SGI® Origin® 3900 Server User's Guide

007-4653-001

CONTRIBUTORS

Written by Nancy Heller

Illustrated by Dan Young

Edited by Dick Brownell

Production by Karen Jacobson

Engineering contributions by Steve Dean, Mike Peterson, Jens Petersohn, Dale Purdy, Russ Anderson, Brian Larson, Steve Modica, Corky Seeber, Bill Kellerman

Record of Revision

Version	Description
001	October 2003 Original Release

Contents

Figures

Tables

About This Guide

This guide provides an overview of the architecture and descriptions of the major components that compose the SGI Origin 3900 server. It also provides the standard procedures for powering on and powering off the system, basic troubleshooting information, and important safety and regulatory specifications.

Audience

This guide is written for owners, system administrators, and users of the SGI Origin 3900 server. It is written with the assumption that the reader has a general knowledge of computers and computer operations.

Important Information

Warning: To avoid problems, you must ask your SGI system support engineer (SSE) to perform all the set up, addition or replacement of parts, cabling, and service of your SGI Origin 3900 server, with the exception of the following items that you can perform yourself:

- Using your system console and your L2 controller touch display to enter commands and perform system functions such as powering on and powering off, as described in this guide.
- Adding and replacing PCI and PCI-X cards, as described in this guide.
- Adding and replacing disk drives in the TP900 and D-brick2 storage modules, and in the IX-brick, as described in this guide.
- Using the On/Off switch and other switches (the reset and non-maskable interrupt [NMI] switches on the Cx-bricks) on the front panel of your system bricks.
- Using the ESI/ops panel (operating panel) on the D-brick2.

Chapter Descriptions

The following topics are covered in this guide:

- Chapter 1, “Operation Procedures,” provides instructions for connecting a system console to your server, powering on and powering off your server, and monitoring your server.
- Chapter 2, “System Overview,” describes the SGI Origin 3900 server and its architecture, and provides a brief description of the system components and configurations.
- Chapter 3, “Cx-brick,” describes the function of the Cx-brick and its external components (for example, connectors and LEDs).
- Chapter 4, “IX-brick,” describes the function of the IX-brick and its external components (for example, connectors and LEDs).
- Chapter 5, “PX-brick,” describes the function of the PX-brick and its external components (for example, connectors and LEDs).
- Chapter 6, “X-brick” describes the function of the X-brick and its external components (for example, connectors and LEDs).
- Chapter 7, “R-brick,” describes the function of the R-brick and its external components (for example, connectors and LEDs).
- Chapter 8, “System Control,” describes the function of the L1 and L2 controllers and provides instructions for using the controllers.
- Chapter 9, “Power Components,” provides an overview of the power bay, power distribution unit, and power distribution strip.
- Chapter 10, “SGI TP900 Storage Module,” describes the function of the TP900 storage module and its external components.
- Chapter 11, “D-brick2,” describes the function of the D-brick2 storage module and its external components.
- Chapter 12, “InfinitePerformance Graphics Components” provides an overview of the V12 VPro graphics board, the V-brick, and the compositor.
- Chapter 13, “InfiniteReality Graphics Components” provides an overview of the G-brick and the N-brick.
- Chapter 14, “Maintenance and Upgrade Procedures,” provides instructions for installing and removing the customer-replaceable components of your server.
- Chapter 15, “Troubleshooting,” provides recommended actions if problems occur on your server.

- Appendix A, “Technical Specifications and Pinouts," provides physical, environmental, and power specifications for your server. Also included are the pinouts for the non-proprietary connectors.
- Appendix B, “Safety Information and Regulatory Specifications," lists all regulatory information related to use of the SGI Origin 3900 server in the United States and other countries. It also provides a list of safety instructions to follow when installing, operating, or servicing your server.

Related Publications

The following SGI documents are relevant to the SGI Origin 3900 server:

- SGI Total Performance 900 Storage System User’s Guide (P/N 007-4428-*xxx*)

  This fully illustrated guide explains how to operate and maintain the SGI Total Performance 900 (TP900) SCSI storage system.
- SGI Total Performance 9100 (2Gb TP9100) Storage System User’s Guide (P/N 007-4522-*xxx*)

  This fully illustrated guide explains how to operate and maintain the 2Gb SGI Total Performance 9100 Fibre Channel storage system.
- SGI TP9400 and SGI TP9500 RAID User’s Guide (P/N 007-4304-*xxx*)

  This fully illustrated guide explains how to operate and maintain the SGI TP9400 and SGI TP9500 Fibre Channel storage systems.
- SGIconsole Hardware Connectivity Guide (P/N 007-4340-*xxx*)

  This fully illustrated guide explains how to connect the SGIconsole to the various SGI server and graphics system configurations. SGIconsole is a multi-server management system that manages and monitors multiple servers throughout a customer’s computing environment, whether those servers are on site or remote.
- SGI L1 and L2 Controller Software User’s Guide (P/N 007-3938-*xxx*)

  This guide describes how to use the L1 and L2 controller commands at your system console to monitor and manage your SGI system.
- Man pages (online)

  Man pages locate and print the titled entries from the online reference manuals.

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.
- The release notes, which contain the latest information about software and documentation in this release, are in a file named README.SGI in the root directory of the SGI ProPack for Linux Documentation CD.
- You can also view man pages by typing **man** <*title*> on a command line.

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 `xscsidisktest` command, type the following on a command line:

```
man xscsidisktest
```

References in the documentation to these pages include the name of the command and the section number in which the command is found.

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)`.

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 Web page: 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

SGI values your comments and will respond to them promptly.

Operation Procedures

This chapter explains how to operate your SGI Origin 3900 server in the following sections:

Precautions

Before operating your server, familiarize yourself with the safety information in the following sections:

- "ESD Precaution" on page 2
- "Safety Precautions" on page 3

ESD Precaution

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

Safety Precautions

Warning: **Before operating or servicing any part of this product, read the "Safety Information" on page 249.**

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 server are indicated with high-voltage warning labels.**

Caution: Power off the server only after the system software has been shut down in an orderly manner. If you power off the server before you halt the operating system, data may be corrupted.

Note: A lithium battery is installed on the IO9 card located in the IX-brick.

Warning: **Only qualified SGI service personnel should replace the lithium battery.**

Connecting System Console

The system console enables you to perform the following activities:

- Monitor your server by reading the server's status and error message information generated and displayed by the L1 and L2 controllers.
- Enter L1 and L2 controller commands to monitor or change particular server functions. You can, for example, monitor the speed of fans for a particular brick. See your *SGI L1 and L2 Controller Software User's Guide* for descriptions of these commands.
- Power on or power off individual bricks or all bricks (except for the storage modules) in your server.

If you connect a console that contains SGIconsole software, you can perform the functions listed above, manage multiple systems from one console, and have boundary scan capabilities. Boundary scan capabilities enable an SGI system support engineer (SSE) to test the interconnections of your server.

To connect a system console, follow these steps:

1. If your server has multiple L2 controllers, connect each L2 controller (via its Ethernet port) to an Ethernet hub.
2. Connect your console to the Ethernet hub or to the Console port of an L2 controller as shown in Figure 1-1. The connection of the system console to the Console port requires a special cable that you can purchase from SGI. This configuration also requires terminal emulator software (not available from SGI).

Note: You can also use SGIconsole to monitor your server. SGIconsole connects to multiple L2 controllers via an Ethernet hub. For instructions on how to connect SGIconsole to your server, see your *SGIconsole Hardware Connectivity Guide*.

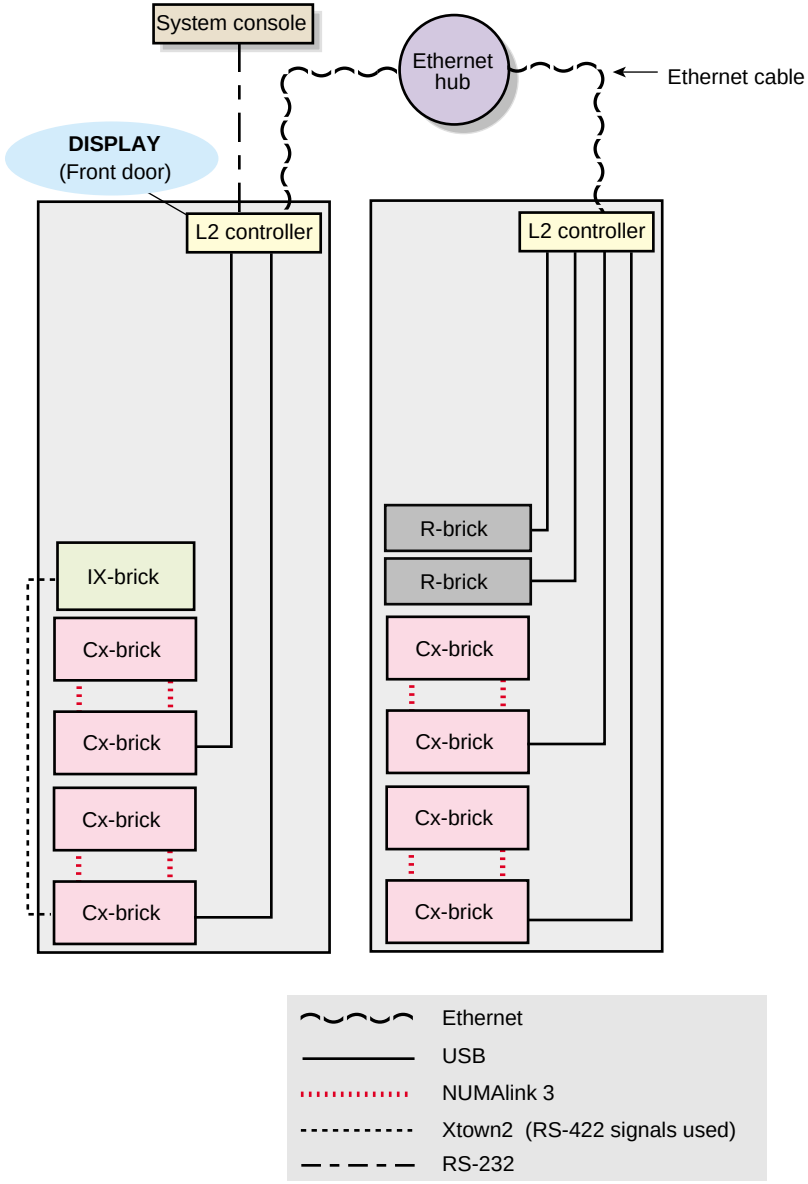

Figure 1-1 Connecting System Console to Multiple L2 Controllers

Installing Optional Components

Besides adding a system console, you can add or replace the following hardware items on your Origin 3900 server:

- Peripheral component interface (PCI) cards
- Disk drives

The sections that follow discuss these activities in more detail.

