, large models can fit into memory with no programming restrictions. Rather than waiting for all of the processors to complete their assigned tasks, the system dynamically reallocates memory, resulting in faster time to solution.

The Origin 350 server system can be configured with or without a NUMAlink module. When the system does not have a NUMAlink module, the system can contain from 2 to 8 processors. When the system does have a NUMAlink module, the system can contain from 4 to 32 processors.

Note: For more information about these configurations, see "System Configurations" on page 75.

The processors are housed in compute modules (see Figure 2-2) that can be configured as one the following devices:

- **Base compute module with base I/O functionality.** All Origin 350 server systems contain one base compute module that contains the following components:
  - Two or four 64-bit MIPS RISC processors.
  - 4 MB of secondary (L2) cache per processor.
  - 1 GB to 8 GB of local memory.
  - Four PCI/PCI-X slots.

    Note: The lowermost PCI/PCI-X slot comes with a factory-installed IO9 PCI 66 MHz card. Consequently, the slot (third slot down), which is on the same bus as the slot in which the IO9 PCI card is installed, can only support a PCI card that runs at a speed of 66 MHz or slower. Therefore, the two uppermost slots can support PCI/PCI-X cards, while the third one down can only support a PCI card.

  - One IO9 PCI card that comes factory-installed in the lowermost PCI/PCI-X slot. The IO9 card has a real time interrupt input port and output port, an Ethernet port, and a SCSI connector. The IO9 card is also needed to support the module's two SCSI disk drives, the DVD-ROM, a serial port, and a daughtercard with three more serial ports and two PS/2 connectors for a keyboard and a mouse.
  - One Bedrock ASIC (the crossbar between the processors, local memory, the network interface, and the I/O interface).
- **Expansion compute module (no base I/O functionality).** For Origin 350 server systems that contain more than one compute module, the additional modules are expansion compute modules. The only difference between the base compute module and the expansion compute module is that the expansion compute module

may or may not contain an IO9 PCI card and the devices and connector ports the IO9 card supports.

Note: Each system requires one IO9 PCI card; this required card resides in the base compute module. The system can contain additional IO9 cards that reside in the expansion compute modules; these cards are required only when you want additional SCSI hard disk drives, DVD-ROMs, and/or the connectors the IO9 card supports.

For more information about the compute module (base compute module and system expansion compute module), see "Compute Module" on page 83.

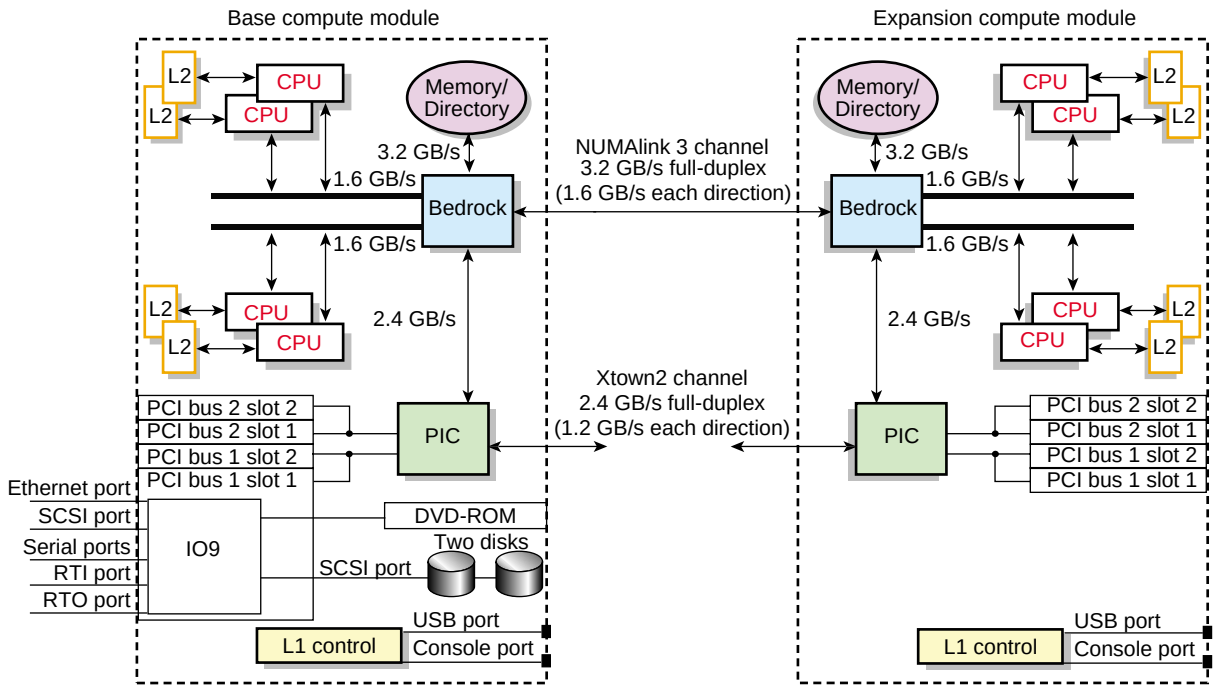


Figure 2-2 Base Compute Module Connected to an Expansion Compute Module

When the system consists of a base compute module only, the maximum number of processors 4. To increase the number of processors in the system, the base compute module can connect to one or more expansion compute modules. When a system has more than two compute modules, a NUMAlink module is required. The NUMAlink module is a 2U AC-powered device that can connect up to eight compute modules. See Figure 2-3.

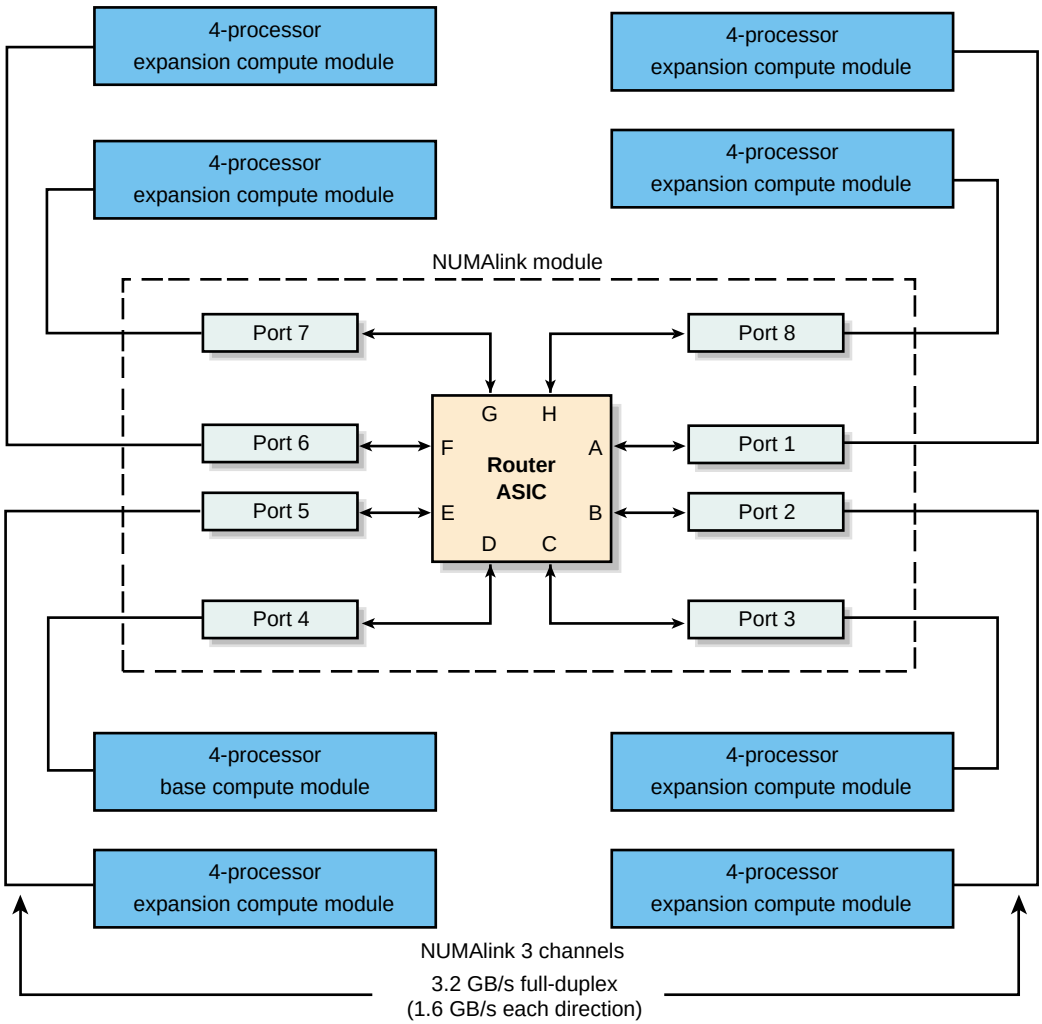


Figure 2-3 Compute Modules Connected via a NUMAlink Module

To increase the amount of memory in the system, the compute modules can connect to a memory and PCI expansion (MPX) module as shown in Figure 2-4.The MPX module is a 2U AC-powered device that can have from 1 GB to 8 GB of memory. This module also has four PCI/PCI-X slots.

For more information about the MPX module, see “MPX Module” on page 86.

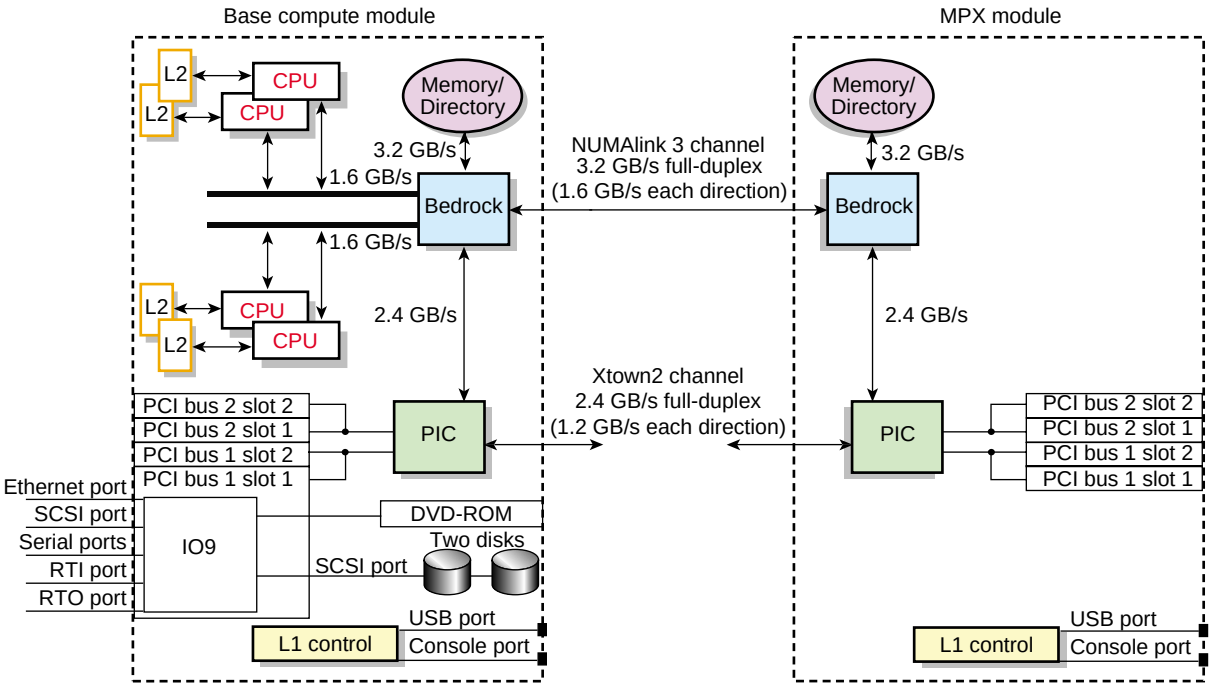


Figure 2-4 Base Compute Module Connected to an MPX Module

To increase the number of PCI/PCI-X slots, the base compute module can connect to an MPX module. The MPX module is a 2U AC-powered device that has four PCI/PCI-X slots. This module also increases the amount of memory by 1 GB to 8 GB.

To increase the number of PCI slots, the base compute module can connect to a PCI expansion module. The PCI expansion module is a 4U, DC-powered device that can have either 6 or 12 PCI slots.

The MPX and PCI expansion modules are peer-attached devices; they connect to the compute module via the NUMAlink connector. If the system has a NUMAlink module, the MPX and PCI expansion modules connect to the compute modules via the NUMAlink module (see Figure 2-5).

For more information about the MPX module, see “MPX Module” on page 86. For more information about the PCI expansion module, see “PCI Expansion Devices” on page 87.

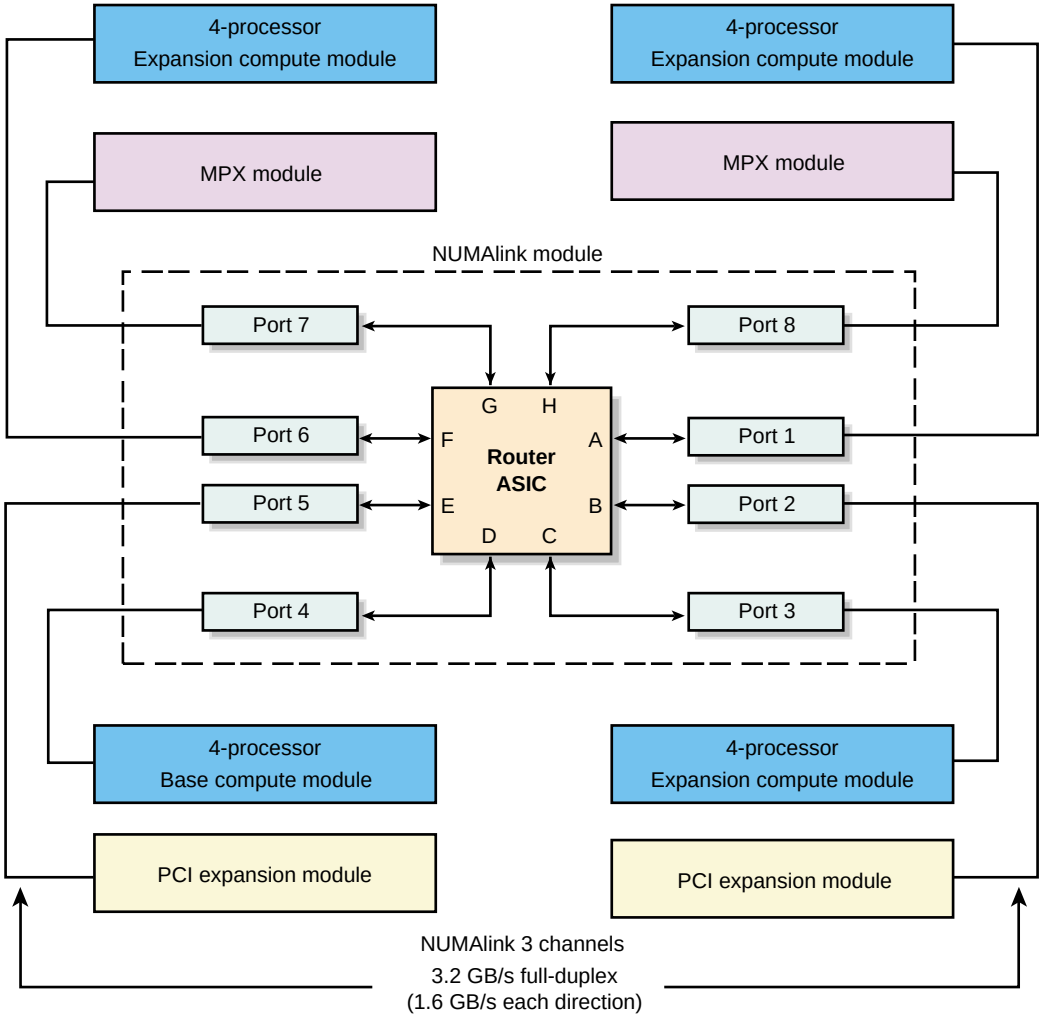


Figure 2-5 Connection of MPX and PCI Expansion Modules to Compute Modules via NUMAlink Module

System Configurations

The Origin 350 server system can be configured with or without a NUMAlink module. If the system does not have a NUMAlink module, this configuration is referred to as a base configuration. If the system has a NUMAlink module, it is referred to as a NUMAlink configuration.

The NUMAlink module, which is the key component of the NUMAlink 3 interconnect, transfers messages among up to eight compute modules. If the system does not have a NUMAlink module, the NUMAlink 3 interconnect consists of a cable that connects a compute module to another compute module, an MPX module, or a PCI expansion module.

Table 2-1 lists the minimum and maximum ranges of the configurable items for the base and NUMAlink configurations.

Table 2-1 Origin 350 Configuration Ranges

	Base Configuration Minimum	Base Configuration Maximum	NUMAlink Configuration Minimum	NUMAlink Configuration Maximum
Compute modules	1	2	2	8
Processors	2	8	4	32
Peak performance of R16000 processors:				
600 MHz	~ 2.4 GFLOPS	~ 9.6 GFLOPS	~ 4.8 GFLOPS	~ 38.4 GFLOPS
700 MHz	~ 2.8 GFLOPS	~ 11.2 GFLOPS	~ 5.6 GFLOPS	~ 44.8 GFLOPS
Memory capacity	1 GB (1 module)	16 GB (2 modules)	2 GB (2 modules)	64 GB (8 modules)
Internal disk storage	One 18-GB or 73-GB SCSI disk	Four 18-GB or 73-GB SCSI disks	One 18-GB or 73-GB SCSI disk	16 18-GB or 73-GB SCSI disks
Internal PCI/PCI-X slots[a] (without PCI expansion device)	3 (1 module)	7 (2 modules)	7 (2 modules)	31 (8 modules)
NUMAlink module	None	None	1	1
PCI expansion device	None	1	None	4

Table 2-1 Origin 350 Configuration Ranges **(continued)**

	Base Configuration Minimum	Base Configuration Maximum	NUMAlink Configuration Minimum	NUMAlink Configuration Maximum
Storage device	None	Customer-configurable	None	Customer-configurable
Compute rack	None	1	1	1
L2 controller	None	1	1	1

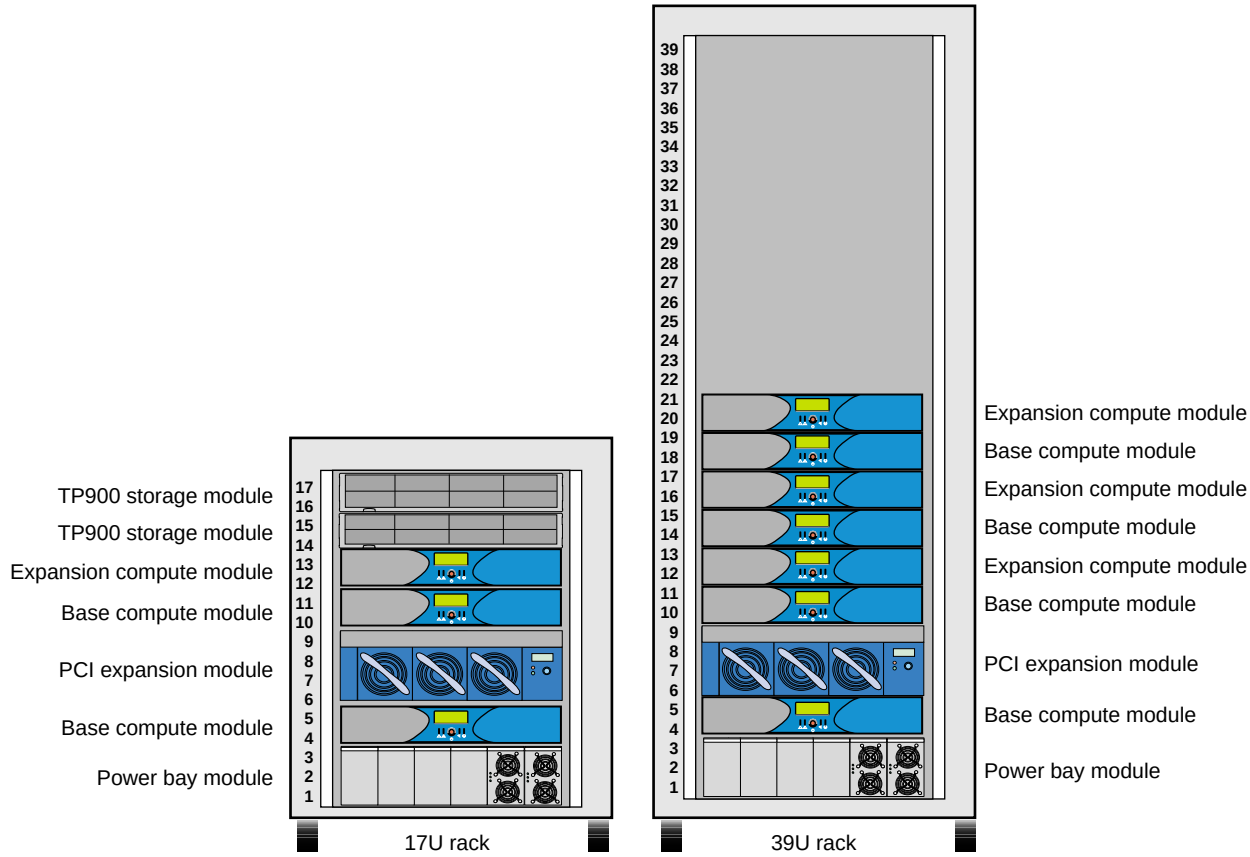
a. Each compute module has four internal PCI/PCI-X slots; however, the lowermost slot of the base compute module is required for the IO9 PCI 66 MHz card. Therefore, only the two topmost slots are available for PCI/PCI-X cards while the third slot down, which is on the same bus as where the IO9 card is installed, can only support a PCI card running at a speed of 66 MHz or slower.

Base Configuration

The base configuration can consist of 2 to 8 processors. A system that contains 2 or 4 processors requires one base compute module. With this system configuration, you can add one PCI expansion module or one MPX module to your system. If space is available in the rack, you can also add SGI TP900 storage modules to your system or you can add additional storage racks to your system.

A system that contains 6 or 8 processors requires one base compute module and one expansion compute module that are connected together with a NUMAlink cable. This system configuration does not allow you to add a PCI expansion module or an MPX module to your system. However, you can add TP900 storage modules or storage racks to your system.

The components of the base configuration can be placed on a table top or housed in a 17U rack or a 39U rack. Each rack can contain more than one system, as shown in Figure 2-6.



Note: The 17U rack contains two systems: one system contains two compute modules and one storage device, and the other system contains one compute module, one PCI expansion module, and one storage device.

The 39U rack contains four systems: three systems contain two compute modules, and the fourth system contains one compute module and one PCI expansion module.

Figure 2-6 Examples of Base Configurations in 17U and 39U Racks

NUMAlink Configuration

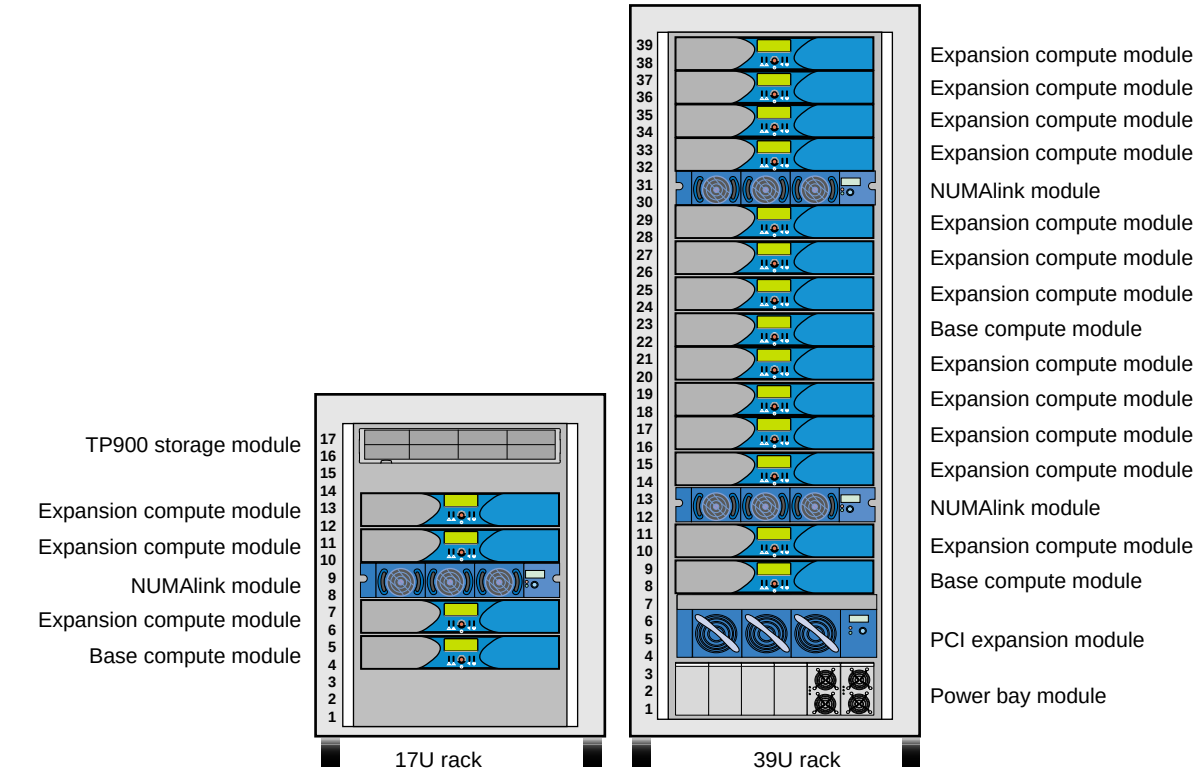
A NUMAlink configuration consists of one base compute module and up to seven expansion compute modules that are interconnected via the NUMAlink module, as shown in Figure 2-1 on page 67. This configuration can be housed in a 17U rack or a 39U rack; however, the 17U rack can house only one NUMAlink module, one base compute module, and up to five expansion compute modules. The 39U rack can house one or two Origin 350 server systems, as shown in Figure 2-7.

In addition to the base and expansion compute modules, a NUMAlink configuration supports the following PCI expansion devices: the MPX module and the PCI expansion module. The number of each type of module is dependent on the following configuration rules:

- A maximum of four MPX modules can reside in a NUMAlink configuration.
- The number of PCI expansion modules cannot exceed the number of compute modules.
- The total number of compute modules, MPX modules, and PCI expansion modules cannot exceed eight.

For example, a NUMAlink configuration can consist of one base compute module, three expansion compute module, two MPX modules, and two PCI expansion modules.

The NUMAlink configuration also allows you to increase the amount of storage in your system. If space is available in the rack, you can add TP900 storage modules to your system or you can add additional storage racks to your system.



Note: The 17U rack contains one system that contains four compute modules.

The 39U rack contains two systems: one system contains eight compute modules, and the other system contains six compute modules and one PCI expansion module.

Figure 2-7 Examples of NUMAlink Configurations in 17U and 39U Racks

System Components

This section lists the major system components of a base configuration and a NUMAlink configuration, and briefly describes several of these components, in the following subsections:

Major Components of a Base Configuration

The base configuration can contain the following major components:

- Base compute module.
- One of the following modules (all are optional):
  - Expansion compute module.
  - MPX module.
  - PCI expansion module.
- 17U or 39U rack with power distribution unit (optional).
- L2 controller (optional).

- One or more power components (for example, power distribution unit [PDU], power strip, and power bay module).

  Note: The power bay is required when the system contains a PCI expansion module.

- One or more TP900 storage modules (optional). (The maximum number of TP900s is dependent on the number of SCSI connections in the system; each TP900 requires one SCSI connection.)
- 2Gb SGI TP9100 storage system, SGI TP9400 storage system, or SGI TP9500 storage system (optional).

Major Components of a NUMAlink Configuration

The NUMAlink configuration can contain the following major components (see Figure 2-8):

- 17U or 39U rack with power distribution unit.
- Base compute module.
- NUMAlink module.
- A combination of the following modules:

  Note: The total number of compute modules, MPX modules, and PCI expansion devices cannot exceed eight. For example, a system can contain six compute modules, one MPX module, and one PCI expansion module.

  - One to seven expansion compute modules (only one expansion compute module is required).
  - Zero to four MPX modules.
  - Zero to four PCI expansion modules.
- L2 controller.

- One or more power components (for example, power distribution unit (PDU), power strip, and power bay module).

Note: The power bay is required when the system contains a PCI expansion module.

- One or more TP900 storage modules (optional). (The maximum number of TP900s is dependent on the number of SCSI connections in the system; each TP900 requires one SCSI connection.)
- 2Gb SGI TP9100 storage system, SGI TP9400 storage system, or SGI TP9500 storage system (optional).

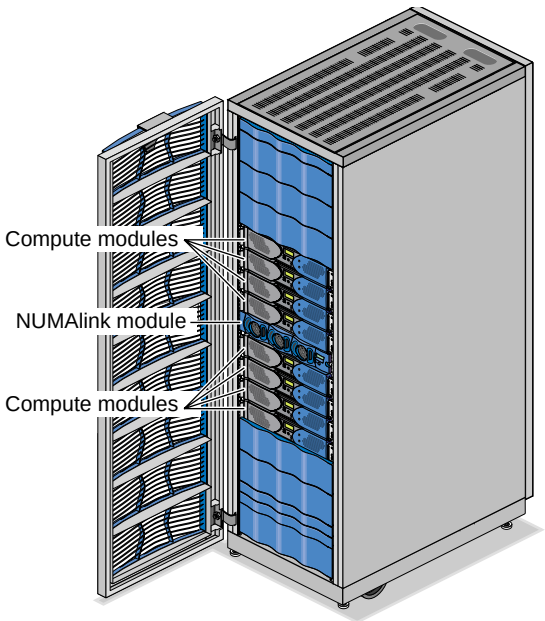


Figure 2-8 Component Example of NUMAlink Configuration

Compute Module

The compute module is a 2U AC-powered device that consists of the following:

- Two or four 64-bit MIPS RISC processors.
- 4 MB of secondary cache per processor.
- 1 GB to 8 GB of memory.
- Zero to four PCI/PCI-X cards.

Note: The base compute module comes factory-installed with a PCI IO9 card in the lowermost PCI/PCI-X slot.

- One or two sled-mounted Ultra3 SCSI disk drives (optional component of the expansion compute module).
- DVD-ROM (optional).

The SCSI disk drives and the DVD-ROM require an IO9 PCI card.

Note: A compute module is not limited to two disk drives or four PCI/PCI-X slots. The compute module can connect to external devices that expand the I/O and storage capabilities. For information about these devices, see "PCI Expansion Devices" on page 87.

Each compute module also contains an L1 controller that provides the following services:

- Controls and sequences power.
- Controls and monitors the environment.
- Initiates a reset.
- Stores identification and configuration information.

Figure 2-9 shows the front and rear views of an Origin 350 compute module. See Chapter 3, “Compute Module,” for more information about this module.

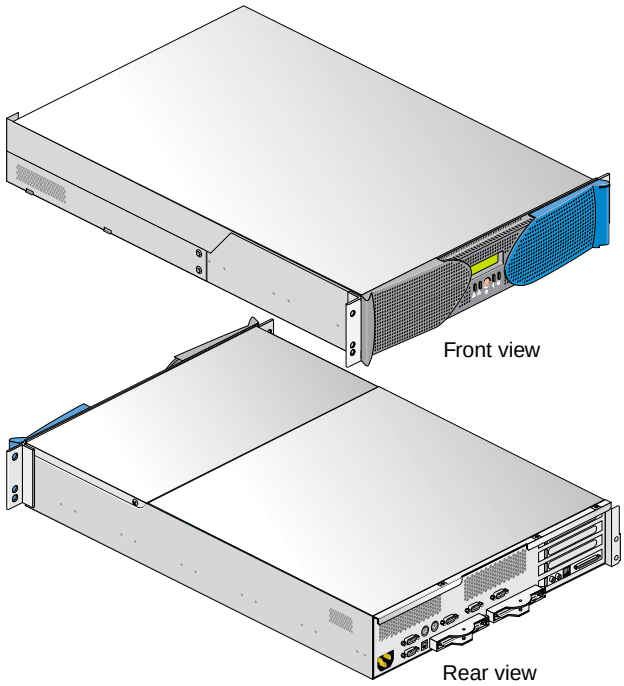


Figure 2-9 Front and Rear Views of Compute Module

NUMAlink Module

The NUMAlink module, shown in Figure 2-10, is a 2U AC-powered device that transfers messages between the compute modules via the NUMAlink 3 interconnect. This module is required for systems that contain more than two compute modules.

The NUMAlink module consists of eight ports; four ports can connect to four compute modules or four MPX modules. The other four ports, which carry USB signals, can connect to compute modules, MPX modules, or PCI expansion modules.

The NUMAlink module also contains an L1 controller that provides the following services:

- Controls and sequences power.
- Controls and monitors the environment.
- Initiates a reset.
- Stores identification and configuration information.

See Chapter 5, "NUMAlink Module," for more information about the NUMAlink module.

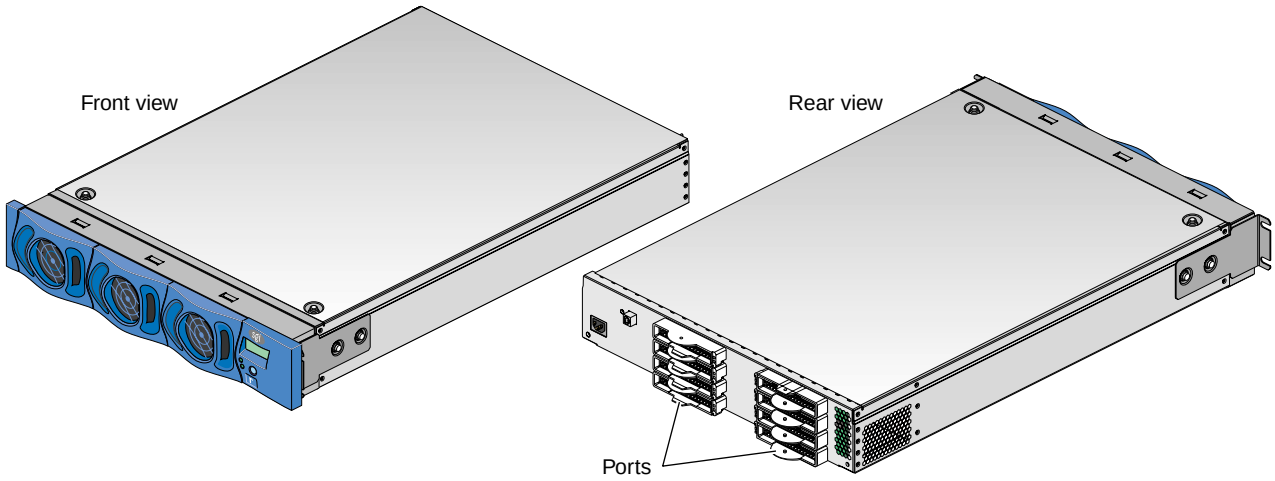


Figure 2-10 NUMAlink Module

MPX Module

The memory and PCI expansion (MPX) module is a 2U AC-powered device that has 1 GB to 8 GB of memory and four PCI/PCI-X slots (see Figure 2-11). You can add one MPX module to a base configuration that contains one base compute module. In a NUMAlink configuration, you can add up to four MPX modules.

The MPX module also contains an L1 controller that provides the following services:

- Controls and sequences power.
- Controls and monitors the environment.
- Initiates a reset.
- Stores identification and configuration information.

See Chapter 4, "Memory and PCI Expansion (MPX) Module," for more information about the MPX module.

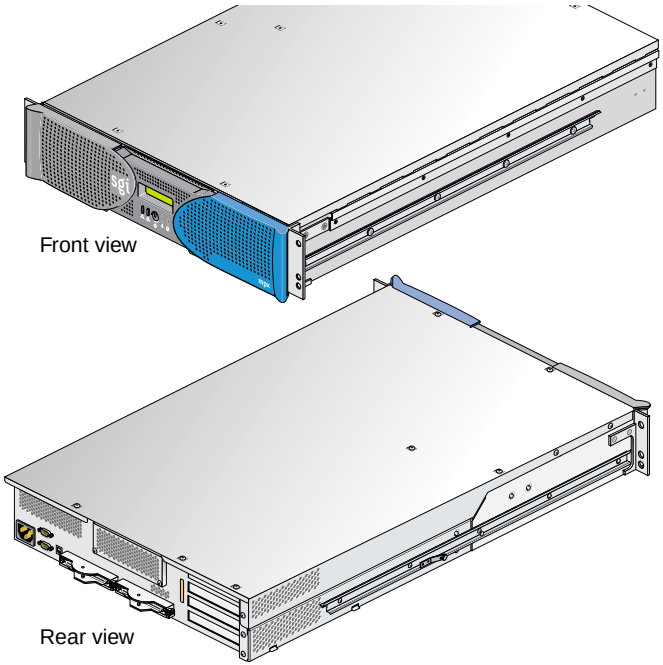


Figure 2-11 MPX Module

PCI Expansion Devices

A compute module contains four PCI/PCI-X slots; however, the base compute module has only two PCI/PCI-X slots and one PCI slot available because the lowermost slot is reserved for the IO9 PCI 66 MHz card, and the slot immediately above where the IO9 card is installed can only support PCI cards that run at a speed of 66 MHz or slower.

