

PCI Expansion Module User's Guide

007-4499-001

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Cover Design By Sarah Bolles, Sarah Bolles Design, and Dany Galgani, SGI Technical Publications.

Record of Revision

Version	Description
001	November 2001 Initial Rev

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About This Guide

This guide provides an overview of the PCI expansion module and it describes how to install and operate this module. Specifically, it provides the following information:

- Chapter 1, “Installation Procedures”
- Chapter 2, “Operation Procedures”
- Chapter 3, “Product Description”
- Chapter 4, “Troubleshooting”

An index completes this guide.

Audience

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

Your SGI system support engineer (SSE) should perform the addition or replacement of parts and service of your PCI expansion module, with the exception of the following procedures that you may perform yourself:

- Installing the PCI expansion module.
- Cabling the PCI expansion module.
- Installing and removing PCI cards.

Information Sources

This section lists SGI documents that are relevant to the use of the PCI expansion module:

- *PCI Expansion Module User's Guide* (this manual) (hard copy shipped with module)
- *SGI Origin 300 System with NUMALink Module User's Guide*
- *SGI Origin 300 User's Guide*
- *IRIX Admin Software Installation and Licensing Guide*
- Other SGI documentation
- Online man pages
- IRIX release notes (on CD)

PCI Expansion Module User's Guide

Use this guide to become familiar with your PCI expansion module and to learn how to operate, monitor, maintain, and troubleshoot the module. This guide contains information on installing the module, and installing and replacing PCI cards.



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. Please contact your SGI system support engineer (SSE) to install or replace any hardware components that are not designated as customer replaceable in this guide.

SGI Origin 300 System with NUMALink Module User's Guide

This guide describes how to operate, monitor, maintain, and troubleshoot the SGI Origin 300 system with NUMALink module. It contains information on installing the system, and installing and replacing the following components: PCI cards, disk drives, and memory (DIMMs).

SGI Origin 300 User's Guide

This guide describes how to operate, monitor, maintain, and troubleshoot the SGI Origin 300 server. It contains information on installing the server, and installing and replacing the following components: PCI cards, disk drives, and memory (DIMMs).

IRIX Admin: Software Installation and Licensing Guide

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, refer to the online *Personal System Administration Guide*.

Other SGI Documentation

You can access other SGI documentation in either of the following two ways:

- SGI manuals are available in various formats at:
<http://techpubs.sgi.com>
- If you have an SGI workstation running IRIX software, you can use the online documentation package called *IRIS InSight*. Select **Online Books** from the Help toolchest. You will see bookshelves for end-user, developer, and administration manuals. Double-click the name of a book to open it. For descriptions of hard-copy manuals that are available for purchase, double-click **Documentation Catalog**.

Online Man Pages

Your system includes a set of IRIX online manual pages, which are formatted in the standard UNIX “man page” style. These man pages are located 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, enter the following command at a shell prompt:

```
man Add_disk
```

Man pages document important system configuration files and commands. References in SGI documentation to these pages include the name of the command and the section number in which the command is located. For example, “`Add_disk(1)`” refers to the `Add_disk` command and indicates that it is located in section 1 of the IRIX reference. For

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

The `apropos` command locates man pages based on keywords. For example, to display a list of man pages that describe disks, enter the following command at a shell prompt:

```
apropos disk
```

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

IRIX Release Notes

You can view the release notes for various SGI products and software subsystems by using one of two utilities:

```
relnotes    Text-based viewer for online release notes.
```

```
grelnotes  Graphics viewer for online release notes.
```

To see a list of available release notes, type the following command at a shell prompt:

```
relnotes
```

For more information, see the `relnotes(1)` and `grelnotes(1)` man pages.

Product Support

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

- If you are in North America and want support for your SGI-supported products, contact the Technical Assistance Center at +1 800 800 4SGI or your authorized service provider.
- If you are outside North America, please contact the SGI subsidiary or authorized distributor in your country.

Conventions

The following conventions are used throughout this document:

Convention	Meaning
<code>command</code>	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
<i>variable</i>	Italic typeface denotes variable entries and words or concepts being defined.
user input	This bold, 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.
manpage(<i>x</i>)	Man page section identifiers appear in parentheses after man page names.

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.)

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Installation Procedures

This chapter describes the steps that you must perform to install your PCI expansion module in a tall or short rack. Specifically, it explains how to perform the following procedures:

- “Determining Placement within the Rack” on page 2
- “Mounting Shelf Rails to the Rack” on page 8
- “Installing the PCI Expansion Module in the Rack” on page 10
- “Cabling the PCI Expansion Module” on page 12

Note: The PCI expansion module cannot be installed in a tower chassis.

Determining Placement within the Rack

The placement of the PCI expansion modules within the rack depends on the system configuration and rack type. This section discusses the following:

- Determining placement within a short rack
- Determining placement within a tall rack

Note: Within the rack, a PCI expansion module is identified by the lowest unit number that it occupies. For example, in Figure 1-1, the PCI expansion module in the short rack is identified as U14. The top PCI expansion module in the tall rack is identified as U30.

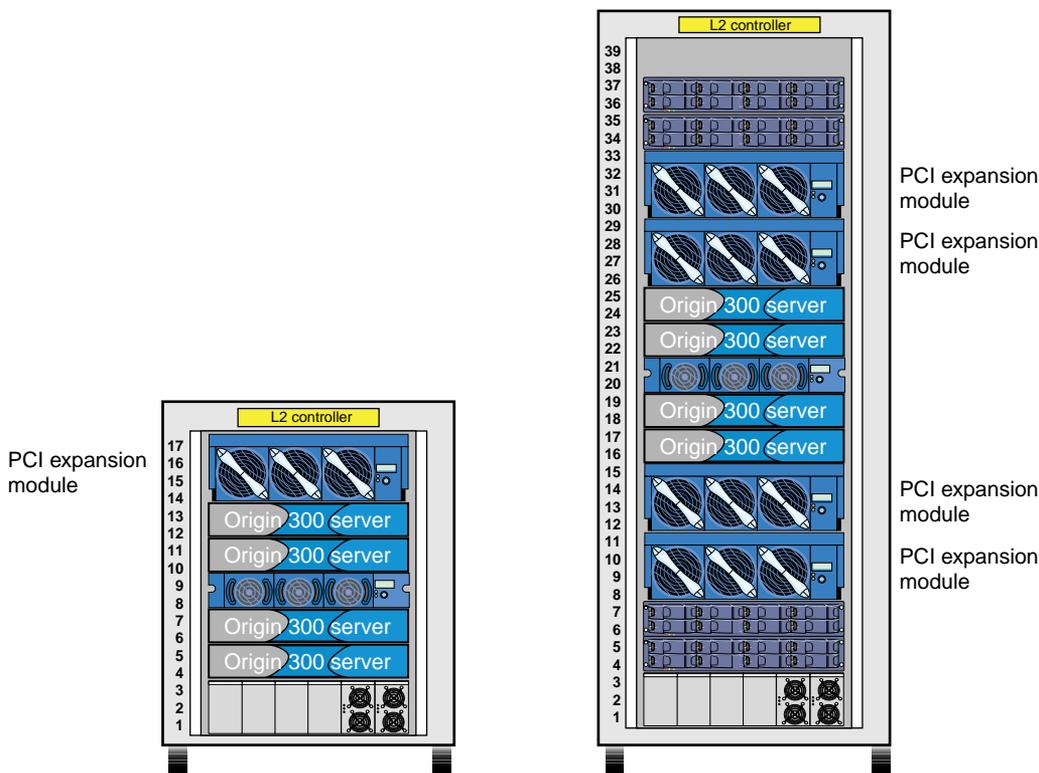


Figure 1-1 Unit Numbers

Determining Placement within a Short Rack

A system that is housed in a short rack can contain one or two PCI expansion modules. These modules should be placed in the first available location above the Origin 300 servers.

For example, in a system that contains a NUMAlink module (refer to Figure 1-2), place the first PCI expansion module in location U10. If you are adding a second PCI expansion module, place it in location U14. In a system that does not contain a NUMAlink module, place the first PCI expansion module in location U08 and place the second module in location U12.

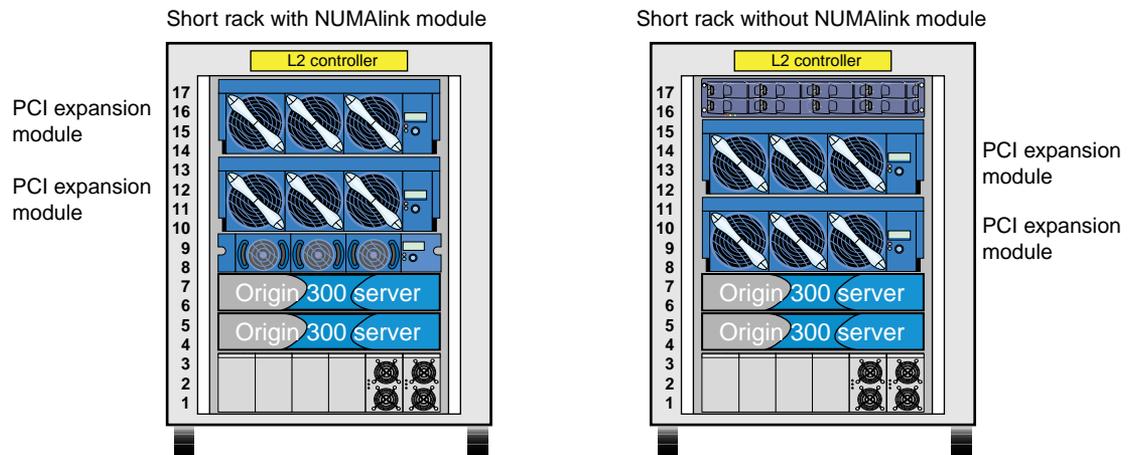


Figure 1-2 Placement of PCI Expansion Module (Short Rack)

Determining Placement within a Tall Rack

A tall-rack system with a NUMAlink module can contain as many as four PCI expansion modules. The number of modules depends on:

- The number of servers in your system; the PCI expansion module must be paired with an Origin 300 server
- The number of available ports on the NUMAlink module

Note: The PCI expansion module must connect to port 2, 3, 4, or 5 of the NUMAlink module. The PCI expansion module will not function if it is connected to port 1, 6, 7, or 8 of the NUMAlink module.

Table 1-1 lists the number of supported PCI expansion modules for a tall-rack system that contains a NUMAlink module.

Table 1-1 Number of Supported PCI Expansion Modules

Number of Servers	Maximum Number of Supported PCI Expansion Modules
Two	Two
Three	Three
Four	Four
Five	Three
Six	Two
Seven	One
Eight	Zero

The PCI expansion modules should reside above and below the NUMAlink module and the Origin 300 servers. Place the first PCI expansion module in the highest available location in the bottom section of the rack. For example (refer to Figure 1-3), place the first PCI expansion module in U12. Place the second PCI expansion module in the first available location in the top portion of the rack (for example, U26). Continue to alternate between the top and bottom portions of the rack until all of the PCI expansion modules are installed.

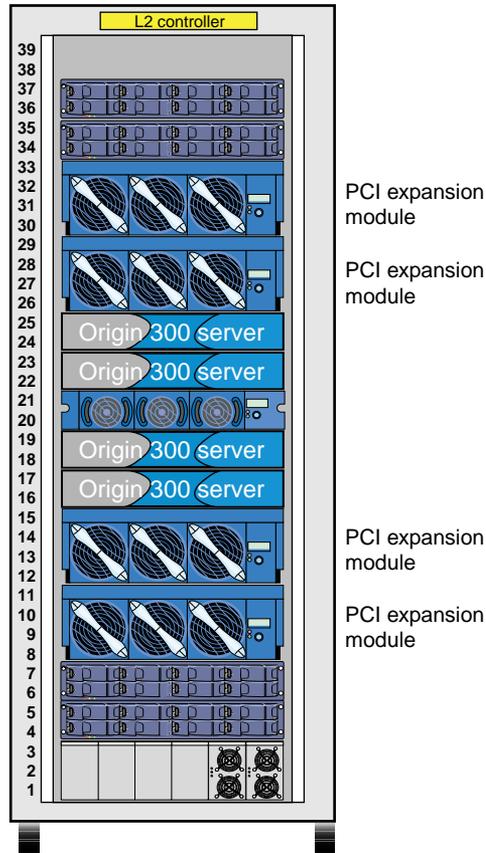


Figure 1-3 Placement of PCI Expansion Module (Tall Rack with NUMAlink Module)

A tall-rack system without a NUMAlink module can contain as many as six PCI expansion modules. The number of modules depends on the number of servers in your system. The PCI expansion module must be paired with an Origin 300 server; therefore, the system must contain at least six servers to support six PCI expansion modules.

Ideally, the PCI expansion module should be placed directly above the Origin 300 server to which it will be cabled (refer to Example A in Figure 1-4); however, if your configuration is similar to the one shown in Example B, place the PCI expansion module in the first available location above the Origin 300 servers.