Warning: You can add or replace only the items listed in this section. For your safety and for the protection of your server, contact your SGI system support engineer (SSE) to install any hardware items not listed in this section.

Warning: Before installing, operating, or servicing any part of this product, read the "Safety Information" on page 249.

Adding or Removing PCI Cards

The PCI-X based I/O system, an industry standard for connecting peripherals to a processor, is the primary I/O system for the Origin 3900 server. The hardware components of this I/O system are contained in IX- and PX- bricks. The IX-brick provides the base I/O functionality for the server and 12 PCI/PCI-X slots. One of the 12 slots is reserved for a system PCI card. If additional PCI slots are required beyond the 11 remaining slots in the IX-brick, PX-bricks are configured into the server. Each PX-brick provides an additional 12 PCI/PCI-X slots.

For instructions on how to install or remove PCI cards, see "Installing or Replacing PCI or PCI-X Card" on page 202.

Adding or Removing Disk Drives

The IX-brick provides the system boot functions and has one or two low-profile SCSI disk drives. For instructions on how to install or remove these disk drives, see "Installing or Replacing Disk Drives in IX-brick" on page 211.

The TP900 is a SCSI-based disk storage module that provides JBOD (just a bunch of disks) mass storage. Each TP900 can contain up to 8 disk drives. For instructions on how to install or remove these disk drives, see "Installing or Replacing TP900 Drive Carrier Module" on page 216.

The D-brick2 is a Fibre Channel-based disk storage enclosure that provides JBOD mass storage. Each D-brick2 can contain up to 16 disk drives. For instructions on how to install or remove these disk drives, see "Installing or Replacing D-brick2 Drive Carrier Module" on page 221.

Powering Server On and Off

This section explains how to power on and power off individual bricks or your entire SGI Origin 3900 server, as follows:

- "Powering On Server" on page 8
- "Powering Off Server" on page 24

You can power on and power off individual bricks or the entire server at the L2 controller touch display on the front door of rack 001 (the leftmost rack when viewing the front of the racks). Or if your server has a system console, you can power on and power off individual bricks or the entire server at the system console.

Powering On Server

This section describes how to prepare to power on your server, and how to power on your server by using either of the following:

- L2 controller touch display
- System console

The L1 controller display, located on the front of each brick, should display `L1 running` once the power-on procedure starts.

Note: If you have a problem while powering on and an error message appears on your L2 controller touch display, your console, or the L1 controller display, see your online log files and, see "L1 Controller Error Messages" on page 232 to learn what the error message indicates and how to resolve the problem.

Preparing to Power On

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

1. Check to ensure that the cabling between the power distribution unit (PDU) and the wall power-plug receptacle is secure.
2. For each individual brick that you want to power on, make sure that the **PWR** (power) switch is set to the **1** (on) position, as shown in Figure 1-2. When the power switch is on and power is supplied to the brick, the L1 controller of the brick powers on. The 12-VDC LED of the brick illuminates green when 12 VDC is present.

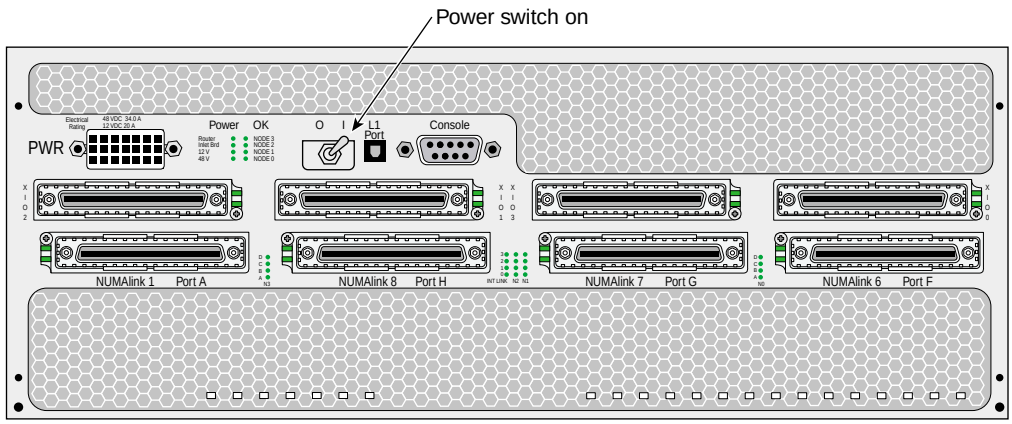

Figure 1-2 Cx-brick Power Switch

3. If you plan to power on a D-brick2, or an entire rack of D-brick2s, see "Powering On D-brick2" on page 23.
4. To power on a TP900 storage module, set the power switch of each TP900 storage module to the **1** (on) position.

Note: The standard configuration of the TP900 storage module has one power supply, as shown in Figure 1-3. You can add a second power supply to the TP900 system to provide n+1 redundant power. The second power supply is identical to the first power supply and would be located in the lower-right section of the TP900 storage module. Both power switches must be in the **1** (on) position to provide redundant power.

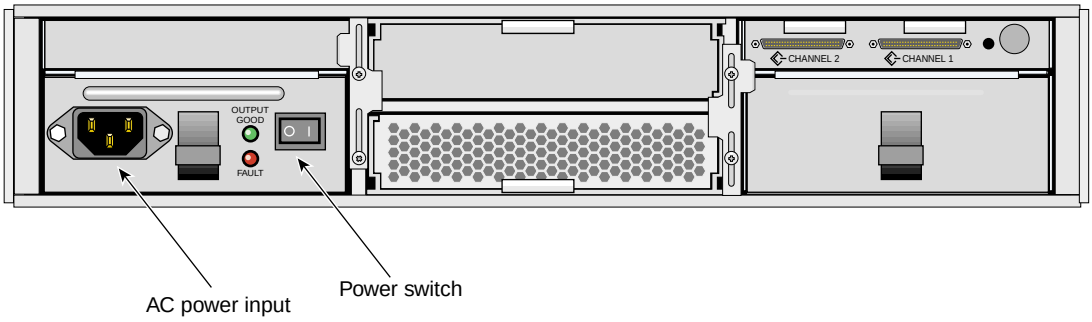

Figure 1-3 TP900 Storage Module Power Switch

5. Make sure that the circuit breaker switches of the power distribution unit (PDU) and power distribution strip (PDS) shown in Figure 1-4 are in the on position.

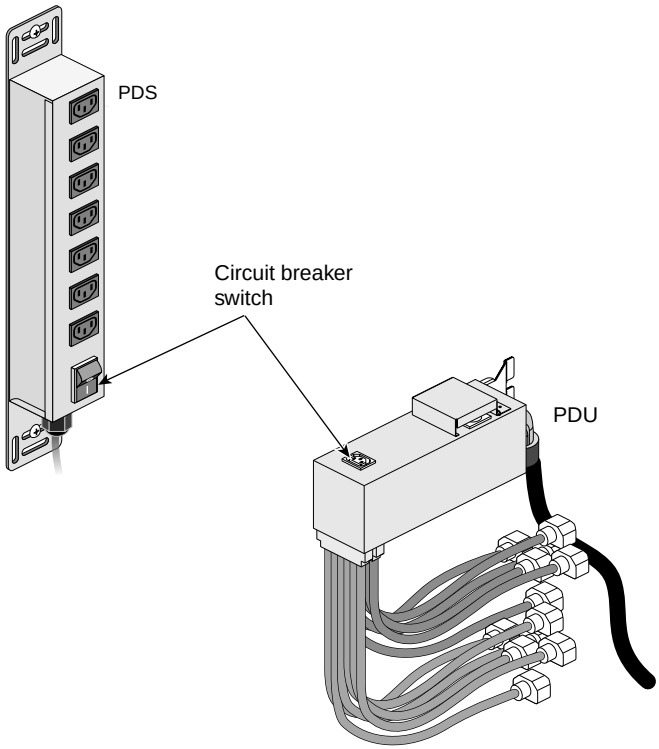

Figure 1-4 PDS and PDU Circuit Breaker Switches

Powering On at L2 Controller Touch Display

This section describes how to power on individual bricks or the entire server from your L2 controller touch display (see Figure 1-5), which is located on the front door of rack 001.

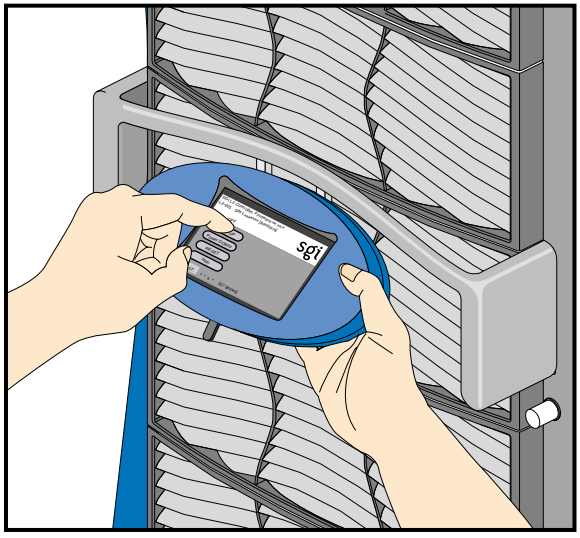

Figure 1-5 L2 Controller Touch Display

For instructions on how to use the L2 controller touch display, see “L2 Controller” on page 116.