You can expand your I/O capabilities by adding PCI expansion devices to your system to increase the amount of PCI/PCI-X and PCI slots.

Two types of PCI expansion devices are available: the MPX module and the PCI expansion module. Both modules are peer-attached devices; they connect to the NI (network interface) port of the compute module's Bedrock ASIC via the compute module's NUMAlink connector or via the NUMAlink module.

The MPX module is a 2U AC-powered device that has four PCI/PCI-X slots (see Figure 2-11 on page 86). In a base configuration that contains one compute module, you can add one MPX module to your system. In a NUMAlink configuration, you can add up to four MPX modules. See Chapter 4, "Memory and PCI Expansion (MPX) Module," for more information about the MPX module.

The PCI expansion module, shown in Figure 2-12, contains six PCI buses (buses 1 through 6) that can seat as many as twelve PCI cards. Each bus has two PCI slots (see Figure 2-13 on page 89) that are labeled 1 and 2.

There are two versions of the PCI expansion module: one version has 12 slots that support 3.3-V or universal PCI cards, and the other version has 6 slots that support 5-V or universal PCI cards and 6 slots that support 3.3-V or universal PCI cards.

In the base configuration and in a NUMAlink configuration, the PCI expansion module must be paired with a compute module. Therefore, follow these guidelines:

- In a base configuration that contains one compute module, you can add one PCI expansion module to your system.
- In a NUMAlink configuration, you can add one to four PCI expansion modules to your system. The following rules indicate how many PCI expansion modules you can add to your system:
  - You can add one PCI expansion module to a system that contains two to seven compute modules.

- You can add two PCI expansion modules to a system that contains two to six compute modules.
- You can add three PCI expansion modules to a system that contains three to five compute modules.
- You can add four PCI expansion modules to a system that contains four compute modules.

For more information about the PCI expansion module, see *PCI Expansion Module User's Guide* (007-4499-00*x*).

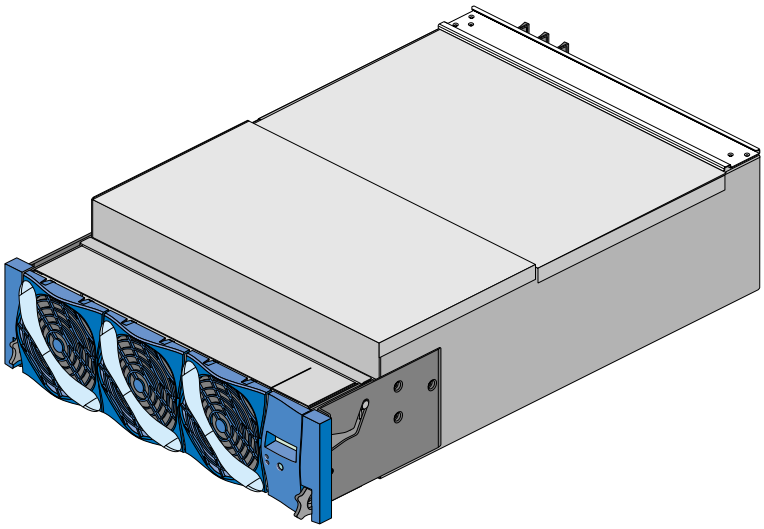


Figure 2-12 PCI Expansion Module

Figure 2-13 shows the PCI card slot numbering on the PCI expansion module.

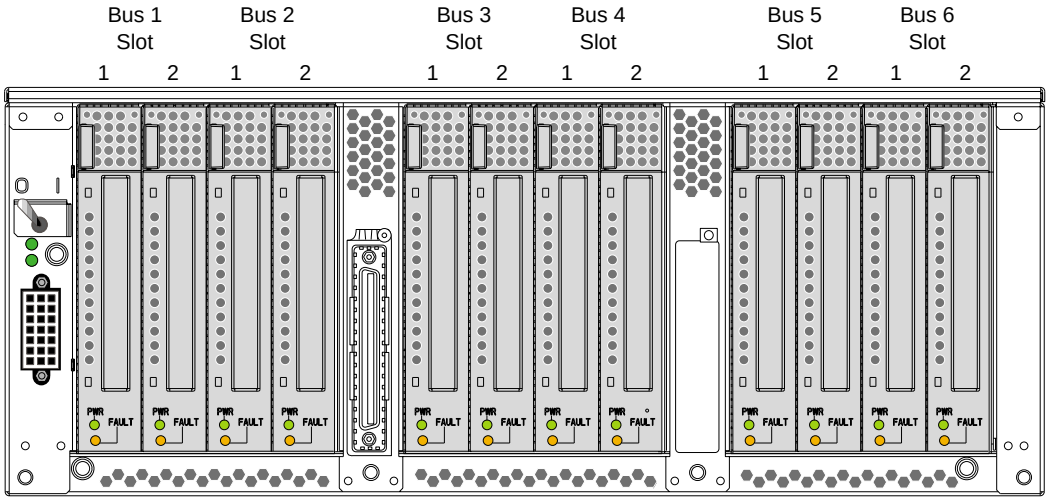


Figure 2-13 PCI Card Slot Numbering on the PCI Expansion Module

Storage Expansion

The base compute module contains two disk-drive bays; however, you can add additional storage to the system as follows:

- For a SCSI (small computer system interface) JBOD (just a bunch of disks) solution, SGI offers the TP900 storage module, or SCSI disks can be added to expansion compute modules.

  Note: Adding SCSI disks to an expansion compute module requires an IO9 PCI card.

- For a Fibre Channel solution that supports both JBOD and RAID configurations, SGI offers the 2Gb SGI TP9100 storage system.
- For Fibre Channel RAID solutions, SGI offers the SGI TP9400 storage system and the SGI TP9500 storage system.

- The Origin 350 server system also supports a number of tape devices.

The various storage devices are discussed in the subsections that follow.

SGI TP900 Storage Module

The TP900 storage module, shown in Figure 2-14, is a 2U-high 8-drive storage system that provides compact, high-capacity, high-availability JBOD storage. The enclosure backplane connects the 8 drives on one SCSI bus. As an option, the storage module can also be configured on two SCSI buses (2 strings of 4 drives).

This storage module has the following features:

- It mounts in a standard 19-inch rack; it is available in factory-installed configurations.
- It uses SCSI Parallel Interface 3 (SPI-3) capable Low Profile (1-inch high) 3.5-inch disk drives.
- Its drive carriers accept SGI-qualified 10,000- or 15,000-RPM U160 SCSI disk drives.

For more information about the TP900 storage module, see *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*).

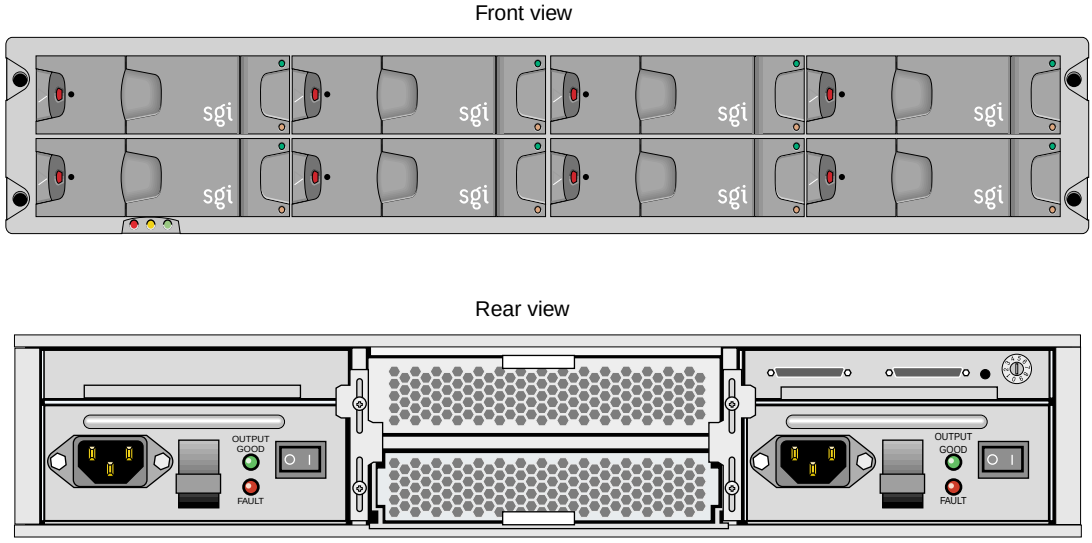


Figure 2-14 SGI TP900 Storage Module

2Gb SGI TP9100 Storage System

The 2Gb SGI TP9100, shown in Figure 2-15, is an affordable, entry-level RAID storage array that is easily expandable and comes in either a deskside tower or a rackmounted configuration. You can start with a basic JBOD configuration and later add RAID controllers, or you can start with a RAID configuration.

The 2Gb SGI TP9100 storage system connects to the compute module via a Fibre Channel PCI card. For more information about the SGI TP9100 storage system, see *SGI Total Performance 9100 (2 Gb TP9100) Storage System User's Guide* (007-4522-00*x*).

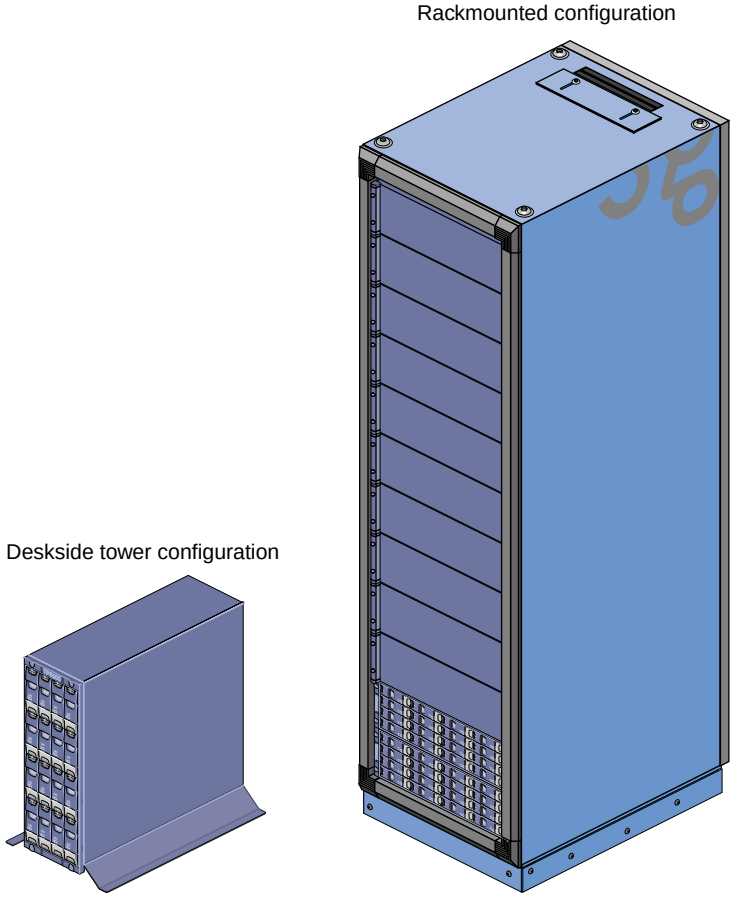


Figure 2-15 2Gb SGI TP9100 Storage System

SGI TP9400 and SGI TP9500 Storage Systems

The SGI TP9400, shown in Figure 2-16, and the SGI TP9500 are highly scalable RAID storage subsystems. These storage systems have vast storage capacities and can grow to whatever size you require without disruption to normal processing activities. This continuous availability enables all active components to be configured redundantly and installed "hot" as customer-replaceable or expansion units.

The TP9400 and TP9500 storage systems connect to compute modules via Fibre Channel PCI cards.

For more information about the TP9400 and TP9500 storage systems, see *SGI Total Performance 9400 and SGI Total Performance 9500 RAID User's Guide* (007-4304-00*x*).

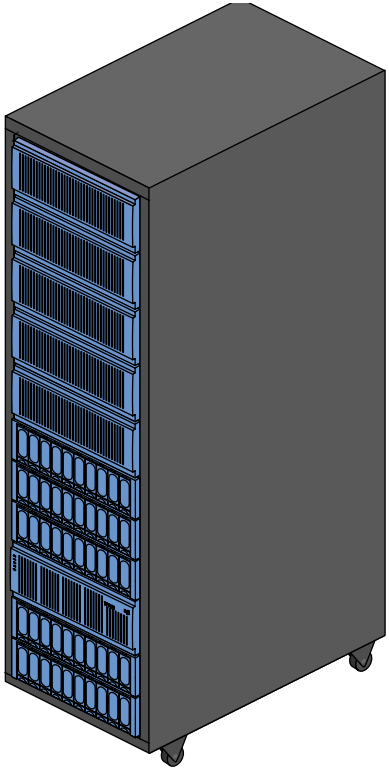


Figure 2-16 SGI TP9400 Storage System

Tape Devices

The Origin 350 server systems support the following tape drives:

- DLT 8000 - 8000 native (6-MB/s transfer rate, 40-GB storage capacity)
- DLT 8000 - 7000 emulation (5-MB/s transfer rate, 35-GB storage capacity)
- LTO (15-MB/s transfer rate, 100-GB storage capacity)
- SDLT220 (11-MB/s transfer rate, 110-GB storage capacity)
- SDLT320 (16-MB/s transfer rate, 160-GB storage capacity)
- T9840 (10-MB/s transfer rate, 20-GB storage capacity)
- T9840B (20-MB/s transfer rate, 20-GB storage capacity)
- T9940A (10-MB/s transfer rate, 60-GB storage capacity)
- T9940B (30-MB/s transfer rate, 200-GB storage capacity)

Table 2-2 describes these tape drives.

For the most current list of supported tape drives, see the following website:
http://sales.corp.sgi.com/products/storage/stk/matrices.html

Table 2-2 Supported Tape Drive Subsystems

Tape Drive	Marketing Code	Library	Interface	Media Capacity	Drive Speed	GB/hr	Average Access Time in Seconds	HSM or Backup
DLT 8000 (8000 native)	3100157251	L20/L40/L80	SCSI	40 GB	6 MB/s	21.6	125	Backup
	3100157202	L180/L700	SCSI	40 GB	6 MB/s	21.6	125	Backup
DLT 8000 (7000 emulation)	3100157651	9740	SCSI	35 GB	5 MB/s	18	110	Backup
	3100157103	L180/L700	SCSI	35 GB	5 MB/s	18	110	Backup
	3100101434	9730	SCSI	35 GB	5 MB/s	18	110	Backup
	3100101435	9710	SCSI	35 GB	5 MB/s	18	110	Backup
	3100101432	9714	SCSI	35 GB	5 MB/s	18	110	Backup
LTO	3100222201	L180/L700	SCSI	100 GB	15 MB/s	54	75-115	Backup
	3100222501	L180/L700	SCSI	100 GB	15 MB/s	54	75-115	Backup
	3100222502	L20/L40/L80	SCSI	100 GB	15 MB/s	54	75-115	Backup
	3100222501	L20/L40/L80	SCSI	100 GB	15 MB/s	54	75-115	Backup
	3100222301	L180/L700	FC	100 GB	15 MB/s	54	75-115	Backup
SDLT220	3100157956	L20/L40/L80	SCSI	110 GB	11 MB/s	40	125	Backup
	3100157931	L180/L700	SCSI	110 GB	11 MB/s	40	125	Backup
	3100157932	L180/L700	SCSI	110 GB	11 MB/s	40	125	Backup
	3100157955	L20/L40/L80	SCSI	110 GB	11 MB/s	40	125	Backup
	3100157934	9710	SCSI	110 GB	11 MB/s	40	125	Backup
	3100157933	9730	SCSI	110 GB	11 MB/s	40	125	Backup
SDLT320	3100157935	L180/L700	SCSI	160 GB	16 MB/s	57	125	Backup
	3100157959	L20/L40/L80	SCSI	160 GB	16 MB/s	57	125	Backup
	3100157960	L20/L40/L80	SCSI	160 GB	16 MB/s	57	125	Backup

Table 2-2 Supported Tape Drive Subsystems **(continued)**

Tape Drive	Marketing Code	Library	Interface	Media Capacity	Drive Speed	GB/hr	Average Access Time in Seconds	HSM or Backup
T9840	3100140007	L180/L700	SCSI	20 GB	10 MB/s	36	18	HSM
	3100140008	9740/9310	FC	20 GB	10 MB/s	36	18	HSM
	3100140001	9740/9310	SCSI	20 GB	10 MB/s	36	18	HSM
	3100140009	9740/9310	FC	20 GB	10 MB/s	36	18	HSM
	3100140003	9710	SCSI	20 GB	10 MB/s	36	18	HSM
T9840B	3100218006	L180/L700	SCSI	20 GB	20 MB/s	72	18	HSM
	3100218008	9740/9310	FC	20 GB	20 MB/s	72	18	HSM
	3100218001	9740/9310	SCSI	20 GB	20 MB/s	72	18	HSM
	3100218010	9740/9310	FC	20 GB	20 MB/s	72	18	HSM
	3100218004	9710	SCSI	20 GB	20 MB/s	72	18	HSM
	3100218009	9710	FC	20 GB	20 MB/s	72	18	HSM
T9940A	3100216001	9740	SCSI	60 GB	10 MB/s	36	63	HSM/Backup
	3100216003	9740	FC	60 GB	10 MB/s	36	63	HSM/Backup
	3100216004	L700	SCSI	60 GB	10 MB/s	36	63	HSM/Backup
	3100216005	L700	FC	60 GB	10 MB/s	36	63	HSM/Backup
T9940B	3100231001	9310	FC2	200 GB	30 MB/s	108	63	HSM/Backup
	3100231002	L700	FC2	200 GB	30 MB/s	108	63	HSM/Backup
	3100231003	9740	FC2	200 GB	30 MB/s	108	63	HSM/Backup

L2 Controller

The L2 controller, which is shown in Figure 2-17, is a rack-level controller that performs the following functions:

- Controls resource sharing.
- Controls L1 controllers.
- Maintains system configuration and topology information.
- Enables remote maintenance.
- Routes data between upstream and downstream devices, as follows:
  - Upstream devices (for example, the system console) provide control for the system, initiate commands for the downstream devices, and act on the messages that they receive from downstream devices.
  - Downstream devices (for example, L1 controllers) perform the actions specified by the L2 controller commands, send responses to the L2 controller that indicate the status of the commands, and send error messages to the L2 controller.

All components within a rack that have an L1 controller must connect to the L2 controller (see Figure 2-18 and Figure 2-19). For example, the NUMAlink, compute, MPX, and PCI expansion modules can connect to the L2 controller as follows:

- The NUMAlink module connects to the L2 controller directly via a USB cable.
- The compute and MPX modules can connect to the L2 controller directly, or via the NUMAlink module or a USB hub.
- The PCI expansion module connects to the L2 controller via the NUMAlink module. If the system does not have a NUMAlink module, it communicates with the L2 controller via the compute module to which it connects.

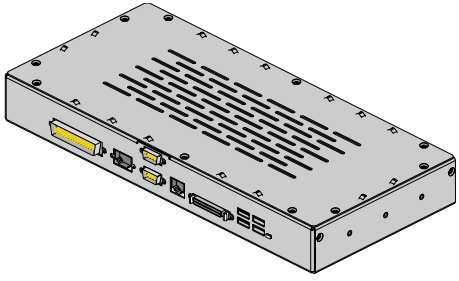


Figure 2-17 L2 Controller

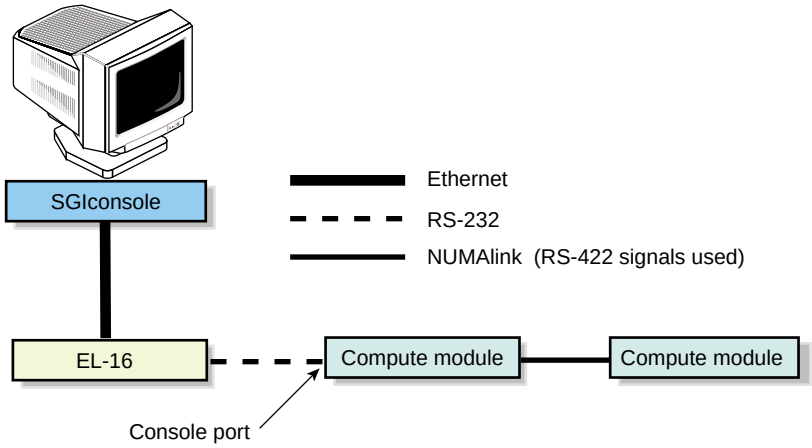


Figure 2-18 System Control for Base Configuration

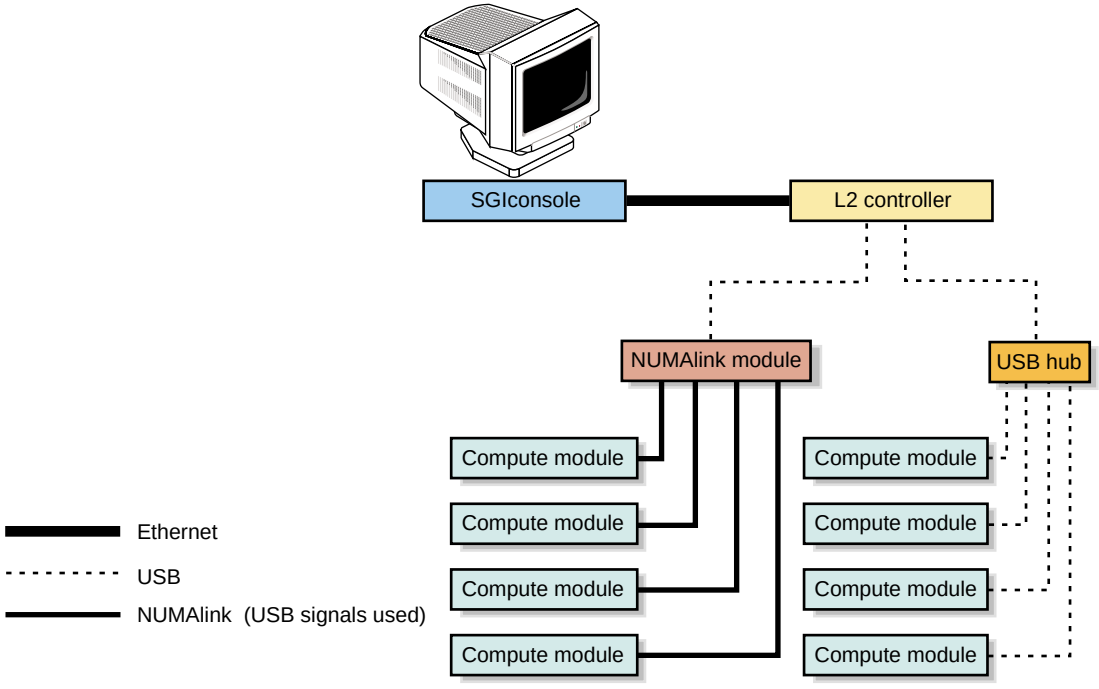


Figure 2-19 System Control for NUMAlink Configuration

USB Hub

The USB hub, shown in Figure 2-20, routes information between the L2 controller and the four compute modules and/or MPX modules that connect to NUMAlink module ports 1, 6, 7, and 8 (the ports that do not carry USB signals).

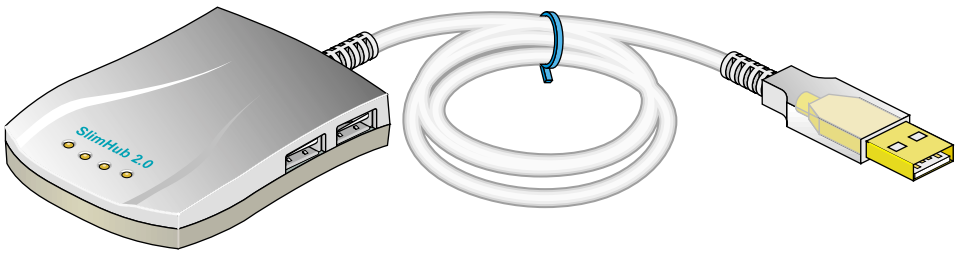


Figure 2-20 USB Hub

Power Components

The Origin 350 server system can consist of the following power components:

- **One or two power distribution units (PDUs)** (see Figure 2-21). The second PDU is added to the system when more than 15 AC power receptacles are needed within the rack.

  The PDU inputs AC voltage from an external power receptacle and it can output AC voltage to the compute modules, MPX module, NUMAlink module, TP900 storage modules, USB hub, power bay module, and power strip.

- **Power strip.** The power strip exists in the system when the system requires 11 to 15 AC power receptacles (see Figure 2-21).

  The power strip inputs AC voltage from the PDU, and it can output AC voltage to the compute modules, MPX module, NUMAlink module, TP900 storage modules, USB hub, and power bay module.

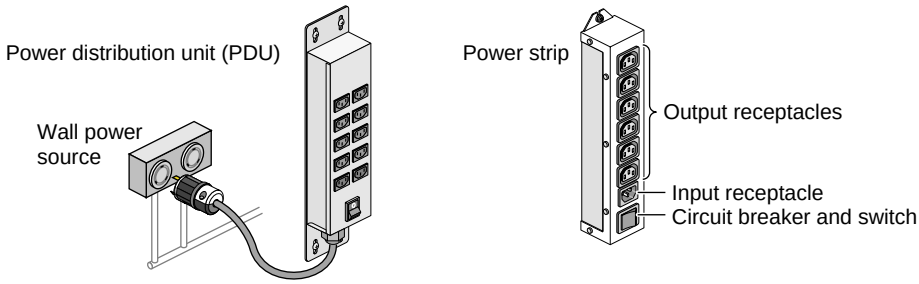


Figure 2-21 Power Distribution Unit and Power Strip

- **Power supply.** The L2 controller receives power from a power supply that is attached to the side of the rack. This power supply receives AC voltage from a PDU and converts the voltage to 48 VDC, which is the input voltage that the L2 controller requires.
- **Power bay module.** This module exists in the system when the system contains a PCI expansion module. It inputs AC voltage from a PDU and converts this AC voltage to 48 VDC and 12-VDC standby voltage. The power bay outputs these voltages to the PCI expansion module. The 48 VDC powers on the PCI expansion module. The 12-VDC standby voltage powers on the L1 controller logic within the PCI expansion module.

  The power bay module, shown in Figure 2-22, can house as many as six power supplies; however, this system requires only two or three power supplies. The third power supply is required when a rack has more than one PCI expansion module.

  When the power bay contains two power supplies, the outputs of the power supplies are bused together to provide 1,840 W at 48 VDC and 90 W at 12-VDC standby. When the power bay contains three power supplies, the outputs of the power supplies are bused together to provide 2,720 W at 48 VDC and 138 W at 12-VDC standby.

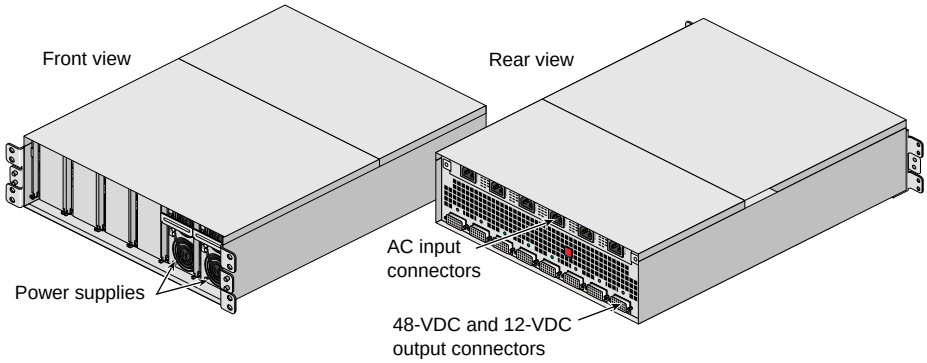


Figure 2-22 Power Bay Module

Figure 2-23 shows the power connections for a sample Origin 350 server system.

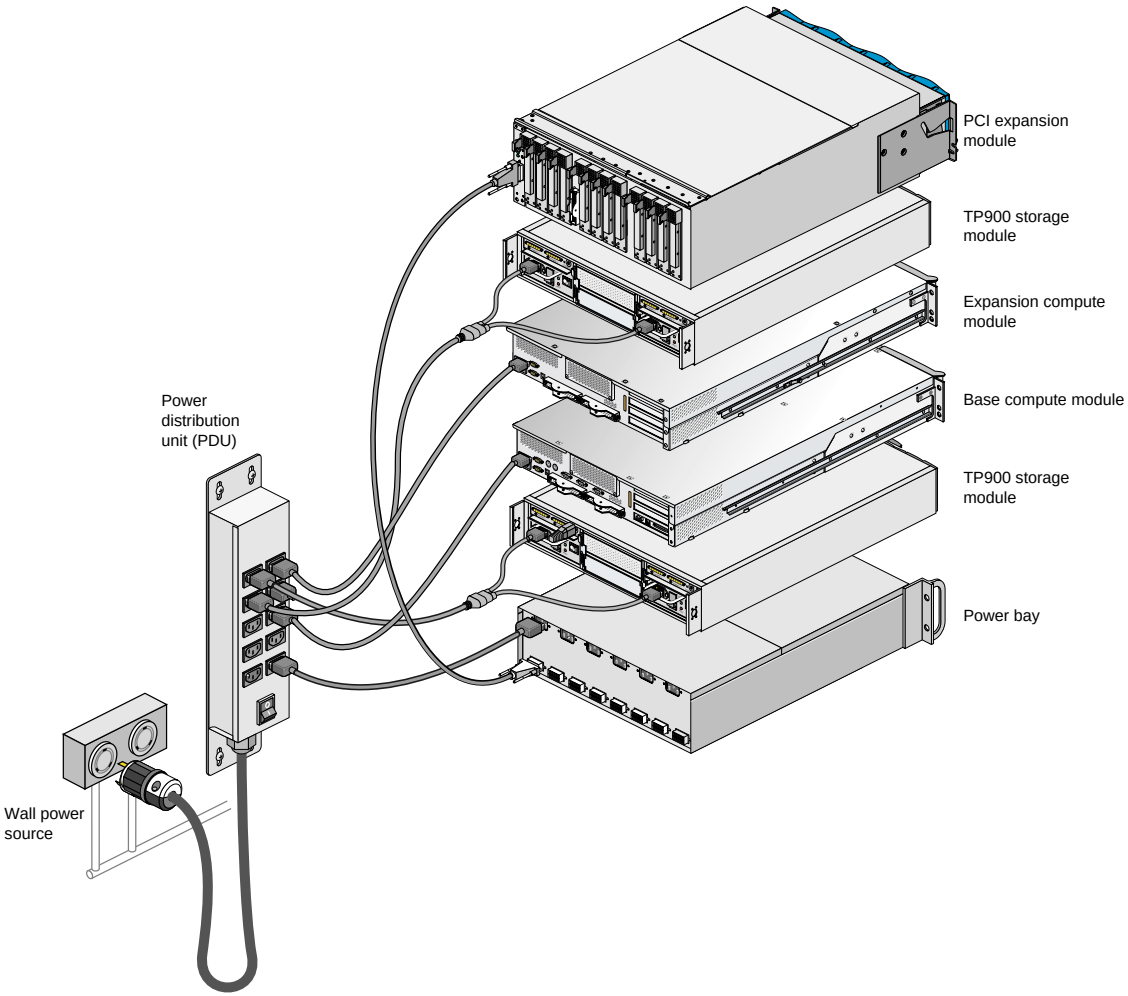


Figure 2-23 Power Connections for a Sample Origin 350 Server System

Rack

The Origin 350 server system supports two rack types: a short rack and a tall rack. The racks are measured in standard units (U); one U is equal to 1.75 in. (4.45 cm). The short rack is a 17U rack and the tall rack is a 39U rack (see Figure 2-24).

The components within the rack are identified by the lowest U number that they occupy. For example, the NUMAlink modules shown in Figure 2-24 are identified as U8 in the short rack and U20 in the tall rack.

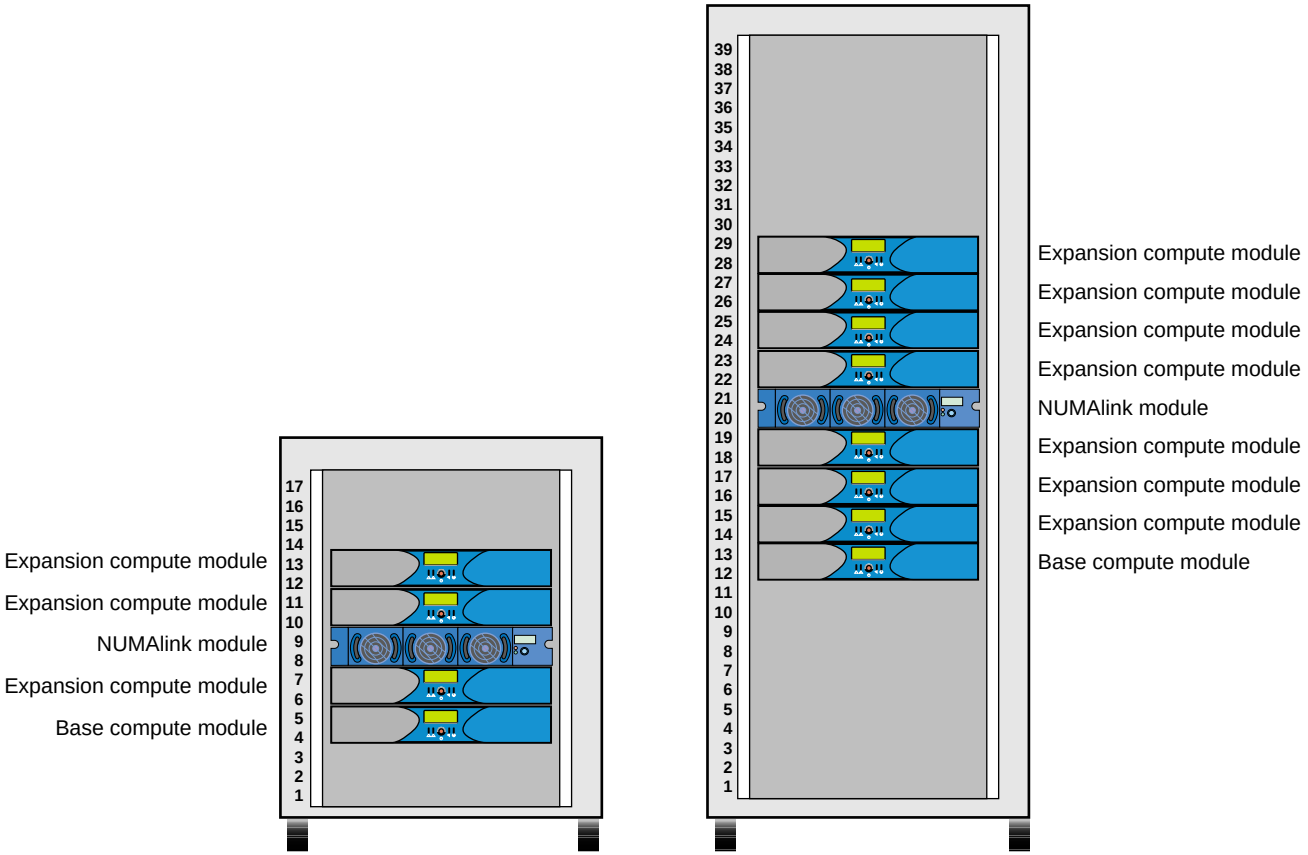


Figure 2-24 Unit Numbering within Rack

Both rack types are industry-standard 19-inch racks, and they support two types of mounting rails (slide rails and shelf rails - also known as fixed rails) that hold the modules within the rack. For example, the compute modules use slide mounting rails (see Figure 2-25).

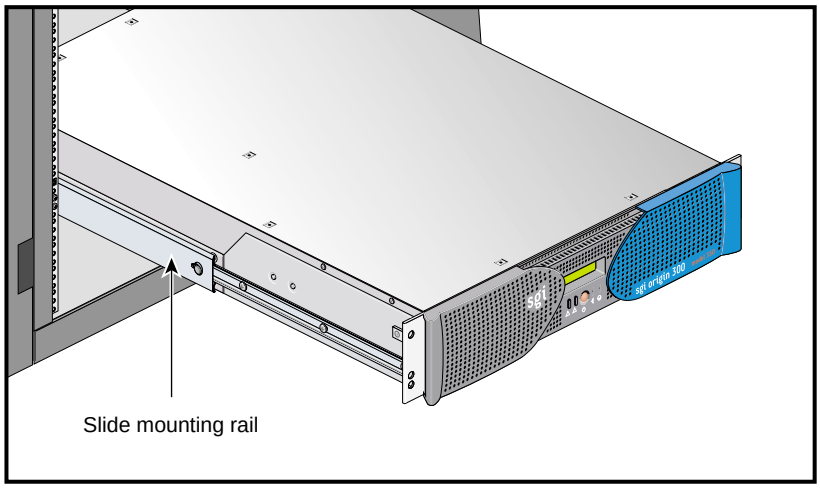


Figure 2-25 Slide Mounting Rails

The NUMAlink module, PCI expansion module, and TP900 storage module are supported by two parallel L-shaped mounting rails within the rack called shelf rails (see Figure 2-26).