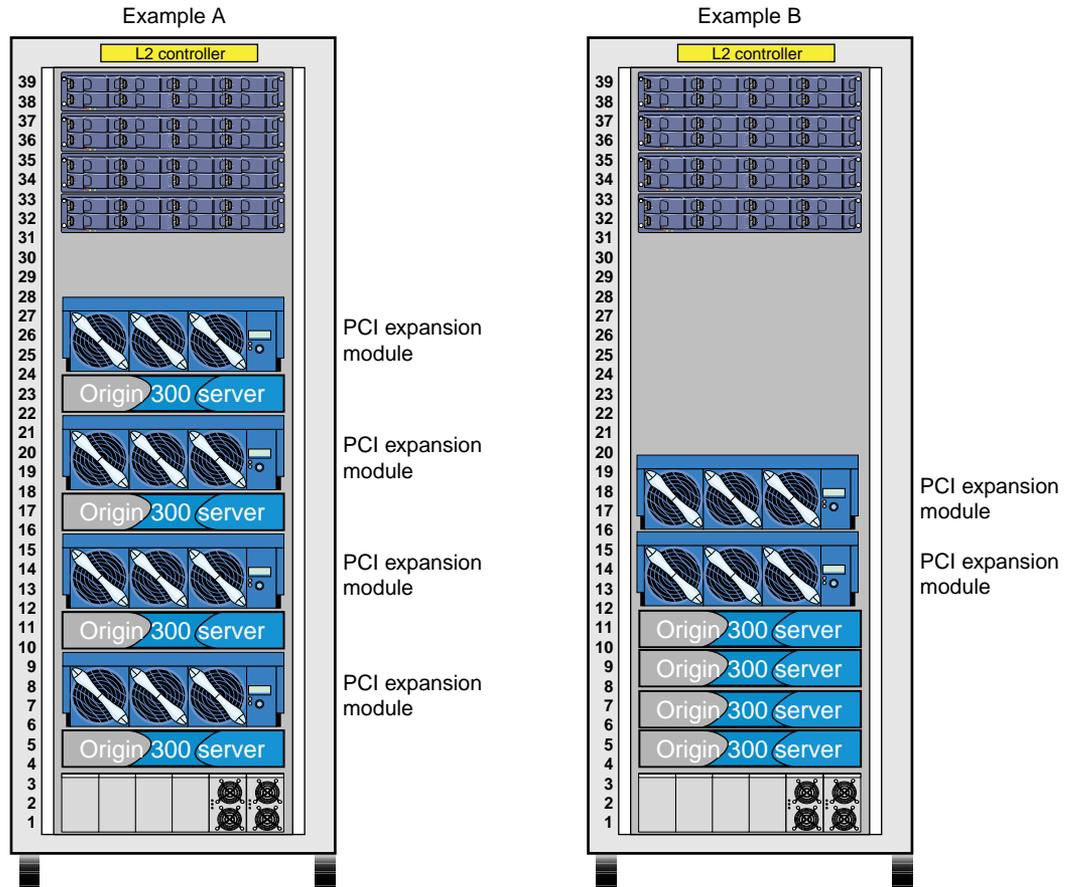


Figure 1-4 Placement of PCI Expansion Module (Tall Rack without NUMAlink Module)

Mounting Shelf Rails to the Rack

The PCI expansion module ships with shelf rails that you need to mount to the rack. The shelf rails support the PCI expansion module within the rack.

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

1. Locate the slot location in the rack where you will install the PCI expansion 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 (refer to Figure 1-5).
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 T25 Torx screws that secure the bracket and the shelf to the rear rack rail.
8. Repeat steps 2 through 7 for the right shelf rail.

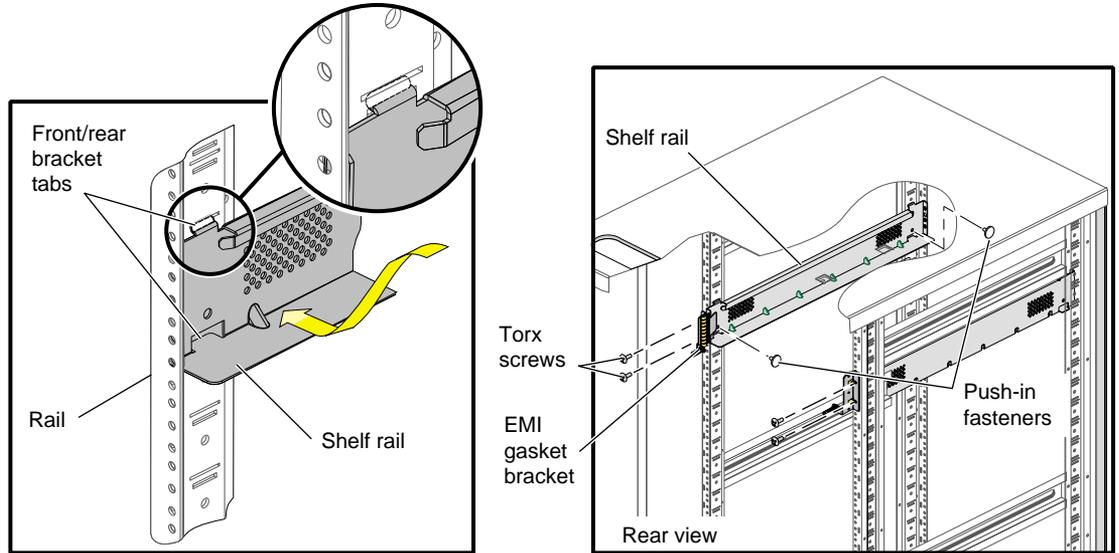


Figure 1-5 Shelf Rail Installation

Installing the PCI Expansion Module in the Rack

Perform the following steps to install the PCI expansion module in your system. SGI recommends that you use a service shelf during the installation. The PCI expansion module weighs approximately 70 lbs (31.5 kg).

1. If your service shelf looks like the one shown in Figure 1-6a, follow these steps:
 - a. Hold the hook end of the service shelf at an angle slightly lower than the rest of the shelf.
 - b. Insert the service shelf's uppermost hooks into the rack slots so that the service shelf is at the same height as the slot where you will install the PCI expansion module. Refer to Figure 1-6a.
 - c. Lower the free end of the service shelf until the shelf is at a right angle to the rack and the service shelf hooks lock into the rack frame.
 - d. Push down firmly on the shelf to ensure that the shelf can support the full weight of the module.

If your service shelf looks like the one shown in Figure 1-6b, follow these steps:

- a. Insert the alignment peg of the service shelf into the rack rail so that shelf is at the same height as the slot where you will install the PCI expansion module.
 - b. Insert two M5 Phillips screws to secure the shelf to the rack.
2. Place the module on the service shelf; the connector end of the module should be closest to the rack.
3. Slide the module off of the service shelf and into the rack.

Note: If you are using the service shelf shown in Figure 1-6b, do not slide the module all the way into the rack. Leave enough space between the module and the rack rail so that you can remove the screws that secure the shelf to the rack rail. After you remove the shelf, slide the module completely into the rack.

4. Install the two T25 Torx screws that secure the module to the front of the rack. Refer to Figure 1-7.
 5. If you are using the service shelf shown in Figure 1-6a, remove the service shelf by lifting the free end of the service shelf until the shelf hooks disengage from the rack.

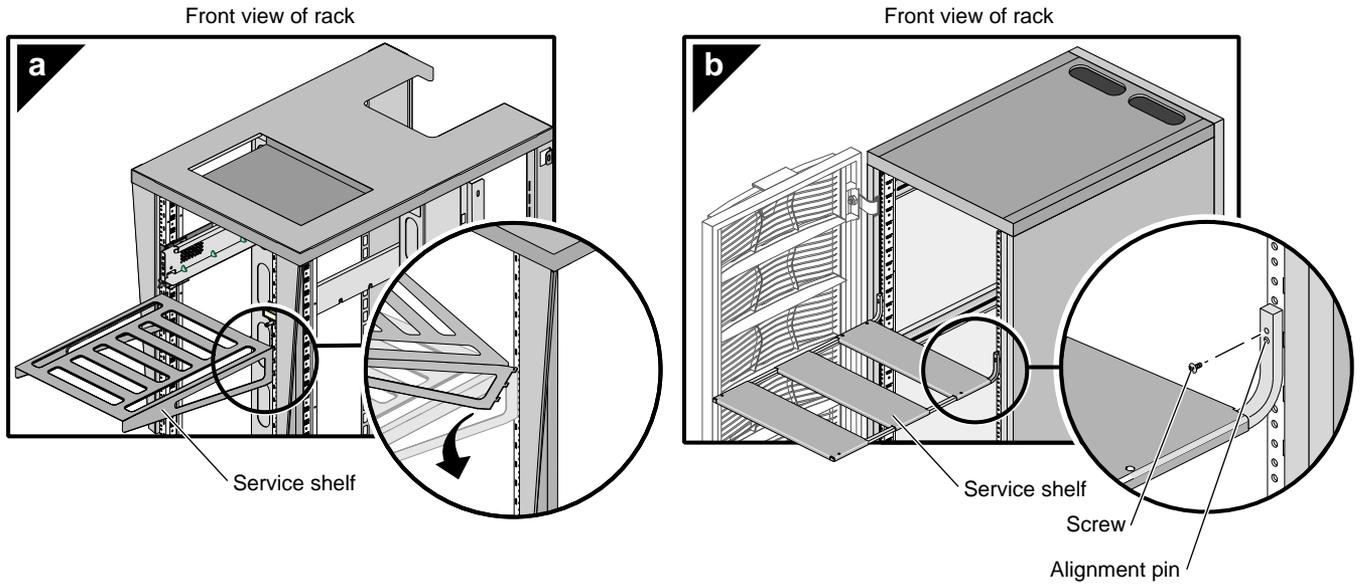


Figure 1-6 Service Shelf Installation

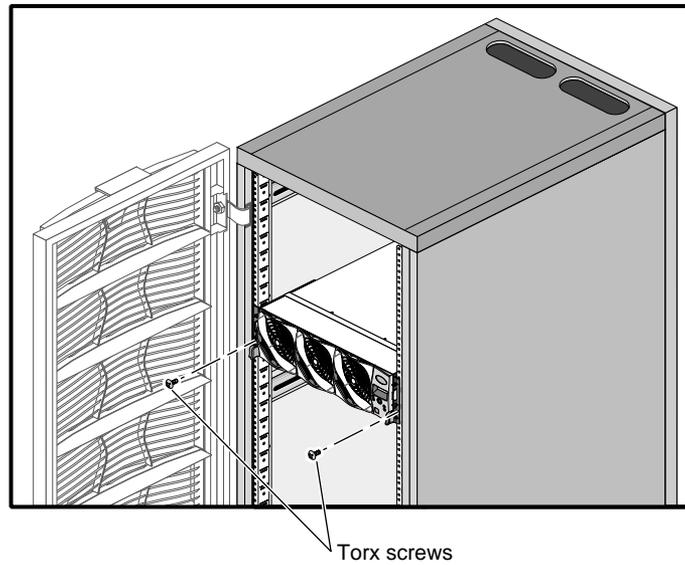


Figure 1-7 Module Installation

Cabling the PCI Expansion Module

This section describes how to cable your PCI expansion module to an Origin 300 server and to a NUMalink module. Refer to the procedure that applies to your system configuration. This section also describes how to cable the PCI expansion module to the power bay.

Cabling PCI Expansion Module to Origin 300 Server

Cable the PCI expansion module to the LINK (NI) connector of an Origin 300 server that is within 8U of the PCI expansion module (refer to Figure 1-8).

Note: The NUMalink cable is 1 meter in length (39 inches); however, after subtracting the allowance for cable bends (12 in., 0.3 m) and cable management (12 in., 0.3 m), you should cable the PCI expansion module to an Origin 300 server that is not more than 8U away from the PCI expansion module.

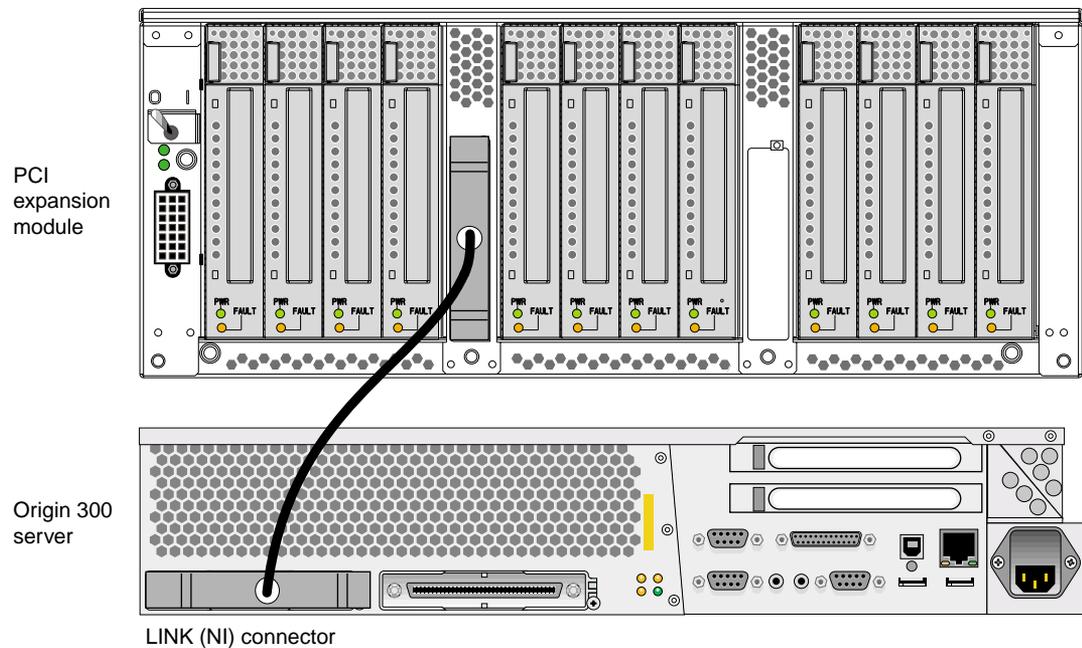


Figure 1-8 Cabling a PCI Expansion Module to an Origin 300 Server

Cabling PCI Expansion Module to NUMAlink Module

In an SGI Origin 300 with NUMAlink module system, the PCI expansion modules connect to ports 2, 3, 4, and 5 of the NUMAlink module.