The home window, shown in Figure 1-6, displays the following items:

- Firmware (*xx.xx.x*) version of the L2 controller.
- Rack number (*L2-001*) of the L2 controller to which the L2 controller touch display is connected.
- System serial number (*Lxxxxxxx*).
- Server name in parentheses (*firestorm*).
- Power status (**Power:** *OFF*) for the bricks designated in the destination (**DEST:**) field. For this example, all slots in all racks (*r * s **), which amounts to 57 bricks, are powered off.
- Four command buttons (**Power UP**, **Power DOWN**, **RESET**, and **NMI**) that when selected activate a confirmation window for the command. The command is sent to the bricks that are listed in the **DEST:** field after you okay the command from the confirmation window.
- **DEST:** button that enables you to select the bricks that will receive a command. In addition, to the right of this button is an area that lists the current brick selection. For this example, all slots in all racks (*r * s **), which amounts to 57 bricks, are selected to receive a command.

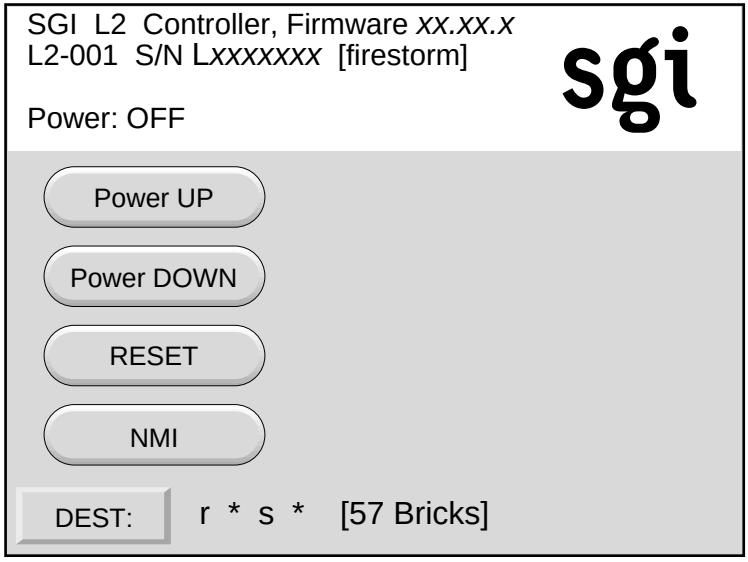

Figure 1-6 Home Window

To power on selected bricks, a partition, or the entire server, follow these steps:

1. Touch the **DEST:** button in the home window and the destination selection window, shown in Figure 1-7 appears. Use this window to select the bricks or partitions that you want to power on.

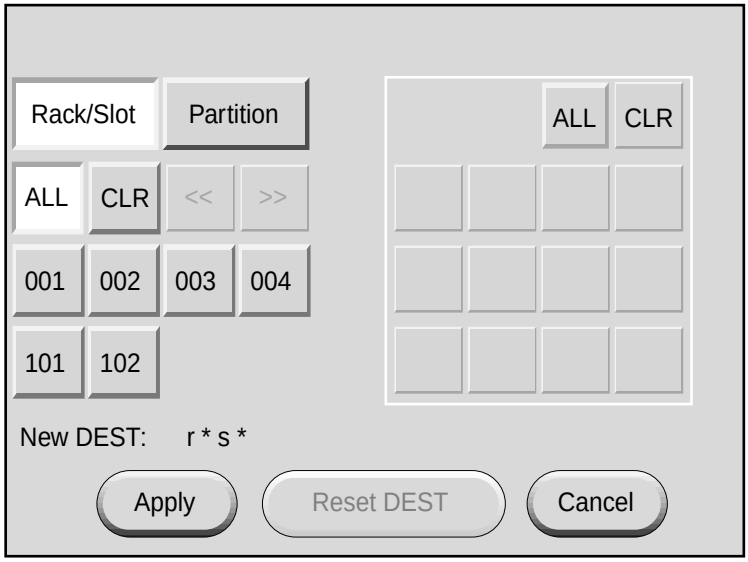

Figure 1-7 Destination Selection Window

2. The bricks are selected by their rack and slot/unit number, or by partition. Select **ALL** in the display if you want to power on all the bricks in the server. You can also select the bricks in all the slots of multiple racks, but you cannot select slots for multiple racks.

   If you want to power on individual bricks, select the rack that contains the bricks that you want to power on from the **Rack/Slot** segment of the display. A box appears that lists the slot numbers for all of the bricks in the selected rack (see Figure 1-8).

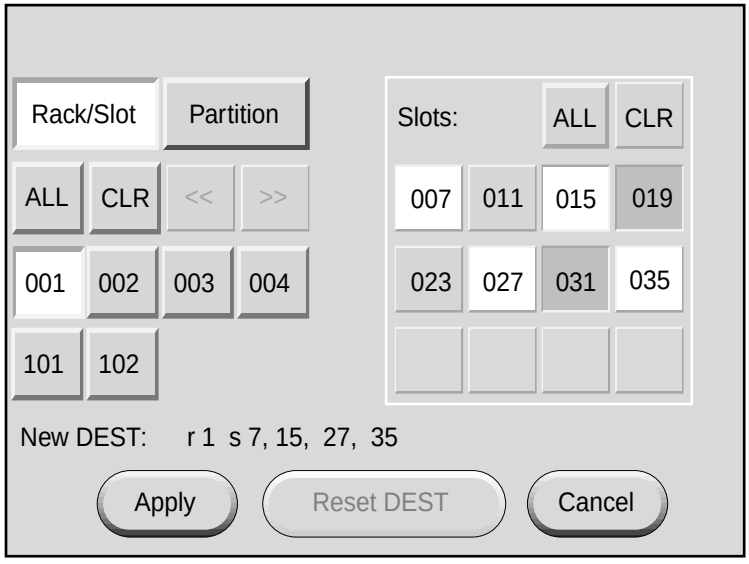

Figure 1-8 Slots Section

3. Select the slot number of each brick that you want to power on. (Figure 1-8 shows slots 007, 015, 027, and 035 selected). The **New DEST:** field lists your selections. After you complete your selections, select **Apply**.

The home window shown in Figure 1-9 appears. The **DEST:** field of this window indicates that you want to power on the bricks that reside in slots 07, 15, 27, and 35 of rack 001.

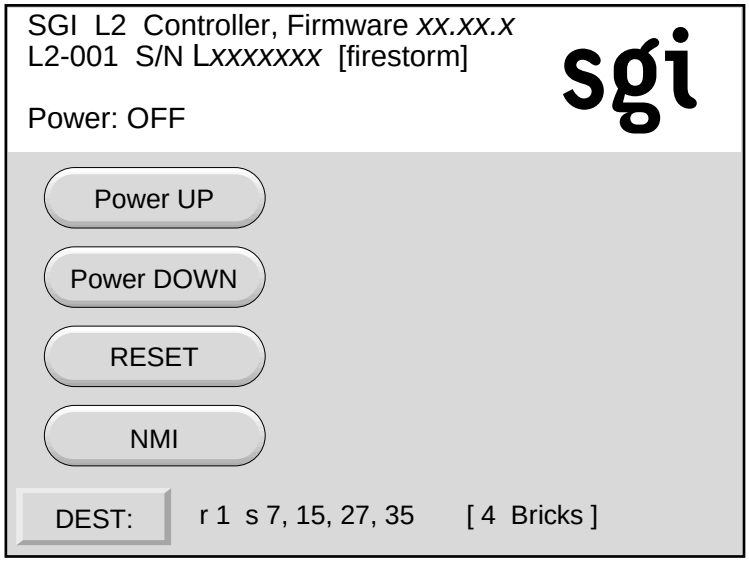

Figure 1-9 DEST Field on Home Window

4. If you want to power on a partition, select **Partition** from the destination selection window. The partition selection window, shown in Figure 1-10, appears.

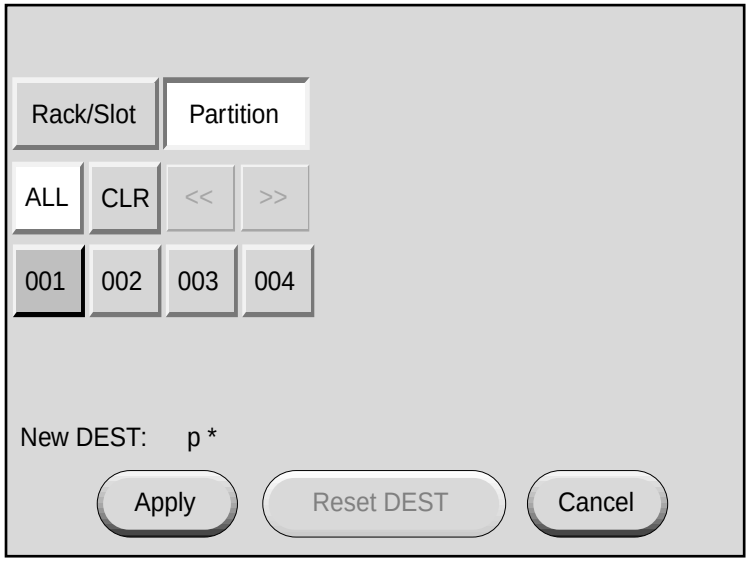

Figure 1-10 Partition Selection Window

5. You can select all partitions by selecting **ALL** on the partition selection window, or you can select a single partition or multiple partitions by selecting the individual partition numbers. Figure 1-11 shows partition 001 selected.