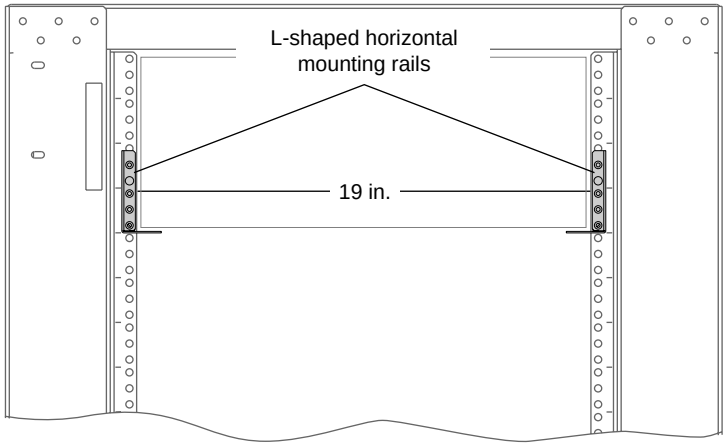


Figure 2-26 L-shaped Mounting Rails (Shelf Rails)

Both rack types, as shown in Figure 2-27, have front and rear doors that have keylocks to prevent unauthorized access of the system. The racks also have cable entry/exit areas at the bottom of the racks and cable management hardware in the rear of the racks.

Both rack types are mounted on four casters, two of which are swivel casters. The casters enable the rack to be rolled out of a shipping crate and to its placement at your site.

The base of the racks have seismic tie-down attachment points. The base of the tall rack also has leveling pads.

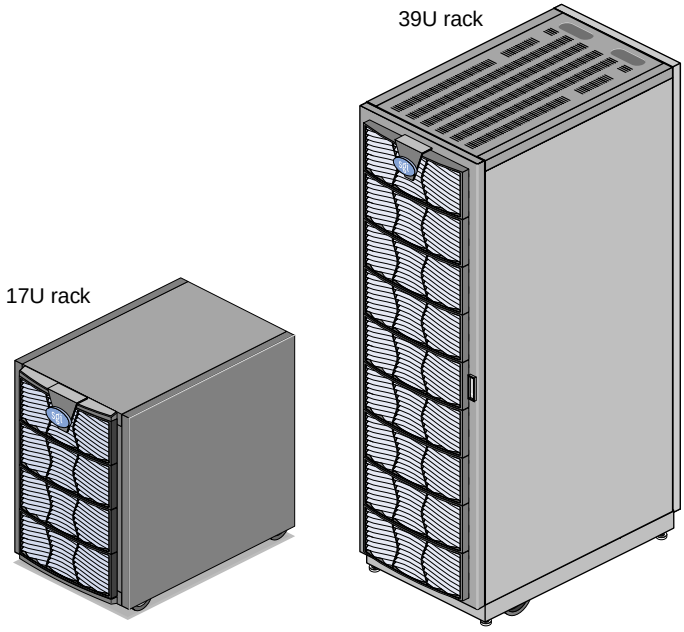


Figure 2-27 Front Views of Short and Tall Racks

Compute Module

This chapter describes the function and physical components of the compute module. It also describes the possible system configurations and the technical specifications for this module. Specifically, this chapter includes the following information.

Two types of compute modules are available for the SGI 350 server system, as follows:

- **Base compute module.** This module is your system's primary compute module where your server system's operating system resides. (Every system must have a base compute module.) The base compute module provides processors, memory, and PCI/PCI-X slots to connect I/O devices. It also comes standard with a factory-installed SCSI disk drive, and an IO9 card and a serial daughtercard that provide various I/O ports to your system.
- **System expansion compute module.** This module, in contrast to the base compute module, comes with processors, memory, and PCI/PCI-X slots, but the SCSI disk drive and the IO9 card are optional.

Note: In this chapter, the term "compute module" refers to both types of compute modules, so remember that some of the features that are standard for the base compute module are optional for the system expansion compute module. When information is applicable to only one of the two types of modules, that will be specified.

System Features

This 2U base compute module can serve as a standalone Origin 350 server system, or it can be rackmounted with other optional modules to create an Origin 350 server system with more functionality. The base compute module consists of 2 to 4 64-bit MIPS RISC (reduced instruction set computer) processors and from 1 to 8 GB of local memory available on two to eight dual inline memory modules (DIMMs).

To expand the function of the system, you can combine this base compute module with one or more of the following optional modules:

- The system expansion compute module, which is interconnected to the base compute module via a NUMAlink 3 cable, adds processors, memory, and four PCI and PCI-X card slots to your system. It may or may not include an IO9 card. If it includes an IO9 card, it will take up the lowermost PCI/PCI-X slot. (The new combined single system created by connecting the base compute module with a system expansion compute module can include 4, 6, or 8 processors with local memory of up to 16 GB.)
- The 4U PCI expansion module adds PCI slots, but no processors, no memory, and no IO9 card. There are two versions of the PCI expansion module: one module has 12 PCI slots that support 3.3-V or universal PCI cards, and the other module has 6 PCI slots that support 5-V or universal PCI cards and 6 slots that support 3.3-V or universal PCI cards. For more information about this module, see the *PCI Expansion Module User's Guide (5.0-V Support and/or 3.3-V Support)* (007-4499-00*x*).
- The 2U memory and PCI expansion (MPX) module can provide extra memory and four PCI/PCI-X card slots for your system. See Chapter 4, "Memory and PCI Expansion (MPX) Module," for more information about this module.
- The SGI TP900 storage module, can provide additional storage for the system. See *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*) for information about this module. The Origin 350 server system supports other storage modules. See "Storage Expansion" on page 89 for information.
- The NUMAlink module connects two or more compute modules. See Chapter 5, "NUMAlink Module," for more information about this module.

Figure 3-1 shows front panel and side views of the compute module.

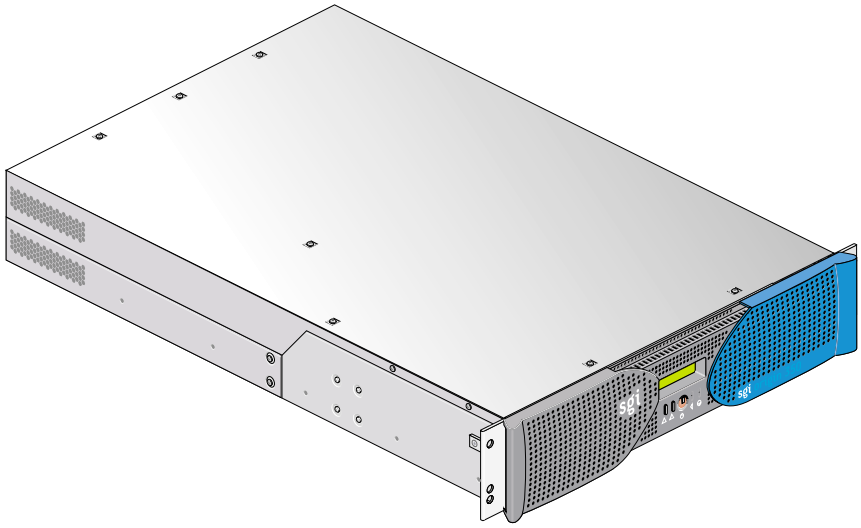


Figure 3-1 Front and Side Views of a Compute Module

The compute module includes the following features:

- L1 controller, which manages and monitors functions of the compute module such as system temperature. The module includes an L1 controller display, which displays system processes and error messages.
- Optional internal read-only slim-line DVD-ROM drive, and two hard disk drives.
- One or two power supplies. The second power supply, which is optional, is redundant to assure that your compute module will always have power.
- NUMAlink 3 port, which connects your system to a system expansion compute module, an MPX module, or a 4U PCI expansion module.
- Crosstown2 XIO port is supported, which enables the server system to connect to an InfiniteReality graphics pipeline.

- Four PCI/PCI-X card slots on two busses. These 64-bit slots can contain 33-MHz and 66-MHz PCI cards, or 66-MHZ and 100-MHz PCI-X cards. Your base compute system comes standard with an IO9 PCI card that is installed in the lowermost of these slots.

  Note: Because the IO9 card is a PCI card that runs at 66 MHz, the slot in the same bus as the IO9 card (bus 1, slot 2) can only run in PCI mode and no faster than 66 MHz.

- Two DB-9 serial ports. One labeled **L1 console port** (console and diagnostic port) enables you to connect a system console to the L1 controller on the compute module. The other, labeled **Serial port 1**, connects a serial device such as a printer or modem to the compute module.
- Type B USB (Universal Serial Bus) L1 port, which connects the compute module to an L2 controller.
- Factory-installed serial daughtercard (in the base compute module), which includes the following:
  - Three DB-9 serial ports, which connect RS-232/RS-422 serial devices, such as modems or printers, to the server system.
  - Two PS/2 connectors, one to connect a PS/2 keyboard, and one to connect a PS/2 mouse.
- IO9 card, which provides the following connectors and functions to your compute module:
  - Real-time interrupt input (RTI) port, and real-time interrupt output (RTO) port.
  - 10/100/1000 BaseT Ethernet port.
  - 68-pin VHDCI Ultra3 SCSI connector.

Table 3-1 compares an Origin 300 server system with an Origin 350 server system, and highlights the expanded functionality of the compute module.

Table 3-1 Comparing Origin 300 Server System with Origin 350 Server System

System Feature	Origin 300 Server System	Origin 350 Server System
MIPS RISC processors	2 or 4	2 or 4
Memory	512 MB to 4 GB	1 GB to 8 GB

Table 3-1 Comparing Origin 300 Server System with Origin 350 Server System **(continued)**

System Feature	Origin 300 Server System	Origin 350 Server System
I/O expansion slots	Two 64-bit slots for 33 MHz or 66 MHz PCI cards.	Three 64-bit slots for 33 MHz or 66 MHz PCI cards, and two 66 MHz or 100 MHz PCI-X cards.[a]
Serial ports	2 DB-9 RS-232 or RS-422 serial ports.	4 DB-9 RS-232 or RS-422 serial ports
Console port	1 DB-9 serial console port to connect a console to the server.	1 DB-9 serial console port to connect a console to the server.
3.5-inch drive bays	2	2
DVD-ROM (read-only)	None	1
USB type A ports	2 USB type A ports to connect keyboard and mouse.	None
PS/2 ports	None	2 PS/2 ports to connect keyboard and mouse.
L1 port (USB type B)	1 L1 port (USB type B) to connect the server to the L2 controller.	1 L1 port (USB type B) to connect the server to the L2 controller.
NUMAlink port	1	1
XIO port	1	1
Power supplies	1	2 (one power supply is redundant).
Ethernet port	One 10BaseT/100BaseT port	One 10BaseT/100BaseT/1000BaseT port
SCSI channel (internal)	1 Ultra3 SCSI, 160 MB/s	1 Ultra3 SCSI, 160 MB/s
SCSI channel (external)	1 Ultra3 SCSI (VHDCI)	1 Ultra3 SCSI (VHDCI)
RT interrupt input and output ports	1 input and 1 output	1 input and 1 output

a. This system has three (and not four) card slots available because the lowermost slot is used for a factory-installed IO9 card. Also, the number of slots available for PCI and PCI-X cards and for cards of different speeds differs because the IO9 card is a 66 MHz PCI card, which limits the slot located in the same bus as the IO9 card to operate in PCI mode with a speed of 66 MHz or less.

The compute module architecture includes the following components, which are shown in Figure 3-2 on page 113 and discussed in the following subsections:

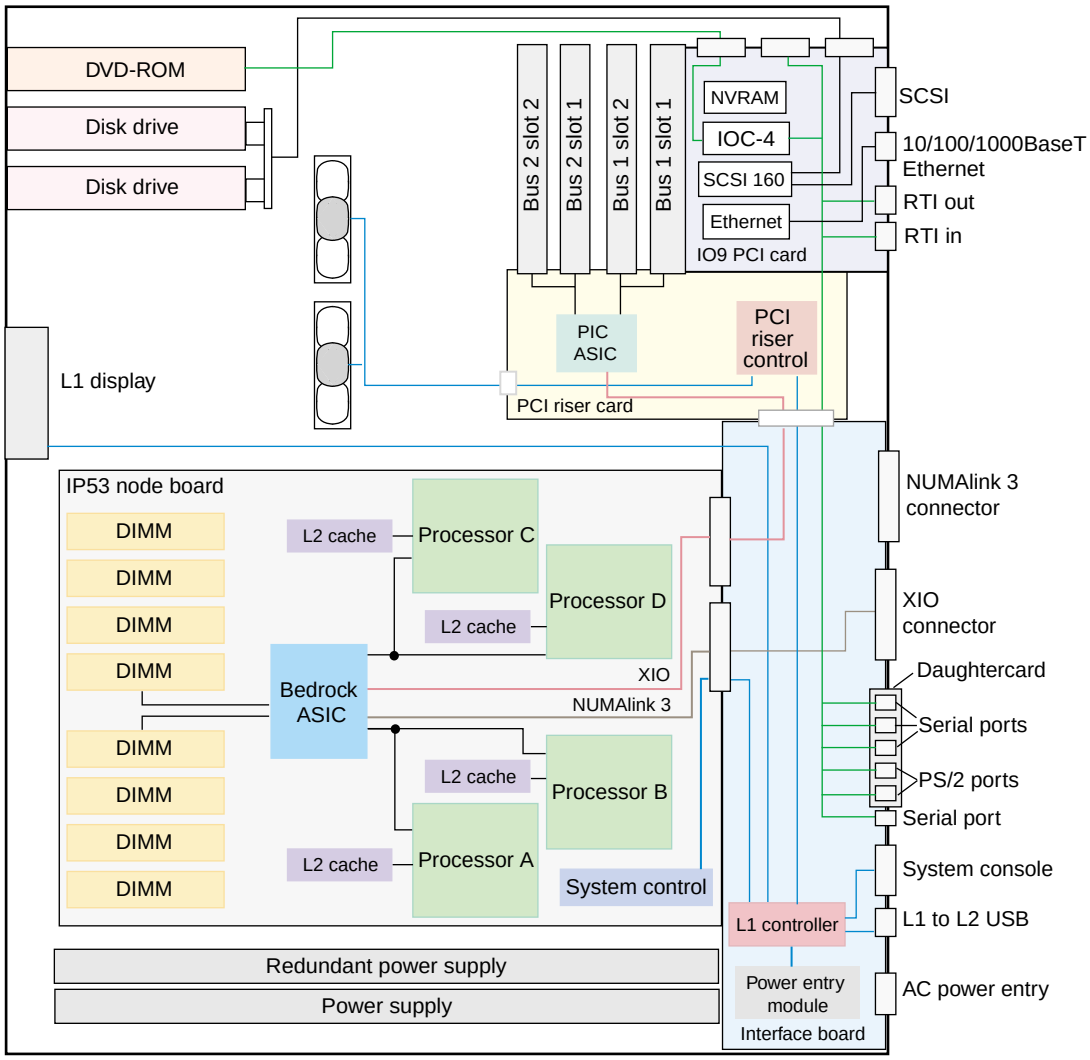


Figure 3-2 Block Diagram of Base Compute Module

IP53 Node Board

The IP53 node board consists of the following components, most of which are discussed in the subsections that follow.

- Two or four MIPS RISC processors (labeled CPU in Figure 3-3). Each processor has a secondary L2 cache.
- Primary and secondary (L2) cache. (The primary cache is internal to the processor. The L2 cache is labeled SRAM in Figure 3-3.)
- Eight dual inline memory module (DIMM) slots, for installation of DIMMs to provide 1 to 8 GB of main memory to local memory bank pairs on your server. See "Local Memory (DIMMs)" on page 116, for more information about DIMMs.
- Bedrock ASIC (or hub ASIC), which enables communication between the processors, memory, and I/O devices.
- Serial ID EEPROM, which contains component information.
- Three VRMs, which convert incoming voltages to voltages required by components.

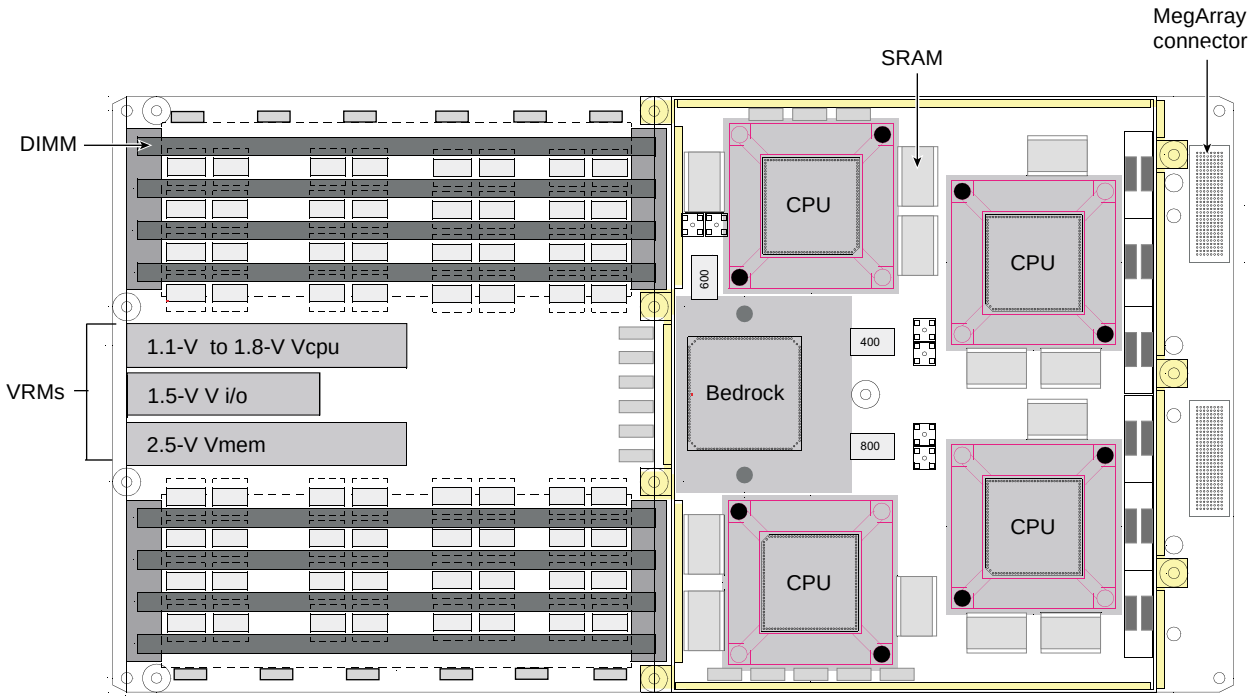


Figure 3-3 IP53 Node Board

Processors (CPUs)

The R16000 processors, which are soldered to the IP53 node board, implement the 64-bit MIPS IV instruction set architecture. The architecture gathers and decodes four instructions per cycle and issues the instructions to five fully pipelined execution units. It predicts conditional branches and executes instructions along the predicted path.

Each processor also uses a load/store architecture in which the processor does not operate on data located in memory; instead, it loads the memory data into its registers and then operates on the data. When the processor is finished manipulating the data, the processor stores the data in memory.

Primary and Secondary Cache

To reduce memory latency, a processor has access to two on-chip 32-KB L1 (primary) caches (one cache is for data and the other cache is for instructions) and an off-chip L2 (secondary) cache. The L1 caches are located within the processor for fast, low-latency access of instructions and data. The compute module supports a 4-MB L2 cache.

Note: The IP53 node boards use SECDED ECC to protect data when transferred to and from secondary cache, main memory, and directory memory.

The IP53 node boards use parity to protect data when transferred between a processor and primary cache, and to protect system commands sent between the Bedrock ASIC and a processor.

Local Memory (DIMMs)

Each compute module has from 1 to 8 GB of local memory, which includes main memory and directory memory for cache coherence.

Local memory is provided by DIMMs, which contain double data rate synchronous dynamic random-access memory (DDR SDRAM chips), installed in two or more DIMM slots located on the compute module.

These eight DIMM slots are laid out into one group of even-numbered slots 0, 2, 4, and 6, and a second group of odd-numbered slots 1, 3, 5, and 7, as shown in Figure 3-4.

DIMMs are installed or removed one per DIMM slot, and two at a time, so that the two DIMMs installed provide local memory, or remove local memory, for the same pair of banks. For example, you could install a DIMM in slot 0 and another in slot 1 to provide local memory for banks 0 and 1. And conversely, you could remove a DIMM from slot 0 and another from slot 1 in order to remove local memory from banks 0 and 1.

Note: The two DIMMs that compose a bank pair must be the same size; however, the bank pairs can differ in memory size.

Table 3-2 lists the DIMM slots and the corresponding bank pairs to which local memory is provided when DIMMs are installed:

Table 3-2 DIMMs and Bank Pairs

DIMM in Slot Number	Provides Local Memory for Bank Pair Numbers
0[a]	0 and 1
1	0 and 1
2	2 and 3
3	2 and 3
4	4 and 5
5	4 and 5
6	6 and 7
7	6 and 7

a. The first two DIMMs must be installed in DIMM slot 0 and DIMM slot 1.

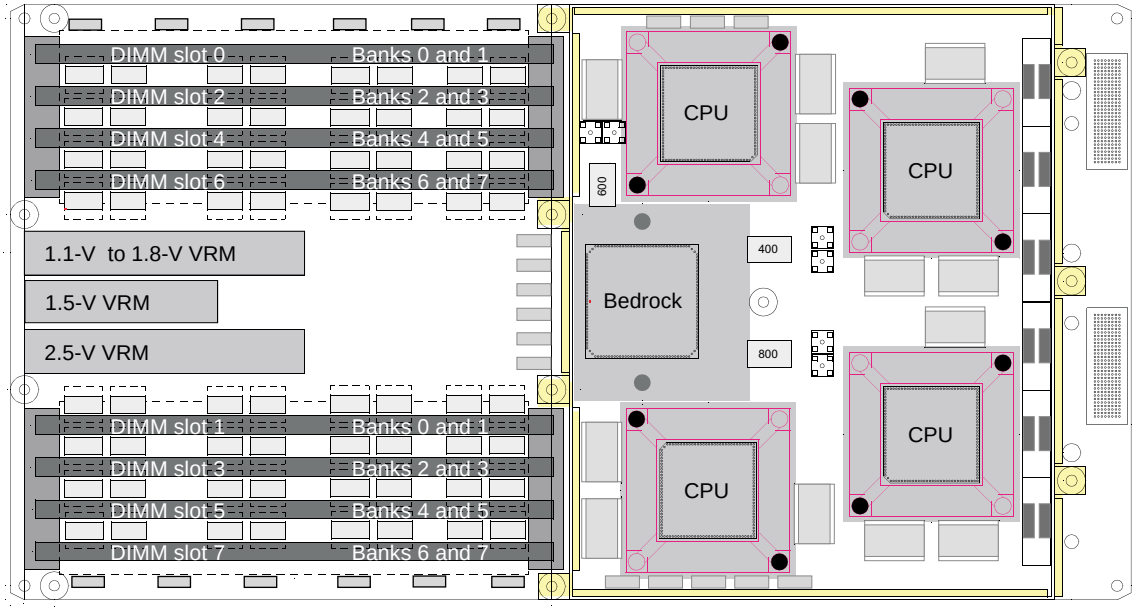


Figure 3-4 Local Memory Layout

Table 3-3 lists the DIMM sizes that the IP53 node boards support.

Table 3-3 Memory DIMM Specifications

DIMM Capacity	Chip Capacity	Total Memory Capacity
512 MB	128 MB	2 DIMMs (1 bank pair): 1 GB 8 DIMMs (4 bank pairs): 4 GB
1 GB	256 MB	2 DIMMs (1 bank pair): 2 GB 8 DIMMs (4 bank pairs): 8 GB

Bedrock ASIC

The Bedrock ASIC enables communication among the processors, memory, network, and I/O devices. It controls all activity within the node board (for example, error correction and cache coherency). The Bedrock ASIC also supports page migration.

The Bedrock ASIC consists of the following:

- A central crossbar (XB) provides connectivity between the Bedrock ASIC interfaces.
- Each of two processor interfaces (PI_0 and PI_1) communicates directly with two processors. If the node board contains two processors, only one processor interface is used.
- A memory/directory interface (MD) controls all memory access.
- A network interface (NI) is the interface between the crossbar unit and the NUMAlink 3 interconnect.
- An I/O interface (II) allows I/O devices to read and write memory (direct memory access [DMA] operations) and allows the processors within the system to control the I/O devices (PIO operations).
- A local block (LB) services processor I/O (PIO) requests that are local to the Bedrock ASIC.

IO9 Card

The IO9 PCI card, which resides in bus 1, slot 1 (the lowermost slot) of the base compute module, provides the base I/O functionality for the system.

Note: The expansion compute module can be ordered with an IO9 PCI card. This card resides in bus 1, slot 1.

The IO9 PCI card has the following connectors:

- External VHDCI 68-pin SCSI connector.
- 10/100/1000BaseT Ethernet connector.
- Real-time interrupt output (RTO) connector, and real-time interrupt input (RTI) connector.

The IO9 card also contains an IOC-4 ASIC that supports the following features:

- One IDE channel for the DVD-ROM.
- Four serial ports.
- Two PS/2 ports for keyboard and mouse connections.

Note: The PS/2 ports and three serial ports are located on a daughtercard that is only available on a base compute module.

- NVRAM and time-of-day clock.

Interface Board with a Daughtercard

The interface board contains the following components:

- L1 controller logic.
- Power supply interface.
- IO9 expansion connectors. Each of these connects to the serial daughtercard that contains DB-9 connectors (serial ports) and DIN-6 connectors (PS/2 ports).
- NUMAlink connector.
- XIO connector.
- Switch regulators.
- Connectors to the IP53 node board and the PCI riser card.

PCI Riser Card

The PCI riser card provides the following:

- PIC ASIC.
- Connectors that connect the PCI riser card to the interface board.
- Nonstandard PCI/PCI-X connector that connects to the IO9 card.
- Four PCI/PCI-X card slots (64 bit, 3.3 V) and a slot for a VPro V12 graphics board. (The slot for the VPro V12 graphics board is located on the backside of the PCI riser card.)

DVD-ROM

The compute module can contain an optional slim-line DVD-ROM that has CD-ROM capabilities.

Note: The DVD-ROM requires an IO9 PCI card.

The DVD-ROM is located at the front left side of the module (above the disk drives).

Disk Drives

The base compute module supports one or two sled-mounted Ultra3 SCSI disk drives that have a peak data transfer speed of up to 160 MB/s between the disks and system memory. The two disks connect to a SCSI backplane. The SCSI backplane connects to the internal SCSI 160 logic on the IO9 PCI card.

Note: An expansion compute module can also be ordered with SCSI disk drives. This configuration requires an IO9 PCI card.

Two disk drive sizes are available, as follows:

- 18-GB 15,000-RPM disk drive
- 73-GB 10,000-RPM disk drive

The disk drives are located at the front left side of the module (below the DVD-ROM). The master drive is the bottom drive.

Power Supplies

The compute module can contain one or two power supplies; the second power supply is optional and is required only when the customer wants redundant power. The power supply can input 110/220 VAC and output 500 W (12 VDC, 5 VDC, and -12 VDC.

Both power supplies are hot-swappable. They are located at the front right side of the module. The primary power supply is the left supply, and the redundant power supply is the right supply.

External Components

This section describes the external components of the compute module, which are located in the front and rear panels.

Front Panel Items

This section describes the front panel controls and indicators of the compute module, as shown in Figure 3-5.

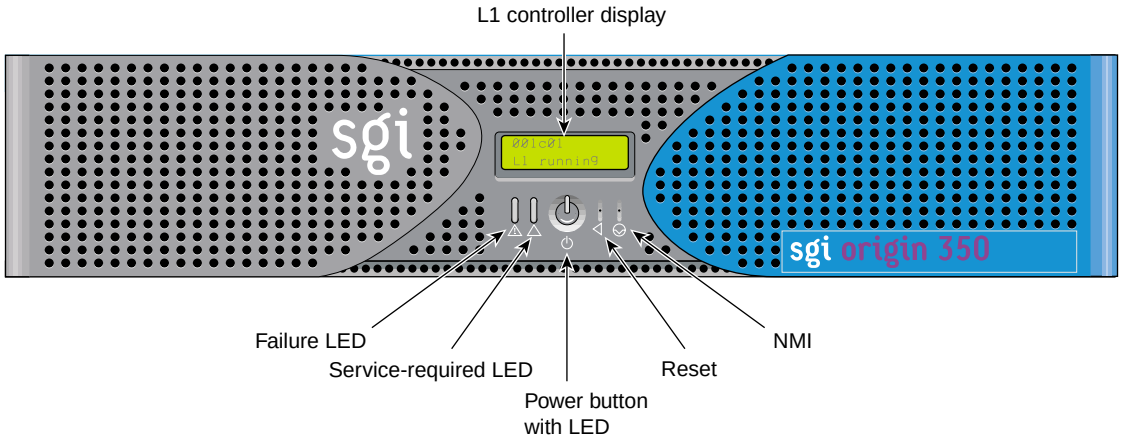


Figure 3-5 Front Panel Items

The front panel of the compute module has the following items:

- **L1 controller display.** A liquid crystal display (LCD) displays status and error messages that the L1 controller generates.

  Note: See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on the L1 controller.

- **Power button with LED**. Press this button to power on the internal components. Alternatively, you can power on the internal components at a system console. The LED illuminates green when the internal components are on.
- **Reset button**. Press this button to reset the internal processors and ASICs. The reset will cause a memory loss. (To perform a reset without losing memory, see the NMI button information that follows.)
- **NMI button**. Press the NMI (non-maskable interrupt) button to reset the internal processors and ASICs without losing memory. Register data and memory are stored in a `/var/adm/crash` file.
- **Service-required LED**. This LED illuminates yellow to indicate that an item has failed or is not operating properly, but the compute module is still operating.
- **Failure LED**. This LED illuminates red to indicate that a failure has occurred and that the compute module is down.

Rear Panel Items

This section describes the rear panel connectors, PCI/PCI-X slots, and LEDs of the compute module, as shown in Figure 3-6.

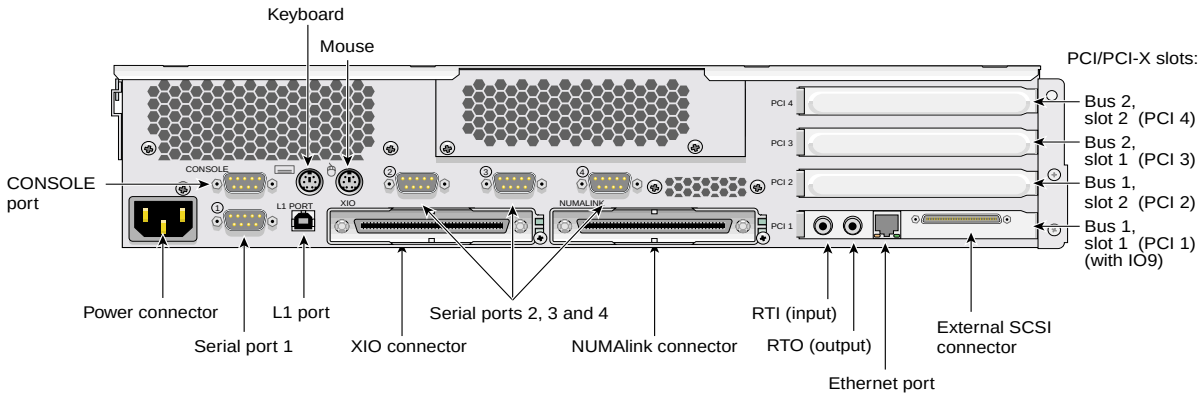


Figure 3-6 Rear Panel Items

The rear panel of the compute module has the following items:

- **Power connector.** This connector connects the base compute module to an AC power outlet.
- **Console port.** This DB-9 serial port (console and diagnostic port) enables you to connect a system console to the L1 controller on the compute module.
- **Serial port 1.** This DB-9 RS-232/RS-422 serial port connects a serial device, such as a printer or modem, to the compute module.
- **L1 port (USB type B).** This Universal Serial Bus (USB) type B connector connects the compute module's L1 controller to an L2 controller.
- **XIO connector**. This Crosstown2 connector connects the base compute module to an InfiniteReality graphics pipeline. This connection is made with a NUMAlink 3 cable at 800 MB/s in each direction.

    - **XIO connector LEDs.** The XIO connector has two LEDs. These LEDs are located to the right of the XIO connector. One LED lights yellow to indicate that both the compute module and the InfiniteReality graphics pipeline to which the compute module is connected are powered on. The other LED lights green when the compute module link to the graphics pipeline is established.

- **NUMAlink connector.** This NUMAlink 3 connector connects the base compute module to one of the following modules: expansion compute module, NUMAlink module, PCI expansion module, or MPX module. This connection is made with a NUMAlink 3 cable at 1.6 GB/s in each direction.

    - **NUMAlink 3 LED.** The NUMAlink 3 connector has two LEDs. These LEDs are located to the right of the NUMAlink 3 connector. One LED lights yellow to indicate that the compute module and the module to which it is connected are powered on. The other LED lights green when the link between the compute module and the module to which it is connected is established.

- **PCI/PCI-X slots (bus 1, slot 1; bus 1, slot 2; bus 2, slot 1; bus 2, slot 2).** These slots are labeled from bottom to top **PCI 1**, **PCI 2**, **PCI 3**, and **PCI 4**. Two of these slots are on one bus, and two slots are on another. These 64-bit slots can contain 33-MHz and 66-MHz PCI cards, and 66-MHz and 100-MHz PCI-X cards. (For an updated list of supported cards, see SGI Supportfolio at http://support.sgi.com.) The bottom-most slot contains an IO9 PCI card in the base compute module.

Note: If you run PCI and PCI-X cards on the same bus at the same time, the PCI-X card will run on PCI mode. And if you run cards of different speeds on the same bus, the highest-speed card will run at the speed of the slower card. For example, if a card is running at 100 MHz in one slot of a bus, and a card is running at 33 MHz in the second slot of the same bus, both cards will run at 33 MHz.

The factory-installed serial daughtercard (only available on the base compute module) provides the following connectors:

- **Two PS/2 ports (keyboard and mouse).** These ports connect a PS/2 keyboard and mouse to the system.
- **Serial ports 2, 3, and 4.** These three DB-9 RS-232/RS-422 serial ports connect serial devices, such as printers and modems, to the system.

The factory-installed IO9 card provides the following connectors:

- **Real-time interrupt input and output.** RTO (output) enables the compute module to interrupt an external device. RTI (input) enables an external device to interrupt the compute module.
- **Ethernet port (10/100/1000** Mbits)**.** This autonegotiating 10BaseT/100BaseT/1000BaseT twisted-pair Ethernet port connects the compute module to an Ethernet network.
- **SCSI connector.** This 68-pin VHDCI external SCSI port enables you to connect SCSI devices to the compute module. For an updated list of supported SCSI devices, see the SGI Supportfolio at http://support.sgi.com.

System Configuration

This section lists the internal compute module configuration options, such as the number of DIMMs that can be installed in the compute module to increase its local memory.

This section also lists external compute module configuration options that can enhance the performance of the Origin 350 server system. For example, the compute module can connect to a 2U TP900 storage system to expand storage, or it can connect to a PCI expansion module to increase I/O capabilities.

Internal Configurations

Processors, PCI and PCI-X cards, disk drives, and memory (DIMMs) are the configurable internal components of the compute module.

Warning: Of these configurable items, processors and the IO9 PCI card, can be installed and removed only by trained SGI system support engineers (SSEs).

As a customer, you can configure PCI and PCI-X cards, disk drives, and memory. See Chapter 4, “Installing and Removing Customer-replaceable Units,” for information about installing and removing these items to reconfigure your server module.

Warning: To prevent personal injury or damage to your system, only trained SGI system support engineers (SSEs) can service or configure internal components of the compute module that are not specifically listed as serviceable and configurable by customers.