Note: The PCI expansion module will not function if it is connected to port 1, 6, 7, or 8 of the NUMAlink module.

Table 1-2 and Table 1-3 indicate the NUMAlink port to which you should cable your PCI expansion module. Table 1-2 provides this information for a short rack.

Table 1-2 Connecting PCI Expansion Module to NUMAlink Module in Short Rack

If your PCI expansion module resides in location		NUMAlink module port
U10	connect to	3
U12	connect to	3
U14	connect to	2

Table 1-3 provides the NUMAlink port information for a tall rack.

Table 1-3 Connecting PCI Expansion Module to NUMAlink Module in Tall Rack

If your PCI expansion module resides in location		NUMAlink module port
U8	connect to	4
U10	connect to	4
U12	connect to	5
U26	connect to	3
U28	connect to	2
U30	connect to	2

Figure 1-9 provides an illustration of the cabling between the NUMAlink module and the PCI expansion modules in a tall rack.

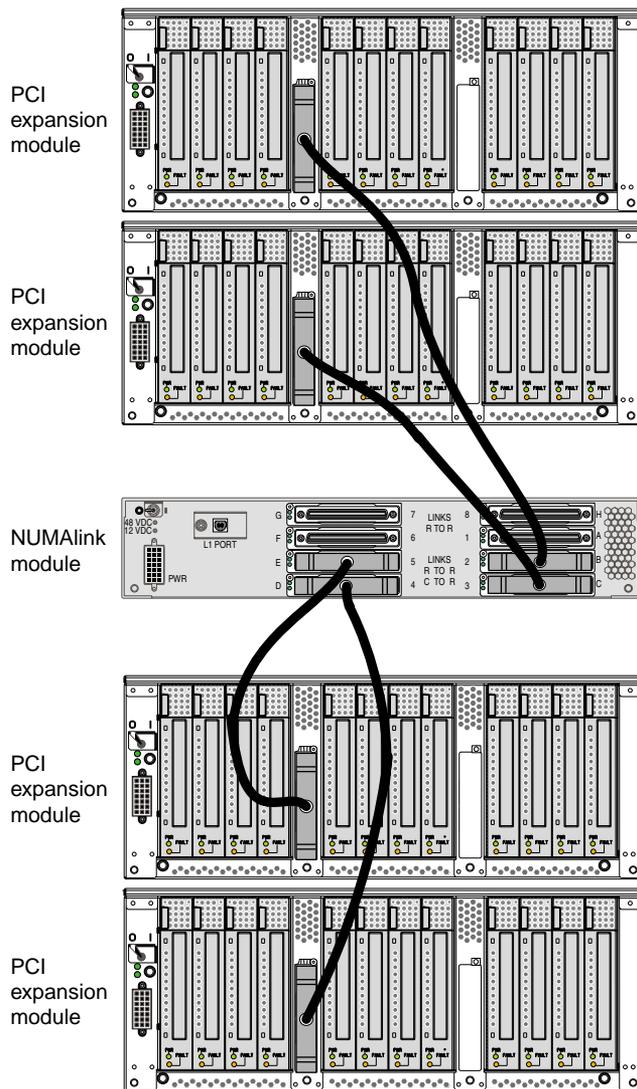


Figure 1-9 Cabling PCI Expansion Module to NUMAlink Module (Tall Rack)

Figure 1-10 provides an illustration of the cabling between the NUMalink module and the PCI expansion modules in a short rack.

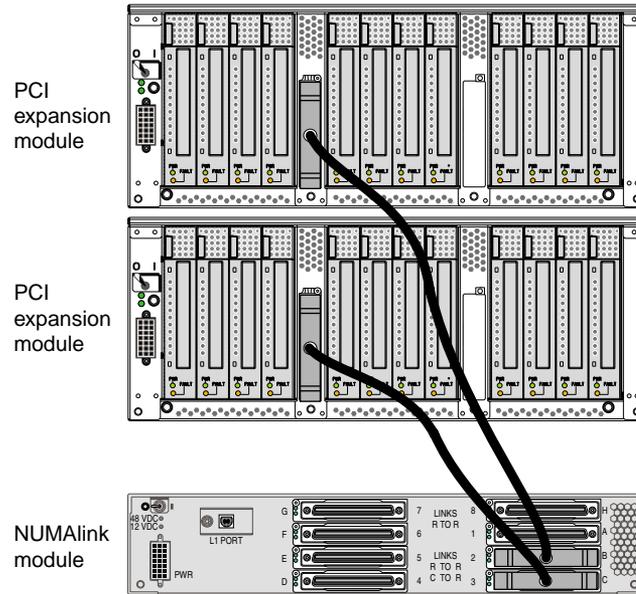


Figure 1-10 Cabling PCI Expansion Module to NUMalink Module (Short Rack)

Cabling PCI Expansion Module to Power Bay

You must also cable the PCI expansion module to the power bay as shown in Figure 1-11.

The PCI expansion module can connect to a 110- or 220-V power bay:

- The 110-Vac power bay contains two power supplies; each power supply inputs single-phase AC power and outputs 650 W at 48 Vdc. The outputs are bused together to provide 1250 W of available power in an N+1 redundant configuration. Each power supply also outputs 12 Vdc standby voltage at 42 W. The outputs are bused together to provide 90 W of available power in an N+1 redundant configuration.
- The 220-Vac power bay also contains two power supplies; each power supply inputs single-phase AC power and outputs 950 W at 48 Vdc. The outputs are bused together to provide 1840 W of available power in an N+1 redundant configuration. Each power supply also outputs 12 Vdc standby voltage at 42 W. The outputs are bused together to provide 90 W of available power in an N+1 redundant configuration.

Both power bays supply the 12 Vdc standby voltage and the 48 Vdc to the PCI expansion module. The 12 Vdc standby voltage powers on the module 's L1 controller. The 48 Vdc powers on the other components within the module.

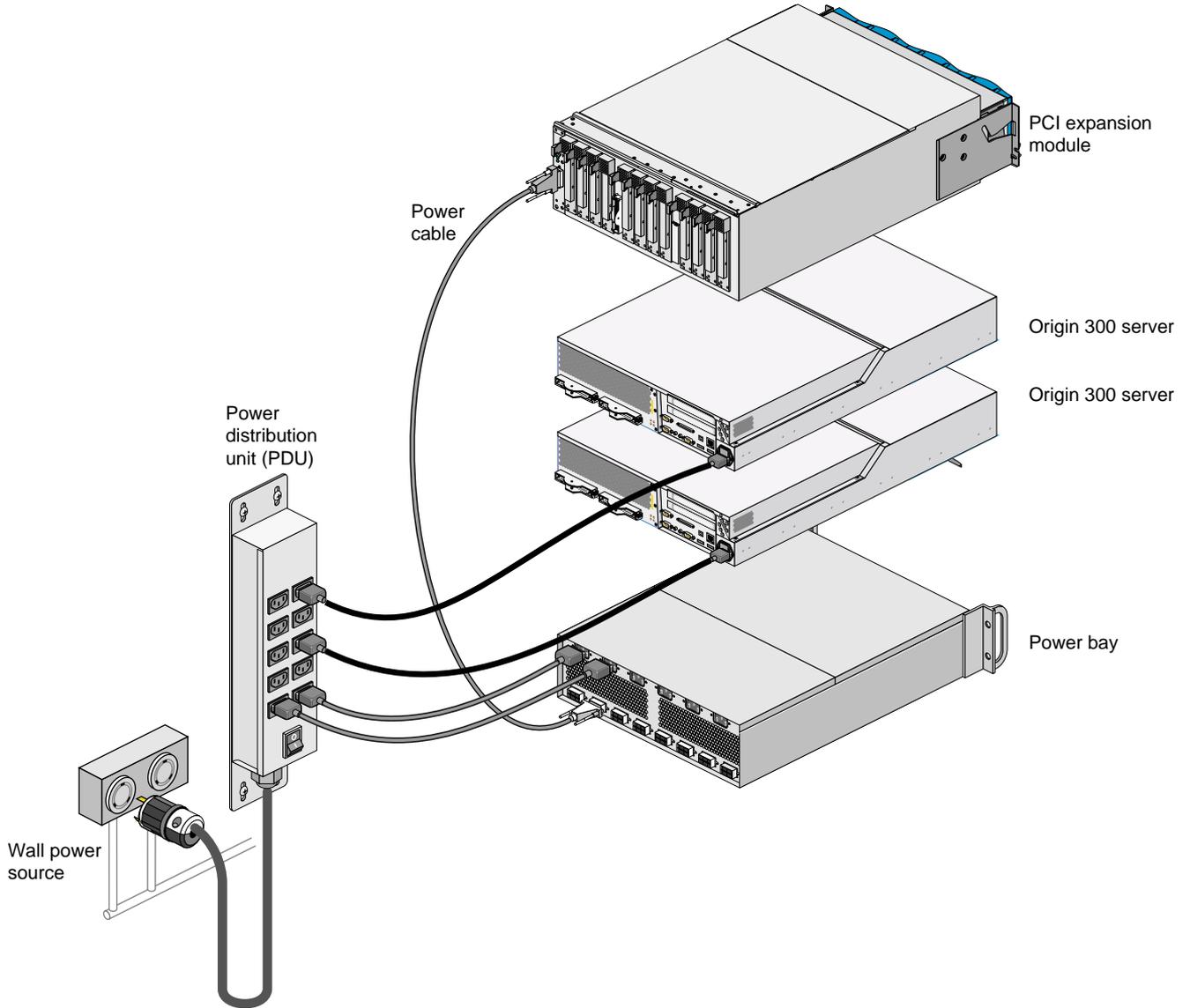


Figure 1-11 Cabling the PCI Expansion Module to the Power Bay

Operation Procedures

This chapter describes how to operate your PCI expansion module. Specifically, it explains how to perform the following procedures:

- “Installing and Removing a PCI Card” on page 19
- “Hot-plugging a PCI Card” on page 24
- “Powering the Module On and Off” on page 26
- “Monitoring the Module” on page 32

Installing and Removing a PCI Card

The PCI expansion module seats as many as twelve 3.3-volt or universal PCI cards. The PCI card slots are numbered bus 1 through bus 6. Each bus has two slots, labeled 1 and 2. All slots support either 32- or 64-bit addressing and can accommodate 66-MHz or 33-MHz PCI cards; however, if a bus has one 33-MHz card and one 66-MHz card, the bus operates at 33 MHz.



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

Tools/Parts Required:

- PCI card carrier assembly P/N 013-2614-002
- Optional PCI cards
- T8 ballpoint Torx driver P/N 7260654

Use the following guidelines when you add PCI cards to your PCI expansion module:

- Populate the PCI slots in the following order:
 1. Slot 1 of buses 1, 3, and 5
 2. Slot 1 of buses 2, 4, and 6
 3. Slot 2 of buses 1, 3, and 5
 4. Slot 2 of buses 2, 4, and 6
- Avoid mixing 33-MHz and 66-MHz cards on the same 66-MHz bus.
- Avoid mixing storage controller cards and networking cards on the same bus.
- Make sure the bandwidth of the PCI cards that occupy a bus does not exceed the bandwidth of the bus.

Although you need not power off the rack or the PCI expansion module to add or replace a PCI card, you must power off the individual slot in which you will replace a PCI card. For more information about powering off an individual slot, refer to “Hot-plugging a PCI Card” on page 24.

To add or replace a PCI card, follow these steps:

1. Remove the PCI carrier from the PCI slot in which you want to add or replace a PCI card. Pull out the PCI carrier actuator tab to extract it from the PCI slot; grasp the PCI card carrier by its edges and slide it out of the module, as shown in Figure 2-1.

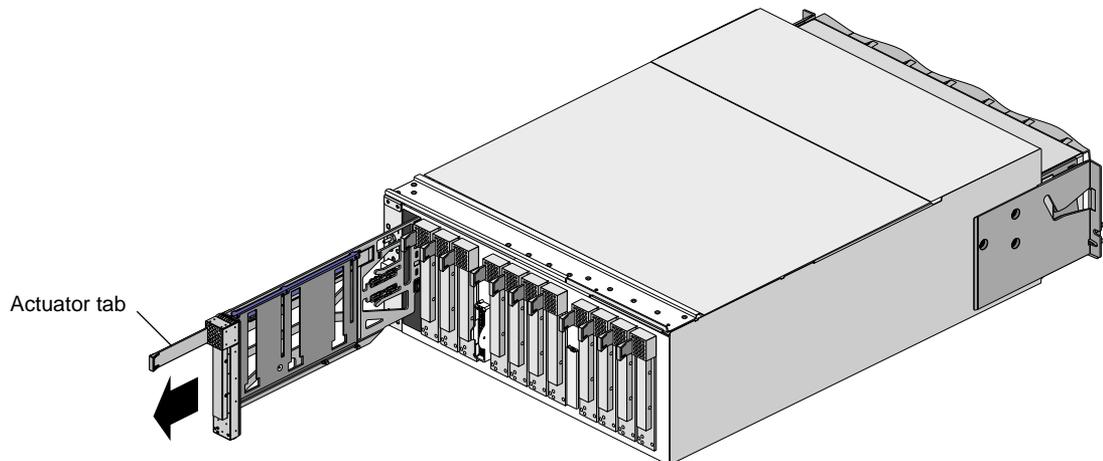


Figure 2-1 Removing a PCI Card Carrier

2. If you are replacing a card, loosen the three T8 Torx adjustment rail screws (refer to Figure 2-2) and gently remove the existing PCI card from the carrier. If adding a PCI card, extract the metal filler plate by pushing down on it as shown in Figure 2-3. This filler plate covers the PCI-card connector area.