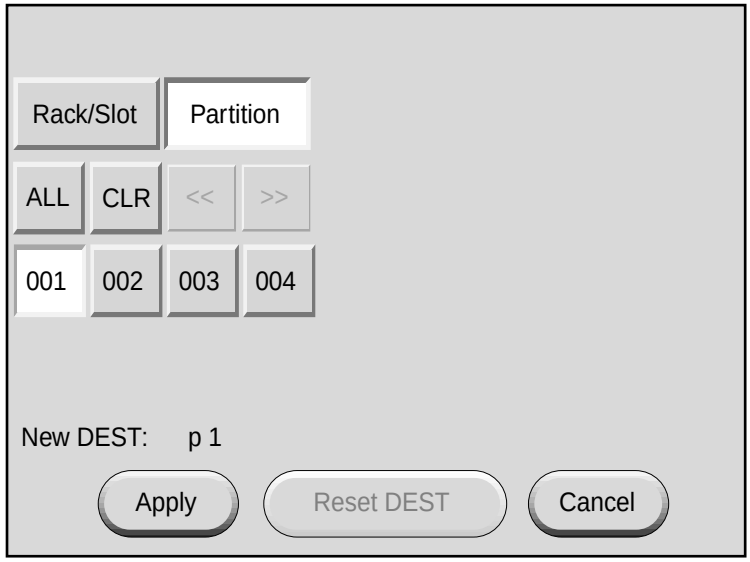

Figure 1-11 Selecting Individual Partition

6. The **New DEST:** field shows *p 1,* which indicates that partition 001 was selected as the new destination. If you select **Apply,** your selection is confirmed and the home window, shown in Figure 1-12, appears. The **DEST:** field shows *p 1 [2 Bricks],* which indicates that the bricks in partition 1 are the new destination.

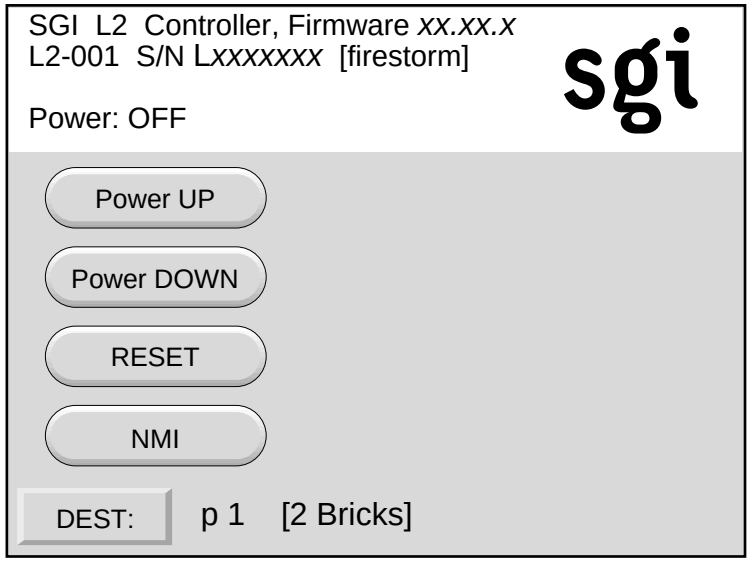

Figure 1-12 Home Window with Partition Destination

7. After you have selected the destination of the bricks you want to power on, select **Power UP** on the home window, and the power up confirmation window, shown in Figure 1-13, appears. This window indicates which bricks will receive the **Power UP** command. In this example, the window indicates that all slots (bricks) in all racks (*r* s**) will be powered on. If you select **OK,** the power-up operation is confirmed, and the home window appears. Selecting **Cancel** stops the power-on operation, and the home window appears.

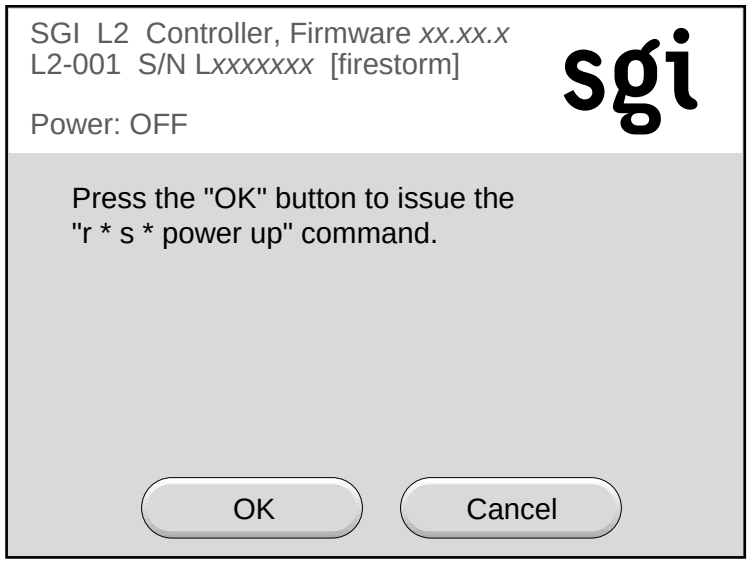

Figure 1-13 Power Up Confirmation Window

Powering On at System Console

To power on your server at the system console, follow these steps:

1. At your console, switch to L2 mode by pressing `Ctrl+T.`
2. From the L2 prompt (L2>), power on an individual brick by entering the following command. (If you want to power on the entire server, proceed to step 3.)

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

   For example, to power on a Cx-brick in rack 1, slot 07, enter the following:

   `L2> r 1 s 7 pwr u`

   The slot number is the lowest unit number that the brick occupies within a rack. For example, in Figure 1-14, the lowest Cx-brick is identified as U07. The next lowest Cx-brick is identified as U11, and so on.

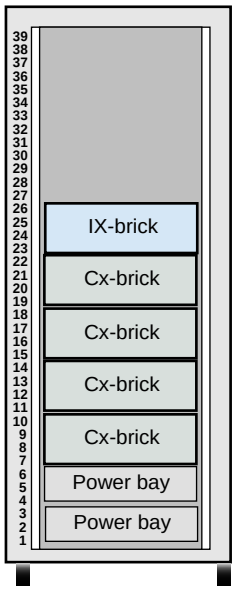

Figure 1-14 Slot or Unit Number

If you want to power on several selected bricks from a rack at the same time, you must enter the rack number followed by the slot numbers of the bricks you want to power on. For example, to power on bricks in slots 7 and 11 of rack 4, enter the following command:

```
L2> r 4 s 7,11 pwr u
```

If you want to power on the bricks that reside in the same slot in multiple racks, you must enter the number of the racks followed by the slot number of the bricks you want to power on. For example, to power on the bricks in slot 11 of racks 3 and 4, enter the following command:

```
L2> r 3, 4 s 11 pwr u
```

Note: To avoid problems with your server, do not try to power on multiple slots for multiple racks at the same time.

---

3. If you want to power on the entire server, enter the following command:

   ```
   L2> pwr u
   ```

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

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

   ```
   L2> config
   ```

   This command lists the bricks in the server and each brick's system controller address.

Powering On D-brick2

Before powering on the D-brick2, confirm that the following is true:

- Drives are seated in the correct bays and blank plates are fitted in any empty bays.
- Ambient temperature is within the specified range of 10 °C to 40 °C (50 °F to 104 °F).
- The rack power distribution unit (PDU) and power distribution strip (PDS) are on.

To power on the D-brick2, follow these steps:

1. Connect an AC power cord to each PSU/cooling module.
2. Connect the AC power cords to the PDS.
3. Turn the power switch on each PSU/cooling module to the "on" position (**1** = on, **0** = off). The location of the power switch on the D-brick2 PSU/cooling module is shown in Figure 1-15.

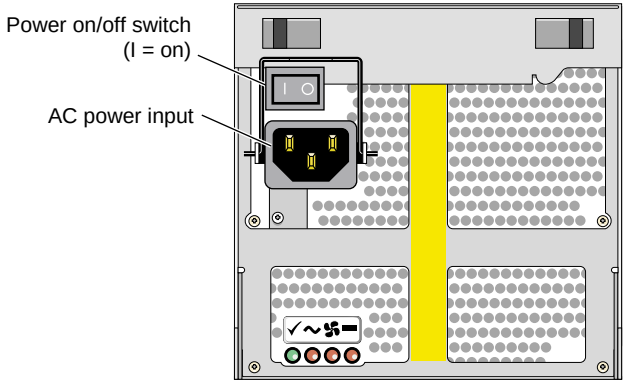

Figure 1-15 D-brick2 PSU/cooling Module Power Switch

The green "PSU good" LED illuminates. Also, the "power on" LED on the ESI/ops panel of each module turns green when AC power is present.

If the "power on" LED on the ESI/ops panel does not illuminate, or if the amber "system/ESI fault" LED illuminates, verify that you followed all steps. For troubleshooting tips, see the *SGI Total Performance 9100 (2Gb TP9100) Storage System User's Guide* or contact your service provider.

Powering Off Server

You can power off individual bricks or your entire server from the L2 controller touch display (located on the front door of rack 001) or from the system console, as explained in the sections that follow.

Note: To verify that the power-off procedure is proceeding properly, make sure that the On/Off LEDs and the 48-VDC LEDs turn off and that your L1 controllers display that the server is powering off for each segment of the procedure. If you have a problem while powering off and an error message appears on your L2 controller touch display, your console, or the L1 controller display, see your online log files and the information in "L1 Controller Error Messages" on page 232 to learn what the error message indicates and how to resolve the problem.

Preparing to Power Down

If you are logged on to the server, log out.

If you are planning to power down a D-brick2 or an entire rack of D-brick2s, see "Powering Off D-brick2" on page 34.

Powering Off at L2 Controller Touch Display

This section describes how to use the L2 controller touch display to power off individual bricks or the entire server. If you have multiple racks whose L2 controllers are interconnected at an Ethernet hub, you can power off any brick in those racks or the entire server at the L2 controller touch display on the front door of rack 001.