External Configurations

The base compute module can be configured with the following optional items to expand its function:

- The system expansion compute module, which is interconnected to the base compute module via a NUMAlink 3 cable, adds processors, memory, and four PCI/PCI-X card slots. It may or may not include an IO9 card. (The combination of the base compute module with the system expansion compute module can create a single system that includes 4, 6, or 8 processors, with up to 16 GB of local memory, and seven PCI/PCI-X card slots.)
- The 4U PCI expansion module adds PCI slots, but no processors, no memory, and no IO9 card. There are two versions of the PCI expansion module: one module has 12 PCI slots that support 3.3-V or universal PCI cards, and the other module has 6 PCI slots that support 5-V or universal PCI cards and 6 slots that support 3.3-V or universal PCI cards. For more information about this module, see *PCI Expansion Module User's Guide (5.0-V Support and/or 3.3-V Support)* (007-4499-00*x*).
- The 2U memory and PCI expansion (MPX) module can provide extra memory and four PCI/PCI-X card slots to your system. See Chapter 4, "Memory and PCI Expansion (MPX) Module," for more information about this module.
- The TP900 storage module provides additional storage to the system. See *SGI Total Performance 900 Storage System User's Guide*, 007-4428-00*x*, for information about this module. The Origin 350 server system supports other storage modules. See "Storage Expansion" on page 89 for information.
- The NUMAlink module connects two or more compute modules. See Chapter 5, "NUMAlink Module," for more information about this module.

The Origin 350 server system can be configured in many different ways to satisfy your computing needs. This section shows two sample configurations.

Figure 3-7 shows an Origin 350 server system on a table top that includes the following items:

- A 2U base compute module has 4 processors, 8 GB of local memory, and three PCI/PCI-X card slots. The fourth lowermost PCI/PCI-X slot comes with a factory-installed IO9 PCI card. (Because the IO9 card is a 66 MHz PCI card, the slot immediately above where the IO9 card is installed, which is on the same bus, can only accommodate PCI cards that will run at a speed of 66 MHz or slower.)
- An MPX module adds 8 GB of local memory and four PCI/PCI-X card slots.

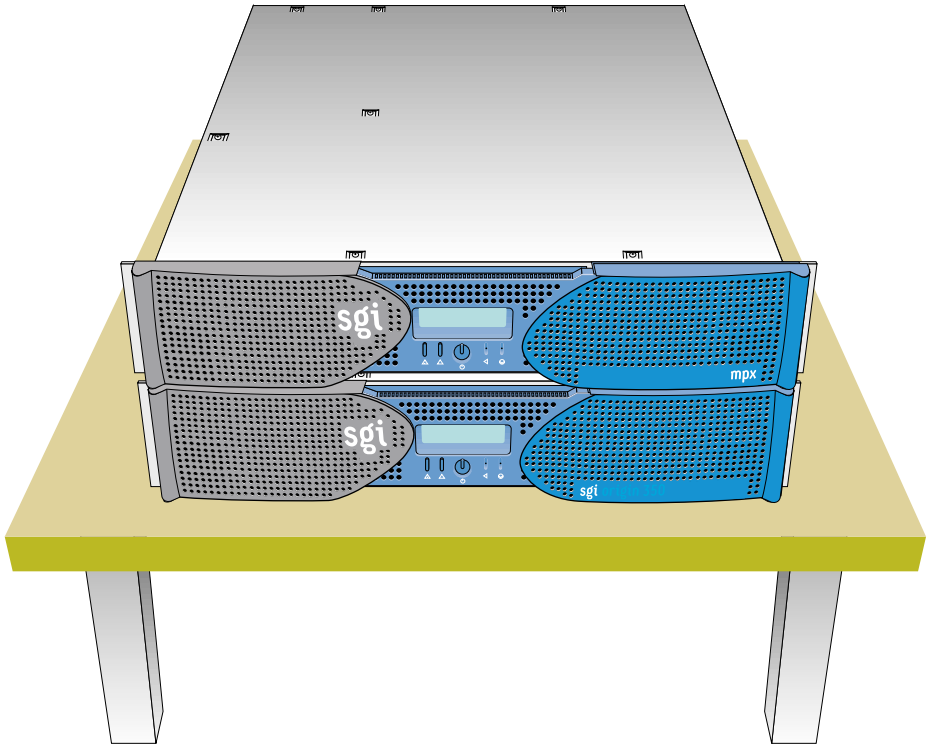


Figure 3-7 System with One Base Compute Module and One MPX Module

Figure 3-8 shows an Origin 350 server system rackmounted in a 17U rack that includes the following items (from top to bottom in the rack):

- A 4U PCI expansion module adds 12 PCI card slots to the server system.
- An MPX module adds 8 GB of local memory and four PCI/PCI-X card slots to your server system.
- A NUMAlink module (router) interconnects all the modules together into one server system.
- A 2U system expansion compute module adds 4 processors, 8 GB of local memory, and four PCI/PCI-X card slots.
- A 2U base compute module adds 4 processors, 8 GB of local memory, and two PCI/PCI-X and one PCI card slots. The fourth lowermost slot comes with a factory-installed IO9 PCI card. (Because the IO9 card is a 66 MHz PCI card, the slot immediately above where the IO9 card is installed, which is on the same bus, can only accommodate PCI cards that run at a speed of 66 MHz or slower.)
- A power bay.

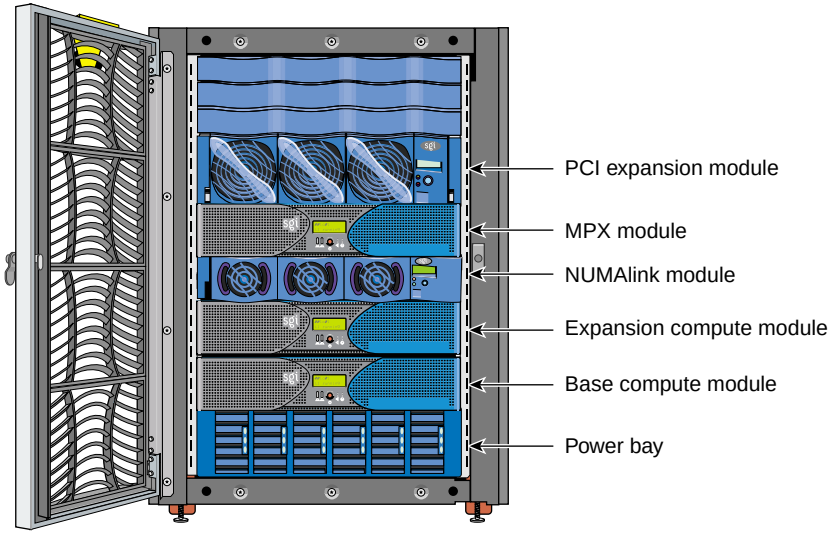


Figure 3-8 System with a PCI Expansion Module, an MPX Module, a NUMAlink Module, a System Expansion Compute Module, and a Base Compute Module

Technical Specifications

Table 3-4 lists the bandwidth characteristics of the compute module.

Table 3-4 Bandwidth Characteristics of the Compute Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	3.2 GB/s full duplex 1.6 GB/s each direction	~1420 MB/s each direction
Xtown2 channel	2.4 GB/s full duplex 1.2 GB/s each direction	~1066 MB/s half duplex ~1744 MB/s full duplex, ~872 MB/s each direction
Main memory	3200 MB/s	2140 MB/s
SYSAD	1600 MB/s	~1400 MB/s

Table 3-5 summarizes the general features of the compute module.

Note: The following table assumes that the expansion compute module does not include an optional IO9 PCI card, which would add one input and one output real-time interrupt port, an Ethernet port, and an internal and external SCSI drive, and support for one serial port. The IO9 card is also needed to support the DVD-ROM, the SCSI disc drives, and the serial daughtercard with the PS/2 connectors and three serial ports (this serial daughtercard is not an option for the expansion compute module).

Table 3-5 General Features of the Compute Module

Feature	Base Compute Module	Expansion Compute Module
MIPS RISC processor	2 or 4	2 or 4
Memory	1 GB to 8 GB	1 GB to 8 GB
Expansion slot	1 PCI, 2 PCI-X	4 PCI-X
Console port	1	1
NUMAlink port	1 (1.6 GB/s each direction)	1 (1.6 GB/s each direction)
XIO port	1 (800 MB/s each direction)	1 (800 MB/s each direction)

Table 3-5 General Features of the Compute Module **(continued)**

Feature	Base Compute Module	Expansion Compute Module
L1 port (USB, type B)	1	1
Serial port	4	
PS/2 port	1 keyboard and 1 mouse	
RT interrupt input port	1	
RT interrupt output port	1	
Ethernet port	One 10BaseT/100BaseT/1000BaseT	
SCSI port (internal)	1 Ultra3 SCSI, 160 MB/s	
SCSI port (external)	1 Ultra3 SCSI (VHDCI)	
3.5-in. drive bay	2	

Table 3-6 lists the specifications for the compute module.

Table 3-6 Compute Module Specifications

Characteristic	Specification
Height	3.44 in. (8.74 cm)
Width	17.06 in. (43.33 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	37.80 lb (17.18 kg) minimum configuration; 44.50 lb (20.23 kg) maximum configuration[a]
Noise	6 Bels sound power, up to 30 ºC
Heat dissipation	1315 Btu/hr maximum
Input power	120 - 240 VAC

a. Weight will vary depending on whether your system has one or two power supplies, on the amount of DIMMs installed, and on whether you have one or two disk drives in your system.

Memory and PCI Expansion (MPX) Module

This chapter describes the function and physical components of the 2U-high SGI memory and expansion (MPX) module, which can add local memory (DIMMs) and four PCI/PCI-X card slots to your system. Specifically, this chapter includes the following information:

System Features

Figure 4-1 shows a front panel and side view of the MPX module.

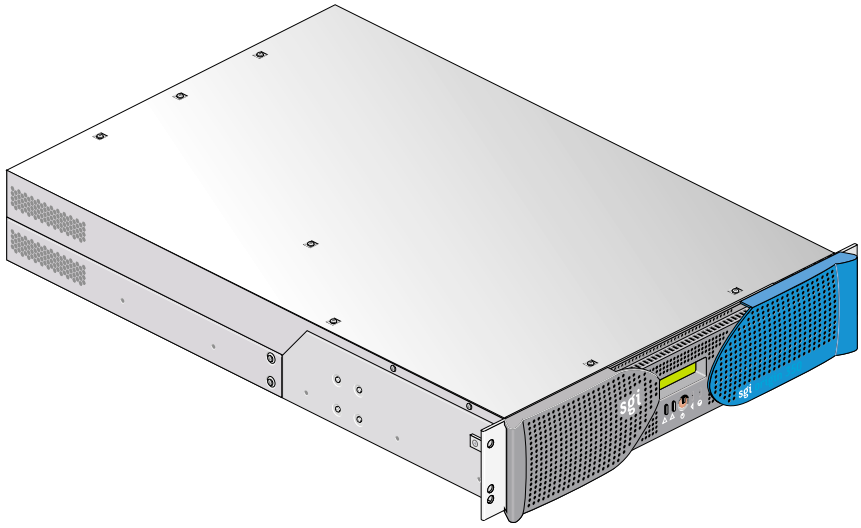


Figure 4-1 Front and Side Views of MPX Module

The MPX module includes the following features:

- The L1 controller manages and monitors the functions of the MPX module, such as system temperature. The system includes an L1 controller display system that processes error messages.
- The module can have one or two power supplies. The second power supply is redundant to assure that your server will always have power.
- The L1 port (type B, USB [Universal Serial Bus]) connector connects the module to an L2 controller.
- The NUMAlink port connects to a compute module.
- The Crosstown2 XIO port enables the server to connect to an InfiniteReality graphics pipeline.
- The console port is an RS-232 DB-9 serial connector used to connect a system console, which is used monitor and manage your system.
- Four 64-bit PCI and PCI-X card slots on two busses can contain 33-MHz and 66-MHz PCI cards, and 66-MHz and 100-MHz PCI-X cards.

The MPX module architecture includes the components discussed in the following subsections

IP53 Node Board

The IP53 node board consists of the following components:

- Eight dual-inline memory module (DIMM) slots allow installation of DIMMs to provide 1 to 8 GB of main memory to local memory bank pairs on your server system. For more information, see the subsection that follows.
- The Bedrock ASIC (or hub ASIC) enables communication between memory and I/O devices. For more information, see "Bedrock ASIC" on page 138.
- The serial ID EEPROM contains component information.
- Three VRMs convert incoming voltages to voltages required by components.

Local Memory (DIMMs)

Each MPX module has from 1 to 8 GB of local memory, which includes main memory and directory memory for cache coherence.

Local memory is provided by DIMMs, which contain double data rate synchronous dynamic random-access memory (DDR SDRAM chips), installed in two or more DIMM slots located on the MPX module.

These eight DIMM slots are laid out into one group of even-numbered slots 0, 2, 4, and 6, and a second group of odd-numbered slots 1, 3, 5, and 7, as shown in Figure 4-2.

DIMMs are installed one per DIMM slot, and two at a time, so that the two DIMMs provide local memory for the same pair of banks (see Table 4-1). Conversely, DIMMs are also removed two at a time, so that removing the two DIMMs removes local memory for the same pair of banks.

For example, if you install a DIMM in slot 0, you must also install a DIMM in slot 1 to provide local memory for bank pair 0 and 1. And conversely, if you remove a DIMM from slot 0, you must also remove a DIMM from slot 1 in order to remove local memory from bank pair 0 and 1.

Note: The two DIMMs that compose a bank pair must be the same size; however, the bank pairs can differ in memory size.

Table 4-1 lists the DIMM slots and the corresponding bank pairs to which local memory is provided.

Table 4-1 DIMM Slots and Corresponding Bank Pairs

DIMM in Slot Number	Provides Local Memory for Bank Pair Numbers
0[a]	0 and 1
1	0 and 1
2	2 and 3
3	2 and 3
4	4 and 5
5	4 and 5
6	6 and 7
7	6 and 7

a. The first two DIMMs must be installed in DIMM slot 0 and DIMM slot 1.

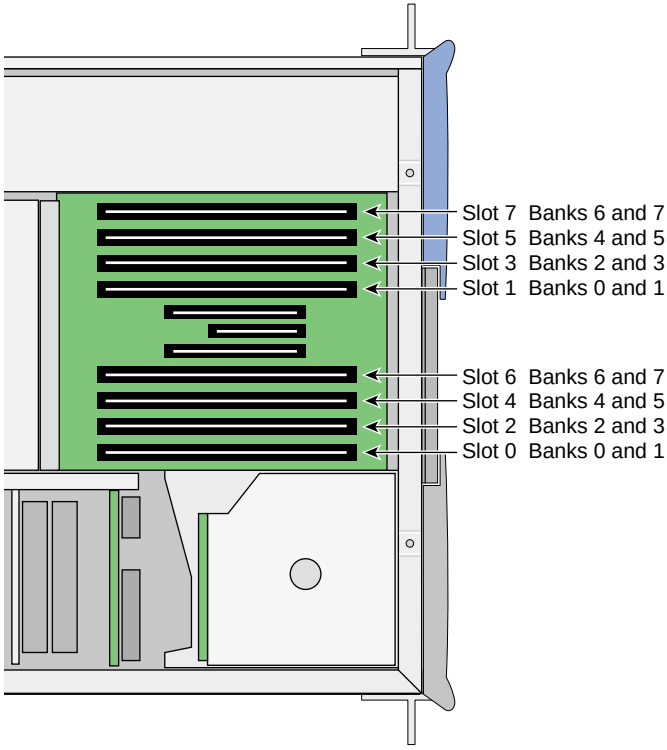


Figure 4-2 Local Memory Layout

Table 4-2 lists the DIMM sizes that the IP53 node boards support.

Table 4-2 Memory DIMM Specifications

DIMM Capacity	Chip Capacity	Total Memory Capacity
512 MB	128 MB	2 DIMMs (1 bank pair): 1 GB 8 DIMMs (4 bank pairs): 4 GB
1 GB	256 MB	2 DIMMs (1 bank pair): 2 GB 8 DIMMs (4 bank pairs): 8 GB

Bedrock ASIC

The Bedrock ASIC enables communication among the memory, network, and I/O devices. It controls all activity within the node board; for example, error correction and cache coherency. The Bedrock ASIC also supports page migration.

The Bedrock ASIC consists of the following:]

- A central crossbar (XB) provides connectivity between the Bedrock ASIC interfaces.
- A memory/directory interface (MD) controls all memory access.
- A network interface (NI) is the interface between the crossbar unit and the NUMAlink 3 interconnect.
- An I/O interface (II) allows I/O devices to read and write memory (direct memory access [DMA] operations).

Interface Board

The interface board contains the following components:

- L1 controller logic.
- Power supply interface.
- NUMAlink connector.
- XIO connector.
- Switching regulators.
- Connectors to the IP53 node board and the PCI riser card.

PCI Riser Card

The PCI riser card provides the following:

- PIC ASIC.
- Connectors that connect the PCI riser card to the interface board.
- Four PCI/PCI-X card slots (64 bit, 3.3 V) and a slot for a VPro V12 graphics board. (The slot for the VPro V12 graphics board is located on the backside of the PCI riser card.)

Power Supplies

The MPX module can contain one or two power supplies; the second power supply is optional and is required only when you want redundant power. The power supply can input 110/220 VAC and output 500 W (12 VDC, 5 VDC, and -12 VDC).

Both power supplies are hot-swappable. They are located at the front right side of the module. The primary power supply is the left supply and the redundant power supply is the right supply.

External Components

This section describes the external components of the MPX module, which are located in the front and rear panels.

Front Panel Items

This section describes the front panel controls and indicators of the MPX module, as shown in Figure 4-3.

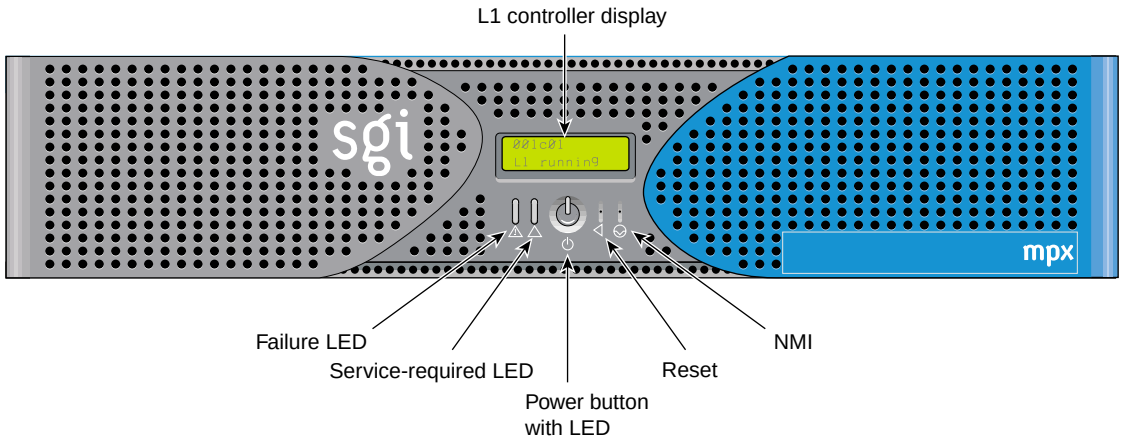


Figure 4-3 Front Panel Items

The front panel of the MPX module has the following items:

- **L1 controller display.** A liquid crystal display (LCD) displays status and error messages that the L1 controller generates.

  Note: See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on the L1 controller.

- **Power button with LED**. Press this button to power on the internal components. Alternatively, you can power on the internal components at a system console. The LED illuminates green when the internal components are on.
- **Reset button**. Press this button to reset the internal processors and ASICs. The reset will cause a memory loss. (To perform a reset without losing memory, see the NMI button information that follows.)
- **NMI button**. Press the NMI (non-maskable interrupt) button to reset the internal processors and ASICs without losing memory. Register data and memory are stored in a `/var/adm/crash` file.
- **Service-required LED**. This LED illuminates yellow to indicate that an item has failed or is not operating properly, but the MPX module is still operating.
- **Failure LED**. This LED illuminates red to indicate that a failure has occurred and that the MPX module is down.

Rear Panel Items

This section describes the rear panel connectors, PCI/PCI-X slots, and LEDs of the MPX module, as shown in Figure 4-4.

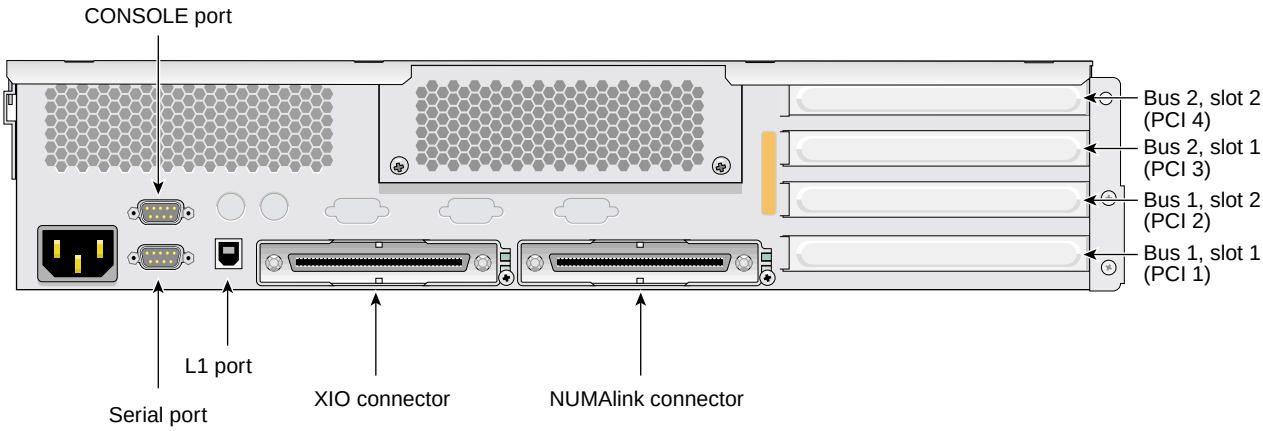


Figure 4-4 Rear Panel Items

The rear panel of the MPX module has the following items:

- **Power connector.** This connector connects the MPX module to an AC power outlet.
- **Console port.** This DB-9 serial port (console and diagnostic port) enables you to connect a system console to the L1 controller on the MPX module.
- **Serial port.** This DB-9 RS-232/RS-422 serial port, which connects a serial device such as a printer or modem to the module, is not operable.
- **L1 port (USB type B).** This Universal Serial Bus (USB) type B connector connects the MPX module's L1 controller to an L2 controller.
- **XIO connector**. This Crosstown2 connector connects the MPX module to an InfiniteReality graphics pipeline. This connection is made with a NUMAlink 3 cable at 800 MB/s in each direction.
    - **XIO connector LEDs.** The XIO connector has two LEDs. These LEDs are located to the right of the XIO connector. One LED lights yellow to indicate that both the MPX module and the InfiniteReality graphics pipeline to which the MPX module is connected are powered on. The other LED lights green when the MPX module link to the graphics pipeline is established.
- **NUMAlink connector.** This NUMAlink 3 connector connects the MPX module to one of the following modules: base compute module, expansion compute module, NUMAlink module, or PCI expansion module. This connection is made with a NUMAlink 3 cable at 1.6 GB/s in each direction.

- **NUMAlink 3 LED.** The NUMAlink 3 connector has two LEDs. These LEDs are located to the right of the NUMAlink 3 connector. One LED lights yellow to indicate that the MPX module and the module to which it is connected are powered on. The other LED lights green when the link between the MPX module and the module to which it is connected is established.

- **PCI/PCI-X slots (bus 1, slot 1; bus 1, slot 2; bus 2, slot 1; bus 2, slot 2).** These slots are labeled from bottom to top **PCI 1**, **PCI 2**, **PCI 3**, and **PCI 4**. Two of these slots are on one bus, and two slots are on another. These 64-bit slots can contain 33-MHz and 66-MHz PCI cards, or 66-MHz and 100-MHz PCI-X cards. (For an updated list of supported cards, see SGI Supportfolio at http://support.sgi.com.)

Note: If you run PCI and PCI-X cards on the same bus at the same time, the PCI-X card will run on PCI mode. And if you run cards of different speeds on the same bus, the highest speed card will run at the speed of the slower card. For example, if a card is running at 100 MHz in one slot of a bus, and a card is running at 33 MHz in the second slot of the same bus, both cards will run at 33 MHz.

System Configurations

This section lists the internal MPX module configuration options such as the number of DIMMs that can be installed in the MPX module to increase its local memory.

This section also lists external MPX module configuration options that can enhance the performance of the Origin 350 server system. For example, the a server system configuration can include an MPX module together with a base compute module, a 2U SGI TP900 storage system to expand storage, and a PCI expansion module to increase I/O capabilities.

Internal Configurations

PCI and PCI-X cards and memory (DIMMs) are the configurable internal components of the MPX module.

As a customer, you can configure PCI and PCI-X cards and memory. See Chapter 4, “Installing and Removing Customer-replaceable Units,” for information about installing and removing these items to reconfigure your MPX module.

Warning: To prevent personal injury or damage to your system, only trained SGI system support engineers (SSEs) can service or configure internal components of the MPX module that are not specifically listed as serviceable and configurable by customers.

External Configurations

The MPX module can be configured together with the following items to expand the function of your server system:

- Every system must include a base compute module. The base compute module can have 2 or 4 processors, up to 8 GB of local memory, an optional DVD-ROM, one or two SCSI disk drives, and two PCI/PCI-X and one PCI slots. The fourth slot includes an IO9 card that adds various connectors to your system, including a serial daughtercard.
- The system expansion compute module, which is interconnected to the base compute module via a NUMAlink 3 cable, adds processors, memory, and four PCI/PCI-X card slots. It may or may not include an IO9 card, but it does not have a serial daughtercard.
- The 4U PCI expansion module adds PCI slots, but no processors, no memory, and no IO9 card. There are two versions of the PCI expansion module: one module has 12 PCI slots that support 3.3-V or universal PCI cards and the other module has 6 PCI slots that support 5-V or universal PCI card and 6 slots that support 3.3-V or universal PCI cards. For more information about this module, see the P*CI Expansion Module User's Guide (5.0-V Support and/or 3.3-V Support)* (007-4499-00*x*).
- The TP900 storage module provides additional storage to the system. See *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*), for information about this module. The Origin 350 server system supports other storage modules. For information, see "Storage Expansion" on page 89.
- The NUMAlink module connects two or more modules. See Chapter 5, "NUMAlink Module," for information about this module.

The Origin 350 server system can be configured with an MPX module in many different ways to satisfy your computing needs. This section shows two sample configurations.

Figure 4-5 shows an Origin 350 server system on a table top that includes the following items:

- An MPX module adds 8 GB of local memory and four PCI/PCI-X card slots to your system.
- A 2U base compute module has 4 processors, 8 GB of local memory, and two PCI/PCI-X and one PCI card slots. (Because the fourth lowermost slot comes with a factory-installed IO9 PCI 66 MHz card, the slot right above it, which is on the same bus as the slot in which the IO9 PCI card is installed, can only accommodate a PCI card that runs at a speed of 66 MHz or slower.)

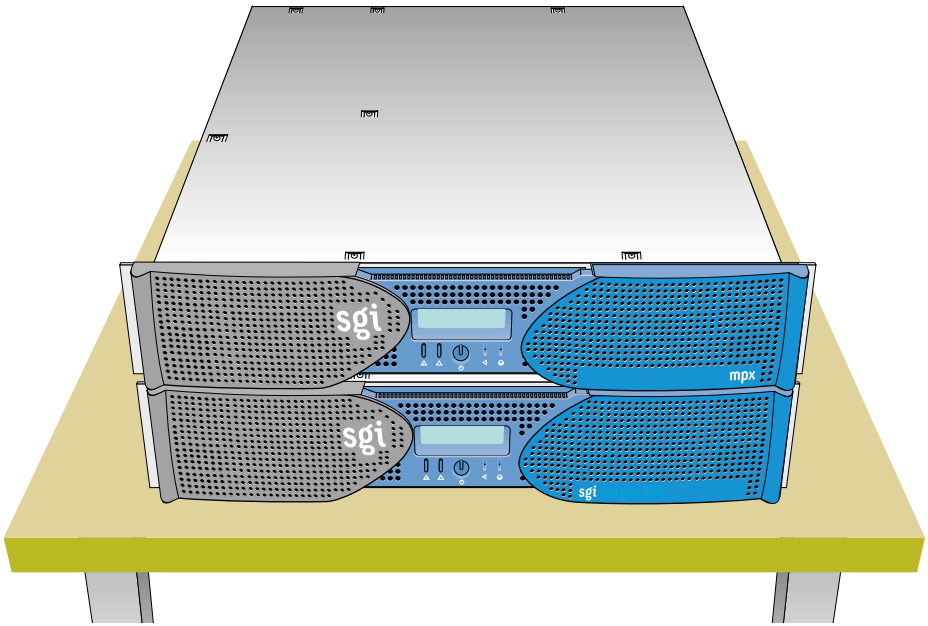


Figure 4-5 System with One MPX Module and One Base Compute Module

Figure 4-6 shows an Origin 350 server system rackmounted in a 17U rack that includes the following items (from top to bottom in the rack):

- A 4U PCI expansion module adds 12 PCI card slots to the server system.
- An MPX module adds 8 GB of local memory and four PCI/PCI-X card slots.
- A NUMAlink module (router) interconnects all the modules together into one server system.
- A 2U system expansion compute module adds 4 processors, 8 GB of local memory, and four PCI/PCI-X card slots.
- A 2U base compute module adds 4 processors, 8 GB of local memory, and two PCI/PCI-X and one PCI card slots. (Because the fourth lowermost slot comes with a factory-installed IO9 PCI 66 MHz card, the slot right above it, which is on the same bus as the slot in which the IO9 PCI card is installed, can only accommodate a PCI card that runs at a speed of 66 MHz or slower.)
- A power bay.

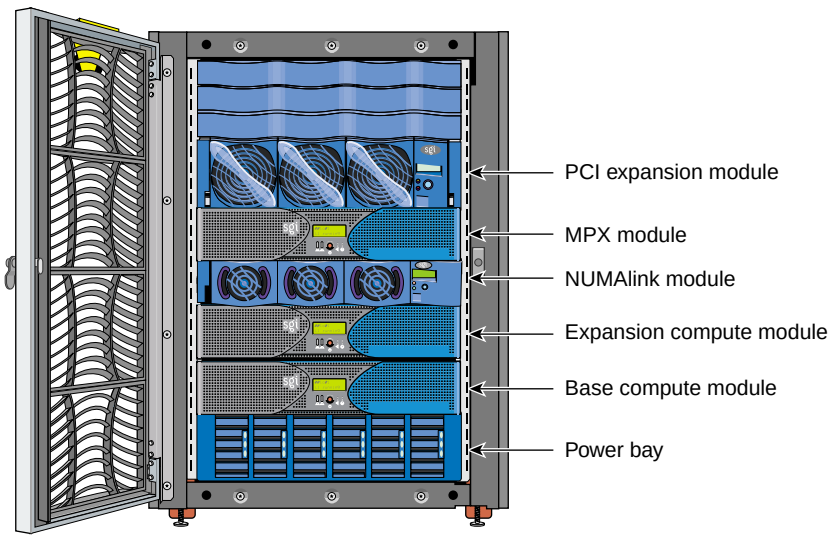


Figure 4-6 System with PCI Expansion Module, MPX Module, NUMAlink Module, System Expansion Compute Module, and a Base Compute Module

Technical Specifications

Table 4-3 lists the bandwidth characteristics of the MPX module.

Table 4-3 Bandwidth Characteristics of the MPX Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	3.2 GB/s full duplex 1.6 GB/s each direction	~1420 MB/s each direction
Xtown2 channel	2.4 GB/s full duplex 1.2 GB/s each direction	~1066 MB/s half duplex ~1744 MB/s full duplex, ~872 MB/s each direction
Main memory	3200 MB/s	2140 MB/s
SYSAD	1600 MB/s	~1400 MB/s

Table 4-4 lists the specifications for the MPX module.

Table 4-4 MPX Module Specifications

Characteristic	Specification
Height	3.44 in. (8.74 cm)
Width	17.06 in. (43.33 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	37.80 lb (17.18 kg) minimum configuration; 44.50 lb (20.23 kg) maximum configuration[a]
Input power	120 - 240 VAC

a. Weight will vary depending on whether your system has one or two power supplies and on the amount of DIMMs installed.

NUMAlink Module

This chapter describes the function and physical components of the NUMAlink module in the following sections:

Overview

The NUMAlink module is a high-speed switch that routes network packets between compute modules, MPX modules, and PCI expansion modules. The NUMAlink module consists of eight ports. Four ports can connect to compute modules and/or MPX modules. The other four ports, which carry USB signals, can connect to compute modules, MPX modules, and/or PCI expansion modules.

Note: The USB signals enable the compute modules, MPX modules, and PCI expansion modules to communicate with the L2 controller. The compute modules and/or MPX modules that connect to the four ports that do not carry USB signals communicate with the L2 controller directly or via a USB hub.

The NUMAlink module has the following features:

- SGI custom-designed router ASIC, which is an eight-port crossbar that connects any input-link channel to any of the seven possible output-link channels (see Figure 5-1). The NUMAlink channels operate at 1.6 GB/s (each direction).
- USB port for system controller support.
- L1 controller and LCD display.
- Two hot-pluggable cooling fans.

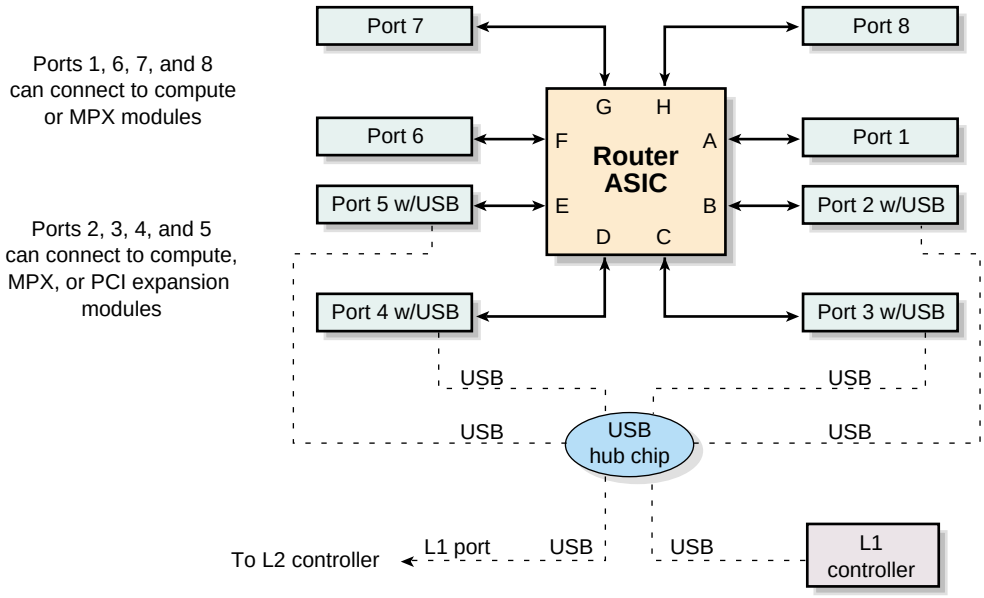


Figure 5-1 Block Diagram of NUMAlink Module

External Components

This section describes the external components on the front and rear panels of the NUMAlink module.

Front Panel Components

The NUMAlink module contains the following front panel items (see Figure 5-2):

- **L1 display.** The L1 display is a 55.7 mm x 32 mm backlit liquid crystal display (LCD) that displays system messages. It displays two lines with a maximum of 12 characters on each line.

  Note: See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information about the L1 controller.

- **On/Off switch with LED.** Press this button to turn on the NUMAlink module internal components. You can also turn on the NUMAlink module internal components at a system console.
- **Three LEDs:**
  - On/Off switch LED. This LED illuminates green when the NUMAlink module internal components are on and turns off when they are off.
  - Service-required LED. This LED illuminates orange to indicate that an item is broken or not operating properly (for example, a fan is off), but the NUMAlink module is still operating.
  - Failure LED. This LED illuminates red to indicate that a system failure has occurred and the NUMAlink module is down.
- **Fans.** Two hot-pluggable fans provide N+1 redundant cooling.