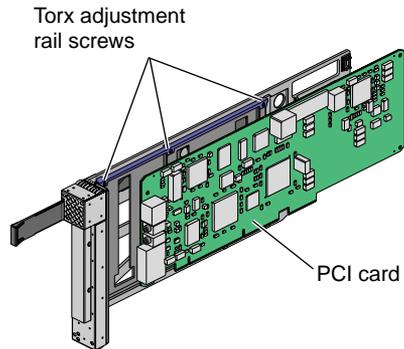


Figure 2-2 Torx Adjustment Rail Screws

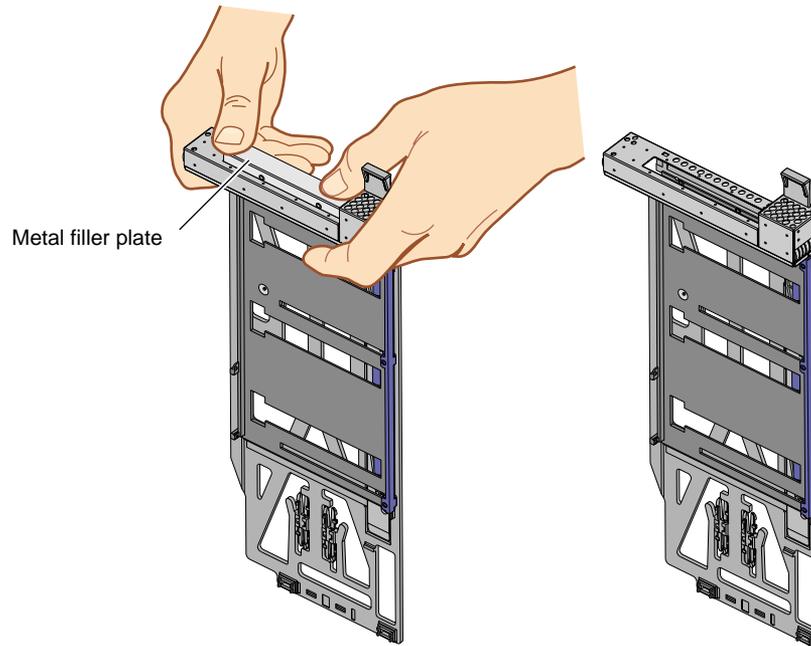


Figure 2-3 Extracting PCI Carrier's Metal Filler

3. Place the new or replacement PCI card in the PCI card carrier. Then move the adjustment rail so that it holds the card in place.
4. Tighten the three T8 Torx adjustment rail screws to secure the card in the carrier. Refer to Figure 2-4.

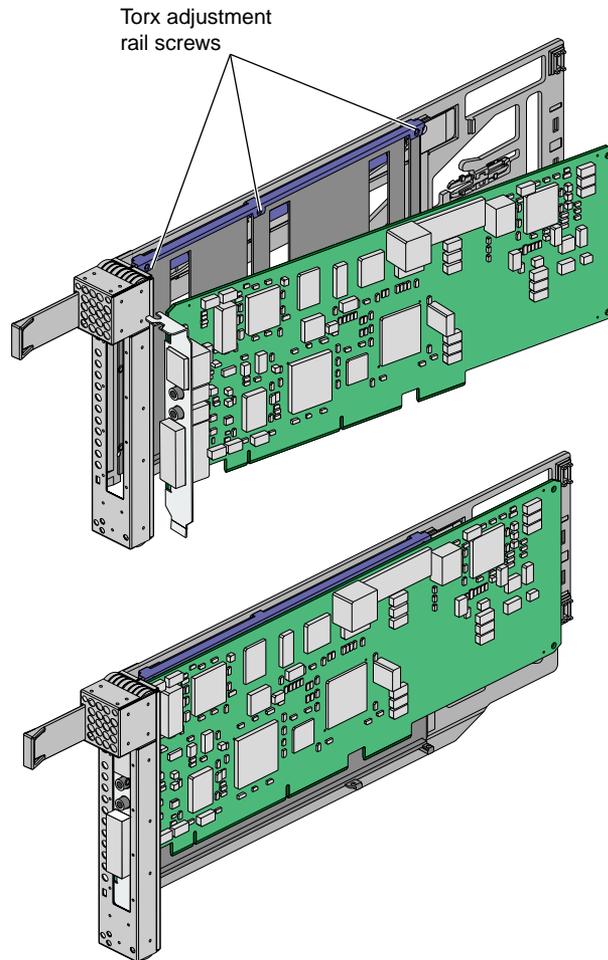


Figure 2-4 Mounting PCI Card Into Carrier

5. Insert the PCI card and carrier into the vacant slot, using the slot guides, as shown in Figure 2-5. Then slide the carrier into the module by grasping the PCI card carrier by its edges and sliding it into the module.

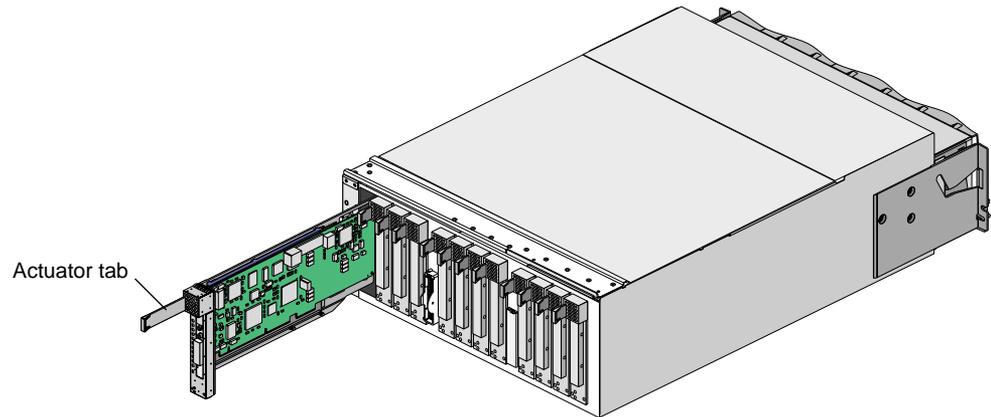


Figure 2-5 Installing a PCI Card in a PCI Slot

6. Push in the PCI card actuator tab until the card seats in its slot (refer to Figure 2-6).
7. Connect any cables to the PCI card.
8. Power on the PCI slot. Refer to “Hot-plugging a PCI Card” on page 24.

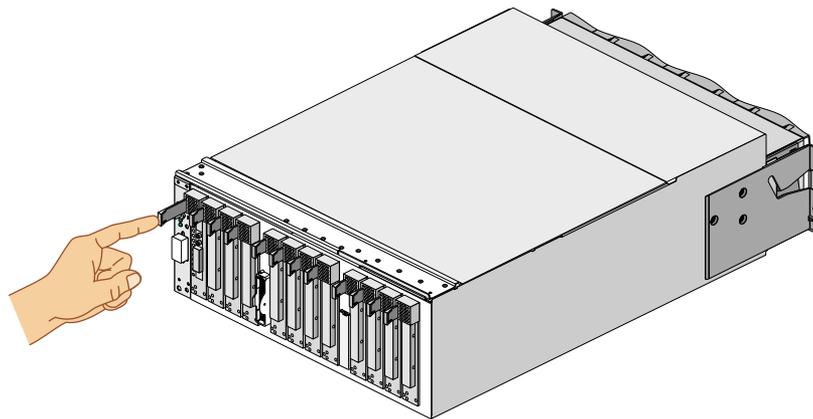


Figure 2-6 Seating the PCI Card in the PCI Slot

Hot-plugging a PCI Card

You can add and remove (hot plug) certified controller cards while the system is powered on; however, only certified device drivers support PCI hot-plug operations. An attempt to hot plug a card that does not have a certified driver will fail. For information on specific certified device drivers, contact your service representative.

You can hot plug a 66-MHz card only in an empty bus (both PCI slots are empty). When you install a card in a bus that already contains a card, the bus operates at the speed of the existing card.



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

Tools/Parts Required:

- PCI card carrier assembly P/N 013-2614-002
- Optional PCI cards
- T8 ballpoint Torx driver P/N 7260654

To install a certified PCI card (for example, QLogic fiber channel and SCSI controller cards), follow these steps:

1. Insert a supported card into an empty PCI slot. Refer to the “Installing and Removing a PCI Card” on page 19.

2. Use the `pciconfig` command to bring the PCI card online.

In the following example, the `pciconfig` command powers on PCI slot 1 in bus 3 of the PCI expansion module in location U30. It also determines the type of card installed and calls the appropriate device driver to initialize the card and its software.

```
pciconfig -b /hw/module/001p30/Pbrick/bus/3/pci -s 1 -u
```

The `-b` option specifies `/hw/module/001p30/Pbrick/bus/3/pci` as the path to bus 3 in the PCI expansion module, the `-s` option specifies slot 1, and the `-u` option indicates that you want to hot-plug (insert) a card in the specified slot. For a description of these options, see the `pciconfig(1M)` man page.

After a successful hot-plug insertion, the system runs as if the card were installed at boot time.

3. Check the hardware graph for the new device entries.

Typically, new device entries are found in the hardware graph. The hardware graph, which is maintained by the IRIX operating system, represents the collection of all significant system hardware. The hardware graph is not really a graph; it is a directory structure that includes all of the system hardware. To view this directory structure, change to the `/hw/module` directory. From this directory, you can continue to view different directories to determine the hardware that composes a system.

You can also use the `pciconfig` command to remove a card from a running system and to queue the status of the slot before and after a hot-plug operation. For more information on these operations, see the `pciconfig(1M)` man page.

Powering the Module On and Off

The following subsections describe how to power on and power off your PCI expansion module:

- “Powering On” on page 26
- “Powering Off” on page 30

Powering On

This section describes three methods for powering on your PCI expansion module, as follows:

- Powering on at the system console that is connected to the L2 controller
- Powering on at the system console that is connected to the server
- Powering on with the power switches

Powering On at System Console Connected to L2 Controller

To power on your PCI expansion module by using the system console that is connected to the L2 controller, follow these steps:

1. Power on the L1 controller by setting the power switch on the rear of the module to the **1** position. Refer to Figure 2-7. The 12 Vdc LED, which is located on the rear of the module, illuminates when the L1 controller is powered on.
2. Ensure that the L1 controller of the PCI expansion module is running; the L1 display should display “L1 running.” If the L1 controller is not running, contact your SGI system support engineer (SSE).
3. At the system console, access the L2 controller by entering the following command:

```
$> /stand/sysco/bin/12
```

4. From the L2 prompt (L2>), power on the PCI expansion module by entering the following command. (If you want to power on the entire system, proceed to step 5.)

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

For example, to power on a PCI expansion module in rack 1, slot 10, enter the following command line:

```
L2> r 1 s 10 pwr u
```

The slot number is the unit number of the module within the rack. For more information about unit numbers, refer to Chapter 1 of this document.

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 PCI expansion modules in slots 10 and 28, enter the following command:

```
L2> r 1 s 10,28 pwr u
```

5. 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 slots.)

The 48 Vdc LED (rear of module) and the On/Off LED (front of module) illuminate when the module is powered on.

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

```
L2> config
```

This command lists the modules in the system and their system controller addresses.

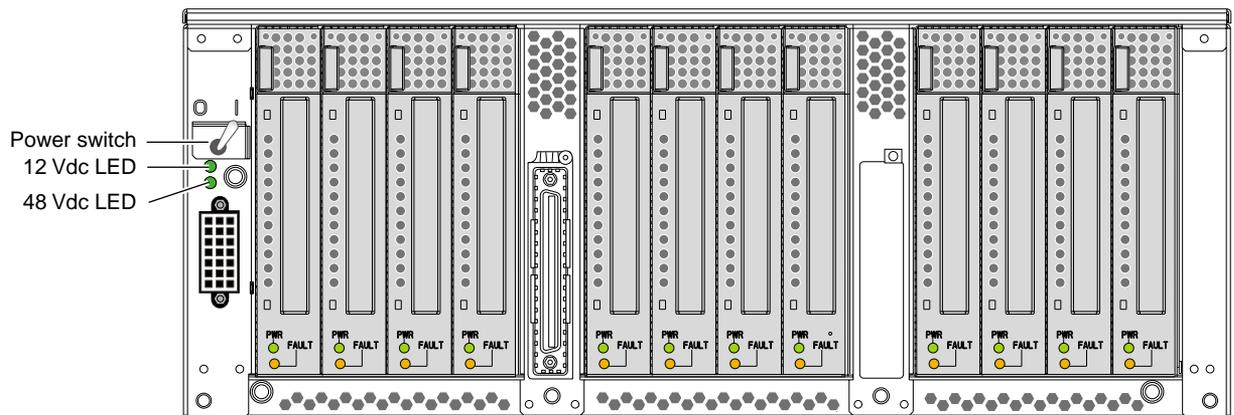


Figure 2-7 Power Switch at the Rear of the Module

Powering On at System Console Connected to Server

To power on your PCI expansion module by using the system console that is connected to the server, follow these steps:

1. Power on the L1 controller by setting the power switch on the rear of the module to the **1** position. Refer to Figure 2-7. The 12 Vdc LED, which is located on the rear of the module, illuminates when the L1 controller is powered on.
2. Ensure that the L1 controller of the PCI expansion module is running; the L1 display should display "L1 running." If the L1 controller is not running, contact your SGI SSE.
3. At the system console, enter the following command:

```
001c01-L1> ctc power up
```

The 48 Vdc LED (rear of module) and the On/Off LED (front of module) illuminate when the module is powered on.