For instructions on how to use the L2 controller touch display, see "L2 Controller" on page 116.

To power off selected bricks, a partition, or the entire server, follow these steps:

1. Select the **DEST:** button from the home window and the destination selection window, shown in Figure 1-17, appears. Use this window to select the bricks or partition you want to power off.

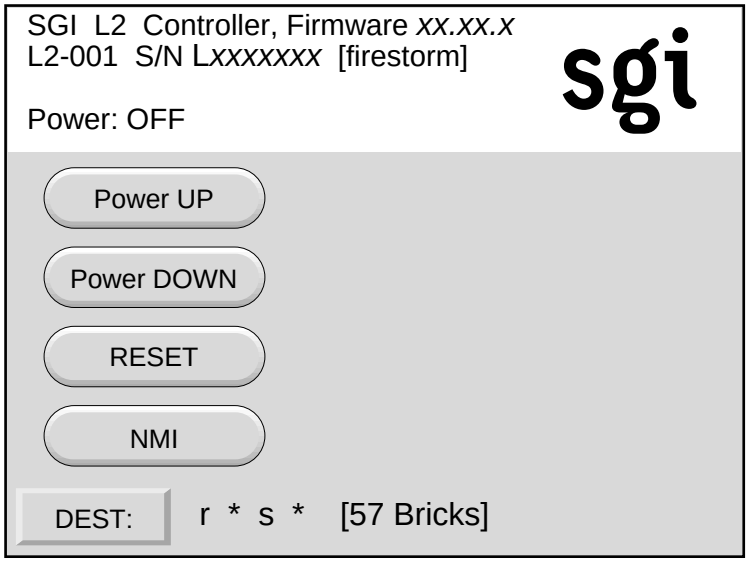

Figure 1-16 Home Window

2. The bricks are selected by their rack and slot/unit number, or by partition. Select **All** in the display if you want to power off all the bricks in all the racks in the server. You can also select the bricks in all the slots of multiple racks, but you cannot select slots for multiple racks.

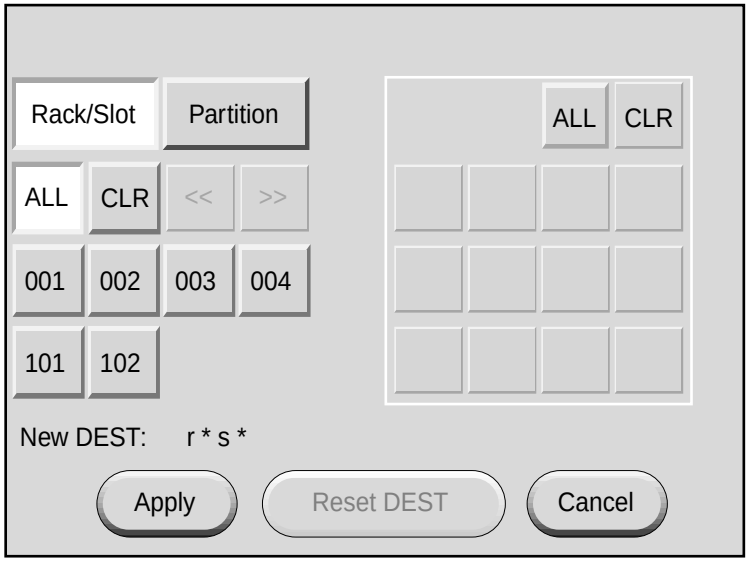

Figure 1-17 Destination Selection Window

If you want to power off individual bricks, select the rack that contains the bricks that you want to power off from the **Rack/Slot** segment of the display. A box appears that lists the slot numbers for all of the bricks in the selected rack (see Figure 1-18).

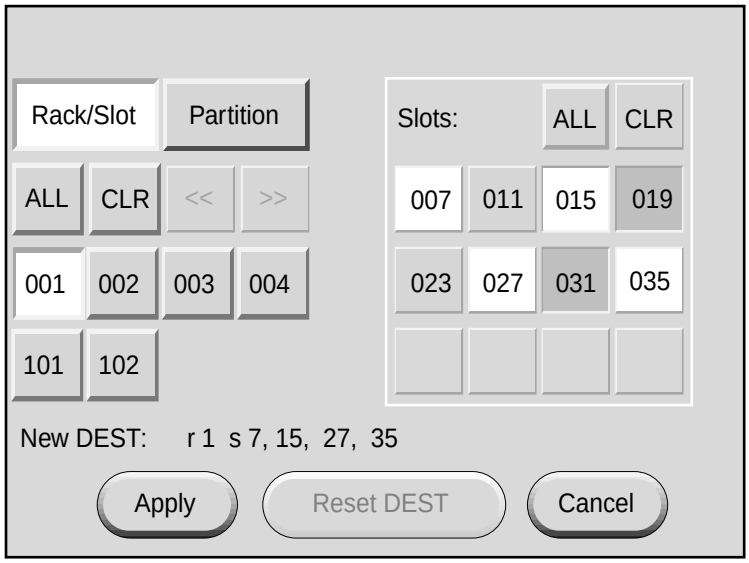

Figure 1-18 Slots Section

3. Select the slot number of each brick that you want to power off. (Figure 1-18 shows slots 007, 015, 027, and 035 selected). The **New DEST:** field lists your selections. After you complete your selections, select **Apply**.

The home window shown in Figure 1-19 appears. The **DEST:** field of this window indicates that you want to power off the bricks that reside in slots 07, 15, 27, and 35 of rack 001.

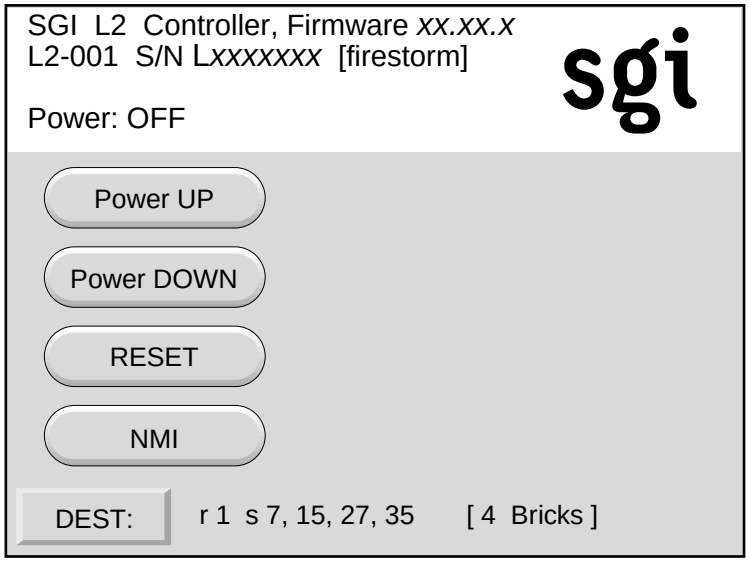

Figure 1-19 DEST Field on Home Window

4. If you want to power off a partition, select **Partition** from the destination selection window. The partition selection window, shown in Figure 1-20, appears.

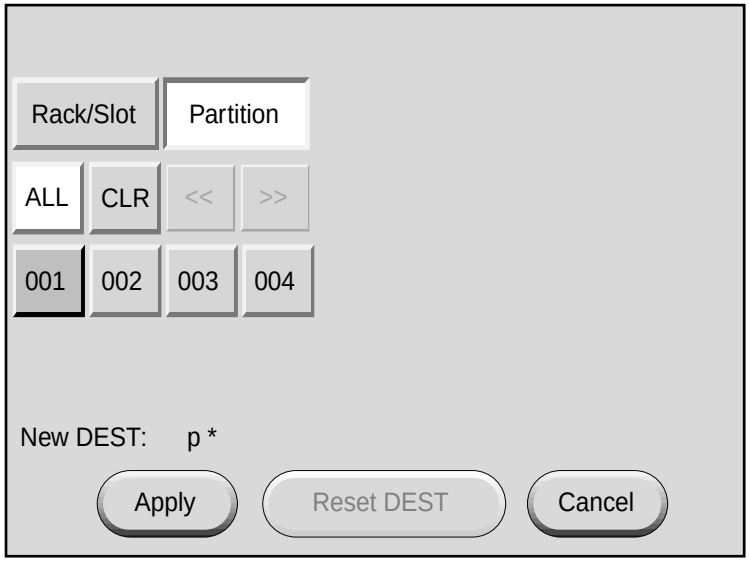

Figure 1-20 Partition Selection Window

5. You can select all partitions by selecting **ALL** on the partition selection window, or you can select a single partition or multiple partitions by selecting the individual partition numbers. Figure 1-21 shows partition **001** selected.

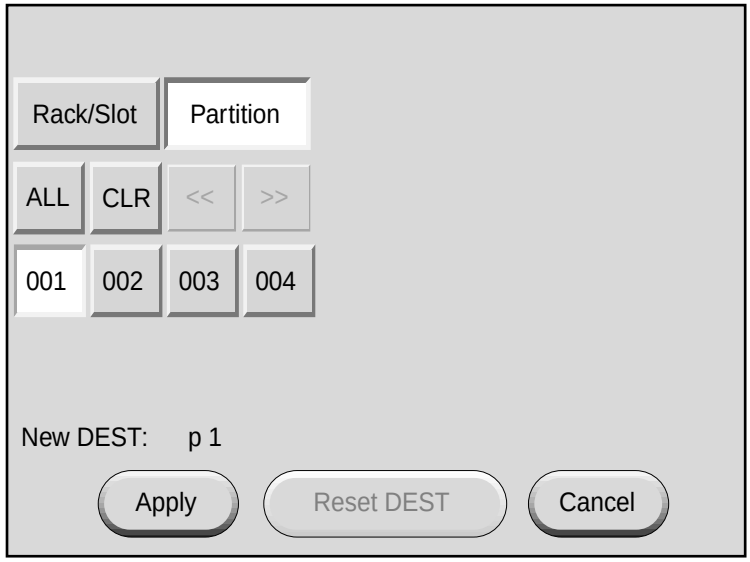

Figure 1-21 Selecting Individual Partition

6. The **New DEST:** field shows *p 1,* which indicates partition **001** was selected as the new destination. If you select **Apply**, your selection is confirmed and the home window, shown in Figure 1-22, appears. The **DEST:** field shows *p 1 [2 Bricks]*, which indicates that the two bricks in partition 1 are the new destination.