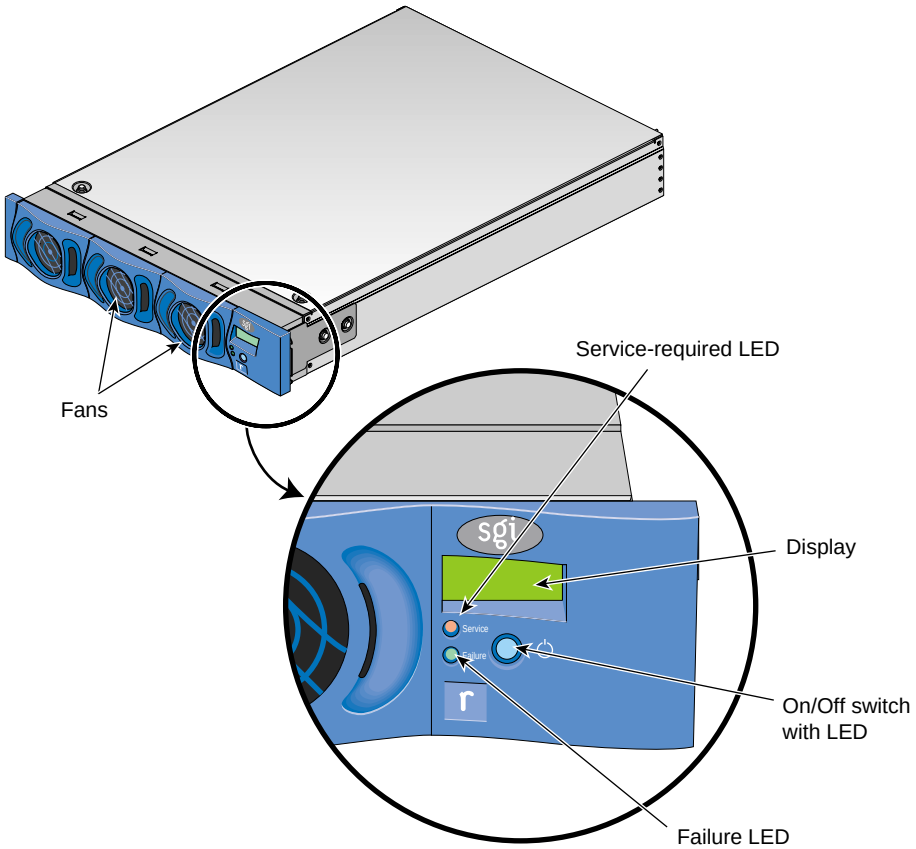


Figure 5-2 Front View of NUMAlink Module

Rear Panel Components

The NUMAlink module has the following rear panel items (see Figure 5-3):

- **Power connector.** This connector connects the NUMAlink module to a power distribution unit or power strip via a power cable.
- **LINKS R TO R connectors** (1, 6, 7, and 8, or A, F, G, and H). These link connectors connect the NUMAlink module to compute modules and/or MPX modules.
- **LINKS R TO R and C TO R connectors** (2, 3, 4, and 5, or B, C, D, and E). These link connectors connect the NUMAlink module to compute modules, MPX modules, and/or PCI expansion modules.
- **Link connector LEDs.** Each link connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the NUMAlink module and the module to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the NUMAlink module and the module to which it is connected.
- **L1 port connector.** This connector connects the internal USB hub of the NUMAlink module to the L2 controller. The internal USB hub receives the USB signals from the L2 controller via this port and distributes these signals to the following components:
  - The L1 controllers of the modules that connect to ports 2, 3, 4, and 5.
  - The internal L1 controller of the NUMAlink module.

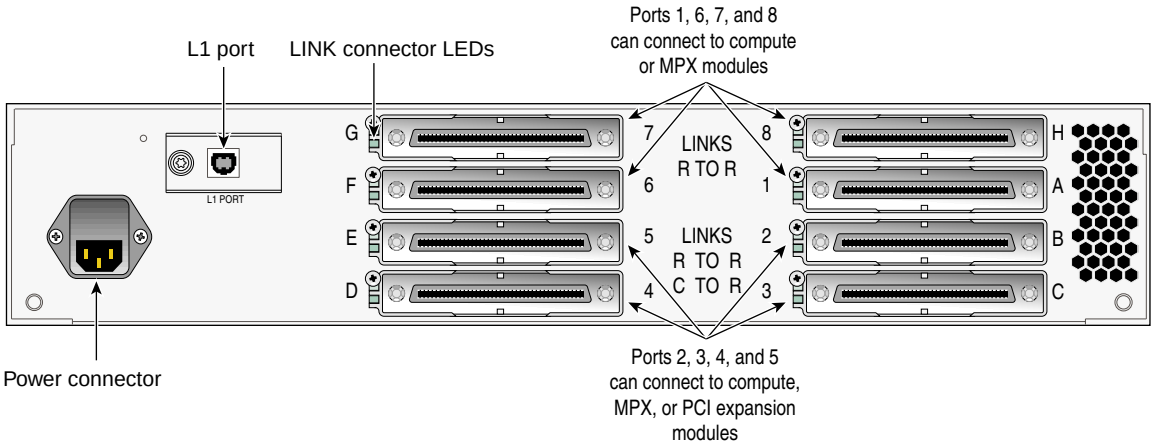


Figure 5-3 Rear View of NUMAlink Module

Technical Specifications

Table 5-1 lists the technical specifications of the NUMAlink module.

Table 5-1 NUMAlink Module Technical Specifications

Characteristic	Specification
Height	3.3 in. (83.82 mm)
Width	17.38 in. (441.45 mm)
Depth	27.5 in. (698.50 mm)
Weight	20 lb (9.1 kg)
Input power	110/220 VAC (~ 60 W)

Table 5-2 lists the specifications of the NUMAlink module ports.

Table 5-2 NUMAlink Module Port Specifications

Port	Quantity	Peak Transfer Rate
Link	8	1.6 GB/s each direction
L1	1	12 Mbits/s

Table 5-3 lists the bandwidth characteristics of the NUMAlink module.

Table 5-3 Bandwidth Characteristics of the NUMAlink Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	3.2 GB/s full duplex 1.6 GB/s each direction	~1420 MB/s each direction

Installing and Removing Customer-replaceable Units

This chapter provides safety instructions to follow when using and maintaining your system. It also describes how to install and remove module customer-replaceable units (CRUs). This information is covered in the following sections:

Safety Instructions

Before you perform any type of maintenance to your system, read the following safety instructions:

- Follow all warnings and instructions marked on the product and noted in this and other documentation included with the product.
- Unplug this product from the wall outlet before you clean it. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- Do not use this product near water.
- Do not place this product or components of this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.

- Slots and openings on the cabinet and components are provided for ventilation, reliable operation, and protection from overheating of the product. These slots and openings must not be blocked or covered. This product should never be placed near or over a radiator or heat register, or in a built-in installation unless proper ventilation is provided.
- This product should be operated with the type of power indicated on the marking label. If you are not sure of the type of power available, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where people will walk on the cord.
- Do not use extension cords with your SGI system.
- Never push objects of any kind into this product through cabinet slots because they may touch dangerous voltage points or short out parts that could result in a fire or electric shock.
- Never spill liquid of any kind on the product.
- Do not attempt to service this product yourself except as noted in this guide. Opening or removing covers of internal components may expose you to dangerous voltage points or other risks. Refer all servicing to qualified service personnel.
- Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
  - If the power cord or plug is damaged or frayed.
  - If the product has been exposed to rain, water, or other type of liquid.
  - If the product does not operate normally when the operating instructions are followed.

    Note: Adjust only those controls that are covered by the operating instructions, because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal condition.

  - If the product has been dropped or if the cabinet has been damaged.
  - If the product exhibits a distinct change in performance, which indicates a need for service.

- Only qualified service personnel should replace the soldered lithium battery (or batteries) in the SGI Origin 350 server system. Please see the “Lithium Battery Statement” on page 242 for more information.
- Use only the proper type of power supply cord set (provided with the system) for this unit.

PCI and PCI-X Cards

Your system module and various optional modules in your system support PCI and PCI-X cards. The following instructions, which describe how to install and remove a PCI or PCI-X card from an Origin 350 server system base compute module, can be used to install and remove PCI and PCI-X cards from the expansion compute module and a memory and PCI expansion (MPX) module. Figure 6-1 shows the location of the PCI and PCI-X card slots in the base compute module.

For an updated list of supported PCI and PCI-X cards, see SGI Supportfolio at http://support.sgi.com.

This section describes the following:

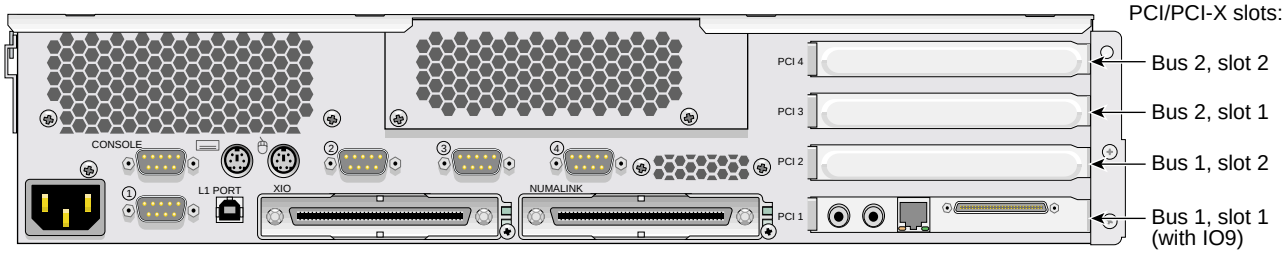


Figure 6-1 PCI and PCI-X Card Slots in the Rear Panel of the Base Compute Module

Rules for Card Installation and Removal

When installing or removing PCI or PCI-X cards from your system, be aware of the following rules:

- If you run a PCI and PCI-X cards on the same bus at the same time, the PCI-X card will run on PCI mode.
- If you run cards of different speeds on the same bus, the highest-speed card will run at the speed of the slower card. For example, if a card is running at 100 MHz in one slot of a bus and a card is running at 33 MHz on the second slot of the same bus, both cards will run at 33 MHz.
- When deciding to install a PCI or PCI-X card, be aware that if an IO9 card (a PCI card that runs at 66 MHz) is installed in your module (usually in the lowermost slot), and if you want to install a card in a slot (slot immediately above where the IO9 card is installed) that is on the same bus as the IO9 card, the slot will operate only in PCI mode at a speed no faster than 66 MHz.
- Note the following caution when installing or removing a card:

Caution: Electronic equipment can be irreparably damaged by electrostatic discharge (ESD). Always follow these preventive measures when you handle a system component:

- Remove a component from its antistatic bag only when you are ready to install it.

- If you handle a component before installation, do not place it on surfaces that produce ESD (carpeting, for example) or near devices that create static electricity.

- Attach a static wrist strap to a grounded connection on your system when you install or remove a component.

Installing a Card

To install a PCI or PCI-X card, follow these steps:

1. Power off the server system. For power off instructions, see “Powering the Server System On and Off” on page 53.
2. Disconnect all of the cables at the rear of the module.

Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. If your module is rackmounted, remove the two screws that secure the module to the front rails of the rack. If your module is not rackmounted, proceed to step 5.
4. Pull the module from the rack until it is stopped by the safety latches.

Note: If you are removing a card from one of the two lower slots (bus 1, slot 1, or bus 1, slot 2), you must remove the module from the rack. For instructions, see "Removing a Module on Slide Rails from a Rack" on page 39.

5. Make sure that you read "Safety Instructions" on page 155, and "Rules for Card Installation and Removal" on page 158 before beginning your card installation.
6. To access the card, remove the ten Phillips screws as shown in Figure 6-2 and lift the hinged cover. If you are installing a card into the top two PCI/PCI-X slots, you can install it without removing the module from the rack.

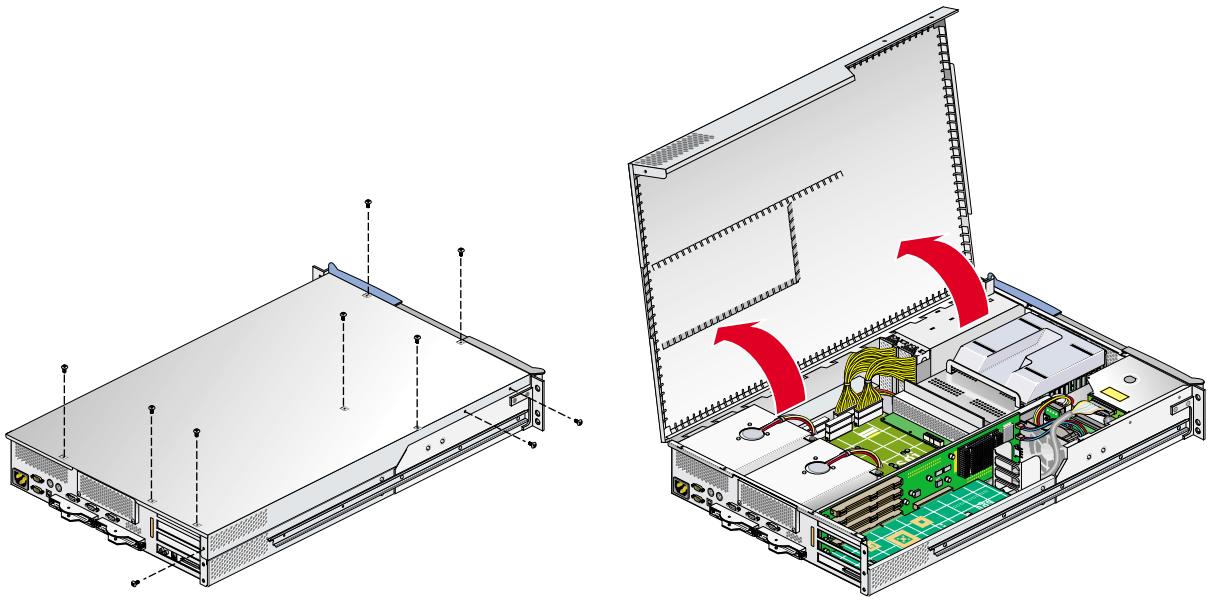


Figure 6-2 Opening the Cover to Install the Card

7. If you are installing a card in one of the two bottom-most card slots, you must also remove the chassis rail by unscrewing the five Phillips screws, as shown in Figure 6-3. (If you are not installing a card into one of the bottom-most card slots, proceed to step 9.)

Caution: Your system may or may not have a factory-installed IO9 card, which always comes installed in the lowermost slot. To prevent damage to your system, only a trained SGI service support engineer can install or remove an IO9 card.

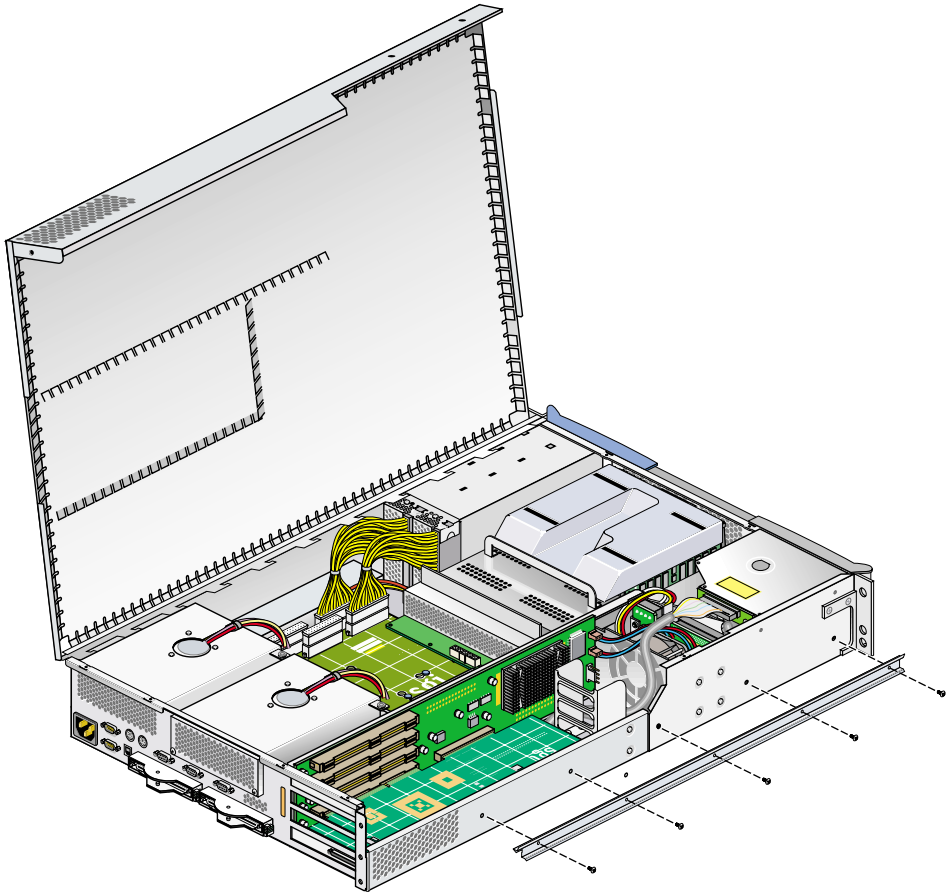


Figure 6-3 Removing the Chassis Rail

8. If you are installing a card in one of the two lowermost card slots, you must also remove the lower PCI/PCI-X support bracket that covers the two lowermost slots, as shown in Figure 6-4, by removing the four Phillips screws.

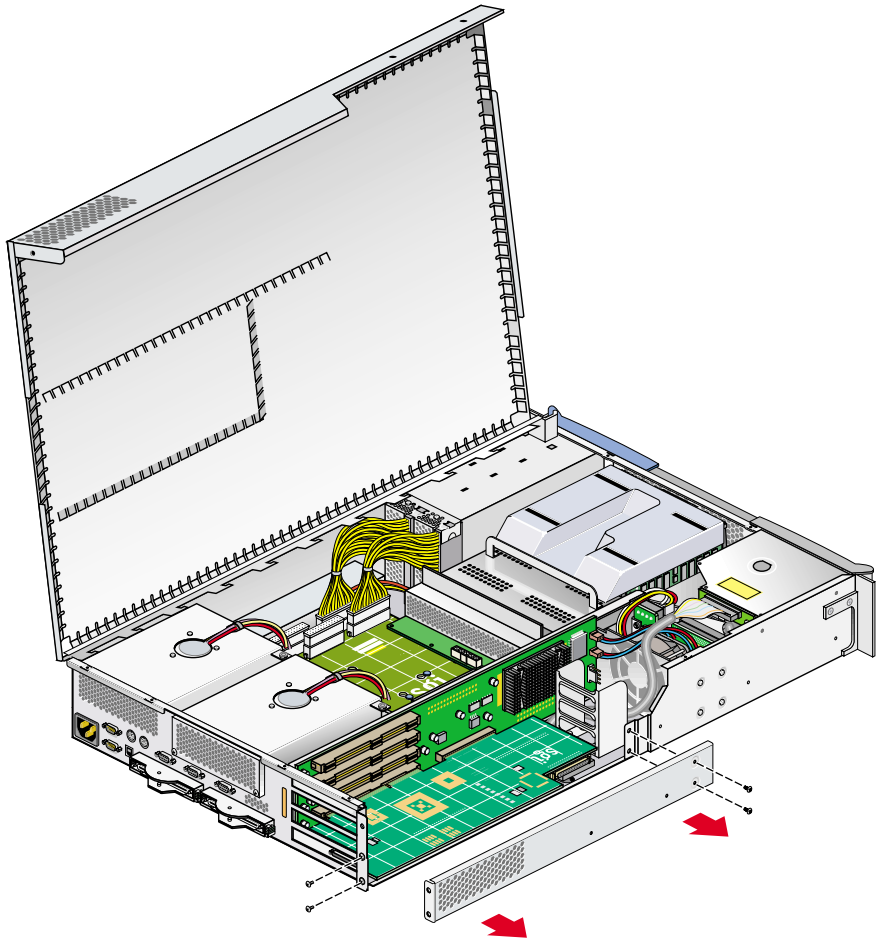


Figure 6-4 Removing the Lower PCI/PCI-X Support Bracket

9. If a blanking plate covers the slot that is needed for the installation, remove the retaining screw, as shown in Figure 6-5, and the blanking plate.

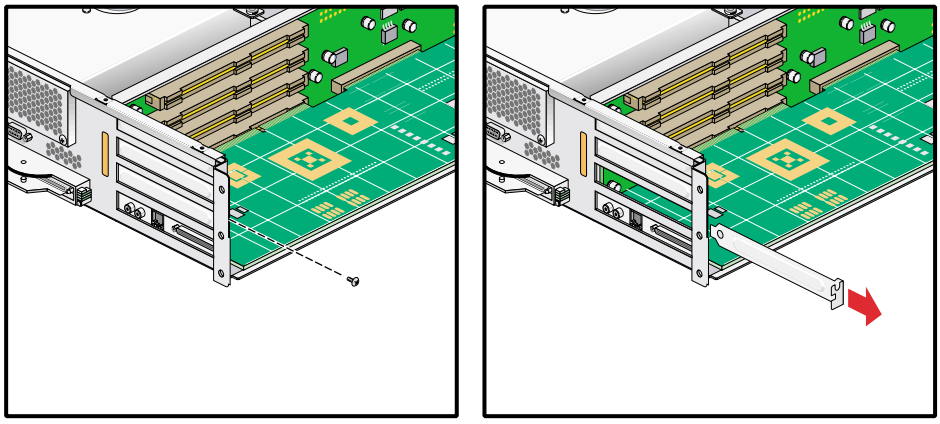


Figure 6-5 Removing Blanking Plate

10. Insert the card into the slot by pushing the card into the connector until it is properly seated and install the retaining screw, as shown in Figure 6-6. If you have installed the card into one of the upper two slots, proceed to step 13.

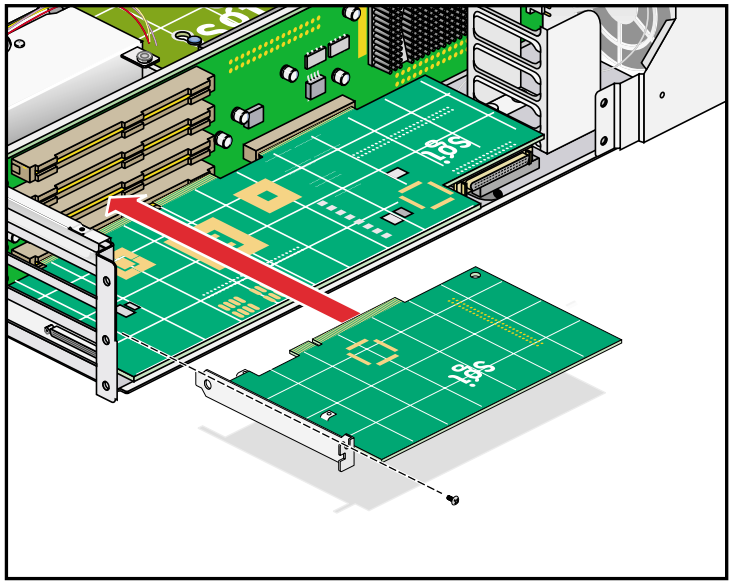


Figure 6-6 Installing the Card and Installing the Retaining Screw

11. If you have installed a card in one of the two bottom-most card slots, replace the lower PCI/PCI-X support bracket that covers the two bottom-most slots and screw in the four Phillips screws, as shown in Figure 6-7.

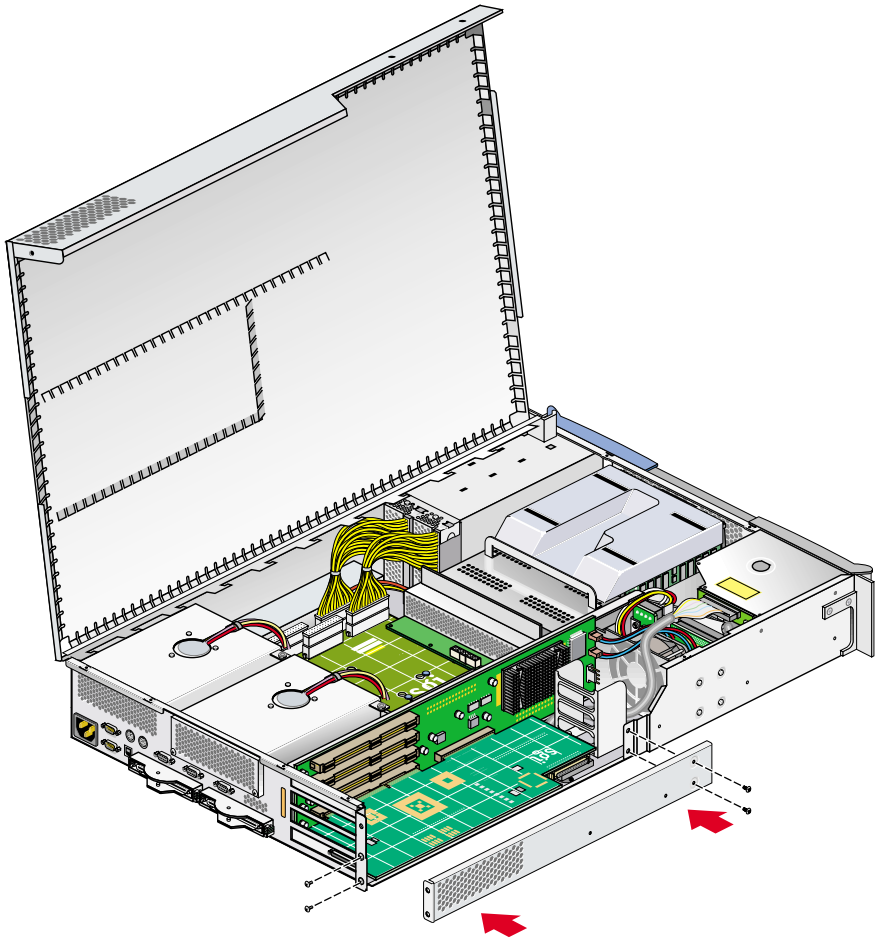


Figure 6-7 Replacing the Lower PCI/PCI-X Support Bracket

12. Replace the chassis rail by screwing in the five Phillips screws, as shown in Figure 6-8.

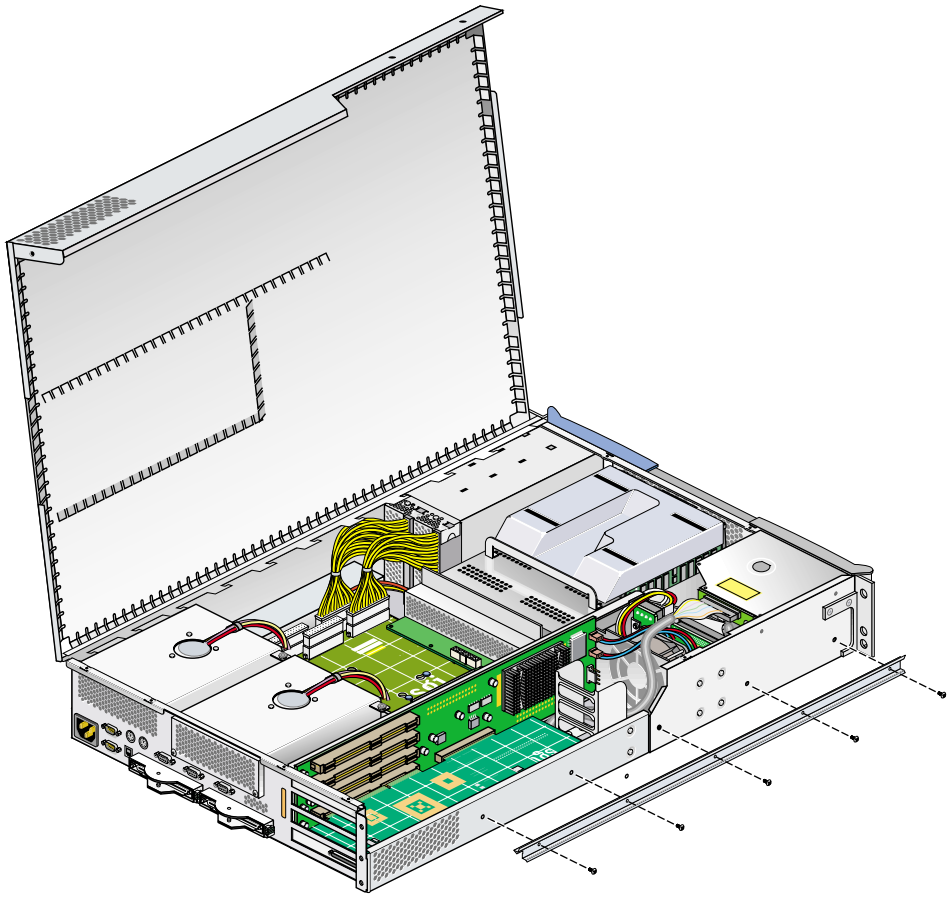


Figure 6-8 Replacing the Chassis Rail

13. Close the hinged cover on the system and screw in the ten Phillips screws to secure the cover, as shown in Figure 6-9.

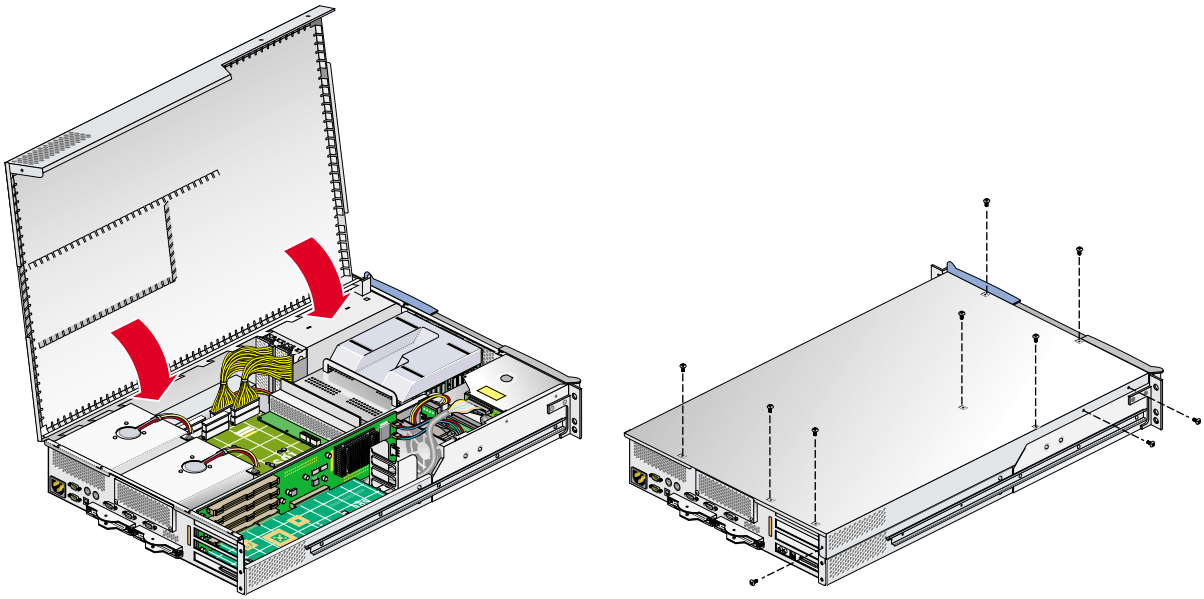


Figure 6-9 Closing the Cover

14. If you removed the module from the rack, perform the following substeps. (If you have not removed the module from the rack, proceed to step 15.)
    a. Fully extend the left and right slide rails from the rack until they lock into place.
    b. This step requires two people. With one person holding each side of the module, align the chassis rails of the module with the slide rails of the rack.
    c. Slide the chassis rails into the slide rails until the chassis rails are stopped by the safety latches.
15. Press the safety latches on both sides of the module and slide the module into the rack.
16. Install the two screws that secure the module to the front rails of the rack.
17. Install all of the cables at the rear of the module.
18. Power on the server system. For power on instructions, see “Powering the Server System On and Off” on page 53.

Removing a Card

To remove a PCI or PCI-X card, follow these steps:

1. Power off the server system. For powering off instructions, see "Powering the Server System On and Off" on page 53.
2. Disconnect all of the cables at the rear of the module.

Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. Remove the two screws that secure the module to the front rails of the rack.
4. Pull the module from the rack until it is stopped by the safety latches.

Note: If you are removing a PCI or PCI-X card from one of the two lower slots (bus 1, slot 1, or bus 1, slot 2), you must remove the module from the rack. For instructions, see "Removing a Module on Slide Rails from a Rack" on page 39.

5. Make sure that you read "Safety Instructions" on page 155, and "Rules for Card Installation and Removal" on page 158, before installing the card.

6. To access the card, remove the ten Phillips screws, as shown in Figure 6-10, and lift the hinged cover.

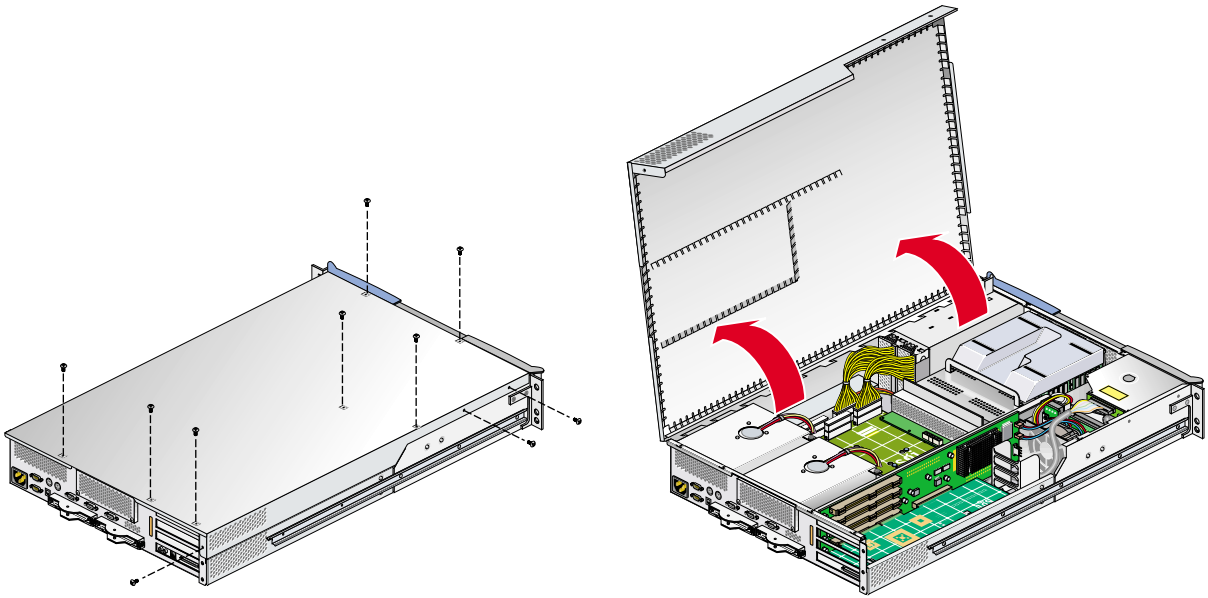


Figure 6-10 Opening the Cover to Remove the Card

7. If you are removing a card from one of the two lowermost card slots, remove the chassis rail, by unscrewing the five Phillips screws as shown in Figure 6-11. (If you are not removing a PCI/PCI-X card from one of the two lowermost card slots, proceed to step 9.)

Caution: Only a trained SGI service support engineer can install and remove an IO9 card. Otherwise, your system could be damaged. Therefore, if an IO9 card is installed in your system (it is always installed in the lowermost slot), you can remove a card only from the upper three slots.

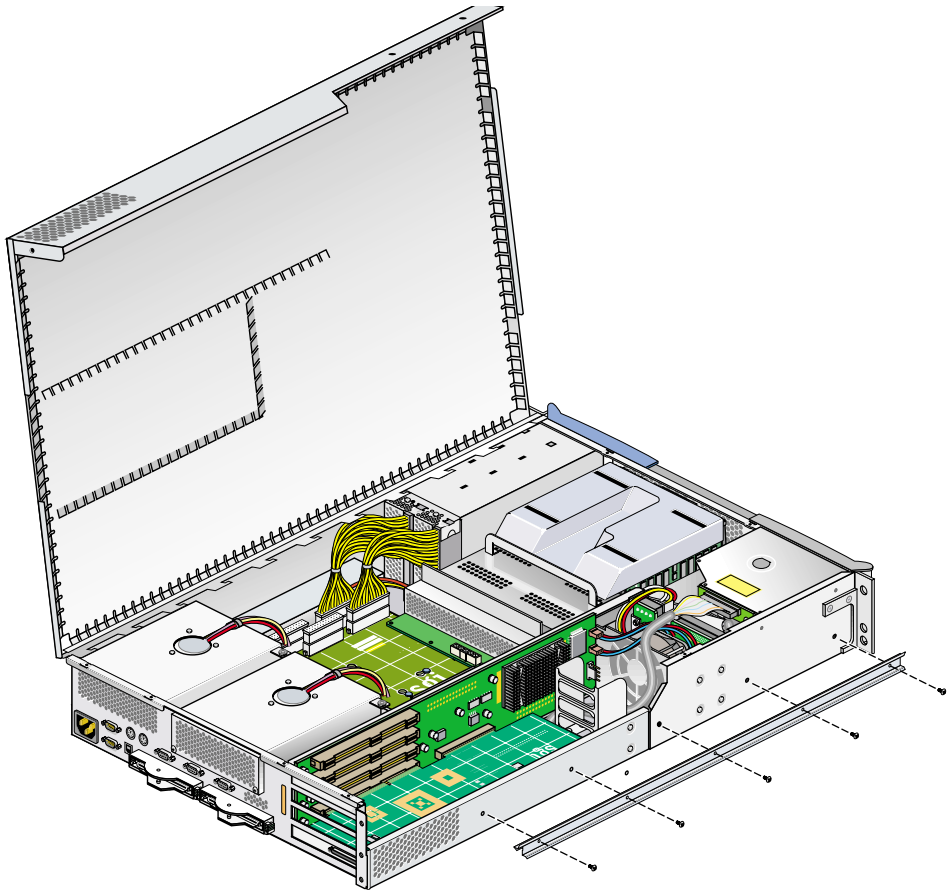


Figure 6-11 Removing the Chassis Rail

8. If you are removing a card from one of the two lowermost slots, you must also remove the lower PCI/PCI-X support bracket that covers the two lowermost slots by unscrewing the four Phillips screws, as shown in Figure 6-12.