Powering On with the Power Switches

To power on your PCI expansion module by using the power switches, follow these steps:

1. Power on the L1 controller by setting the power switch on the rear of the module to the **1** position. Refer to Figure 2-7. The 12 Vdc LED, which is located on the rear of the module, illuminates when the L1 controller is powered on.
2. Ensure that the L1 controller of the PCI expansion module is running; the L1 display should display "L1 running." If the L1 controller is not running, contact your SGI SSE.
3. Press the On/Off switch that is located on the front of the module (refer to Figure 2-8). The 48 Vdc LED (rear of module) and the On/Off LED (front of module) illuminate when the module is powered on.

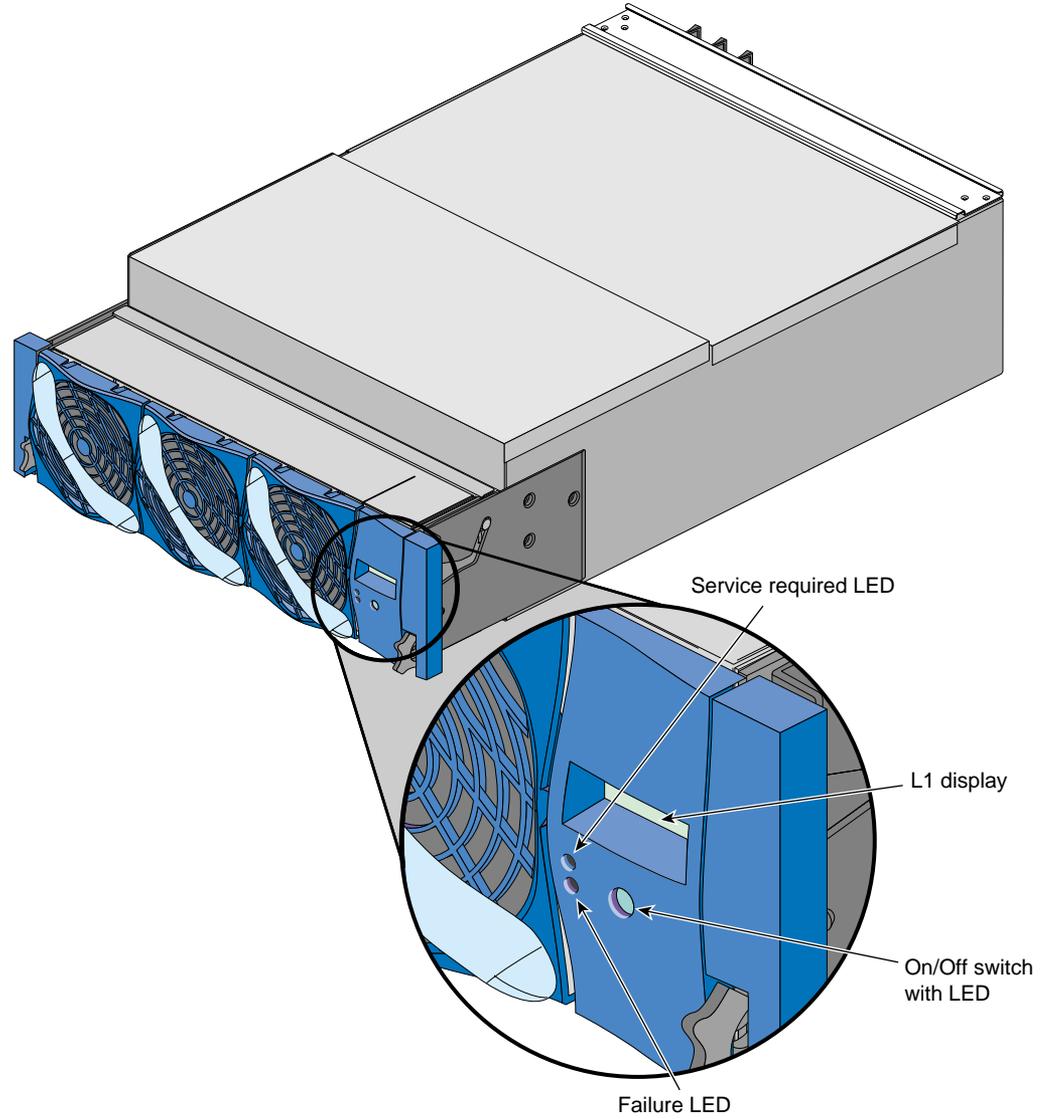


Figure 2-8 On/Off Switch with LED at Front of Module

Powering Off

This section describes three methods for powering off your PCI expansion module, as follows:

- Powering off at the system console that is connected to the L2 controller
- Powering off at the system console that is connected to the server
- Powering off with the power switches

Powering Off at System Console Connected to L2 Controller

To power off your PCI expansion module by using the system console that is connected to the L2 controller, follow these steps:

1. Access the L2 controller by entering the following command:

```
$> /stand/sysco/bin/l2
```

2. 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 3.)

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

For example, to power off the PCI expansion module in rack 1, slot 10, enter the following command:

```
L2> r 1 s 10 pwr d
```

The slot number is the unit number of the module within the rack. For more information about unit numbers, refer to Chapter 1 of this document.

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 10 and 28, enter the following command:

```
L2> r 1 s 10,28 pwr d
```

3. 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 slots.)

4. From the L2 prompt, display the configuration information by entering the following command:

```
L2> config
```

This command lists all of the modules in the system and their system controller addresses.

5. Power off the L1 controller by setting the power switch on the rear of the module to the **0** position. Refer to Figure 2-7 on page 27.

Powering Off at System Console Connected to Server

To power off your PCI expansion module by using the system console that is connected to the server, follow these steps:

1. At the system console, enter the following command:

```
001c01-L1> ctc power down
```

2. Power off the L1 controller by setting the power switch on the rear of the module to the **0** position. Refer to Figure 2-7 on page 27.

Powering Off with Power Switches

To power off your PCI expansion module by using the power switches, follow these steps:

1. Press the On/Off switch that is located on the front of the module (refer to Figure 2-8). The 48 Vdc and On/Off LEDs should not be illuminated when the module is powered off.
2. Power off the L1 controller by setting the power switch on the rear of the module to the **0** position. Refer to Figure 2-7 on page 27.

Monitoring the Module

You can monitor your PCI expansion module from the following sources:

- You can view the status of an individual module and error messages via the module's L1 controller display. For example, you can determine whether the fans of a particular module are operating properly.
- The system console enables you to view the status and error messages that are generated by the L1 and L2 controllers.

Product Description

The PCI expansion module is an I/O subsystem that provides additional I/O capabilities for the Origin 300 server. It can contain as many as twelve 3.3-V or universal PCI cards. It does not support 5-V only PCI cards.

The PCI expansion module connects to an Origin 300 sever via a NUMAlink port or via a NUMAlink module. The NUMAlink module adds scalability to the system. For example, with a NUMAlink module, an Origin 300 server can connect to three other servers and four PCI expansion modules. Without a NUMAlink module, an Origin 300 server can connect to one Origin 300 server or one PCI expansion module.

The PCI expansion module also connects to a 110- or 220-V power bay that supplies 12 Vdc standby voltage and 48 Vdc to the module. The 12 Vdc standby voltage powers on the module's L1 controller. The 48 Vdc powers on the other components within the module.

Note: The 110-V power bay is not available for an Origin 300 system that contains a NUMAlink module.

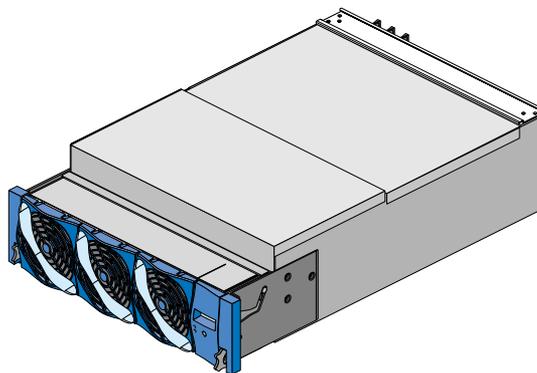


Figure 3-1 PCI Expansion Module

The PCI expansion module is similar to the Origin 3000 series P-brick; however, the PCI expansion module and the P-brick are **not** interchangeable. Table 3-1 lists the similarities and the differences between the PCI expansion module and the P-brick.

Table 3-1 Similarities and Differences between PCI Expansion Module and P-Brick

Similarities	Differences
Seat 12 universal or 3.3-V PCI cards	Use a different interface card: - PCI expansion module uses a Bedrock interface card (BIC) - P-brick uses a host interface card (HIC)
Do not support 5-V only PCI cards	Use a different motherboard; the PCI expansion module motherboard has additional logic to support the BIC
Require 48-Vdc input voltage	Use a different power board; the power board of the PCI expansion module provides additional power for the BIC
Use the same L1 controller	Use different protocol when connecting to a host: - The PCI expansion module uses NUMALink protocol - The P-brick uses Crosstalk protocol
Have the same physical appearance	Connect to different hosts: - The PCI expansion module can connect to an Origin 300 server or a NUMALink module - The P-brick connects to a C-brick

The Origin 300 server cannot connect to a P-brick because the P-brick requires a connection to the I/O interface (II) of a Bedrock ASIC (refer to Figure 3-2). The I/O interface of the Origin 300 server's Bedrock ASIC connects to an internal Xbridge ASIC (refer to Figure 3-3).

In order to expand the I/O capabilities of the Origin 300 server, the network interface (NI) of the Origin 300 server's Bedrock ASIC is used (refer again to Figure 3-3). This interface must connect to another NI port; therefore, it must connect to a device that has a Bedrock ASIC. The PCI expansion module has a Bedrock interface card (BIC) that contains a Bedrock ASIC. (The P-brick does not contain a Bedrock ASIC.)

This Bedrock-to-Bedrock communication is referred to as peer I/O. The PCI expansion module is a "peer" I/O device to the Origin 300 server. In other words, the Origin 300 server communicates with the PCI expansion module in the same manner that it would communicate with another Origin 300 server.

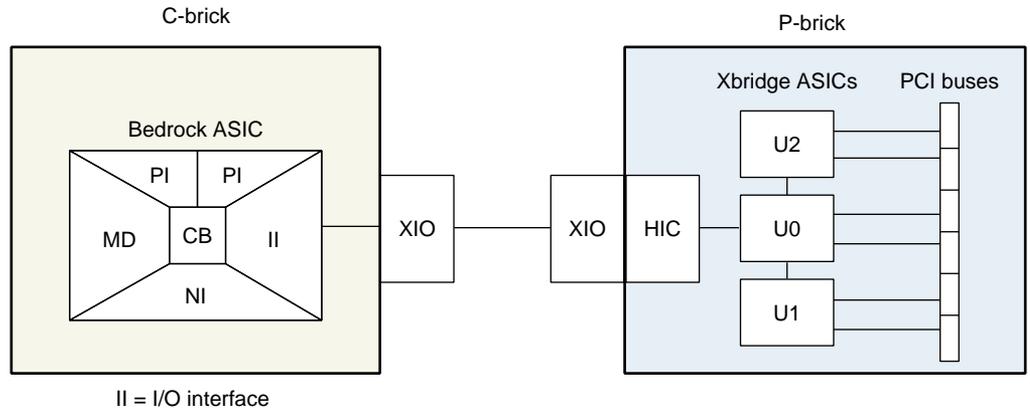


Figure 3-2 P-Brick Block Diagram

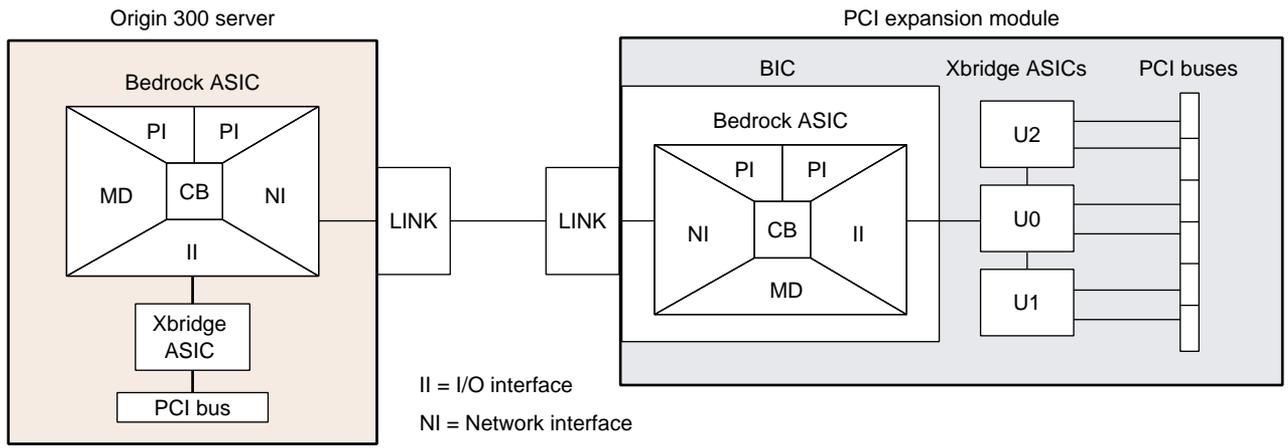


Figure 3-3 PCI Expansion Module Block Diagram

The Bedrock ASIC of the PCI expansion module also communicates with three 600-MHz Xbridge ASICs via its I/O interface (II) port. The Xbridge ASICs control the PCI buses (refer to Figure 3-5): Xbridge ASIC U0 is the interface between the Bedrock ASIC and the PCI slots of bus 3 and bus 4. Xbridge ASIC U0 is also the interface between the Bedrock ASIC and the Xbridge ASICs U1 and U2. Xbridge ASIC U1 controls bus 1 and bus 2, and Xbridge ASIC U2 controls bus 5 and bus 6.