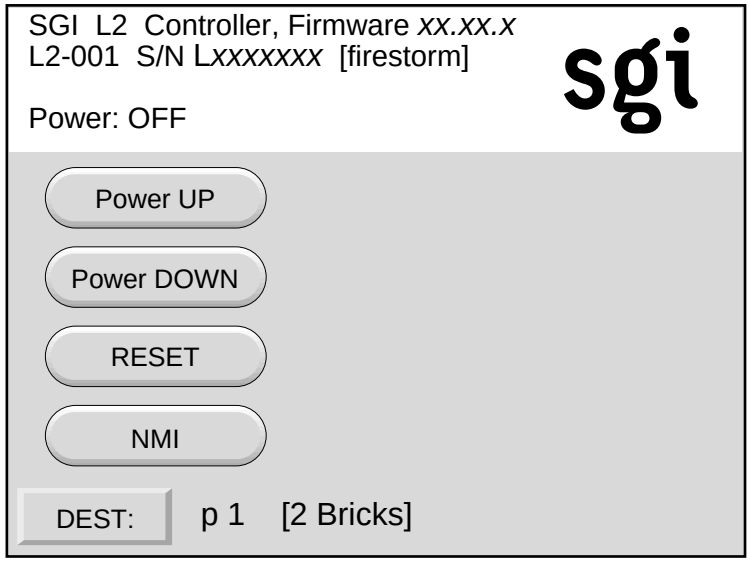

Figure 1-22 Home Window with Partition Destination

7. After you have selected the destination of the bricks you want to power off, select **Power DOWN** from the home window; the power down confirmation window, shown in Figure 1-23, appears. This window indicates which bricks will receive the **Power DOWN** command. In this example, the window indicates that all slots (bricks) in all racks (*r * s**) will be powered off. If you select **OK**, the power-off operation is confirmed and the home window appears. Selecting **Cancel** stops the power-off operation and the home window appears.

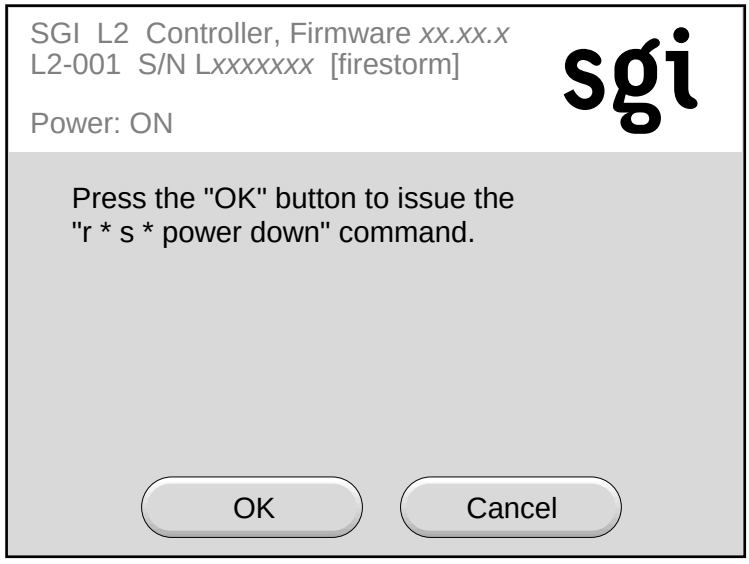

Figure 1-23 Power Down Confirmation Window

Powering Off at System Console

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

1. At your console, switch to L2 mode by pressing `Ctrl+T.`
2. From the L2 prompt (L2>), power off an individual brick by typing the following command. (If you want to power off the entire server, proceed to the next step.)

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

   For example, to power off a Cx-brick in rack 1, slot 07, type the following:

   ```
   L2> r 1 s 7 pwr d
   ```

   The slot number is the lowest unit number that the brick occupies within a rack (see Figure 1-14 on page 21).

   If you want to power off several bricks from a rack at the same time, you must type the rack number followed by the slot numbers of the bricks you want to power off. For example, to power off bricks in slots 7 and 11 of rack 4, type the following:

   ```
   L2> r 4 s 7,11 pwr d
   ```

   If you want to power off bricks that reside in the same location in multiple racks, you must type the number of the racks followed by the slot number of the bricks you want to power off for each rack. For example, to power off the bricks in slot 11 of racks 3 and 4, type the following:

   ```
   L2> r 3, 4 s 11 pwr d
   ```

Caution: To avoid problems with your server, do not try to power off multiple slots for multiple racks at the same time.

3. If you want to power off all the bricks in all the racks, type the following command:

   ```
   L2> pwr d
   ```

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

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

   ```
   L2> config
   ```

   This command lists all the bricks in the server and each brick's system controller address.

The L1 controller display for each brick should display `Powered Down` once the power down procedure completes.

Powering Off D-brick2

Before powering off the D-brick2, confirm that the following has occurred:

- All system users have been notified and are logged off.
- Disk data has been backed up as appropriate.

To power off a D-brick2 enclosure, follow these steps:

1. Move the power switch on the rear of each PSU/cooling module to the "off" position (position **I** = on, **O** = off). The location of the power switch on the D-brick2 PSU/cooling module is shown in Figure 1-24.

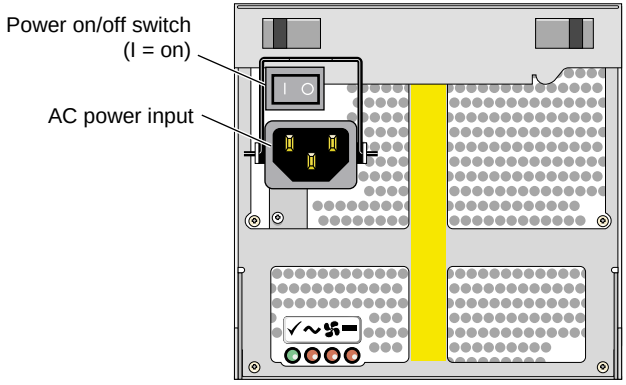

Figure 1-24 D-brick2 PSU/cooling Module Power Switch

2. Unplug the power cable from the PSU/cooling module(s) as appropriate. For example, you would follow this step when you are replacing a module.
3. If you are shutting down all of the D-brick2s in a rack, you may want to move the PDU breaker switch to the "off" position.

The LEDs on the back of the unit should turn dark a few seconds after you power off the PSU/cooling module.

Monitoring Server

You can monitor your SGI Origin 3900 server from the following sources:

- L1 controller display - All bricks (except the TP900 and D-brick2) contain an L1 controller display that displays information about the brick. For example, you can see if the fans on a particular brick are operating properly.
- If your server has a system console, you can view the status and error messages generated by the L1 and L2 controllers in your server. You can also use the system console to input L1 and L2 commands to manage and monitor your server.
- If your server has SGIconsole, you can view the status and error messages generated by the L1 and L2 controllers in your server and you can use various software tools, such as VACM, Console Manager, and PCP, to manage and monitor your server. See the *SGIconsole Start Here* guide for descriptions of these tools and for references to other documents with information about these tools.

System Overview

This chapter provides an overview of the physical and architectural aspects of your Origin 3900 server. System configurations and components are described and illustrated. This chapter includes the following sections:

Product Description

The SGI Origin 3900 server is the latest model in the SGI Origin 3000 family of servers. It can range from 4 MIPS processors and 1 GB of memory to 512 MIPS processors and 1024 GB of memory. Furthermore, the SGI Origin 3900 servers can be clustered to increase the number of processors from 512 to thousands of processors.

Like all models of the Origin 3000 family of servers, this server is based on SGI NUMAflex shared-memory architecture. The main differences between this server and the other Origin 3000 series servers are as follows:

- The Origin 3900 server uses a new packaging scheme that offers four times the processor/memory density over the other Origin 3000 series servers. The Origin 3900 can have up to 128 processors and 256 GB of memory in a single rack; thus, enabling you to have a high-productivity supercomputer in a smaller footprint. For example, a 512-processor Origin 3800 server requires 16 compute racks. An Origin 3900 server that has 512 processors requires only 4 compute racks and 2 router racks (see Figure 2-1).
- The Origin 3900 server uses an enhanced system topology (also referred to as a fat-tree topology) that provides two times the bandwidth capabilities over the hypercube topology, which is the topology used by the other Origin 3000 series servers.

The hardware of the Origin 3900 server is fully compatible with the existing Origin 3000 series servers; therefore, you can upgrade an existing Origin 3000 series server with the new Origin 3900 hardware. This upgrade does require converting the existing hypercube topology to the enhanced topology.