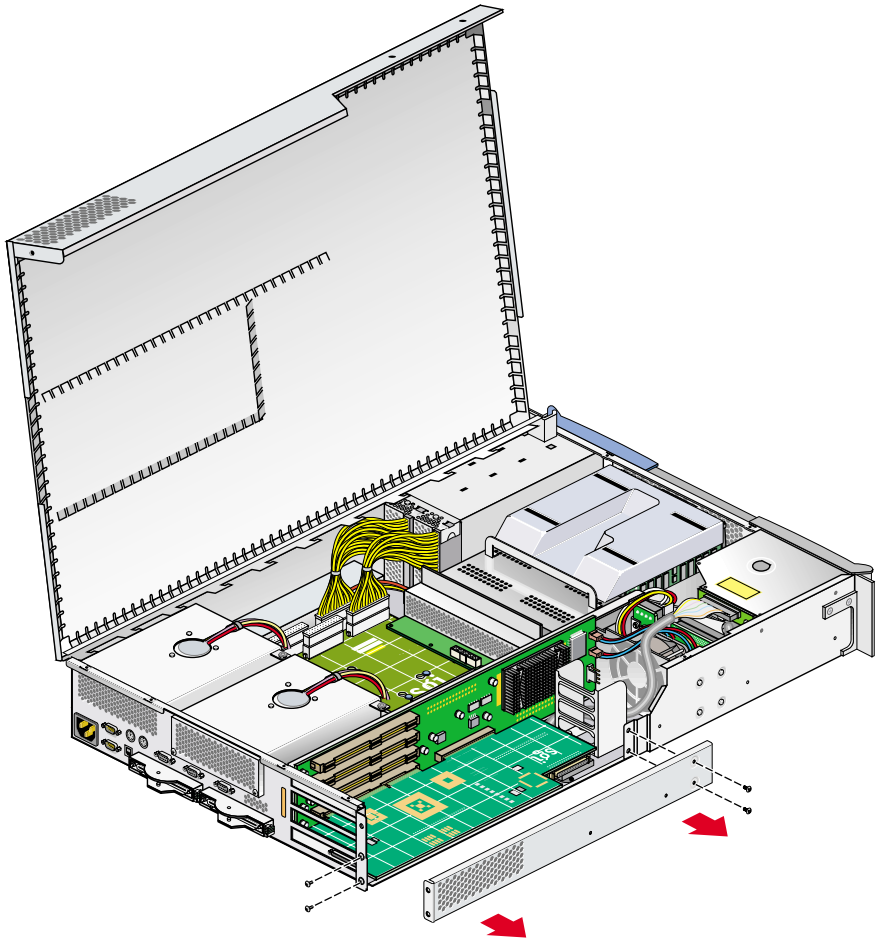


Figure 6-12 Removing the Lower PCI/PCI-X Support Bracket

9. Unscrew the retaining screw from the card that you will remove, and extract the card, as shown in Figure 6-13. Place the card on an ESD-safe surface.

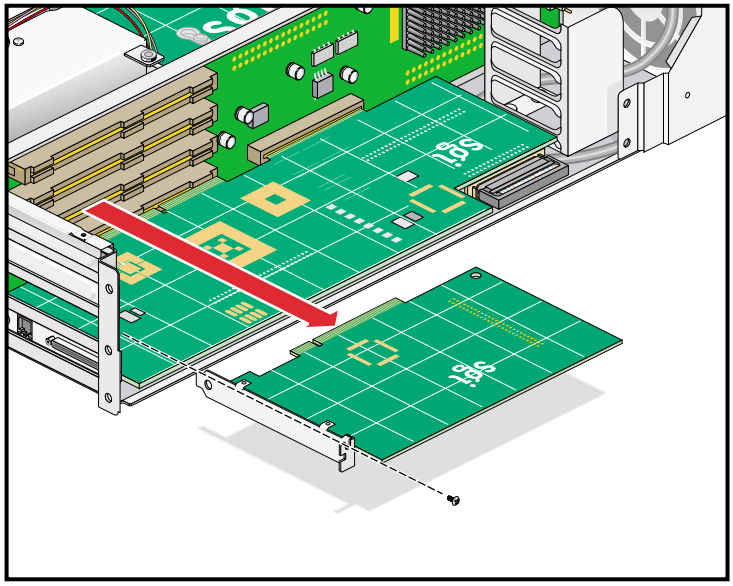


Figure 6-13 Removing the Retaining Screw and Extracting the Card

10. If you are replacing the card that you have removed, proceed to step 10 of "Installing a Card" on page 158. If you are not replacing the card that you have removed, proceed to the next step.
11. Place a blanking plate to cover the slot where you removed the card, and screw in the retaining screw, as shown in Figure 6-14. After installing the blanking plate, if you have removed a card from one of the two lowermost slots, proceed to the next step. Otherwise, proceed to step 14.

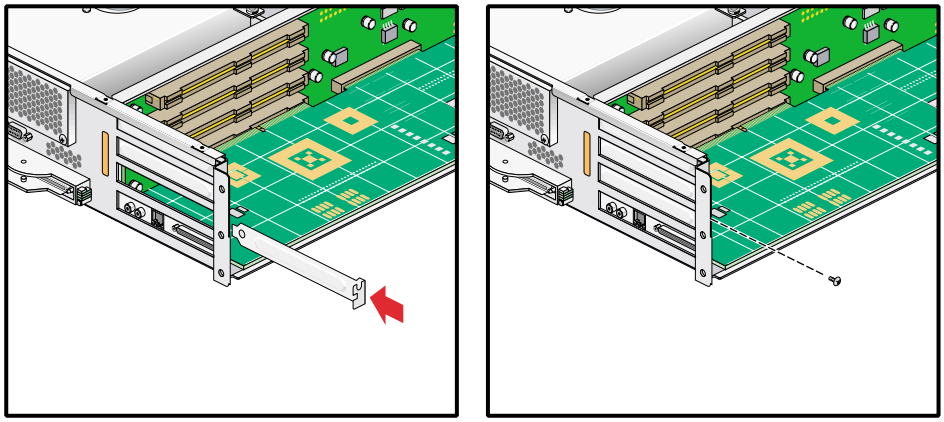


Figure 6-14 Placing a Blanking Plate

12. If you have removed a card from one of the two bottom-most card slots, replace the lower PCI/PCI-X support bracket that covers the two bottom-most slots, and screw in the four Phillips screws, as shown in Figure 6-15.

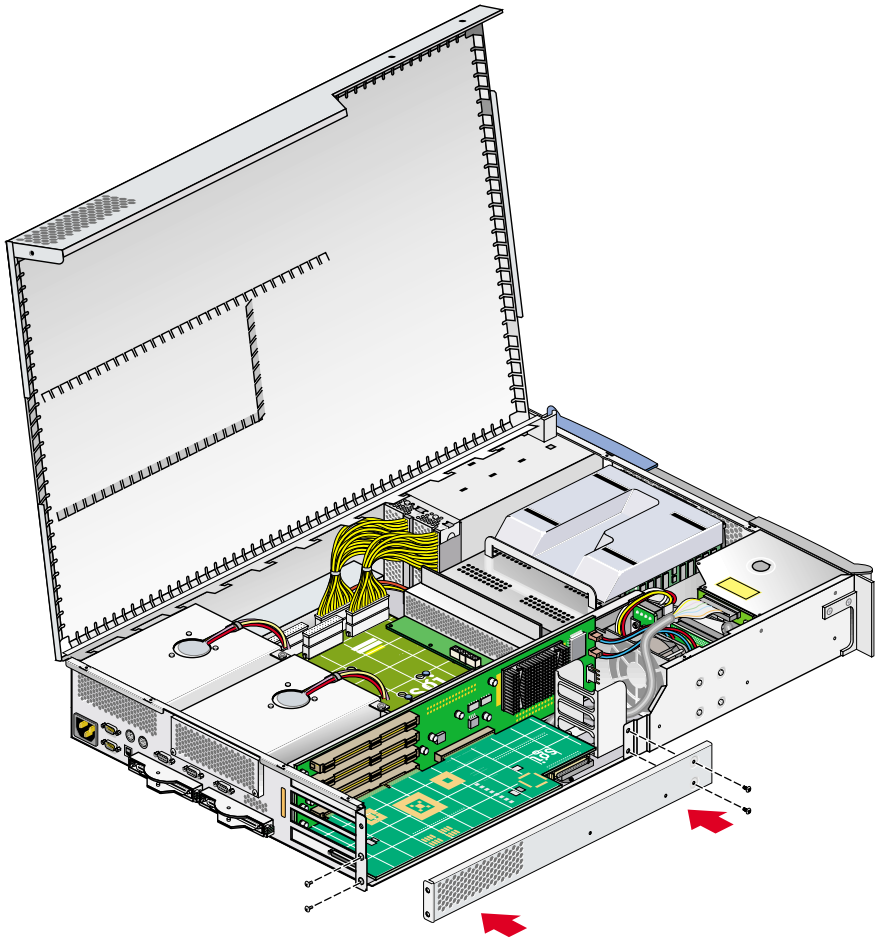


Figure 6-15 Replacing the Lower PCI/PCI-X Support Bracket

13. Replace the chassis rail, by screwing the five Phillips screws, as shown in Figure 6-16.

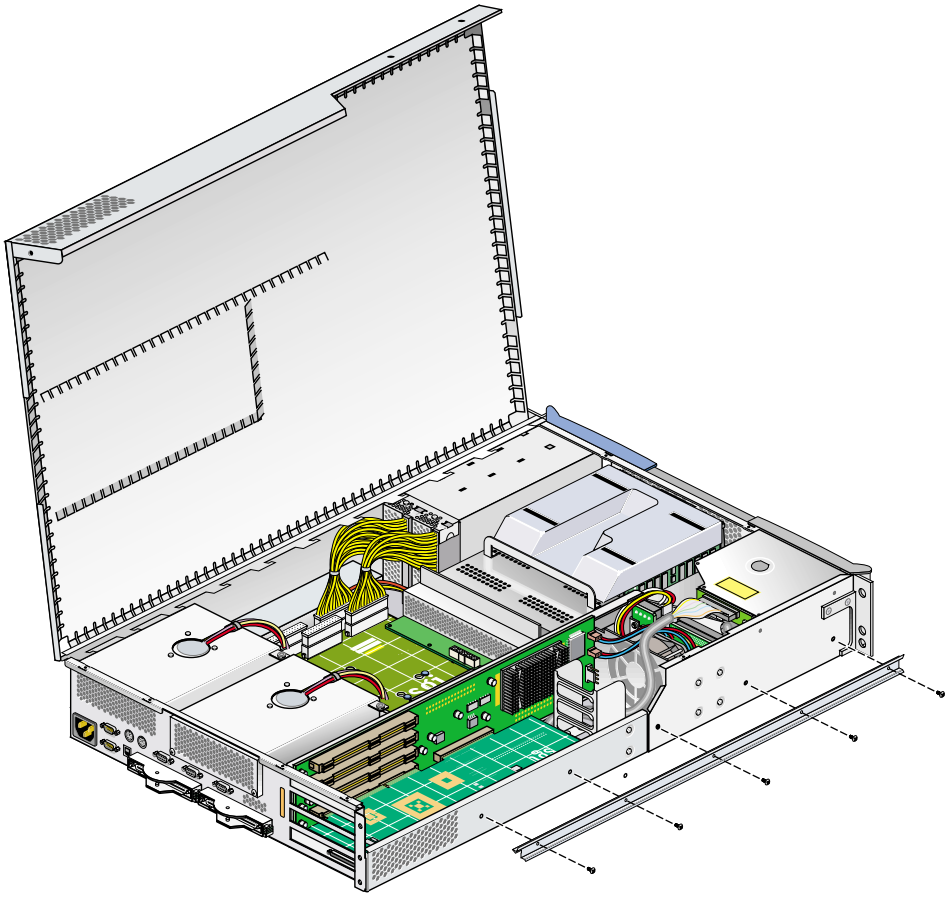


Figure 6-16 Replacing the Chassis Rail

14. Close the hinged cover on the system and screw in the ten Phillips screws to secure the cover, as shown in Figure 6-17.

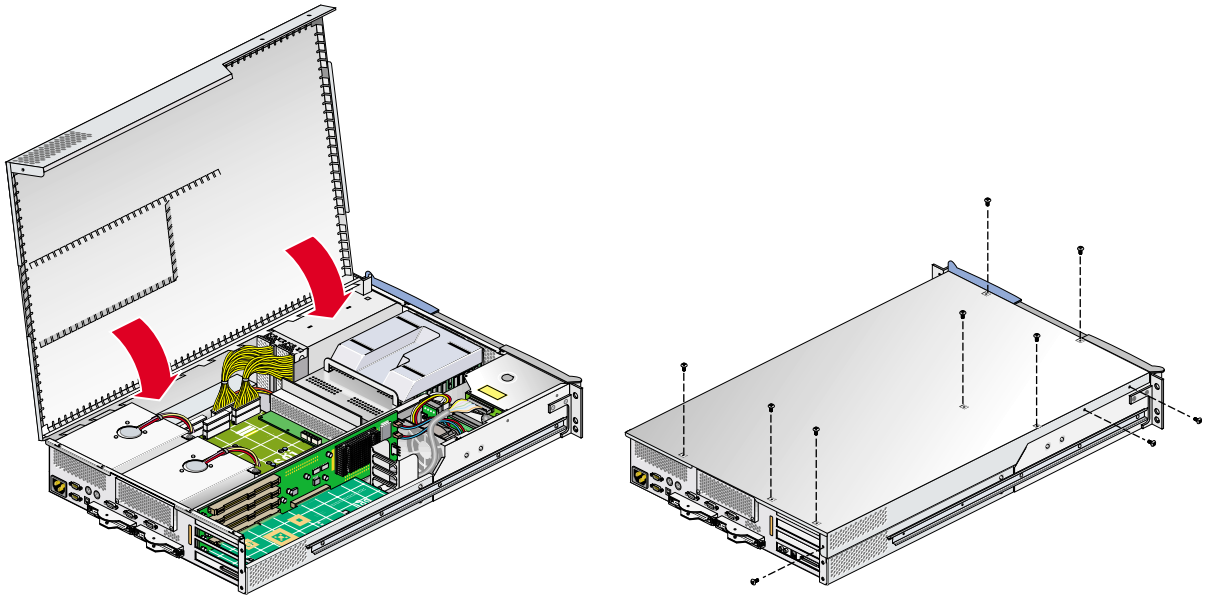


Figure 6-17 Close and Screw Down Cover

15. If you removed the module from the rack, follow these substeps. (If you have not removed the module from the rack, proceed to step 16.)
    a. Fully extend the left and right slide rails from the rack until they lock into place.
    b. This step requires two people. With one person holding each side of the module, align the chassis rails of the module with the slide rails of the rack.
    c. Slide the chassis rails into the slide rails until the chassis rails are stopped by the safety latches.
16. Press the safety latches on both sides of the module, and slide the module into the rack.
17. Install the two screws that secure the module to the front rails of the rack.
18. Install all of the cables at the rear of the module.
19. Power on the server system. For powering on instructions, see “Powering the Server System On and Off” on page 53.

Disk Drives

Each base compute module of an Origin 350 server system can contain one or two sled-mounted Ultra3 SCSI disk drives (see Figure 6-18).

Note: A system expansion compute module, or an MPX module, may or may not contain disk drives. These modules would require an IO9 PCI card in order to have the SCSI disk drives.

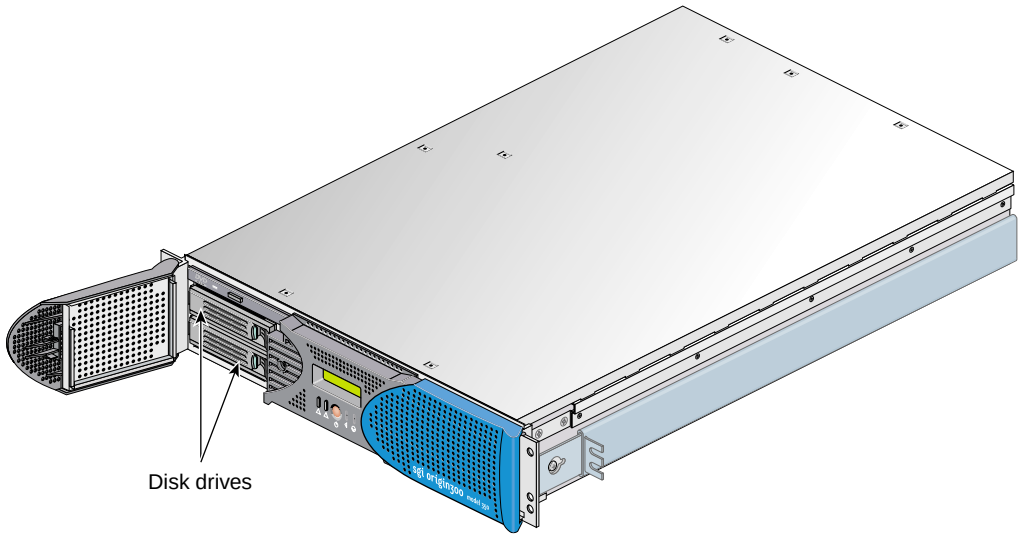


Figure 6-18 Disk Drive Location

Installing a Disk Drive

To install a disk drive, follow these steps:

1. Open the bezel door as far as it will open. Position the drive assembly so that it engages the bay guide rails and, with the locking handle fully swung open, gently push the drive into the bay until the locking handle engages with left side of the bay opening, as shown in Figure 6-19A.

   Note: If you will have only one disk drive in your system, it should be located in the bottom-most slot.

2. Swing the locking handle towards the chassis until the locking handle engages the latch, as shown in Figure 6-19B and Figure 6-19C.
3. Close the bezel door, as shown in Figure 6-19D.

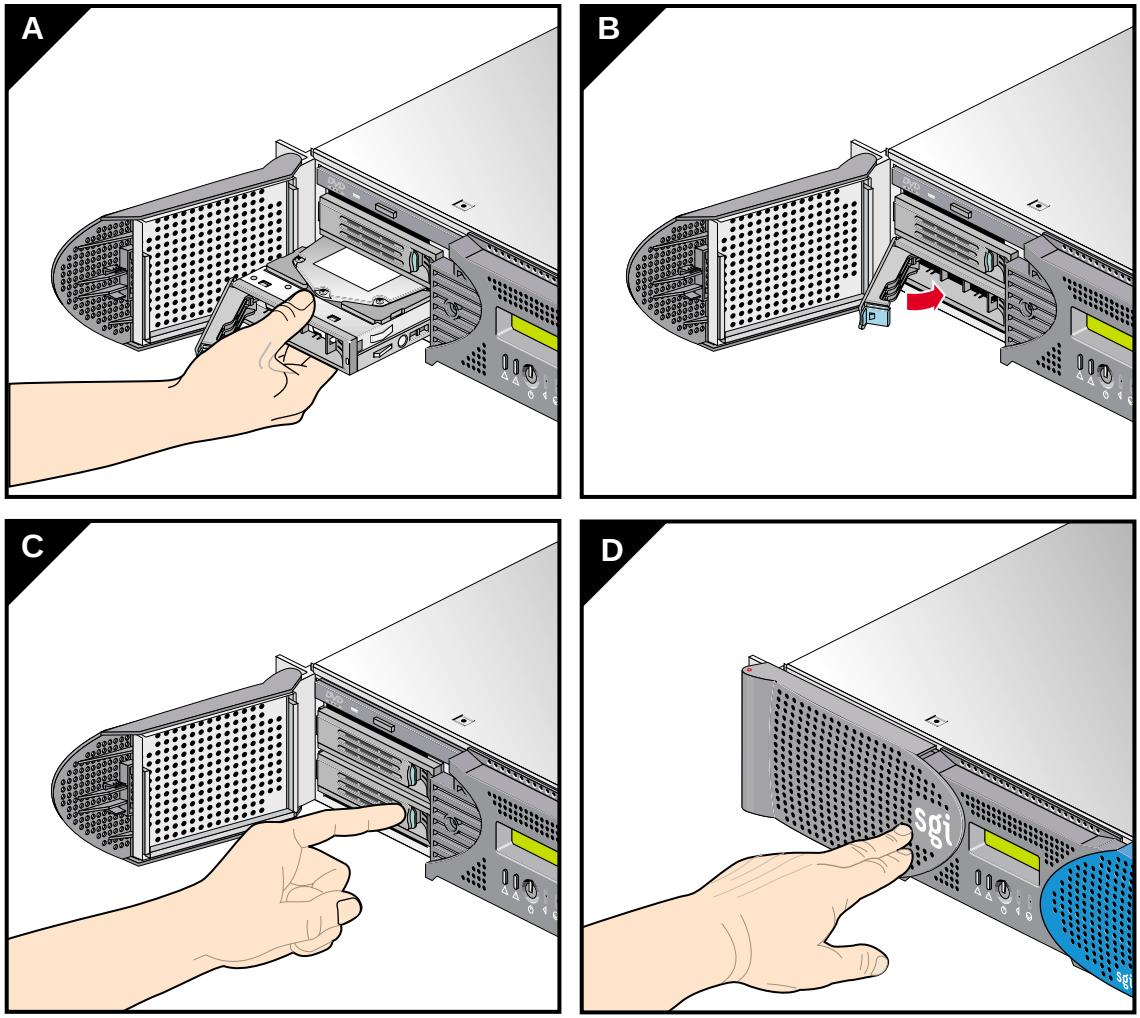


Figure 6-19 Installing a Disk Drive

Removing a Disk Drive

To remove a disk drive, follow these steps:

1. If you are replacing a data drive, ensure that the drive has spun down before you remove it.
2. If you are replacing the system drive, you must first power off the server system. For instructions to power off the server system, see "Powering the Server System On and Off" on page 53.
3. Open the bezel door located on the left side of the front panel of the module, as shown in Figure 6-20A. (Make sure that you open the door as far as it will open.)
4. Remove the drive by depressing the locking handle with your forefinger (Figure 6-20B). Then swing open the locking handle away from the chassis until the handle disengages the drive connector from the backplane connector (see Figure 6-20C).

   Note: If you will have only one disk drive, it should be located in the bottom-most slot.

5. Carefully slide the drive out of the bay (see Figure 6-20D) and gently place it on a flat ESD-safe surface. (Do not use the handle to pull the drive out of the bay.)
6. If you are replacing the disk drive, proceed to "Installing a Disk Drive" on page 177. (After you have replaced the disk drive, return to step 8 for instructions to power on your module.) If you are not replacing the disk drive, proceed to the next step.
7. Close the bezel door.
8. Power on the server system as described in "Powering the Server System On and Off" on page 53.

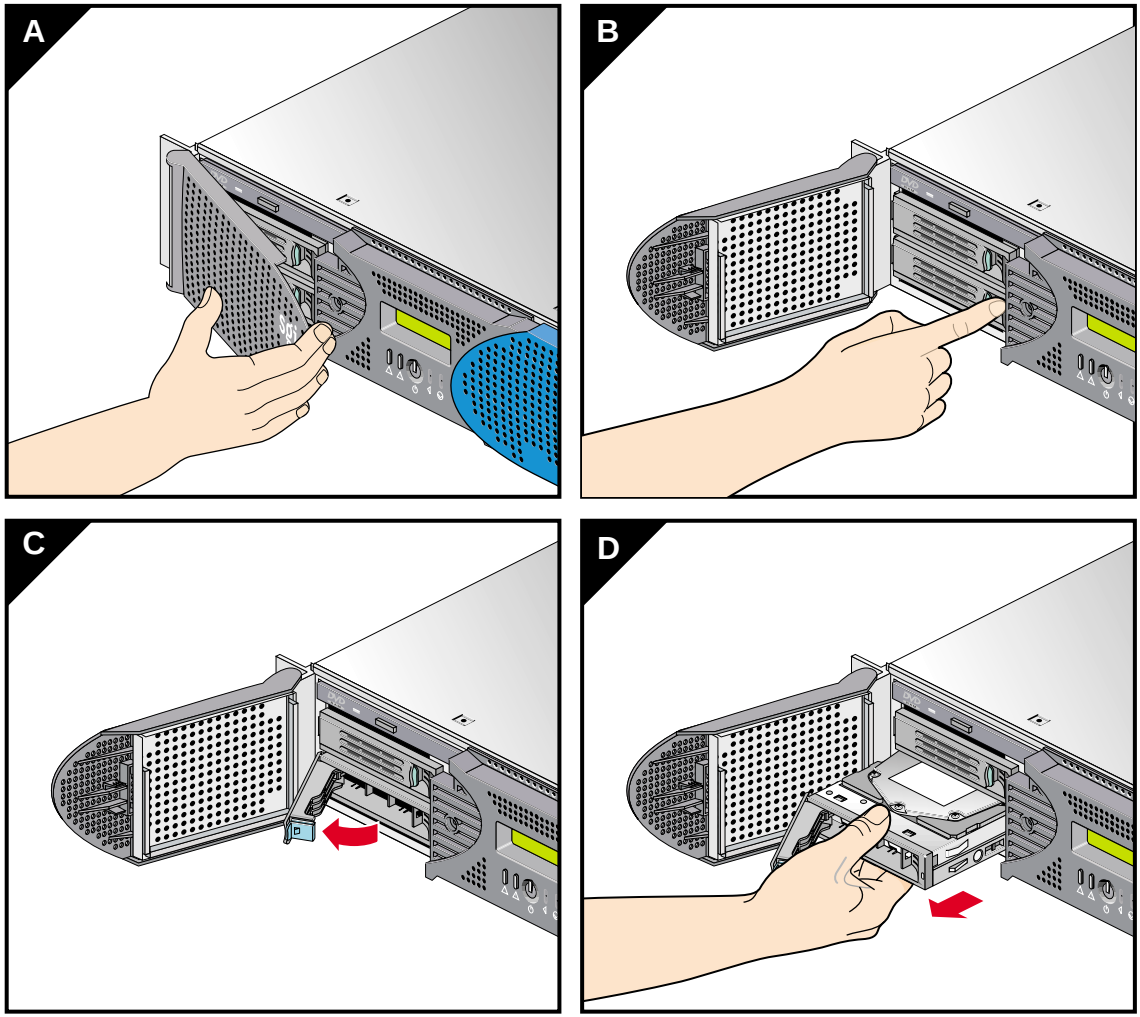


Figure 6-20 Removing a Disk Drive

Power Supplies

Each Origin 350 server system compute module and MPX module can contain one or two sled-mounted power supplies (refer to Figure 6-21). The second is a redundant power supply to assure that your system always has power.

This section provides the following information:

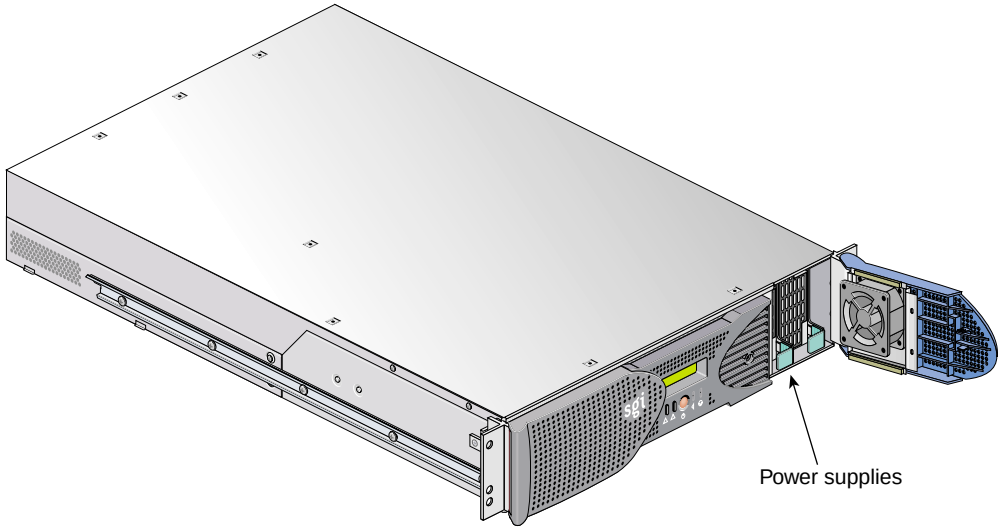


Figure 6-21 Power Supplies Location

Reading the Power Supply LEDs

Use the LED located on the front (towards the top) of the power supply to read the condition of the power supply. Table 6-1 shows the LED status and the power supply condition the LED status indicates.

Table 6-1 LED Status and Power Supply Condition

LED Status	Power Supply Condition Indicated
Off	If your system has one power supply, it indicates that the power supply is not receiving AC power. If your system has two power supplies, the LED on both power supplies would be Off, and it would indicate that both power supplies are not receiving AC power. Power supplies will not be receiving AC power because either the module is not plugged into power, or a electrical fuse has blown.
Amber	Indicates a fault condition for one of the following reasons: - In a system where you have two power supplies, one of the power supplies is not receiving AC power. - The voltage limit has been exceeded. - The temperature limit has been exceeded. - The current limit has been exceeded.
Blinking Green	The power supply is receiving AC power, but the main primary DC power has not yet activated.
Green	The power supply is operating properly.

Replacing a Power Supply

To replace a power supply, follow these steps:

1. If you are replacing a power supply in a module that has only one power supply (no redundant power supply), power off the server system as described in the “Powering the Server System On and Off” on page 53. If you are replacing a redundant power supply, you do not have to power off your server system to replace the power supply.
2. Remove the power supply to be replaced, as follows:
   a. Swing open the bezel door located on the right side of the module front panel. With a Phillips screw driver, unscrew the two screws on the screen cover as shown in Figure 6-22A.

b. Swing open the screen cover as shown in Figure 6-22B.

c. Disengage the power supply from the power supply bay by pushing the interior release button to the right and pulling up and out on the green-colored handle lock as shown in Figure 6-22C.

d. Gently pull out the power supply from the chassis until it clears the power supply bay as shown in Figure 6-22D. Place the power supply on an ESD-safe surface.

Caution: When pulling out the power supply from the chassis, make sure not to disturb the power supply fan's ribbon cable.

---

3. Install the replacement power supply, as follows:

a. Position the power supply in the slot and with the power supply handle pulled up (fully opened), gently push the power supply into the bay as shown in Figure 6-23A.

Caution: When installing the power supply, make sure that the power supply does not clip or pinch the power supply fan's ribbon cable.

---

b. Push in and down on the green-colored handle and snap the power supply into place as shown in Figure 6-23B.

c. After you have installed the power supply, swing the screen cover until it closes as shown in Figure 6-23C.

Caution: When closing the screen cover, make sure that the cover does not clip or pinch the power supply fan's ribbon cable.

---

d. Screw in the two Phillips screws that you had removed as shown in Figure 6-23D, and close the bezel door.

4. If you have replaced a power supply in a module that has only one power supply, power on the server system, as described in "Powering the Server System On and Off" on page 53.

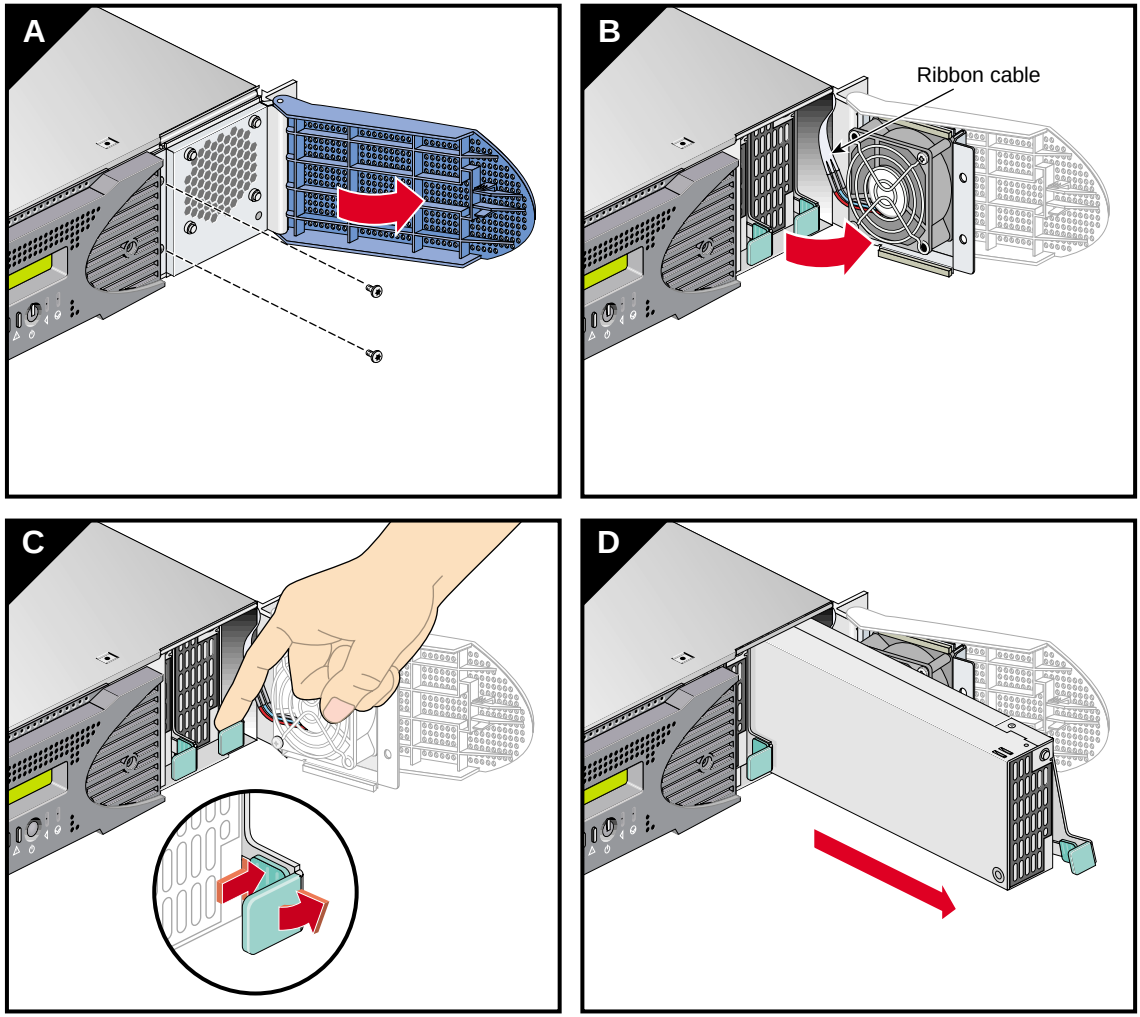


Figure 6-22 Removing a Power Supply

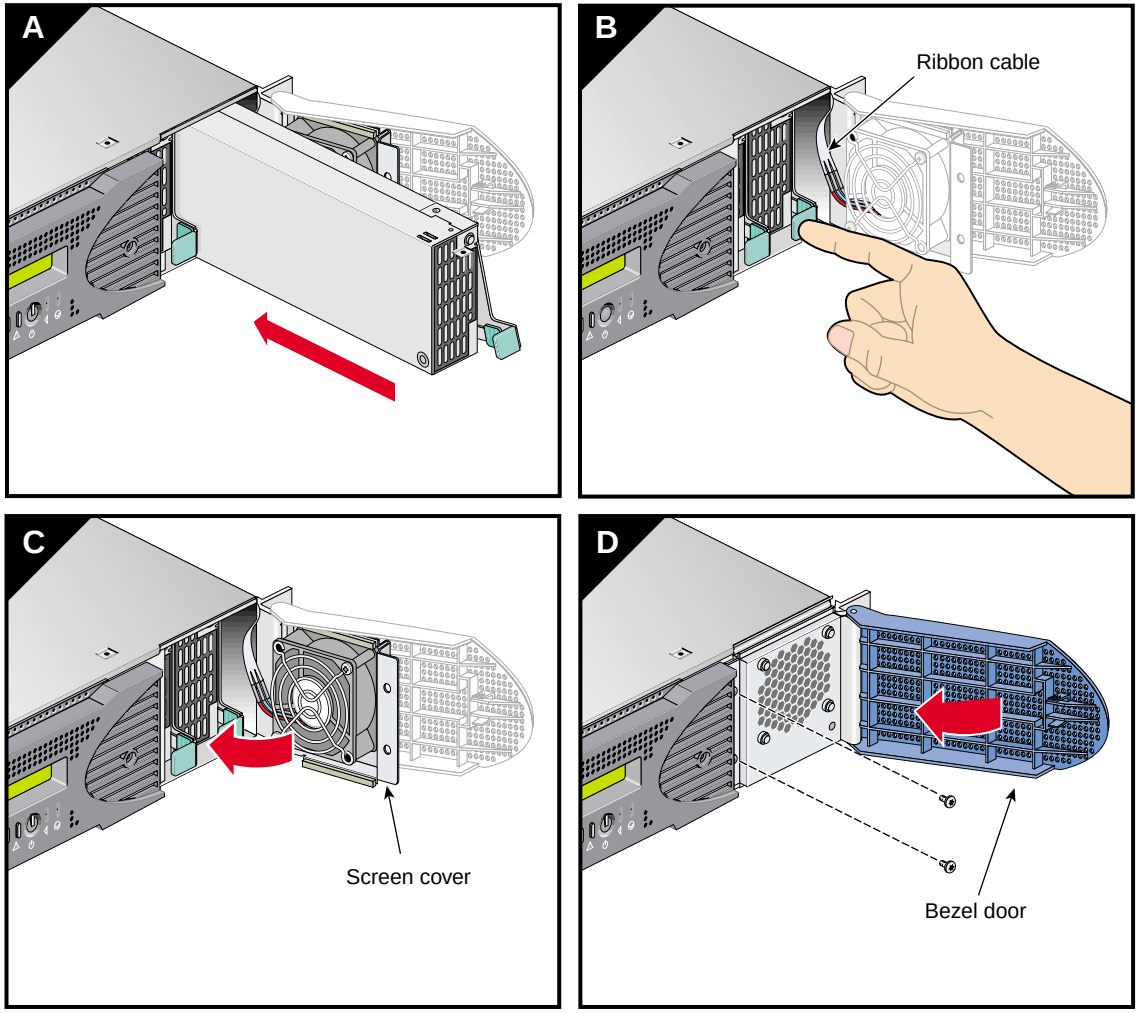


Figure 6-23 Installing the power supply

Memory

Memory is contained on cards that are referred to as DIMMs (dual inline memory modules). Each Origin 350 server system base compute module, system expansion compute module, and MPX module can contain two, four, six, or eight DIMMs installed on eight DIMM slots located on the module.