Each bus has two slots, labeled 1 and 2 as shown in Figure 3-4. Via these slots, the PCI expansion module seats up to twelve 3.3-volt or universal PCI cards. All slots support either 32-or 64-bit addressing and can accommodate 66-MHz or 33-MHz PCI cards; however, if a bus has one 33-MHz card and one 66-MHz card, the bus operates at 33 MHz.

The PCI cards can be hot plugged, which means that the system and the PCI expansion module can remain powered on while a PCI card is installed or removed. The only component that must be powered off is the PCI slot. More information about hot plugging a PCI card is provided in Chapter 2 of this guide.

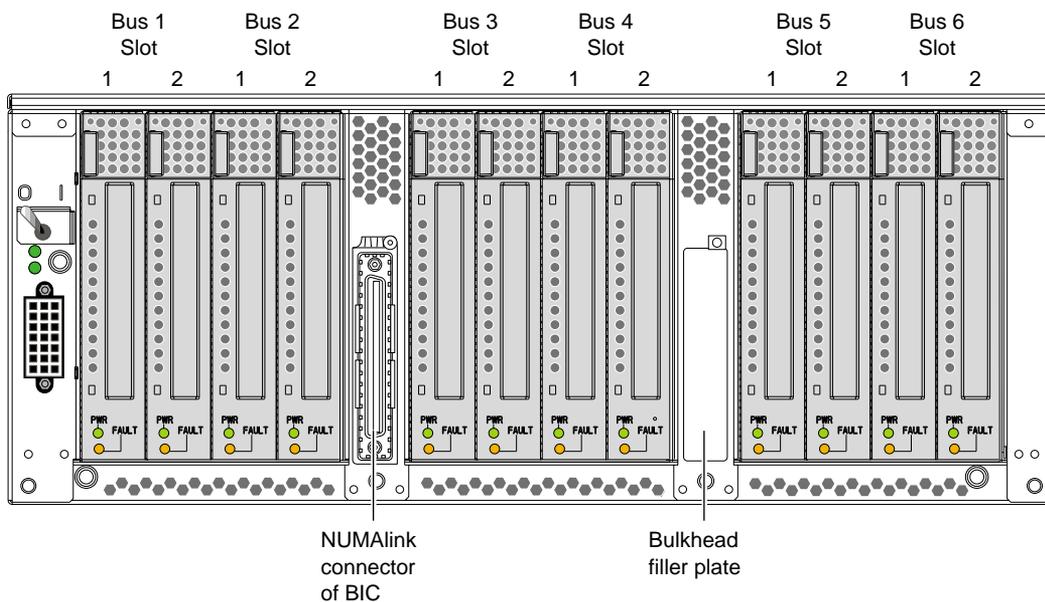


Figure 3-4 Bus Numbering

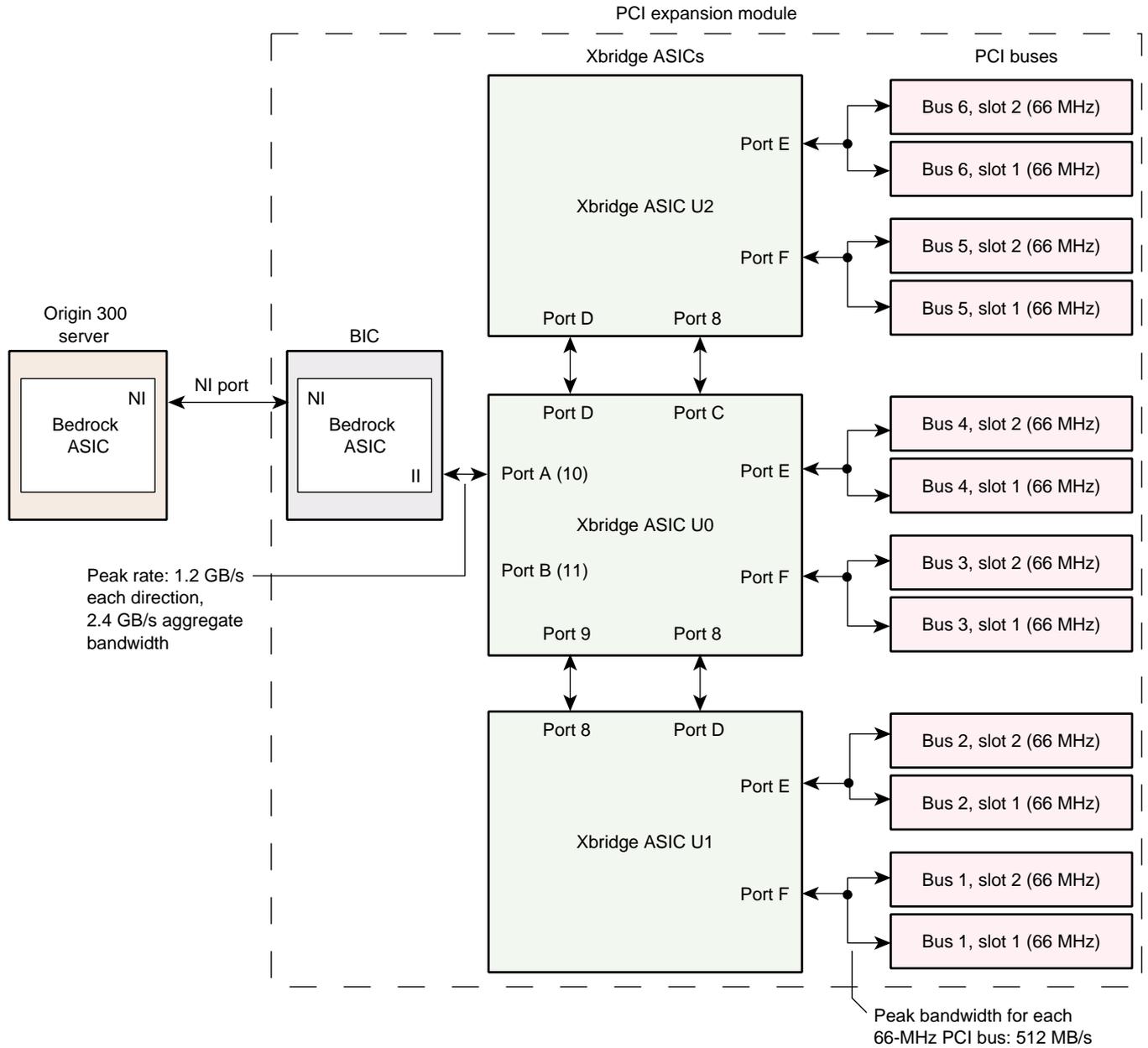


Figure 3-5 PCI Expansion Module Block Diagram

Components

The PCI expansion module requires 4U of space within the rack and has the specifications that are listed in Table 3-2.

Table 3-2 PCI Expansion Module Specifications

Characteristic	Specification
Height	7.0 in. (177.80 mm)
Width	17.5 in. (444.50 mm)
Depth	27.5 in. (698.50 mm)
Weight	70 lb (31.50 kg)

This section describes the front, rear, and internal components of the PCI expansion module.

Front Components

The PCI expansion module contains the following front panel items (refer to Figure 3-6):

- **L1 display** is a 2-line by 12-character liquid crystal display (LCD) that displays status and error messages that the L1 controller generates.
- **On/Off switch with LED** enables you to manually power on and power off the module.
- **L1 controller LEDs:**
 - **On/Off switch LED** illuminates green when the internal components are powered on.
 - **Service required LED** illuminates orange to indicate that an item is not functioning properly (for example, a fan is off), but the PCI expansion module is still operating.
 - **Failure LED** illuminates red to indicate that a failure has occurred and the PCI expansion module is down.
- **Three fans** provide N+1 redundant cooling for the module. The fans move air from the front to the rear of the rack, can be hot swapped, and run at variable speeds.

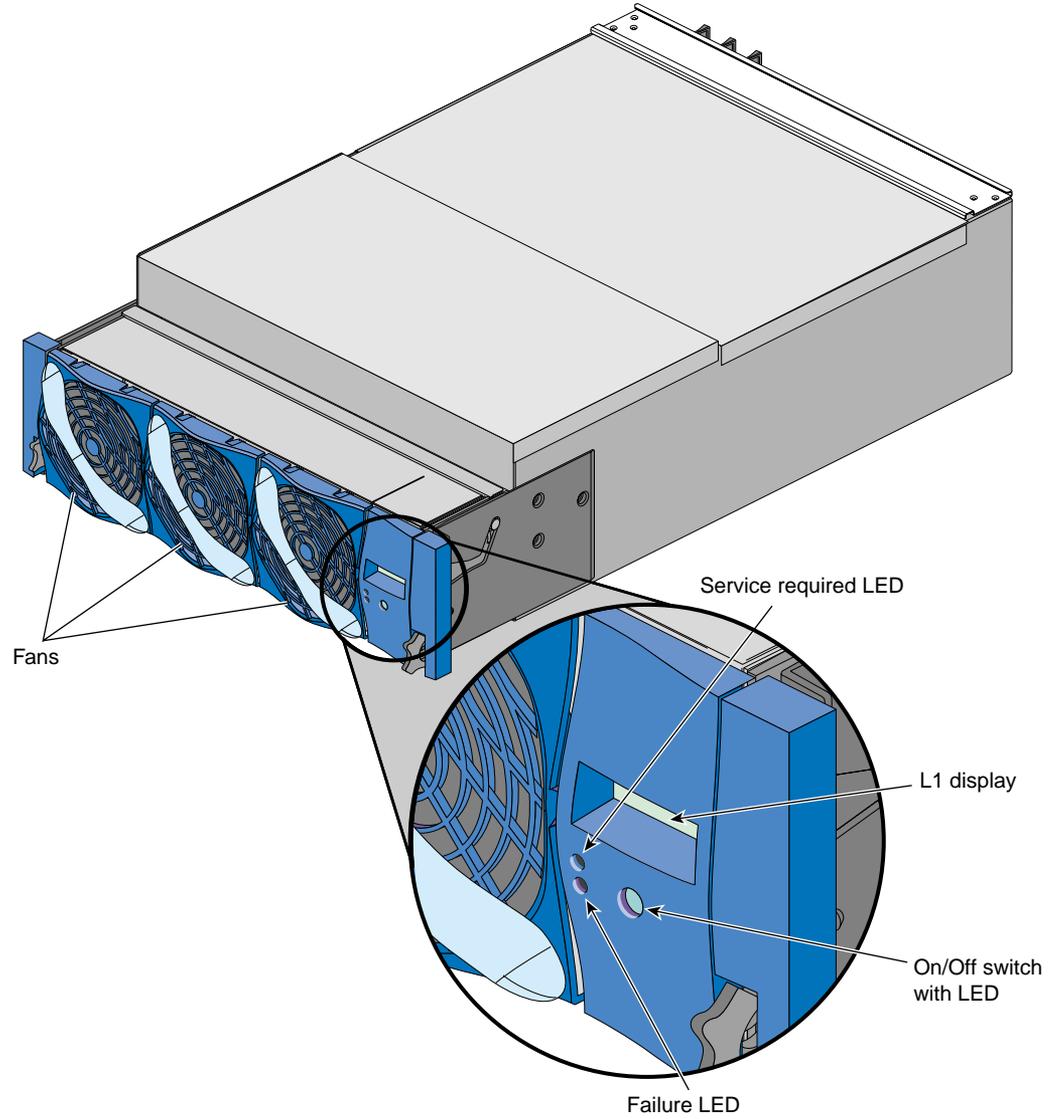


Figure 3-6 Front View of PCI Expansion Module

Rear Components

The PCI expansion module has the following rear panel items (refer to Figure 3-7):

- **Power switch** powers on the L1 controller when moved to the **1** position; moving it to the **0** position powers off the L1 controller.
- **12 Vdc LED** illuminates green when the L1 controller is powered on and operating.
- **48 Vdc LED** illuminates green when the rest of the internal components are powered on and operating.
- **PWR (power) connector** attaches to a power bay. The PCI expansion module inputs 48 Vdc and 12 Vdc standby voltage from the power bay via a DC power cable.
- **PCI slots** seat the PCI cards. Each slot has two LEDs:
 - **PWR (power) LED** illuminates green when the PCI card carrier is installed securely and is receiving power.
 - **Fault LED** illuminates orange when a fault occurs with the PCI card.
- **NUMAlink connector** attaches the PCI expansion module to an Origin 300 server or a NUMAlink module via a NUMAlink cable.
- **Bulkhead filler plate** covers the unused connector slot so that air flows properly through the module.