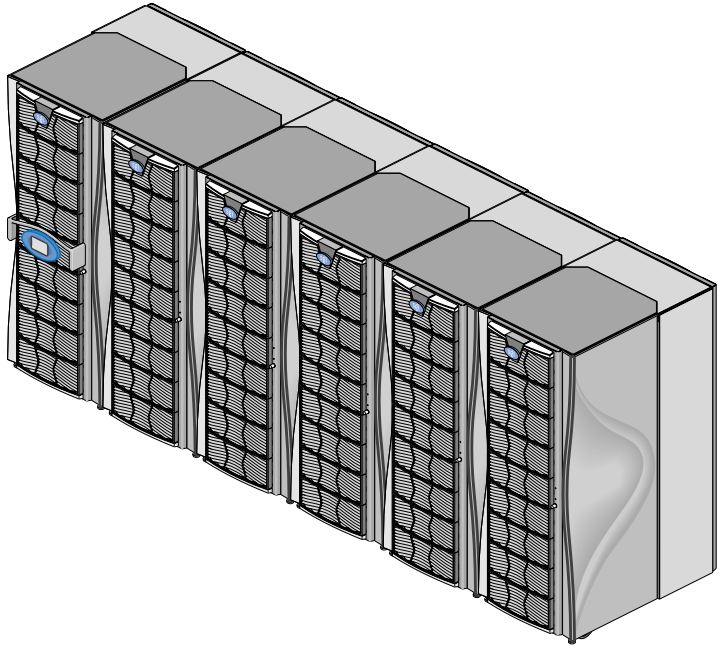

Figure 2-1 512-processor Origin 3900 Server

Architecture

The Origin 3900 sever is based on SGI NUMAflex architecture: 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 NUMAflex architecture contains two key components that enable applications to share the processors, memory, and I/O devices: the Bedrock ASIC and the NUMAlink interconnect (see Figure 2-2).

- 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 bricks in the system to create a single contiguous system memory of up to 1 TB 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 it scales in the following dimensions: computing, I/O, and memory. For example, the computing dimension can range from 4 to 512 processors in a single system image (SSI).

Efficient resource management--The NUMAflex architecture is designed to run complex models, and because the entire memory space is shared, large models 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.

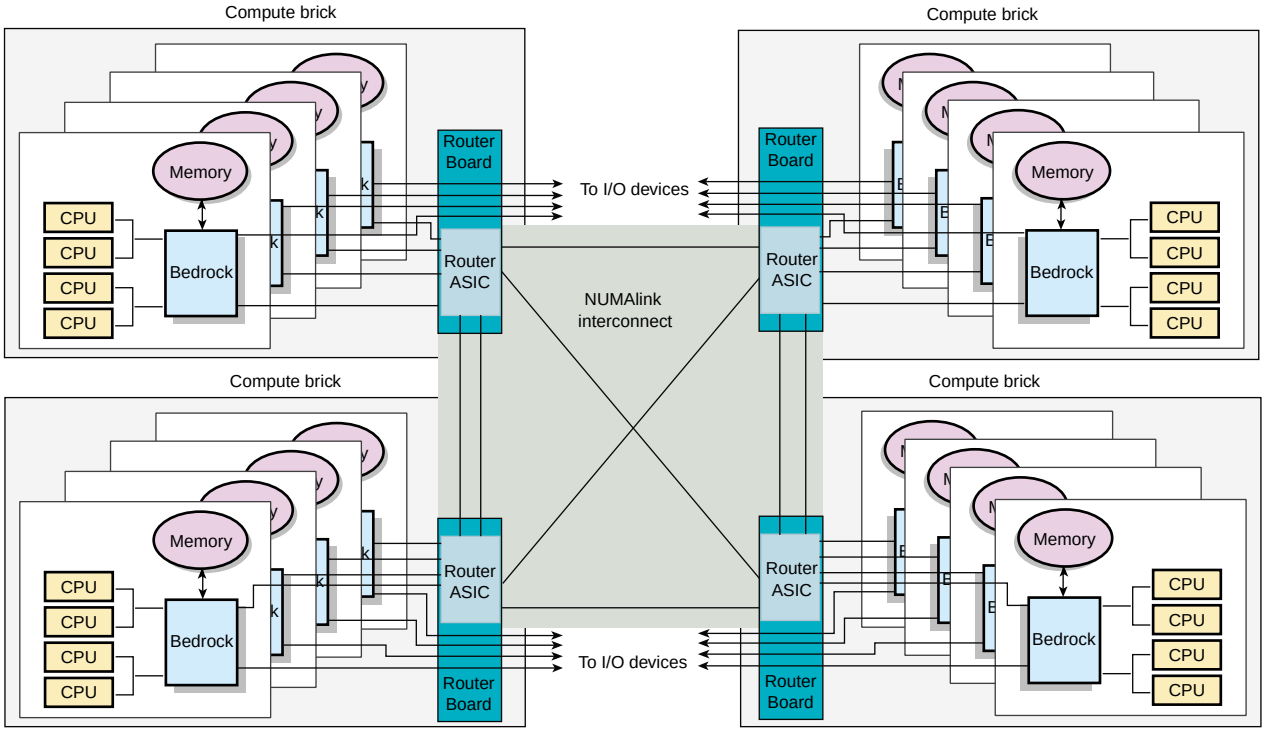

Figure 2-2 System Block Diagram

Standard System Components

The SGI Origin 3900 server features the following standard components (see Figure 2-4):

- Cx-brick - This compute brick contains 4, 8, 12, or 16 MIPS processors, 1 GB to 32 GB of memory, and a router board. The Cx-brick is equivalent to four C-bricks and one R-brick in one enclosure. For more information about the Cx-brick, see Chapter 3, “Cx-brick”.
- IX-brick - This I/O brick is a Crosstalk-to-PCI-X based I/O expansion subsystem that provides the base I/O functionality for the system. For more information about the IX-brick, see Chapter 4, “IX-brick”.
- R-brick - This router brick transfers messages between the Cx-bricks via the NUMAlink interconnect. The R-brick is required for systems that contain more than four Cx-bricks. For more information about the R-brick, see Chapter 7, “R-brick”.
- L2 controller - This rack-level controller manages the bricks within a rack (not shown in Figure 2-4). For more information about the L2 controller, see Chapter 8, “System Control”.
- Power components - The power components of the Origin 3900 server consist of power distribution units (PDUs) and power bays. The PDUs filter input power, protect against over-current conditions, and remove power from the racks (not shown in Figure 2-4). The power bay inputs AC voltage and outputs 48 VDC and 12 VDC standby voltage to the bricks within a rack. For more information about these power components, see Chapter 9, “Power Components”.
- Rack - This industry-standard 19-inch rack contains 39 units (Us) of vertical space that can seat bricks and power bays. (Each U is equivalent to 1.75 inches.) This rack uses two parallel L-shaped mounting rails to support each brick within the rack.

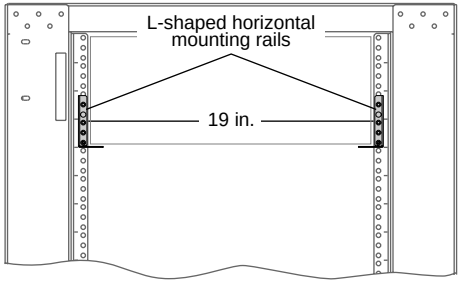

Figure 2-3 L-shaped Mounting Rails

The 39U rack, as shown in Figure 2-4, has front and rear doors that have keylocks to prevent unauthorized access to the system. The rack also has cable entry/exit areas at the bottom of the rack and cable management hardware in the rear of the rack.

The 39U rack is mounted on four casters, two of which are swivel castors. The castors enable the rack to be rolled out of a shipping crate and to its placement at the customer site. The base of the rack has seismic tie-down attachment points and leveling pads. For mechanical specifications of the 39U rack, see Appendix A, "Technical Specifications and Pinouts".

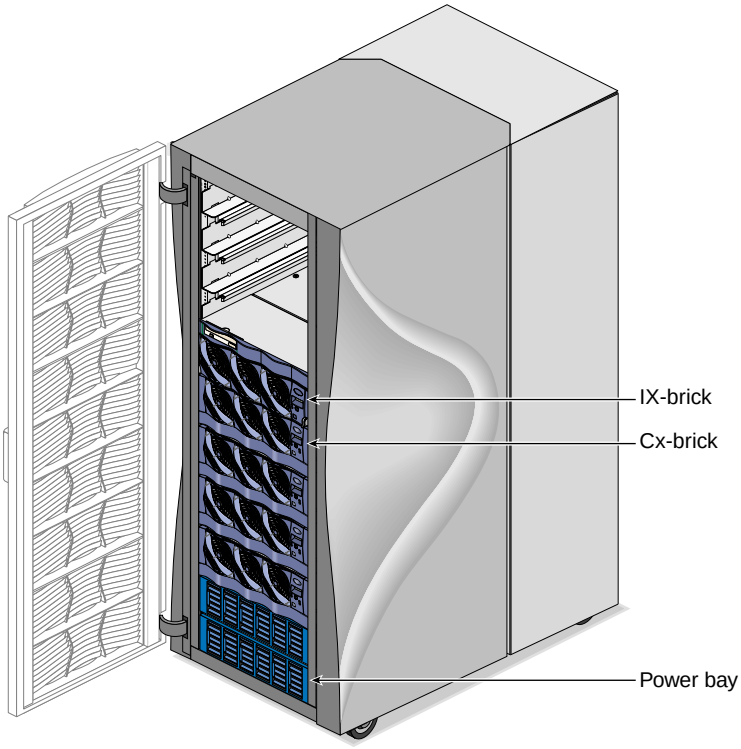

Figure 2-4 Standard System Components

Optional System Components

The Origin 3900 server can contain the following optional components:

- System console - This console enables you to power on and power off the system, monitor the system, and enter L1 controller and L2 controller commands.
- I/O bricks - The Origin 3900 server supports the following I/O bricks: IX-brick, PX-brick, and X-brick. The IX- and PX-bricks are Crosstalk-to-PCI-X based I/O expansion subsystems that can seat up to 12 PCI-X cards. The difference between these two brick types is that the IX-brick has a DVD-ROM and one or two SCSI disk drives. For more information about the IX-brick, see Chapter 4, “IX-brick”. For more information about the PX-brick, see Chapter 5, “PX-brick”.