These eight DIMM slots are organized into a group of even-numbered slots 0, 2, 4, and 6, and a group of odd-numbered slots 1, 3, 5, and 7, as shown in Figure 6-24 on page 188.

DIMMs are installed one per DIMM slot, and two at a time, so that the two DIMMs installed provide local memory for the same pair of banks. For example, if you install a DIMM in slot 0, you must install a DIMM in slot 1. (This adds memory to bank pairs 0 and 1). Table 6-2 lists the DIMM slots and the corresponding bank pairs to which local memory is provided when DIMMs are installed.

Table 6-2 DIMMs and Bank Pairs

DIMM in Slot Number	Provides Local Memory for Bank Pair Numbers
0[a]	0 and 1
1	0 and 1
2	2 and 3
3	2 and 3
4	4 and 5
5	4 and 5
6	6 and 7
7	6 and 7

a. The first two DIMMs must be installed in DIMM slot 0 and DIMM slot 1.

You must note these guidelines when installing DIMMs:

- Memory is increased or decreased in two-DIMM increments only.
- The two DIMMs that make up a bank pair must be the same memory size; however, each pair of DIMMs can differ in memory size.
- The first two DIMMs must be installed in DIMM slot 0 and DIMM slot 1. Subsequent DIMMs can be installed into any bank pairs as long as the two DIMMs are installed so that they provide local memory for the same bank pair. For example, you can install DIMMs in slots 2 and 3 to provide local memory for banks 2 and 3. Or you can install DIMMs in slots 4 and 5 to provide memory to banks 4 and 5, or you can install DIMMs in slots 6 and 7 to provide memory for banks 6 and 7.
- The DIMMs used in the Origin 350 server system base compute module, the system expansion compute module, and the MPX module are not compatible with the DIMMs used in the Origin 200, SGI 2000 series, Onyx2, or Octane systems.
- The Origin 350 server system supports the following memory kits:
  - 1-GB kit with integrated directory memory.
  - 2-GB kit with integrated directory memory.

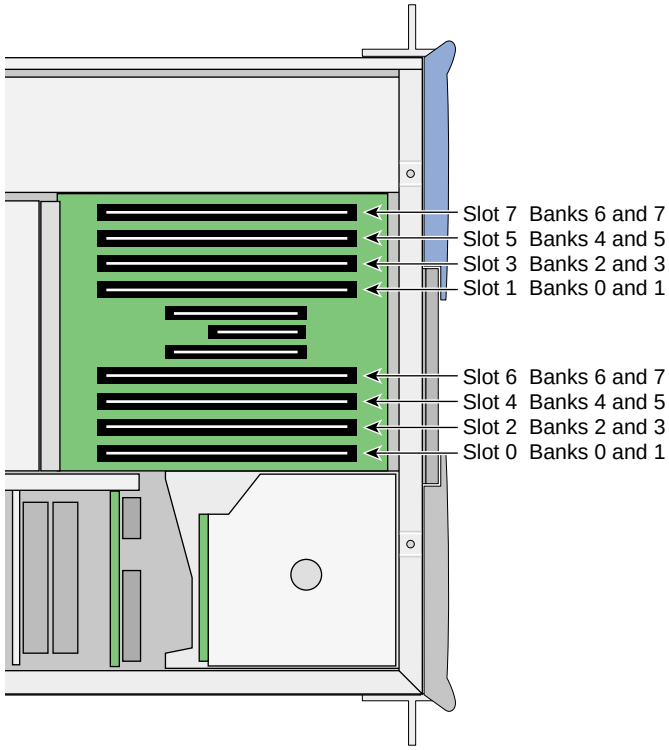


Figure 6-24 Layout of DIMM Slots and Local Memory Banks

Caution: Electronic equipment can be irreparably damaged by electrostatic discharge (ESD). Always follow these preventive measures when you handle a system component:

- Remove a component from its antistatic bag only when you are ready to install it.

- If you handle a component before installation, do not place it on surfaces that produce ESD (carpeting, for example) or near devices that create static electricity.

- Attach a static wrist strap to a grounded connection on your system when you install or remove a component.

Installing a DIMM

To install a DIMM, follow these steps:

1. Power off the server system. For powering off instructions, see "Powering the Server System On and Off" on page 53.
2. Disconnect all of the cables at the rear of the module.

Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. Remove the two screws that secure the module to the front rails of the rack.
4. Pull the module from the rack until it is stopped by the safety latches.

5. To access the DIMMs, remove the ten Phillips screws shown in Figure 6-25 and lift and open the hinged cover.

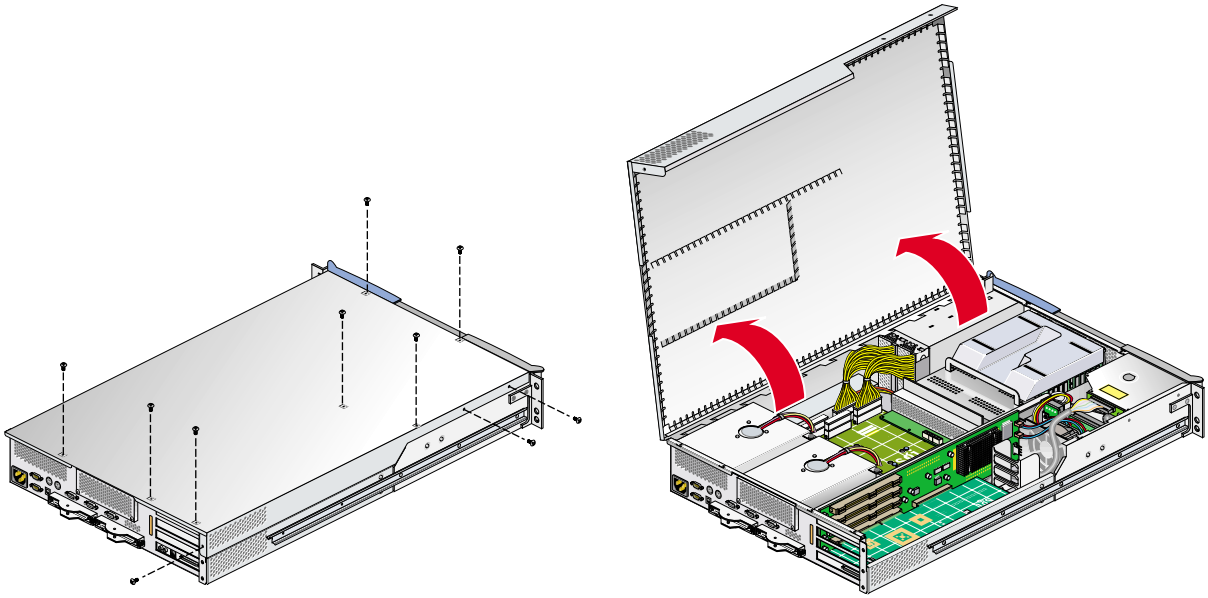


Figure 6-25 Opening Module Cover to Install DIMMs

6. Remove the plastic air baffle covering the DIMMs, as shown in Figure 6-26.

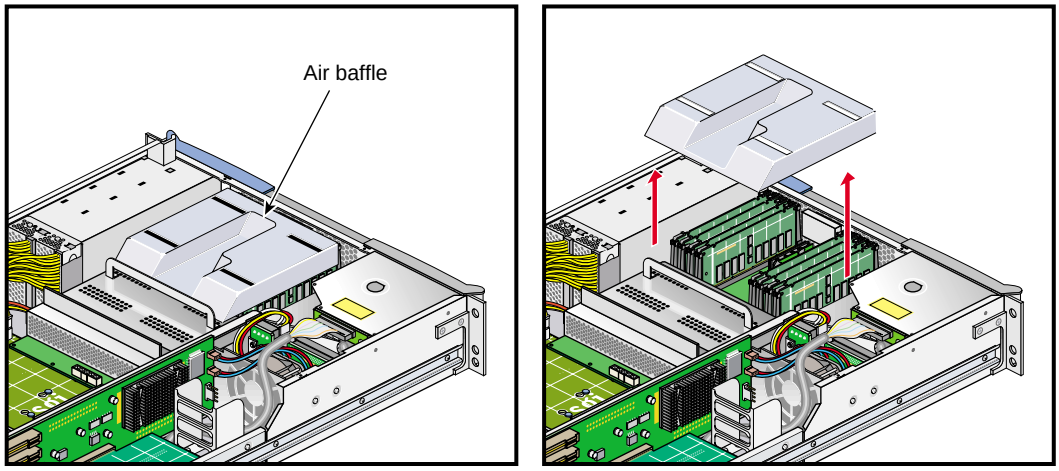


Figure 6-26 Removing the Plastic Air Baffle

7. Install the DIMM, as follows (see Figure 6-27):

Note: If you need to find the correct location in which to install the DIMMs, make sure to read the introductory material in "Memory" on page 186.

---

   a. Open the ejector latches.
   b. Hold the DIMM only by its edges and remove it from its antistatic package.
   c. Align the three notches in the bottom edge of the DIMM with the keyed socket.
   d. Insert the bottom edge of the DIMM into the socket, and then press down on the DIMM until it seats correctly. Use extreme care when you install a DIMM. If you apply too much pressure, you can damage the socket.
   e. Gently push the plastic ejector latches down to secure the DIMM, as shown in Figure 6-27. When the DIMM is fully seated in the connector, the ejector latches snap into place.
8. Replace the plastic air baffle.
9. Attach the hinged cover and secure it to the module with ten Phillips screws.
10. Press the safety latches on both sides of the module and slide the module into the rack.

11. Install the two screws that secure the module to the front rails of the rack.
12. Install all of the cables at the rear of the module.
13. Power on the server system as described in “Powering the Server System On and Off” on page 53.

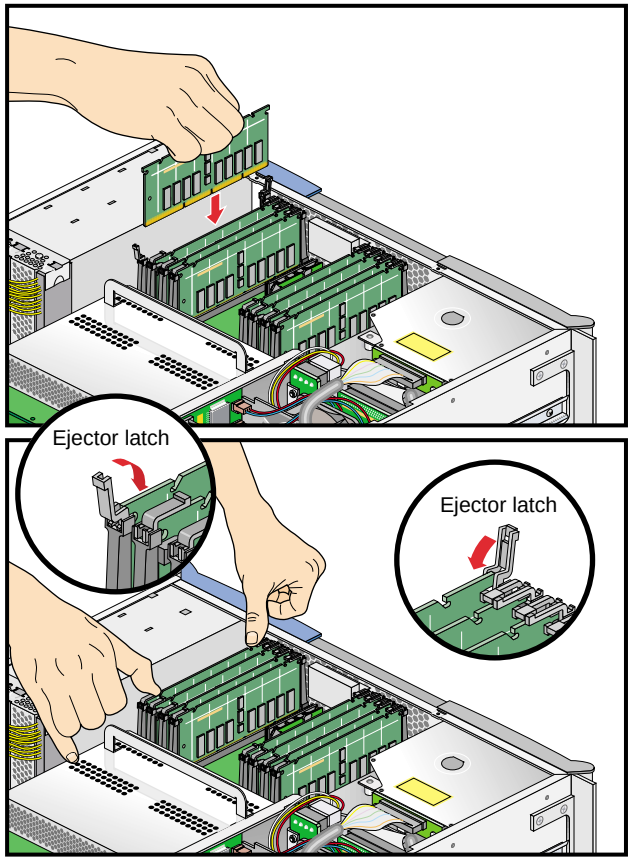


Figure 6-27 Inserting a DIMM

Removing a DIMM

To remove a DIMM, follow these steps:

1. Power off the server system. For powering off instructions, see "Powering the Server System On and Off" on page 53.
2. Disconnect all of the cables at the rear of the module.

Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. Remove the two screws that secure the module to the front rails of the rack.
4. Pull the module from the rack until it is stopped by the safety latches.
5. To access the DIMMs, remove the ten Phillips screws shown in Figure 6-28 and open the hinged cover.

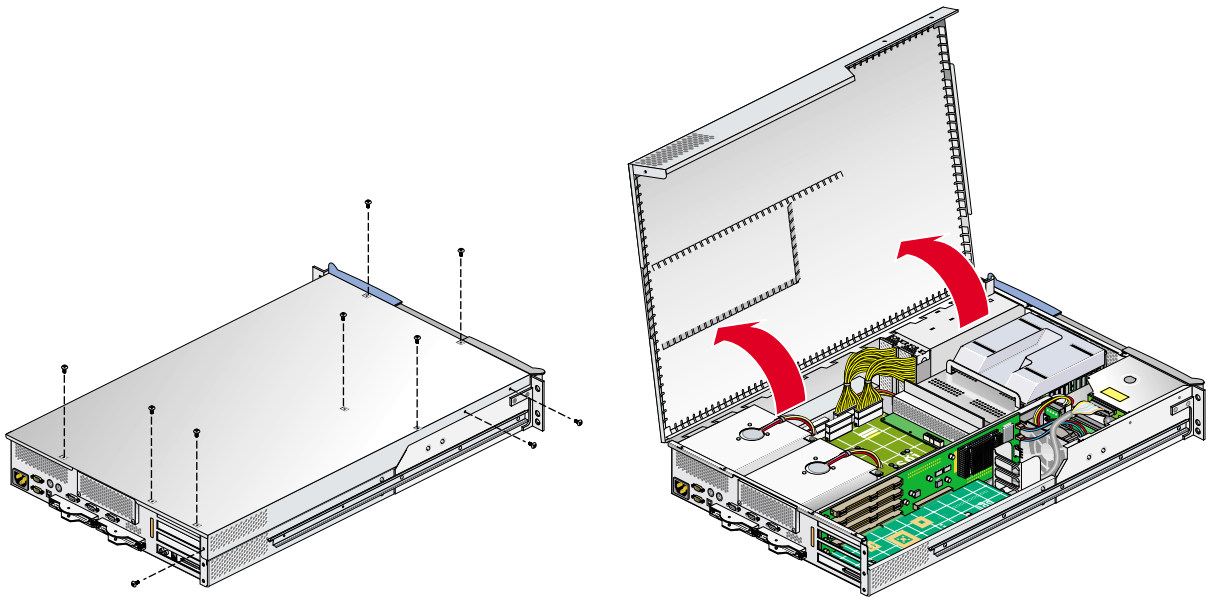


Figure 6-28 Opening Module to Remove DIMM

6. Remove the plastic air baffle covering the DIMMs, as shown in Figure 6-29.

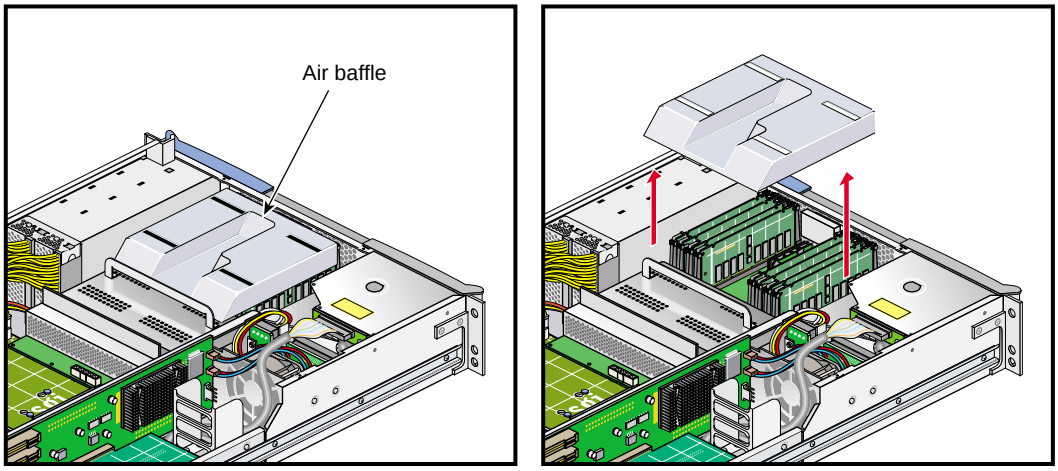


Figure 6-29 Removing the Plastic Air Baffle

7. Remove the DIMM, as follows (see Figure 6-30):

   Note: If you need to find the correct location from which to remove the DIMMs, make sure to read the introductory material in "Memory" on page 186.

   a. Lift the two ejector latches simultaneously to disengage the DIMM from its connector.

   b. Carefully grasp the DIMM and pull it up and out of the guide rails.

      Note: Hold the DIMM only by its edges. Be careful not to touch its components or gold edge connectors.

   c. Place the DIMM on an ESD-safe surface.

8. If you are installing a new DIMM, proceed to "Installing a DIMM" on page 189. If you are not installing a new DIMM, proceed to the next step.
9. Replace the plastic air baffle.
10. Attach or close the hinged cover and secure it to the module with the ten Phillips screws.

11. Press the safety latches on both sides of the module and slide the module into the rack.
12. Install the two screws that secure the module to the front rails of the rack.
13. Install all of the cables at the rear of the module.
14. Power on the server system as described in “Powering the Server System On and Off” on page 53.

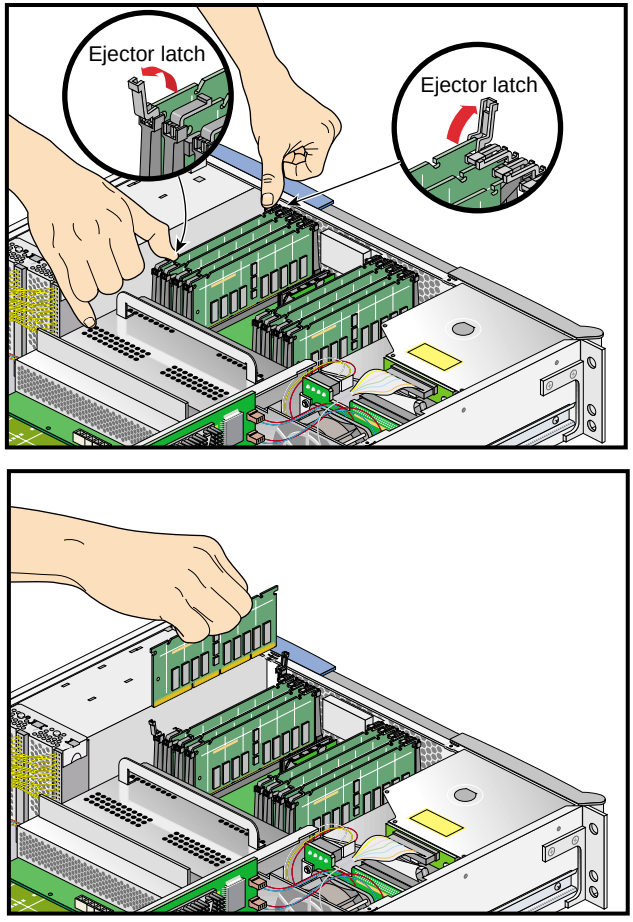


Figure 6-30 Removing a DIMM

L1 Controller Display

The L1 controller, which is used to monitor and manage the base compute module of the Origin 350 server system, has a display located on the front panel of the base compute module as shown in Figure 6-31. Every Origin 350 server system module is factory-shipped with an L1 controller display. This section describes how to replace an L1 controller display panel for a base compute module. (You can also use these instructions to replace an L1 controller display panel for a system expansion compute module and an MPX module.)

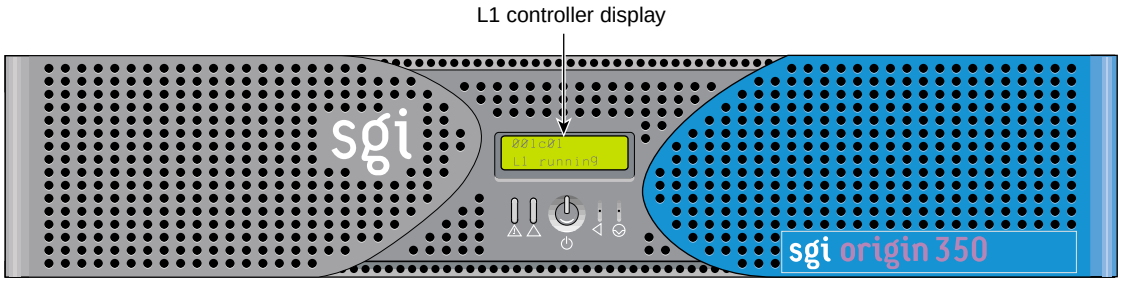


Figure 6-31 L1 Controller Display on Base Compute Module

To replace an L1 controller display, follow these steps:

1. Power off the server system as described in "Powering the Server System On and Off" on page 53.
2. Disconnect all of the cables at the rear of the module.

Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. Remove the two screws that secure the module to the front rails of the rack.
4. Pull the module from the rack until it is stopped by the safety latches.

5. To access the area where the L1 display is replaced, remove the ten Phillips screws shown in Figure 6-32, and lift and open the hinged cover.

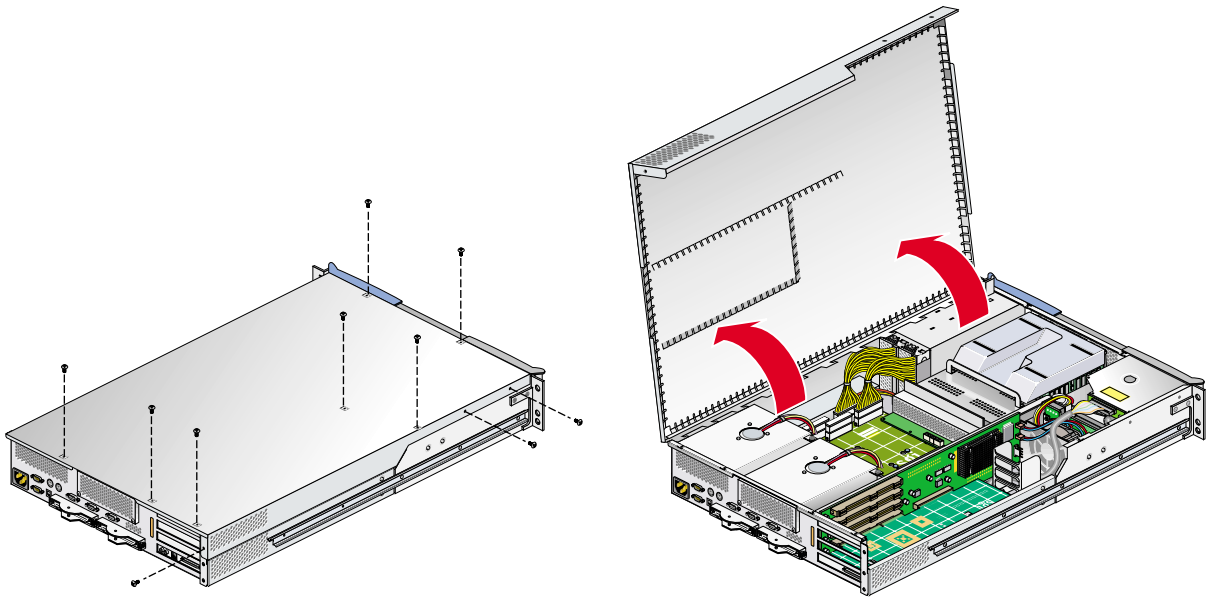


Figure 6-32 Opening the Module to Access the L1 Controller Display

6. On the front panel of your system, remove the front bezel by unscrewing the two Phillips screws holding the bezel to the chassis, as shown in Figure 6-33A.
7. Holding the L1 display cover with one hand, unscrew the single Phillips screw holding the L1 display cover to the chassis, as shown in Figure 6-33B. Gently unhook and pull away the L1 display cover from the chassis.
8. Unscrew the two Phillips screws holding the L1 controller display panel to the L1 display protective cover, as shown in Figure 6-33C.
9. Gently disconnect the L1 controller cable from the connector on the L1 controller display, as shown in Figure 6-33D.

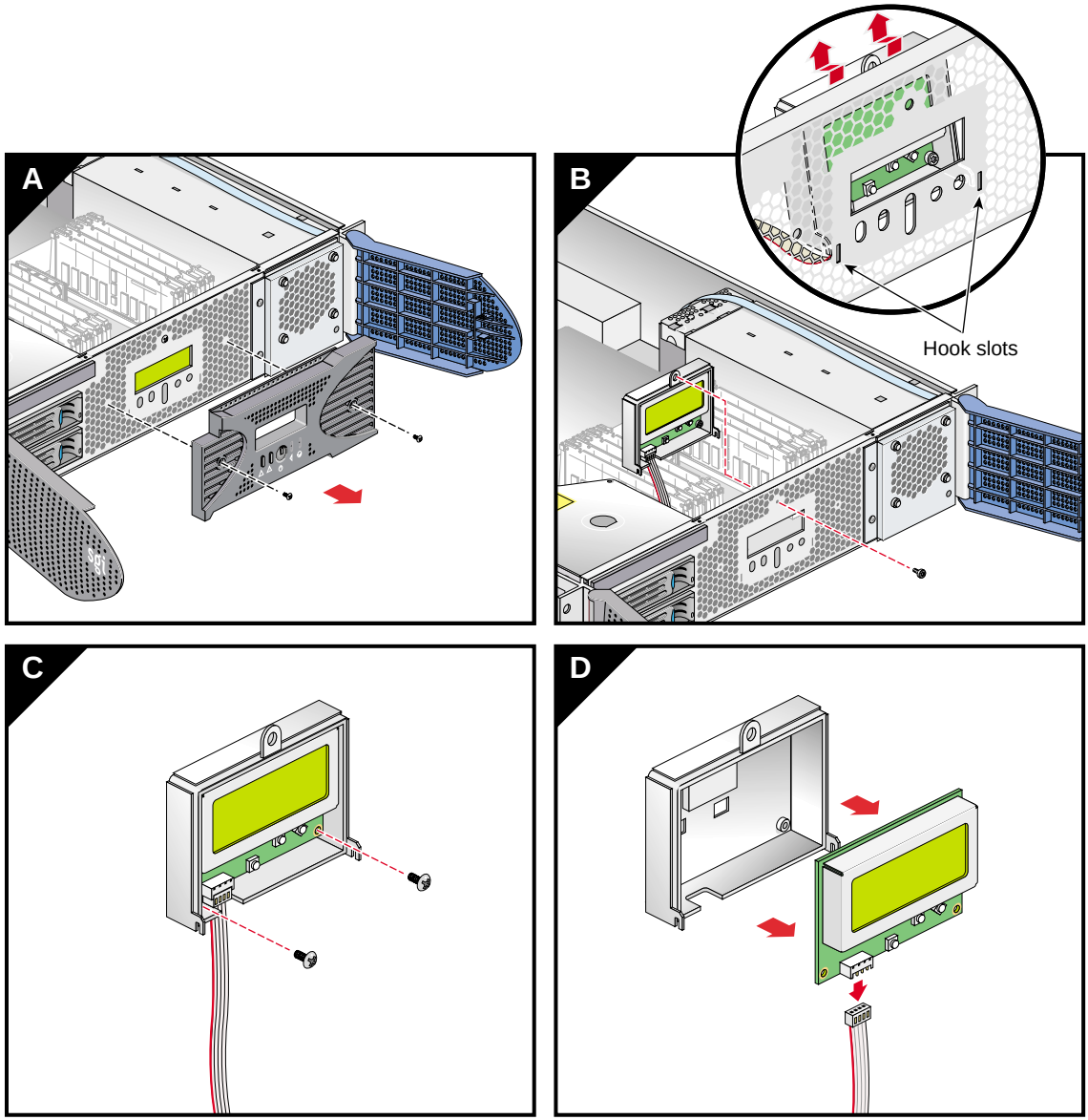


Figure 6-33 Removing the L1 Controller Display Panel

10. Connect the L1 controller cable to the connector on the new L1 controller display, making sure that the red stripe is to your left, as shown in Figure 6-34A.
11. Align the two screw holes on the L1 controller display with the holes on the L1 display protective cover, and screw in the two Phillips screws, as shown in Figure 6-34B.
12. Hook in the L1 display protective cover onto the slots on the front chassis and, holding the L1 display cover up against the front chassis, screw in the Phillips screw, as shown in Figure 6-34C.
13. Replace the front bezel onto the front chassis of the system by screwing in the two Phillips screws holding the bezel to the chassis, as shown in Figure 6-34D.

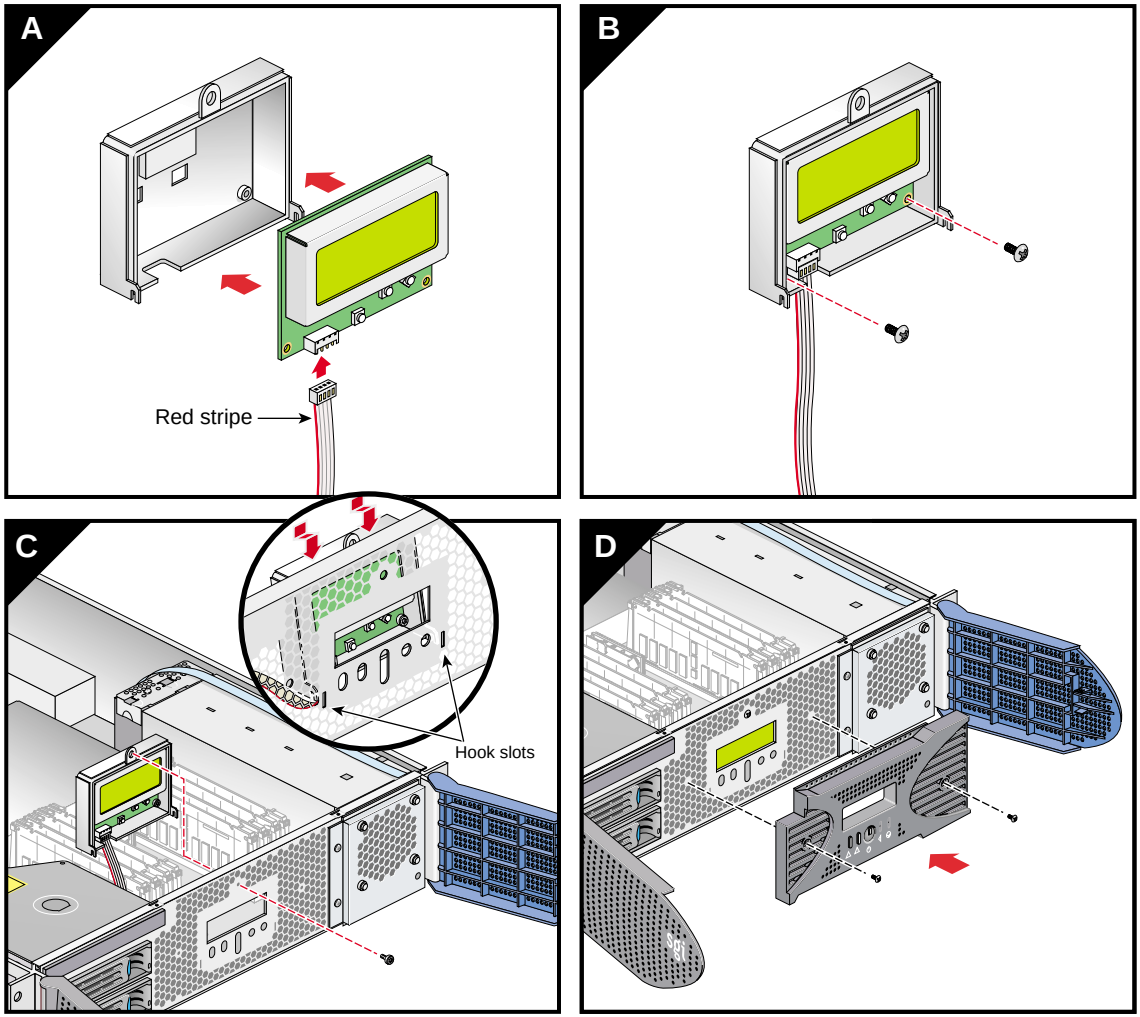


Figure 6-34 Installing an L1 Controller Display Panel

14. Attach the hinged cover and secure it to the module with the ten Phillips screws.
15. Press the safety latches on both sides of the module, and slide the module into the rack.
16. Install the two screws that secure the module to the front rails of the rack.

17. Install all of the cables at the rear of the module.
18. Power on the server system as described in "Powering the Server System On and Off" on page 53.

Troubleshooting

This chapter provides the following sections to help you troubleshoot your system:

Troubleshooting Chart

Table 7-1 lists recommended actions for problems that can occur on your system. For problems that are not listed in this table, use the SGI Electronic Support system to help solve your problem or contact your SGI system support engineer (SSE). More information about the SGI Electronic Support system is provided later in this chapter.

Table 7-1 Troubleshooting Chart

Problem Description	Recommended Action
The system will not power on.	Ensure that the power cord of the PDU is seated properly in the power receptacle. Ensure that the PDU circuit breaker is on. If the power cord is plugged in and the circuit breaker is on, contact your SSE.
An individual module will not power on.	Ensure that the power switch at the rear of the module is on (position I). View the L1 display; see Table 7-2 if an error message is present. If the L1 controller is not running, contact your SSE. Check the connection between the module and its power source.
The system will not boot the operating system.	Contact your SSE.
The service-required LED illuminates on a module.	View the L1 display of the failing module; see Table 7-2 for a description of the error message.
The failure LED illuminates on a module.	View the L1 display of the failing module; see Table 7-2 for a description of the error message.
The green or yellow LED of a NUMAlink port (rear of NUMAlink module) is not illuminated.	Ensure that the NUMAlink cable is seated properly on the NUMAlink module and the destination module.
The PWR LED of a populated PCI slot is not illuminated.	Reseat the PCI card.
The fault LED of a populated PCI slot is illuminated (on).	Reseat the PCI card. If the fault LED remains on, replace the PCI card.

Table 7-1 Troubleshooting Chart **(continued)**

Problem Description	Recommended Action
The system status LED of the TP900 is amber.	Contact your SSE.
The power status LED of the TP900 is amber.	Contact your SSE to replace the power supply module. The power supply module also has an amber LED that indicates a fault.
The cooling status LED of the TP900 is amber.	Contact your SSE to replace the cooling module. The cooling module also has an amber LED that indicates a fault.
The amber LED of a disk drive is on.	Replace the disk drive.

L1 Controller Error Messages

Table 7-2 lists error messages that the L1 controller generates and displays on the L1 display. This display is located on the front of the Origin 350 base compute modules, the NUMAlink module, and the PCI expansion modules.

Note: In Table 7-2, a voltage warning occurs when a supplied level of voltage is below or above the nominal (normal) voltage by 10 percent. A voltage fault occurs when a supplied level is below or above the nominal voltage by 20 percent.