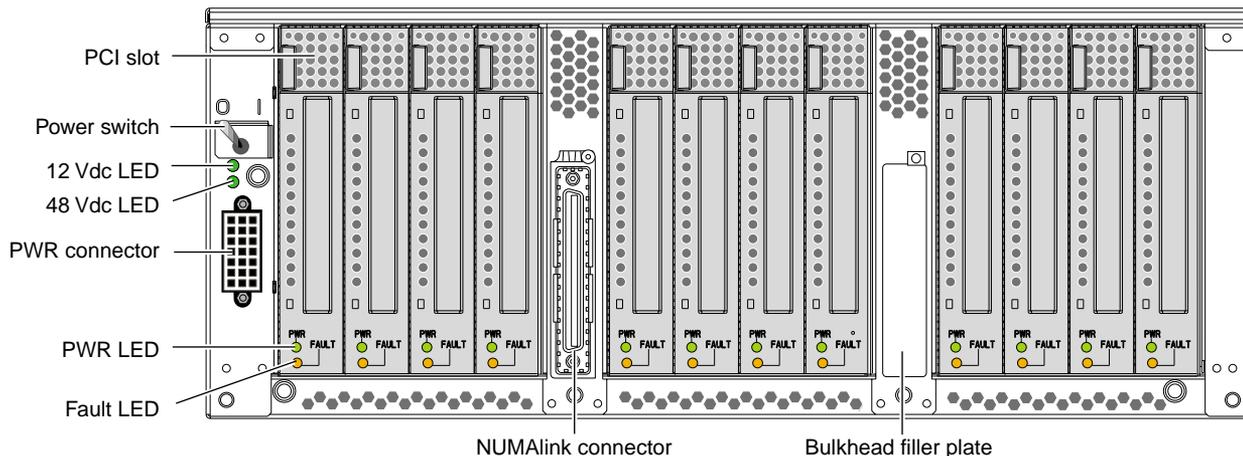


Figure 3-7 Rear View of PCI Expansion Module

Internal Components

The PCI expansion module contains the following internal components (refer to Figure 3-8):

- PCI motherboard
- PCI cards and carriers
- Power board
- Bedrock interface card (BIC)
- L1 controller logic (not shown in Figure 3-8)

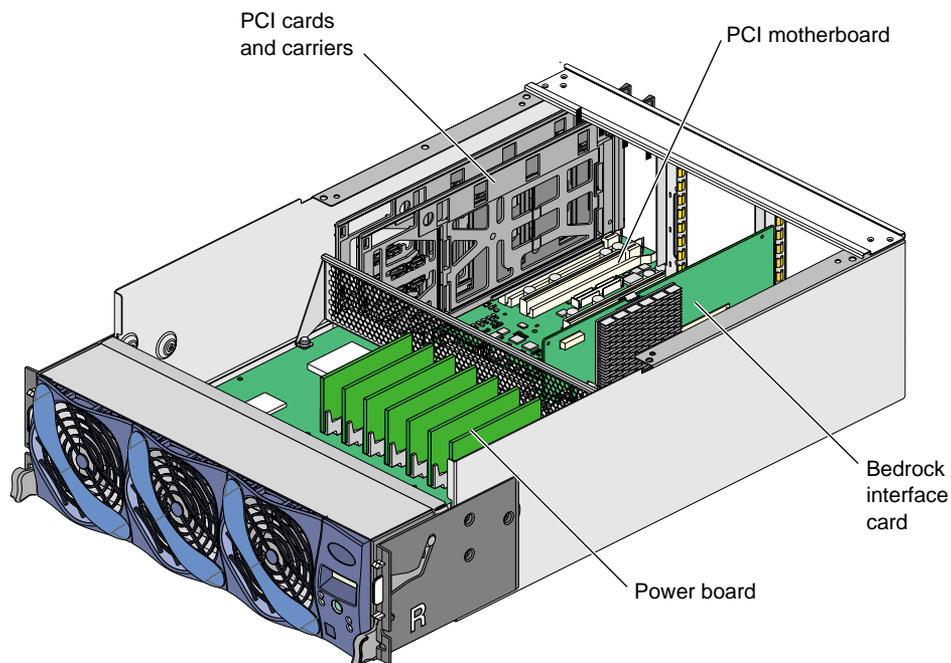


Figure 3-8 Internal View of PCI Expansion Module

PCI Motherboard

The PCI motherboard contains three Xbridge ASICs that serve as the interface between the Bedrock ASIC and the PCI cards (refer to Figure 3-9). The PCI motherboard also contains twelve PCI slots and a serial ID EEPROM that contains component information (not shown in Figure 3-9).

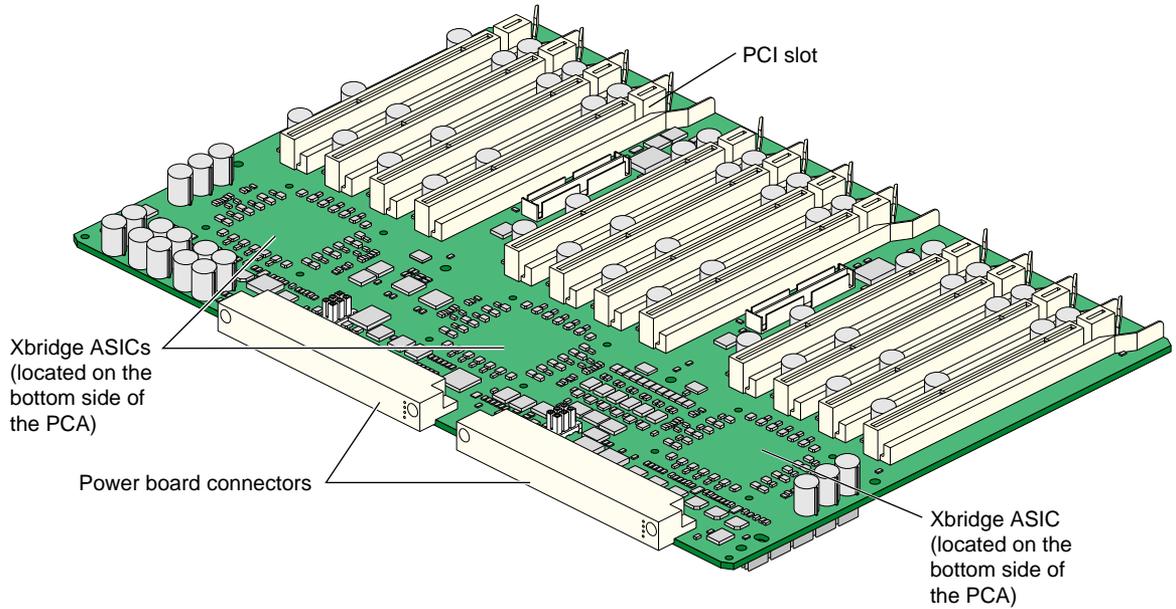


Figure 3-9 PCI Motherboard

PCI Cards and Carriers

The Origin series servers support various PCI cards that are produced by third-party manufacturers who specialize in peripheral devices. Each PCI card is mounted to a carrier so that you can slide the PCI card into and out of the module. The PCI card connects to the PCI motherboard when the PCI carrier is fully inserted into the module. For a list of supported PCI cards, refer to the following URL:

<http://support.sgi.com>

The PCI carrier has a fixed size; however, it contains an assembly that adjusts to fit the varying sizes of the PCI cards (refer to Figure 3-10). Each PCI carrier holds one PCI card. To accommodate dual PCI cards, two PCI carriers are joined.

Empty PCI carriers reside in nonpopulated PCI slots to create even airflow through the PCI slots and to provide EMI (electromagnetic interference) shielding.

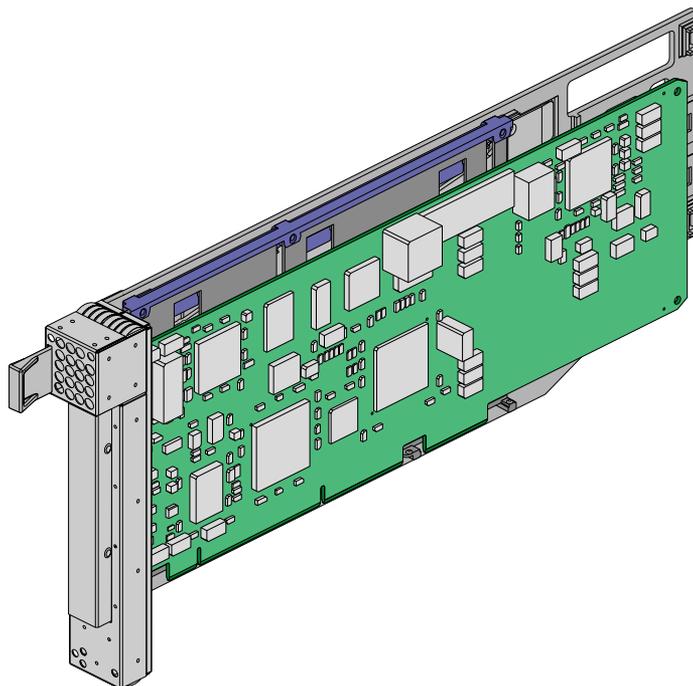


Figure 3-10 PCI Carrier with PCI Card Installed

Power Board

The power board contains the logic components of the L1 controller, five VRMs, one DC-to-DC converter, and two voltage regulators (refer to Figure 3-11). The VRMs, DC-to-DC converter, and voltage regulators convert the incoming 48 Vdc to voltage levels that the components within the module require.

- One 12.0-Vdc, 10-A voltage regulator module (VRM 1)
- One 5.0-Vdc, 25-A voltage regulator module (VRM 2)
- Two 3.3-Vdc, 30-A voltage regulator modules (VRM 3 and VRM 4)
- One 2.5-Vdc, 30-A voltage regulator module (VRM 7)
- One -12.0-Vdc, 4.17-A DC-to-DC converter
- One 3.3-Vdc voltage regulator (auxiliary voltage)
- One 5.0-Vdc voltage regulator (auxiliary voltage)

The power board supplies an average of 10 W (3.3 V) of power to each PCI slot. The L1 controller controls how the power board applies power to the PCI cards. The power board applies power to the PCI cards starting with the lowest-numbered slot. It continues to apply power to the PCI slots until all of the power has been consumed. The L1 controller uses two pins in each PCI slot to total the power consumption of the PCI cards. The L1 controller prints a message to the console if the power board cannot supply power to all of the PCI cards.

The power board installs horizontally in the front of the module and plugs into the PCI motherboard (refer again to Figure 3-8 on page 41).

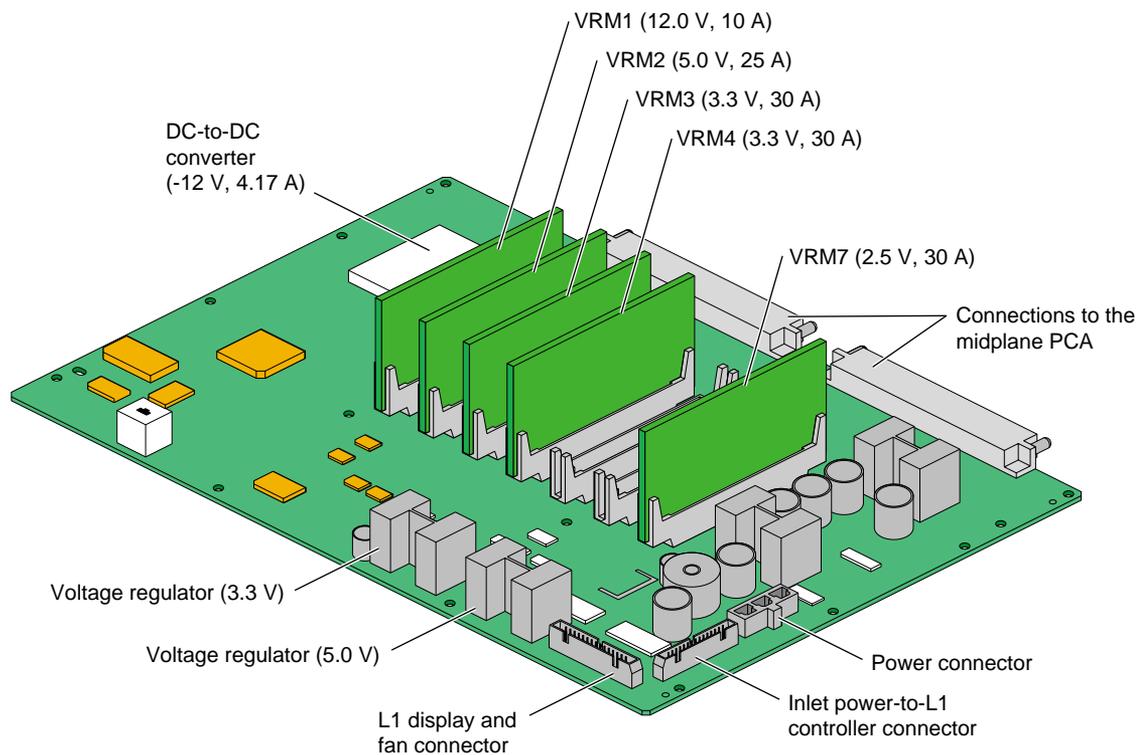


Figure 3-11 Power Board

Bedrock Interface Card (BIC)

The PCI expansion module uses one Bedrock interface card (BIC) (refer to Figure 3-12) that contains:

- One **Bedrock ASIC** that transfers signals between Origin 300 servers and the PCI cards. The Bedrock ASIC is the component that makes the PCI expansion module a peer device to the Origin 300 server. Unlike the Bedrock ASIC of the Origin 300 server, the PCI expansion module uses only two of the Bedrock ASIC interfaces: the I/O interface (II) and the network interface (NI). The processor interfaces (PI_0 and PI_1) and the memory interface (MD) are not used, because the BIC and the PCI expansion module do not contain any processors or memory.
- One **NUMAlink connector** that connects the PCI expansion module to an Origin 300 server or a NUMAlink module. The NUMAlink connector is the left connector on the rear of the PCI expansion module (refer to Figure 3-7 on page 40). The right connector slot is not used; therefore, it contains a bulkhead filler plate to maintain proper airflow through the module (refer to Figure 3-13).
- One **power connector** that transfers power from the PCI motherboard to the Bedrock ASIC.
- One **PCI motherboard connector** that connects the BIC to the PCI motherboard. The Bedrock ASIC transfers signals from its II port to the Xbridge ASICs via this connector.