Table 7-2 L1 Controller Messages

L1 System Controller Message	Message Meaning and Action Needed
Internal voltage messages:	
ATTN: x.xV high fault limit reached @ x.xxV	30-second power-off sequence for the module.
ATTN: x.xV low fault limit reached @ x.xxV	30-second power-off sequence for the module.
ATTN: x.xV high warning limit reached @ x.xxV	A higher than nominal voltage condition is detected.
ATTN: x.xV low warning limit reached @ x.xxV	A lower than nominal voltage condition is detected.
ATTN: x.xV level stabilized @ x.xV	A monitored voltage level has returned to within acceptable limits.
Fan messages:	
ATTN: FAN # x fault limit reached @ xx RPM	A fan has reached its maximum RPM level. The ambient temperature may be too high. Check to see if a fan has failed.
ATTN: FAN # x warning limit reached @ xx RPM	A fan has increased its RPM level. Check the ambient temperature. Check to see if the fan stabilizes.
ATTN: FAN # x stabilized @ xx RPM	An increased fan RPM level has returned to normal.

Table 7-2 L1 Controller Messages **(continued)**

L1 System Controller Message	Message Meaning and Action Needed
Temperature messages: low alt.	
ATTN: TEMP # advisory temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 30 ºC.
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 35 ºC.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 40 ºC.
Temperature messages: high alt.	
ATTN: TEMP # advisory temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 27 ºC.
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 31 ºC.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 35 ºC.
Temperature stable message:	
ATTN: TEMP # stabilized @ xxC/xxF	The ambient temperature at the module's air inlet has returned to an acceptable level.
Power off messages:	
Auto power down in xx seconds	The L1 controller has registered a fault and is shutting down. The message displays every five seconds until shutdown.
Base module appears to have been powered down	The L1 controller has registered a fault and has shut down.

SGI Electronic Support

SGI Electronic Support provides system support and problem-solving services that function automatically, which helps resolve problems before they can affect system availability or develop into actual failures. SGI Electronic Support integrates several services so they work together to monitor your system, notify you if a problem exists, and search for solutions to the problem.

Figure 7-1 shows the sequence of events that occurs if you use all of the SGI Electronic Support capabilities.

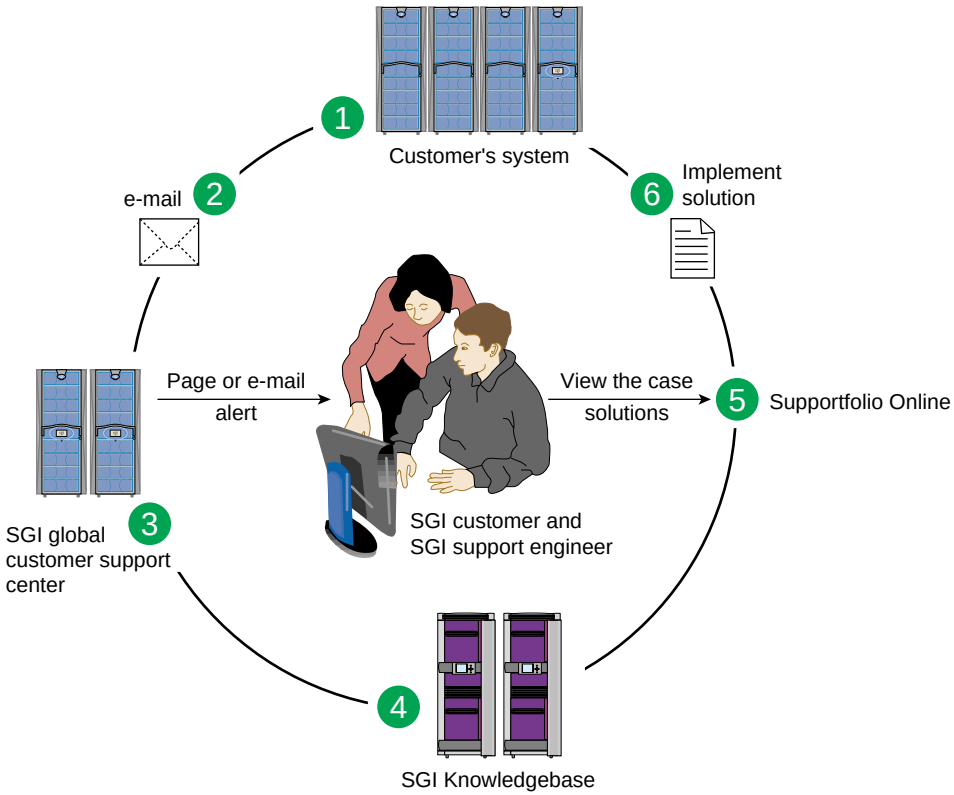


Figure 7-1 Full Support Sequence

The sequence of events can be described as follows:

1. Embedded Support Partner (ESP) monitors your system 24 hours a day.
2. When a specified system event is detected, ESP notifies SGI via e-mail (plain text or encrypted).
3. Applications that are running at SGI analyze the information, determine whether a support case should be opened, and open a case if necessary. You and SGI support engineers are contacted (via pager or e-mail) with the case ID and problem description.
4. SGI Knowledgebase searches thousands of tested solutions for possible fixes to the problem. Solutions that are located in SGI Knowledgebase are attached to the service case.
5. You and the SGI support engineers can view and manage the case by using Supportfolio Online as well as search for additional solutions or schedule maintenance.
6. Implement the solution.

Most of these actions occur automatically, and you may receive solutions to problems before they affect system availability. You also may be able to return your system to service sooner if it is out of service.

In addition to the event monitoring and problem reporting, SGI Electronic Support monitors both system configuration (to help with asset management) and system availability and performance (to help with capacity planning).

The following three components compose the integrated SGI Electronic Support system:

SGI Embedded Support Partner (ESP) is a set of tools and utilities that are embedded in the IRIX operating system. ESP can monitor a single system or group of systems for system events, software and hardware failures, availability, performance, and configuration changes, and then perform actions based on those events. ESP can detect system conditions that indicate potential problems, and then alert appropriate personnel by pager, console messages, or e-mail (plain text or encrypted). You also can configure ESP to notify an SGI call center about problems; ESP then sends e-mail to SGI with information about the event.

SGI Knowledgebase is a database of solutions to problems and answers to questions that can be searched by sophisticated knowledge management tools. You can log on to SGI Knowledgebase at any time to describe a problem or ask a question. Knowledgebase searches thousands of possible causes, problem descriptions, fixes, and how-to instructions for the solutions that best match your description or question.

Supportfolio Online is a customer support resource that includes the latest information about patch sets, bug reports, and software releases.

The complete SGI Electronic Support services are available to customers who have a valid SGI Warranty, FullCare, FullExpress, or Mission-Critical support contract. To purchase a support contract that allows you to use the complete SGI Electronic Support services, contact your SGI sales representative. For more information about the various support contracts, see the following website:

http://www.sgi.com/support/customerservice.html

For more information about SGI Electronic Support, see the following website:

http://www.sgi.com/support/es

Technical Specifications

This appendix contains technical specification information about your system, as follows:

Environmental System Specifications

Table A-1 lists the environmental specifications of the Origin 350 server system.

Table A-1 Environmental Specifications

Characteristic	Specification
Temperature, operating	+5 ºC (+41 ºF) to +35 ºC (+95 ºF) (up to 1500 m [5,000 ft]) +5 ºC (+41 ºF) to +30 ºC (+86 ºF) (1500 m to 3000 m [5,000 ft to 10,000 ft])
Temperature, non-operating	-40 ºC (-40 ºF) to +60 ºC (+140 ºF)
Humidity	10% to 95% RH, noncondensing
Altitude	Sea level to 40,000 ft (nonoperating) Sea level to 10,000 ft (3000 m) (operating)

Compute Module Specifications

Table A-2 lists the bandwidth characteristics of the compute module.

Table A-2 Bandwidth Characteristics of the Compute Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	3.2 GB/s full duplex 1.6 GB/s each direction	~1420 MB/s each direction
Xtown2 channel	2.4 GB/s full duplex 1.2 GB/s each direction	~1066 MB/s half duplex ~1744 MB/s full duplex, ~872 MB/s each direction
Main memory	3200 MB/s	2140 MB/s
SYSAD	1600 MB/s	~1400 MB/s

Table A-3 summarizes the general features of the compute module.

Note: The following table assumes that the expansion compute module does not include an optional IO9 PCI card, which would add one input and one output real-time interrupt port, an Ethernet port, and an internal and external SCSI drive, and support for one serial port. The IO9 card is also needed to support the DVD-ROM, the SCSI disc drives, and the serial daughtercard with the PS/2 connectors and three serial ports (this serial daughtercard is not an option for the expansion compute module).

Table A-3 General Features of the Compute Module

Feature	Base Compute Module	Expansion Compute Module
NUMAlink port	1 (1.6 GB/s each direction)	1 (1.6 GB/s each direction)
XIO port	1 (800 MB/s each direction)	1 (800 MB/s each direction)
Console port	1	1
Serial ports	4	1[a]
L1 port	1	1
PS/2 ports	One keyboard and one mouse port	

Table A-3 General Features of the Compute Module **(continued)**

Feature	Base Compute Module	Expansion Compute Module
RT interrupt input port	1	
RT interrupt output port	1	
Ethernet port	1 10BaseT/100BaseT/1000BaseT	
SCSI port (external)	1 Ultra3 SCSI (VHDCI)	
SCSI port (internal)	1 Ultra3 SCSI, 160 MB/s	
3.5-in. drive bay	2	
MIPS RISC processor	2 or 4	2 or 4
Memory	1 GB to 8 GB	1 GB to 8 GB
Expansion slot	1 PCI, 2 PCI-X	4 PCI-X

a. The serial port on the expansion compute module is only operable when the module has an IO9 PCI card.

Table A-4 lists the specifications for the compute module.

Table A-4 Compute Module Specifications

Characteristic	Specification
Height	3.44 in. (8.74 cm)
Width	17.06 in. (43.33 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	37.80 lb (17.18 kg) minimum configuration; 44.50 lb (20.23 kg) maximum configuration[a]
Noise	6.0 Bells sound power, up to 30 ºC
Heat dissipation	1315 Btu/hr maximum
Input power	120 - 240 VAC

a. Weight will vary depending on whether the system has one or two power supplies, on the amount of DIMMs installed, and on whether you have one or two disk drives in your system.

MPX Module Specifications

Table A-5 lists the bandwidth characteristics of the MPX module.

Table A-5 Bandwidth Characteristics of the MPX Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	3.2 GB/s full duplex 1.6 GB/s each direction	~1420 MB/s each direction
Xtown2 channel	2.4 GB/s full duplex 1.2 GB/s each direction	~1066 MB/s half duplex ~1744 MB/s full duplex, ~872 MB/s each direction
Main memory	3200 MB/s	2140 MB/s
SYSAD	1600 MB/s	~1400 MB/s

Table A-6 lists the specifications for the MPX module.

Table A-6 MPX Module Specifications

Characteristic	Specifications
Height	3.44 in. (8.80 cm)
Width	17.06 in. (43.36 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	37.80 lb (17.18 kg) minimum configuration; 44.50 lb (20.23 kg) maximum configuration[a]
Input power	120 - 240 VAC

a. Weight will vary depending on whether your system has one or two power supplies, on the amount of DIMMs installed, and on whether you one or two disk drives in your system.

PCI Expansion Module Specifications

Table A-7 lists the bandwidth characteristics of the PCI expansion module.

Table A-7 Bandwidth Characteristics of the PCI Expansion Module

Characteristic	Peak Bandwidth
NUMAlink channel	1.2 GB/s each direction

Table A-8 lists the specifications of the PCI expansion module.

Table A-8 PCI Expansion Module Specifications

Characteristic	Specification
Height	7 in. (177.8 mm)
Width	17.5 in. (444.5 mm)
Depth	27.5 in. (698.5 mm)
Weight	60 lb (27.22 kg)
Input power	+48 VDC (~250 W)

NUMAlink Module Specifications

Table A-9 lists the bandwidth characteristics of the NUMAlink module.

Table A-9 Bandwidth Characteristics of the NUMAlink Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	3.2 GB/s full duplex 1.6 GB/s each direction	~1420 MB/s each direction

Table A-10 lists the specifications for the NUMAlink module, which requires 2U rack space.

Table A-10 NUMAlink Module Specifications

Characteristic	Specification
Height	3.3 in. (83.82 mm)
Width	17.38 in. (441.45 mm)
Depth	27.5 in. (698.5 mm)
Weight	20 lb (9.1 kg)
Input power	110/220 VAC (~60 W)

Table A-11 lists the port specifications of the NUMAlink module.

Table A-11 NUMAlink Module Port Specifications

Port	Quantity	Peak Transfer Rate
Link	8	1.6 GB/s each direction
L1	1	12 Mbits/s

Rack Specifications

The Origin 350 server system can be housed in short (17U) or tall (39U) racks.

Note: One U is 1.75 in. (4.45 cm).

Table A-12 lists the specifications of the short rack.

Table A-12 Short Rack Specifications (with Skins)

Characteristic	Specification
Height	36.06 in. (916 mm)
Width	25.38 in. (645 mm)
Depth	40.63 in. (1032 mm)
Weight (maximum)	488 lb (221 kg)
Shipping weight (maximum)	563 lb (255 kg)

Table A-13 lists the specifications of the tall rack.

Table A-13 Tall Rack Specifications

Characteristic	Specification
Height	75.82 in. (1925.83 mm)
Width	23.62 in. (599.95 mm)
Depth	41.25 in. (1048 mm)
Weight (maximum)	1,100 lb (499 kg)
Shipping weight (maximum)	1,281 lb (581 kg)

SGI TP900 Storage Module Specifications

Table A-14 lists the specifications of the SGI TP900 storage module.

Table A-14 TP900 Storage Module Specifications

Characteristic	Specification
Height	3.37 in. (85.7 mm)
Width	17.6 in. (447 mm)
Depth	21.46 in. (545 mm)
Input power	100 - 254 VAC (~175 W)
Weight:	
Maximum configuration	48.5 lb (22 kg)
Empty enclosure	14.3 lb (6.5 kg)

Power Bay Module Specifications

The power bay requires 3U amount of space within the rack. Table A-15 lists the specifications for the power bay.

Table A-15 Power Bay Module Specifications

Characteristic	Specification
Height	5.118 in. (130 mm)
Width	17.5 in. (443 mm)
Depth	23.898 in. (607 mm)
Weight (with two power supplies)	42 lb (19.05 kg)

Table A-16 lists the specifications of the power supplies.

Table A-16 Power Supply Specifications

Characteristic	Specification
Height	4.86 in. (123.5 mm)
Width	2.74 in. (69.5 mm)
Depth	13.67 in. (347.3 mm)
Weight	7.5 lb (3.38 kg)

USB Hub Specifications

Table A-17 lists the specifications of the USB hub.

Table A-17 USB Hub Specifications

Characteristic	Specification
Height	0.688 in. (17.475 mm)
Width	2.5 in. (63.5 mm)
Depth	3.25 in. (82.55 mm)

Non-proprietary I/O Port Specifications

This section provides pin assignment information for the non-proprietary connectors on the following components:

- Compute module (base and expansion)
- MPX module
- L2 controller
- NUMAlink module
- TP900 storage module
- USB hub

Compute Module

Table A-18 lists the non-proprietary connectors that are located on the rear panel of the compute module (see Figure A-1). The third column of the table indicates where you can find the pin assignments for these connectors.

Table A-18 Compute Module Connectors

Port	Connector	Pin Assignments
Serial ports 1 through 4[a]	DB-9	See Figure A-7 on page 228
Console port	DB-9	See Figure A-7 on page 228
Keyboard and mouse ports[b]	PS/2	See Figure A-13 on page 235 and Table A-26 on page 235
Ethernet port[c]	RJ-45	See Figure A-8 on page 229 and Table A-21 on page 229
External SCSI port[d]	SCSI 68-pin VHDCI	See Figure A-9 on page 230 and Table A-22 on page 230
RT interrupt input and output ports[e]	Stereo jack	See Figure A-10 on page 232 and Table A-23 on page 232
L1 port	USB type B	See Figure A-12 on page 234 and Table A-25 on page 234

a. Serial ports 2, 3, and 4 reside on a daughtercard. This daughtercard is only available with the base compute module.

b. The keyboard and mouse PS/2 ports are available on the daughtercard. This daughtercard is only available with the base compute module.

c. These connectors are available only when the compute module has an IO9 PCI card.

d. These connectors are available only when the compute module has an IO9 PCI card.

e. These connectors are available only when the compute module has an IO9 PCI card.

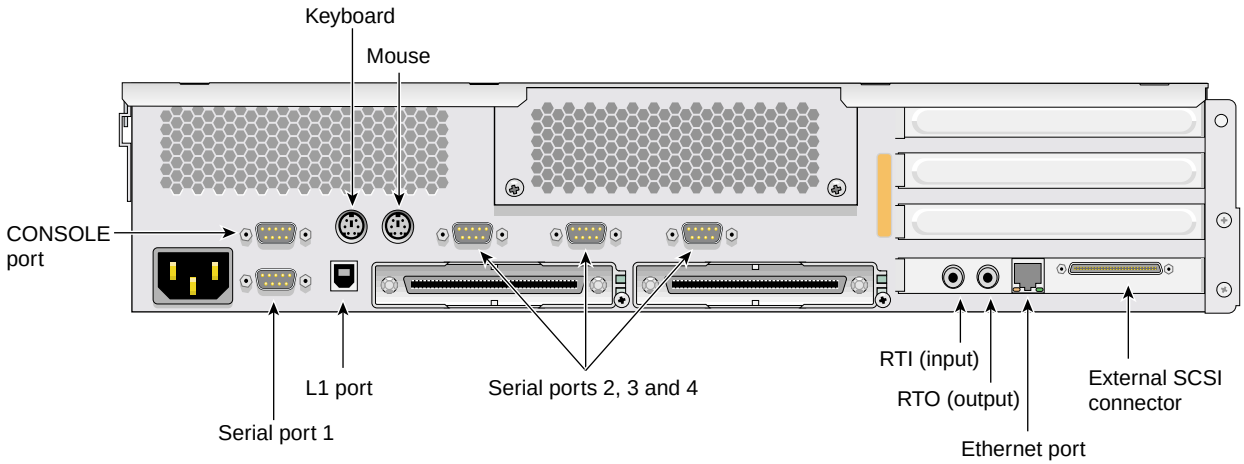


Figure A-1 Rear Panel of Compute Module

MPX Module

Table A-19 lists the non-proprietary connectors that are located on the rear panel of the MPX module (see Figure A-2). The third column of the table indicates where you can find the pin assignments for these connectors.

Table A-19 MPX Module Connectors

Port	Connector	Pin Assignments
Console port	DB-9	See Figure A-7 on page 228
L1 port	USB type B	See Figure A-12 on page 234 and Table A-25 on page 234

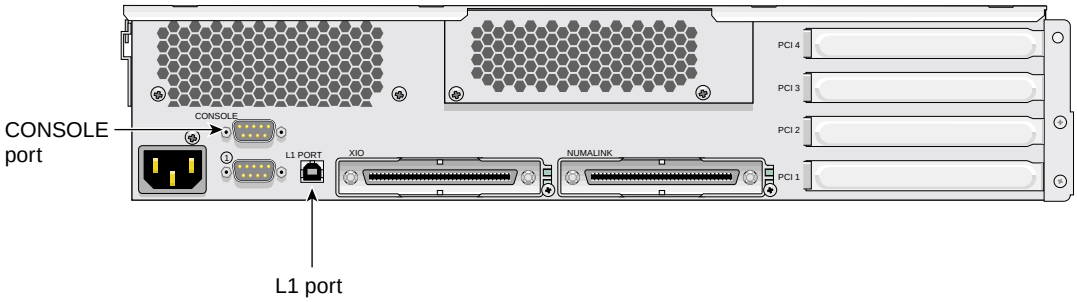


Figure A-2 Non-Proprietary Connectors on Rear Panel of MPX Module

L2 Controller

Table A-20 lists the non-proprietary connectors that are located on the rear panel of the L2 controller (see Figure A-3). The third column of the table indicates where you can find the pin assignments for these connectors.

Table A-20 L2 Controller Connectors

Port	Connector	Pin Assignments
Console (serial port)	DB-9	See Figure A-7 on page 228
Modem (serial port)	DB-9	See Figure A-7 on page 228
Ethernet port	RJ-45	See Figure A-8 on page 229 and Table A-21 on page 229
L1 ports (four ports)	USB type A	See Figure A-11 on page 233 and Table A-24 on page 233

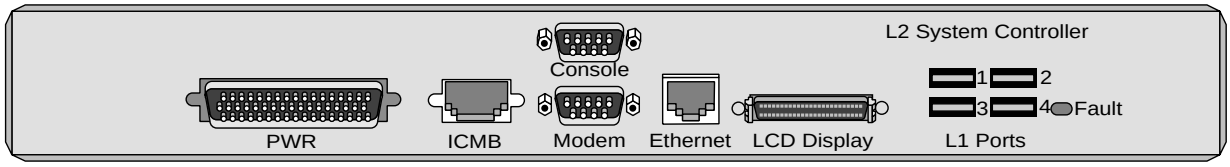


Figure A-3 Non-Proprietary Connectors on Rear Panel of L2 Controller

NUMAlink Module

Figure A-4 shows the L1 port (USB type B connector) on the rear panel of the NUMAlink module. For the pin number locations of the connector, see Figure A-12 on page 234. Table A-25 on page 234 lists the pin assignments.

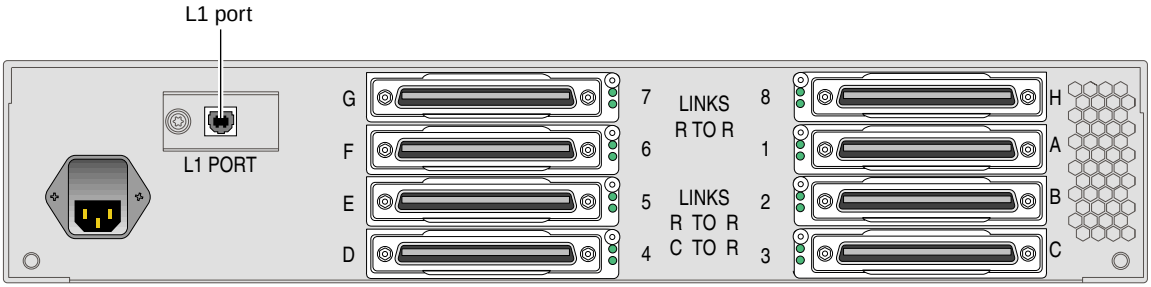


Figure A-4 Non-Proprietary Connector on Rear Panel of NUMAlink Module

SGI TP900 Storage Module

Figure A-5 shows the two SCSI port connectors on the rear panel of the TP900 storage module. Figure A-9 on page 230 shows how the pin numbers are distributed on the SCSI connector, and Table A-22 on page 230 lists the pin assignments.

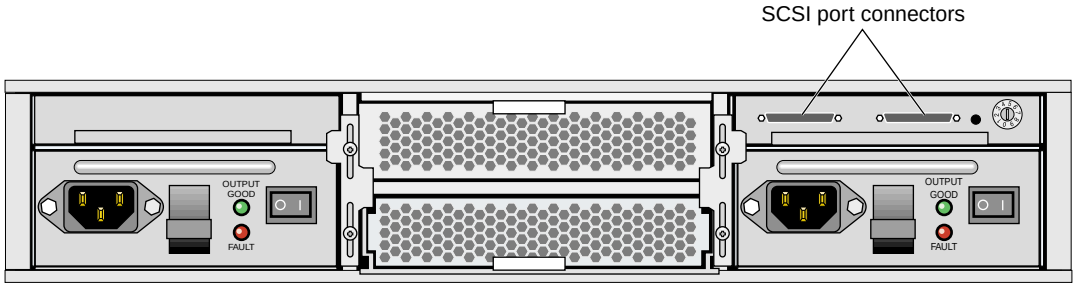


Figure A-5 Non-proprietary Connectors on Rear Panel of TP900 Storage Module

USB Hub

The USB hub (see Figure A-6) has four USB type A connectors (two connectors on each side of the hub). Figure A-11 on page 233 shows how the pin numbers are distributed on the USB type A connector, and Table A-24 on page 233 lists the pin assignments.

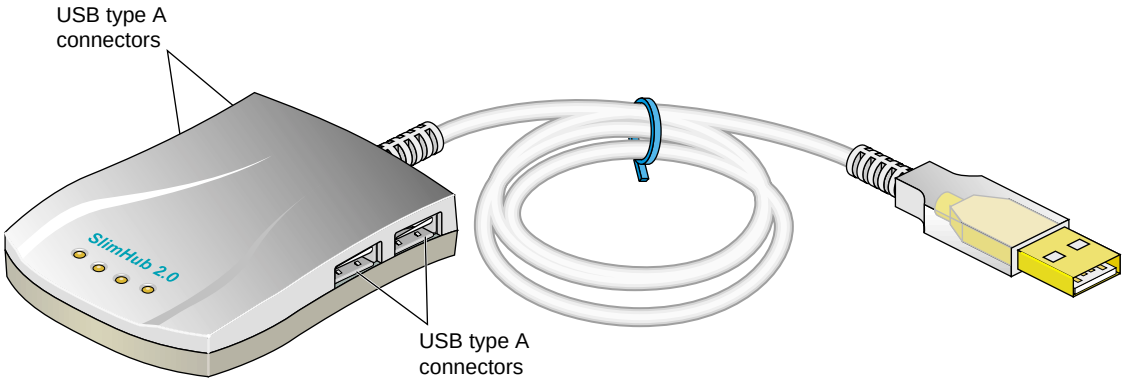


Figure A-6 USB Hub Type A Connectors

DB-9 Connector

Figure A-7 shows the DB-9 connector pin assignments. This connector is used for the console port and serial port(s) of the compute module. It is also used as the console port of the MPX module, and the console and modem ports of the L2 controller.

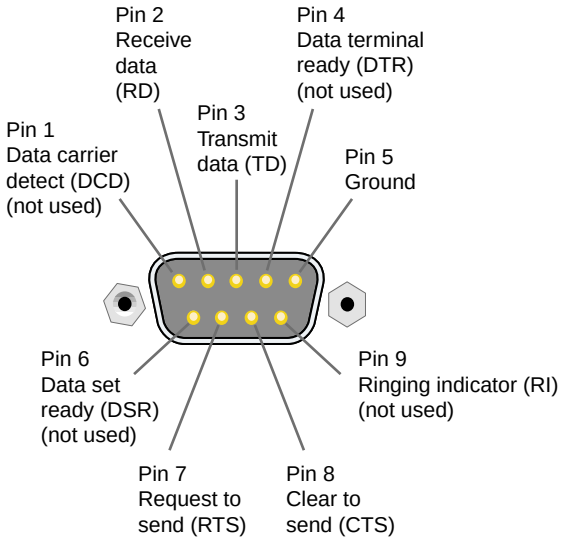


Figure A-7 DB-9 Connector Pin Assignments

RJ-45 Connector

Figure A-8 shows the pin locations for the RJ-45 connector on the IO9 PCI card and the L2 controller. Table A-21 shows the pin assignments for the RJ-45 connector.

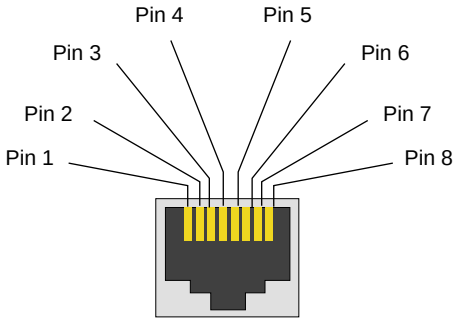


Figure A-8 RJ-45 Connector Pin Assignments

Table A-21 Ethernet Connector Pin Assignments

10/100BaseT Ethernet Pinouts Pin	Assignment	1000BaseT Ethernet Pinouts Pin	Assignment
1	Transmit +	1	Transmit/Receive 0+
2	Transmit –	2	Transmit/Receive 0–
3	Receive +	3	Transmit/Receive 1+
4	Not used	4	Transmit/Receive 2+
5	Not used	5	Transmit/Receive 2–
6	Receive –	6	Transmit/Receive 1–
7	Not used	7	Transmit/Receive 3+
8	Not used	8	Transmit/Receive 3–

External SCSI Port Connector

Figure A-9 shows the connector pin locations for the external SCSI VHDCI connector. This connector is used on the IO9 PCI card and the TP900 storage module. Table A-22 lists the pin assignments for this SCSI connector.

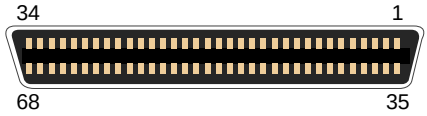


Figure A-9 Pin Number Locations for External SCSI Port

Table A-22 SCSI VHDCI Pin Assignments

Pin Number	Signal Name	Pin Number	Signal Name
1	+DB (12)	35	-DB (12)
2	+DB (13)	36	-DB (13)
3	+DB (14)	37	-DB (14)
4	+DB (15)	38	-DB (15)
5	+DB (P1)	39	-DB (P1)
6	+DB (0)	40	-DB (0)
7	+DB (1)	41	-DB (1)
8	+DB (2)	42	-DB (2)
9	+DB (3)	43	-DB (3)
10	+DB (4)	44	-DB (4)
11	+DB (5)	45	-DB (5)
12	+DB (6)	46	-DB (6)
13	+DB (7)	47	-DB (7)
14	+DB (P0)	48	-DB (P0)
15	Ground	49	Ground

Table A-22 SCSI VHDCI Pin Assignments **(continued)**

Pin Number	Signal Name	Pin Number	Signal Name
16	DIFFSENS	50	Ground
17	TERMPWR	51	TERMPWR
18	TERMPWR	52	TERMPWR
19	Reserved	53	Reserved
20	Ground	54	Ground
21	+ATN	55	-ATN
22	Ground	56	Ground
23	+BSY	57	-BSY
24	+ACK	58	-ACK
25	+RST	59	-RST
26	+MSG	60	-MSG
27	+SEL	61	-SEL
28	+CD	62	-CD
29	+REQ	63	-REQ
30	+IO	64	-IO
31	+DB (8)	65	-DB (8)
32	+DB (9)	66	-DB (9)
33	+DB (10)	67	-DB(10)
34	+DB (11)	68	-DB (11)

Stereo Jack Connector Conductor

Figure A-10 shows the stereo jack connector conductors that are used for the RT interrupt input and RT interrupt output ports of the IO9 PCI card. Table A-23 lists the conductor assignments for the stereo jack connector.

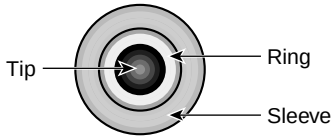


Figure A-10 Stereo Jack Connector Conductors

Table A-23 Conductor Assignments for Stereo Jack Connector

Conductor	Function
Tip	+5 V
Ring	Interrupt (active low)
Sleeve	Chassis ground and cable shield

USB Type A Connector

Figure A-11 shows the USB type A connector that is used for USB ports 1 through 4 of the L2 controller and the four USB ports on the USB hub that connect to the compute and/or MPX modules. Table A-24 lists the pin assignments.

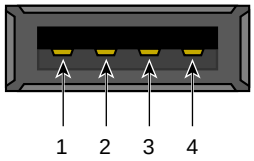


Figure A-11 Pin Number Locations for USB Type A Connector

Table A-24 Pin Assignments for USB Type A Connector

Signal	Color	Pin Number
VCC	Red	1
-Data	White	2
+Data	Green	3
Ground	Black	4

USB Type B Connector

Figure A-12 shows the USB type B connector that is used for the USB L1 port of the compute module and the MPX module, and the L1 port on the NUMAlink module. Table A-25 lists the pin assignments.

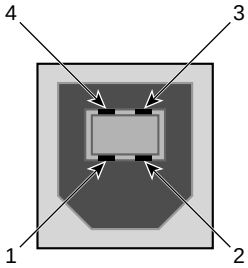


Figure A-12 Pin Number Locations for USB Type B Connector

Table A-25 Pin Assignments for USB Type B Connector

Signal	Color	Pin Number
VCC	Red	1
-Data	White	2
+Data	Green	3
Ground	Black	4

PS/2 Connectors

Figure A-13 shows the pin locations for the PS/2 keyboard and mouse connectors located on the base compute module. Table A-26 lists the pin assignments.

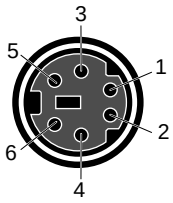


Figure A-13 Pin Number Locations for the PS/2 Keyboard and Mouse Connectors

Table A-26 Pin Assignments for the PS/2 Connectors

Pin	Assignment
1	Keyboard/Mouse Data
2	Reserved
3	Ground
4	Keyboard/Mouse Data (+5 V)
5	Keyboard/Mouse clock
6	Reserved

Regulatory Specifications and Safety Information

This appendix presents regulatory information that may be important to the operation of your SGI Origin 350 server system.

Manufacturer's Regulatory Declarations

The Origin 350 server system products conform to several national and international specifications and European Directives listed on the "Manufacturer's Declaration of Conformity." The CE insignia displayed on each device is an indication of conformity to the European requirements.

Caution: Each SGI server system has several governmental and third-party approvals, licenses, and permits. Do not modify this product in any way that is not expressly approved by SGI. If you do, you may lose these approvals and your governmental agency authority to operate this device.

Server Model Number

The CMN (model) number for each server is printed on the system label on the unit.

CE Notice and Manufacturer's Declaration of Conformity

The "CE" symbol indicates compliance of the device to directives of the European Community. A "Declaration of Conformity" in accordance with the standards has been made and is available from SGI upon request.

Electromagnetic Emissions

This section provides the contents of electromagnetic emissions notices for various countries.

FCC Notice (USA Only)

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

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

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by using one or more of the following methods:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Caution: Changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

Industry Canada Notice (Canada Only)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique német pas de perturbations radioélectriques dépassant les normes applicables aux appareils numériques de Classe A préscrites dans le Règlement sur les interferences radioélectriques établi par le Ministère des Communications du Canada.

VCCI Notice (Japan Only)

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

Chinese Class A Regulatory Notice

警告使用者：

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

Korean Class A Regulatory Notice

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며 만약 잘못 판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Shielded Cables

The Origin 350 server system product is FCC compliant under test conditions that include the use of shielded cables between the server and its peripherals. Your server and any peripherals that you purchase from SGI have shielded cables. Shielded cables reduce the possibility of interference with radio, television, and other devices. If you use any cables that are not from SGI, ensure that they are shielded. Telephone cables do not require shielding.

Optional monitor cables supplied with your server system use additional filtering molded into the cable jacket to reduce radio frequency interference. Always use the cable that is supplied with your system. If your monitor cable becomes damaged, obtain a replacement cable from SGI.

Electrostatic Discharge

SGI designs and tests its products to be resistant to the effects of electrostatic discharge (ESD). ESD is a source of electromagnetic interference and can cause problems ranging from data errors and lockups to permanent component damage.

It is important that you keep all the covers and doors, including the plastics, in place while you are operating the server system. The shielded cables that came with the server and its peripherals should be installed correctly, with all thumbscrews fastened securely.

An ESD wrist strap may be included with some products, such as memory or PCI upgrades. Use the wrist strap when you install these upgrades to prevent the flow of static electricity; it is designed to protect your system from ESD damage.

Laser Compliance Statements

The DVD-ROM drive in this computer is a Class 1 laser product. The DVD-ROM drive-classification label is located on the drive.

Warning: Invisible laser radiation when open. Avoid exposure to beam.

Warning: **Attention: Radiation du faisceau laser invisible en cas d'ouverture. Evitter toute exposition aux rayons.**

Warning: **Vorsicht: Unsichtbare Laserstrahlung, Wenn Abdeckung geöffnet, nicht dem Strahl aussetzen.**

Warning: **Advertencia: Radiación láser invisible al ser abierto. Evite exponerse a los rayos.**

Warning: **Advarsel: Laserstråling vedåbning se ikke ind i strålen**

Warning: **Varo! Lavattaessa Olet Alttina Lasersåteilylle**

Warning: **Varning: Laserstrålning når denna del år öppnad ålå tuijota såteeseenstirra ej in i strålen.**

Warning: **Varning: Laserstrålning nar denna del år öppnadstirra ej in i strålen.**

Warning: **Advarsel: Laserstråling nar deksel åpnesstirr ikke inn i strålen.**

Lithium Battery Statement

Warning: **Only qualified service personnel should replace the soldered lithium battery (or batteries) in the SGI Origin 350 server system.**

Warning: **Advarsel!: Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Léver det brugte batteri tilbage til leverandøren.**

Warning: **Advarsel: Eksplosjonsfare ved feilaktig skifte av batteri. Benytt samme batteritype eller en tilsvarende type anbefalt av apparatfabrikanten. Brukte batterier kasseres i henhold til fabrikantens instruksjoner.**

Warning: **Varning: Explosionsfara vid felaktigt batteribyte. Anvãnd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera anvãnt batteri enligt fabrikantens instruktion.**

Warning: **Varoitus: Päristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.**

Warning: **Vorsicht!: Explosionsgefahr bei unsachgemäßen Austausch der Batterie. Ersatz nur durch denselben oder einen vom Hersteller empfohlenem ähnlichen Typ. Entsorgung gebrauchter Batterien nach Angaben des Herstellers.**

Index

E

F

H

I

K

L

M

N

P

R

S

T

U

V

X