The BIC is secured to the motherboard with the bracket shown in Figure 3-13.

L1 Controller

The L1 controller monitors and controls the environment of the PCI expansion module. It consists of a display, logic components, and a cable. The display is located on the front of the PCI expansion module. The logic components are located on the power board. The cable connects the display to the logic components.

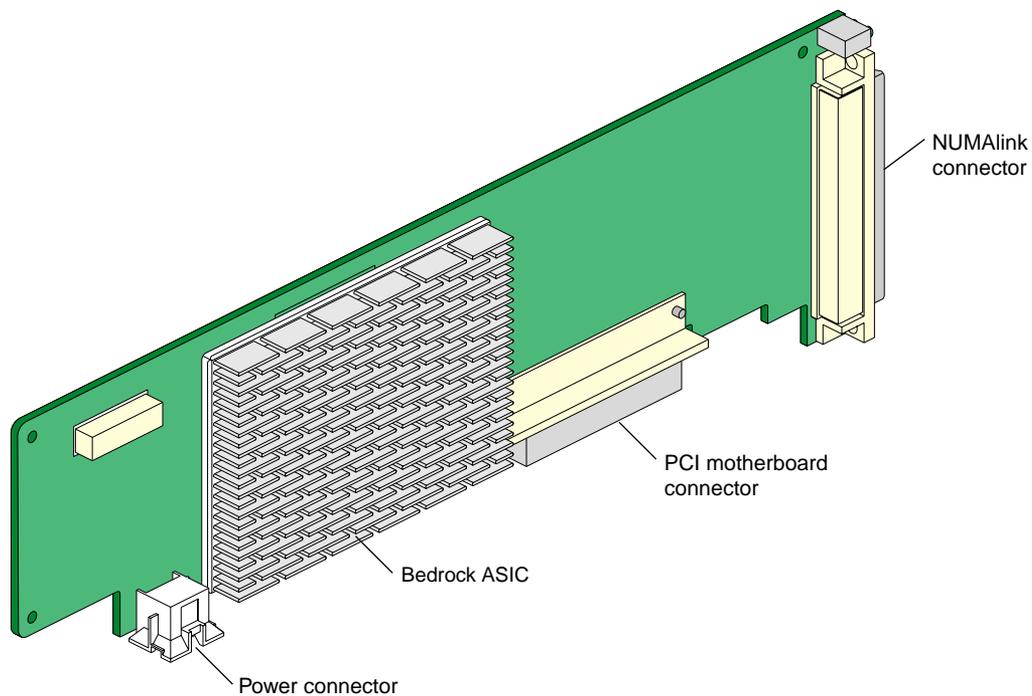


Figure 3-12 Bedrock Interface Card

Figure 3-13 shows the bulkhead filler plate and the mounting bracket.

Bulkhead filler plate



Mounting bracket

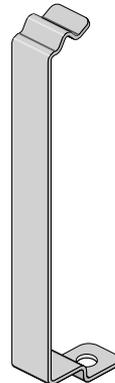


Figure 3-13 Bulkhead Filler Plate and Mounting Bracket

Configurations

The PCI expansion module contains one BIC that connects to the NUMalink [LINK (NI)] port of an Origin 300 server in a system that does not contain a NUMalink module (refer to Figure 3-14).

In a system that contains a NUMalink module, the BIC connects to ports 2, 3, 4, or 5 of the NUMalink module (refer to Figure 3-15). The PCI expansion module must connect to ports 2, 3, 4, or 5 of the NUMalink module, because these ports carry USB signals. The PCI expansion module does not have an external USB port; therefore, it communicates with the L2 controller via the port and USB hub of the NUMalink module.

Note: The PCI expansion module will not function if it is cabled to ports 1, 6, 7, or 8 of the NUMalink module.

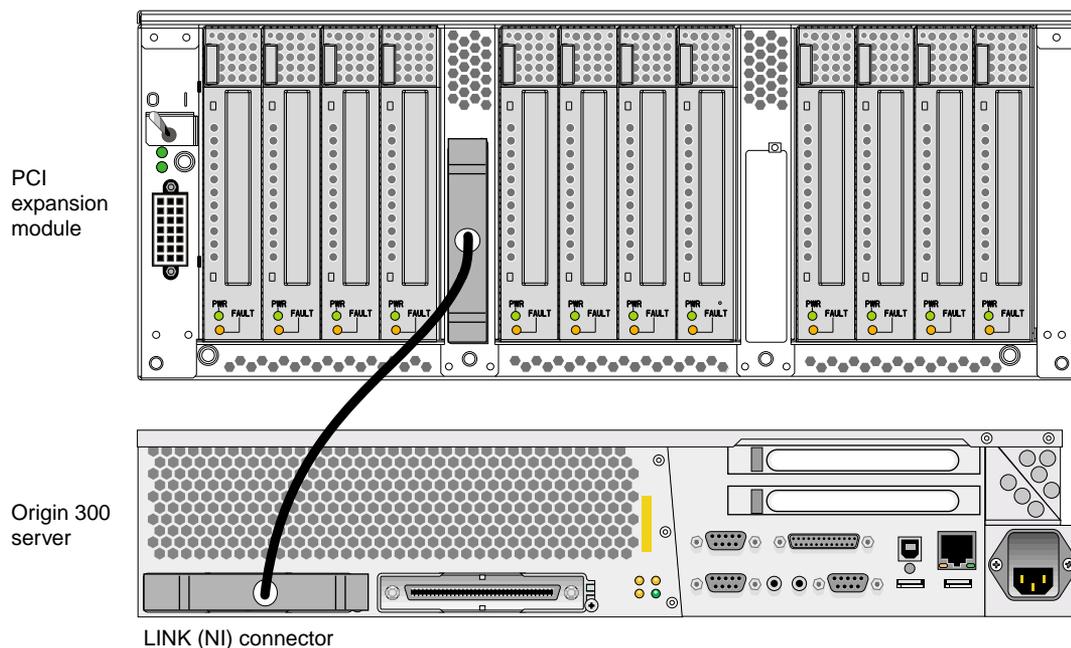


Figure 3-14 Origin 300 Server to PCI Expansion Module Configuration

Figure 3-14 shows four PCI expansion modules connected to a NUMalink module.

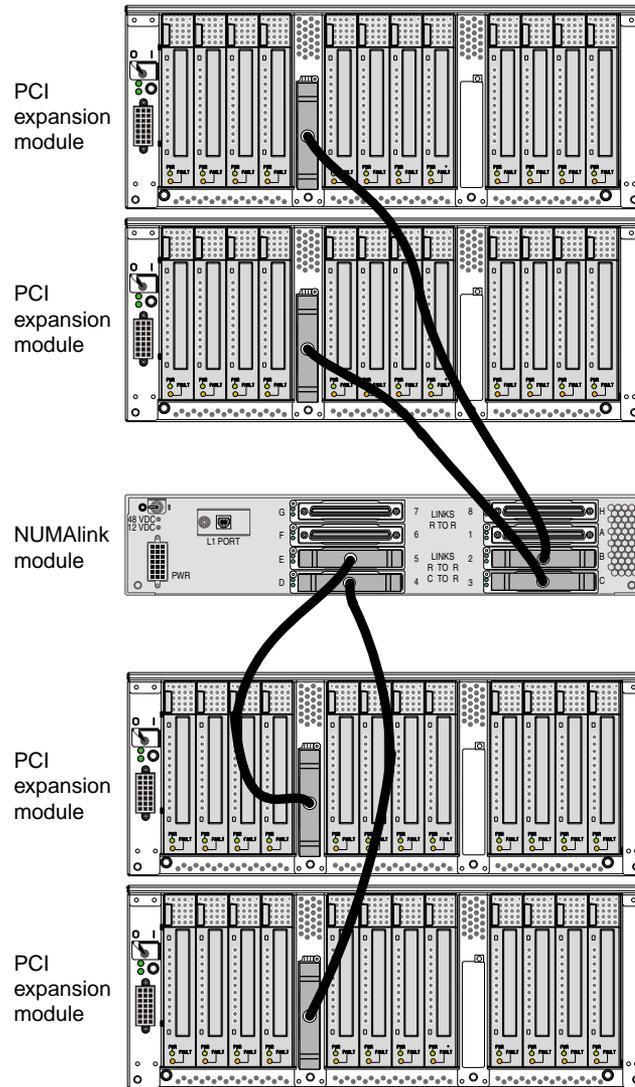


Figure 3-15 NUMalink Module to PCI Expansion Module Configuration

Troubleshooting

This chapter contains the following information to help you troubleshoot your PCI expansion module:

- “Troubleshooting Chart” on page 52
- “L1 Controller Error Messages” on page 53
- “SGI Electronic Support” on page 55

Troubleshooting Chart

Table 4-1 lists recommended actions for problems that can occur on your PCI expansion module. 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 in this chapter.

Table 4-1 Troubleshooting Chart

Problem Description	Recommended Action
A PCI expansion module will not power on.	Ensure that the power switch on the rear of the module is on (1 position). View the L1 display; refer to Table 4-2 if an error message is present. If the L1 controller is not running, contact your SSE. Check the connection between the module and the power bay.
The Service Required LED is on.	View the L1 display of the failing module; refer to Table 4-2 for a description of the error message.
The Failure LED is on.	View the L1 display of the failing module; refer to Table 4-2 for a description of the error message.
The PWR LED of a populated PCI slot is not on.	Reseat the PCI card.
The fault LED of a populated PCI slot is on.	Reseat the PCI card. If the fault LED remains illuminated, replace the PCI card.

L1 Controller Error Messages

Table 4-2 lists the error messages that the L1 controller generates and displays on the L1 display. This display is located on the front of the PCI expansion module.

Note: As noted in Table 4-2, 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 4-2 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 4-2 (continued) L1 Controller Messages

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 °C.
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 35 °C.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 40 °C.
Temperature messages: high alt.	
ATTN: TEMP # advisory temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 27 °C.
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 31 °C.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 35 °C.
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 5 seconds until shutdown.
Server 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 4-1 shows the sequence of events that occurs if you use all of the SGI Electronic Support capabilities.

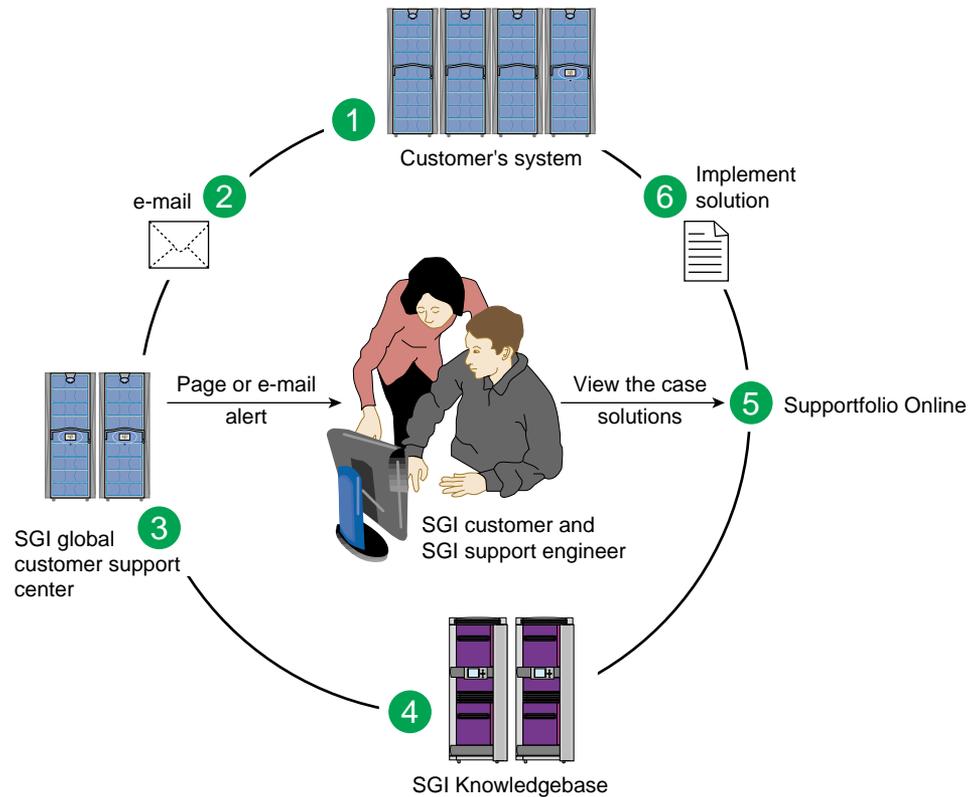


Figure 4-1 Full Support Sequence

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 found 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, refer to the following Web page:

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

For more information about SGI Electronic Support, refer to the following Web page:

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

Regulatory Specifications

This appendix presents regulatory information that may be important to the operation of your PCI expansion module.

Manufacturer's Regulatory Declarations

The PCI expansion modules 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 PCI expansion module 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.

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 from 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 n'émet pas de perturbations radioélectriques dépassant les normes applicables aux appareils numériques de Classe A prescrites dans le Règlement sur les interférences 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 PCI expansion module 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.

Electrostatic Discharge

SGI designs and tests its products to be immune 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 come 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. The wrist strap is used during the installation of these upgrades to prevent the flow of static electricity, and it should protect your system from ESD damage.

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