  The X-brick provides up to four XIO slots for your SGI Origin 3900 server. For more information about the X-brick, see Chapter 6, “X-brick”.
- Disk storage components - The Origin 3900 supports the following disk storage components:
  - For a Fibre Channel solution that supports JBOD (just a bunch of disks) configurations, SGI offers the D-brick2. For more information about the D-brick2, see Chapter 11, “D-brick2”.
  - For a SCSI (small computer system interface) JBOD solution, SGI offers the SGI Total Performance 900 (TP900) storage module. For more information about the TP900, see Chapter 10, “SGI TP900 Storage Module”.
  - For a Fibre Channel solution that supports both JBOD and RAID configurations, SGI offers the SGI Total Performance 9100 [2Gb TP9100] storage system. For more information about the 2Gb TP9100, see the *SGI Total Performance 9100 (2Gb TP9100) Storage System User’s Guide* (007-4522-00*x*).
  - For a Fibre Channel RAID solution, SGI offers the SGI Total Performance 9400 (TP9400) storage system and the SGI Total Performance 9500 (TP9500) storage system. For more information about the TP9400 and TP9500 storage systems, see the *SGI Total Performance 9400 and SGI Total Performance 9500 RAID User’s Guide* (007-4304-00*x*).

- Tape storage components - The Origin 3900 server supports 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)

  For detailed information on the supported tape drives, see the following website: http://sales.corp.sgi.com/products/storage/stk/matrices.html
- Graphics components - The Origin 3900 server supports InfinitePerformance or InfiniteReality graphics. The main components of the InfinitePerformance graphics system are the VPro V12 graphics board, the V-brick, and the compositor (CBOB). For more information about the InfinitePerformance graphics components, see Chapter 12, “InfinitePerformance Graphics Components”. The main components of the InfiniteReality graphics system are the G-brick and the N-brick, which are discussed in detail in Chapter 13, “InfiniteReality Graphics Components”.

System Configurations

The Origin 3900 server supports a wide range of system configurations to serve your computing needs (see Table 2-1). The Origin 3900 server scales in 4-processor increments and in two Cx-brick increments. (The Cx-bricks do not have to be fully populated with processors.) The Origin 3900 server also supports a memory-only Cx-brick that enables you to increase the amount of memory without increasing the number of processors.

Table 2-1 Configuration Specifications

System Size	Maximum Number of Processors	Maximum Amount of Memory in GB	Required Number of Metarouters	Required Number of Racks*
1 Cx-brick	16	32	0	1
2 Cx-bricks	32	64	0	1
4 Cx-bricks	64	128	0	1
6 Cx-bricks	96	192	2	1 or 2
8 Cx-bricks	128	256	2	2
10 Cx-bricks	160	320	4	2 or 3
12 Cx-bricks	192	384	4	2 or 3
14 Cx-bricks	224	448	4	3 or 4
16 Cx-bricks	256	512	4	3 or 4
18 Cx-bricks	288	576	18	5 or 6
20 Cx-bricks	320	640	18	5 or 6
22 Cx-bricks	352	704	20	5 or 6
24 Cx-bricks	384	768	20	5 or 6
26 Cx-bricks	416	832	22	6
28 Cx-bricks	448	896	22	6
30 Cx-bricks	480	960	24	6
32 Cx-bricks	512	1024	24	6

* This number does not include I/O and storage racks.

The following configuration rules apply to the Origin 3900 servers:

- When the server contains more than four Cx-bricks, the server must be configured with metarouters (also referred to as R-bricks). For example, servers that contain 6 or 8 Cx-bricks require two metarouters. The third column of Table 2-1 indicates the number of required metarouters for the supported system sizes. The system topology supports a 200 MB/s per processor bisection bandwidth from 32 processors to 512 processors.
- Each server or partition within the server must contain one system IX-brick that provides the base I/O functionality.
- Each server supports up to eight I/O bricks.
- When the server contains a memory-only Cx-brick, the memory-only Cx-brick must be paired with a Cx-brick that has at least four processors.
- You can configure your server as a single system, or you can divide it into partitions that operate as separate systems. For example, you can configure an Origin 3900 server that has 512 processors as a single 512-processor system, or you can divide it into as many as eight separate systems. The size of a partition can be configured to match your job size. For more information about partitioning, see *Partitioning for Systems that Contain Cx-bricks* (007-4426-00x).
- An Origin 3900 server is configured so that the server resides in the smallest footprint possible and so that the Cx-bricks are placed low within the racks. The number of compute racks is determined by the number of Cx-bricks, I/O bricks, and storage bricks in the server. For example, the smallest footprint for a 10 Cx-brick system is two compute racks; however, if an additional rack is required to house the I/O and storage bricks, a compute rack, rather than an I/O rack, is added to the system. The Cx-bricks are placed low within the three compute racks and the I/O and storage bricks are placed above the Cx-bricks (see Figure 2-5 and Figure 2-6).

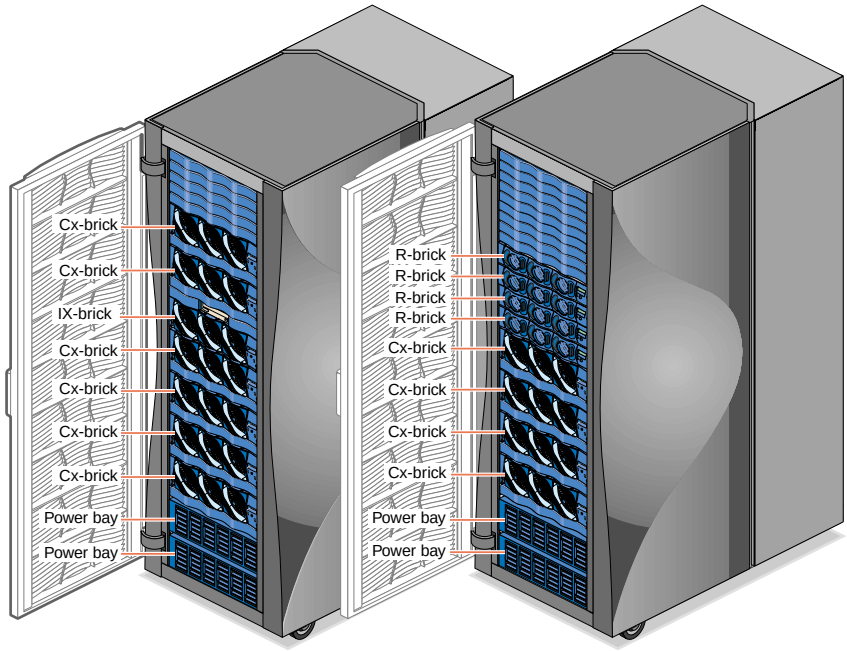

Figure 2-5 10 Cx-brick System in Two Racks

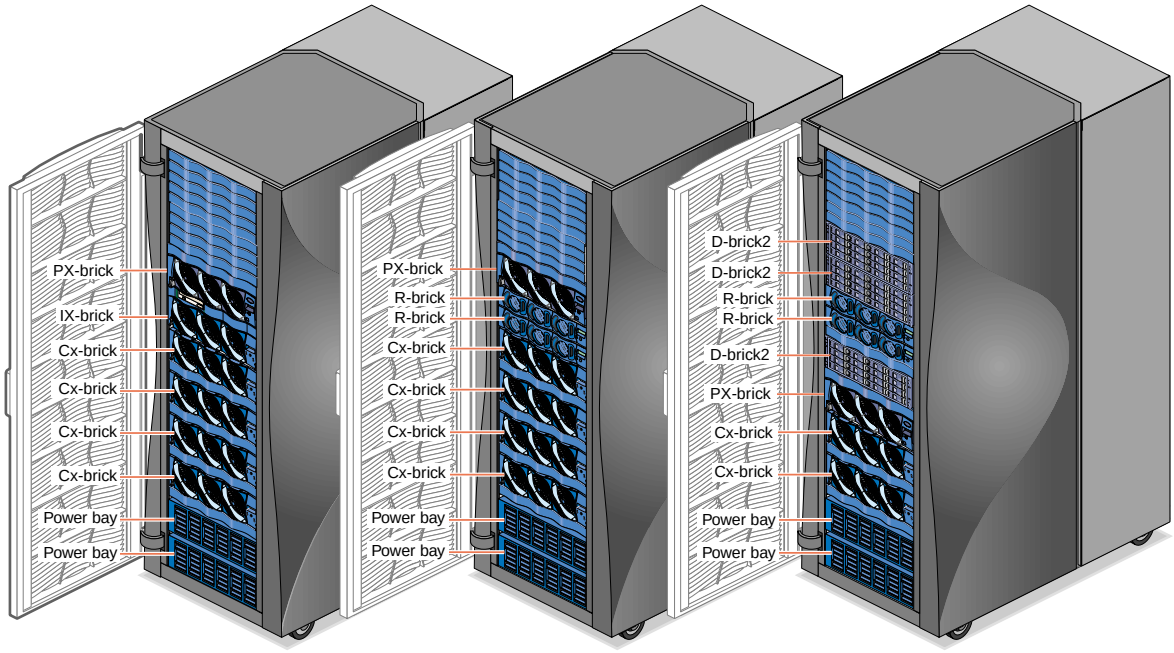

Figure 2-6 10 Cx-brick System in Three Racks

Cx-brick

This chapter describes the function and physical components of the Cx-brick. Specifically, it includes the following information:

Overview

The Cx-brick is a new brick type for the SGI Origin 3000 series product line; it is equivalent to four Origin 3000 series C-bricks and one R-brick in one 4U-high enclosure (see Figure 3-1).

The hardware that is equivalent to four C-bricks is contained on four IP53 node boards; one IP53 node board is equal to one C-brick. The Cx-brick supports the following two types of IP53 node boards:

- Four-processor node board that has 8 MB of L2 cache per processor and up to 8 DIMMs.
- Zero-processor node board that has up to 8 DIMMs (no L2 cache).

The hardware that is equivalent to the R-brick is contained on a single printed circuit board (PCB). The key component on this PCB is the router ASIC, which is the same ASIC used in the R-brick. This router ASIC enables the internal IP53 node boards to connect to other Cx-bricks via the NUMAlink 3 interconnect. This PCB also transfers I/O and system control signals between I/O devices and the IP53 node boards via XIO ports.

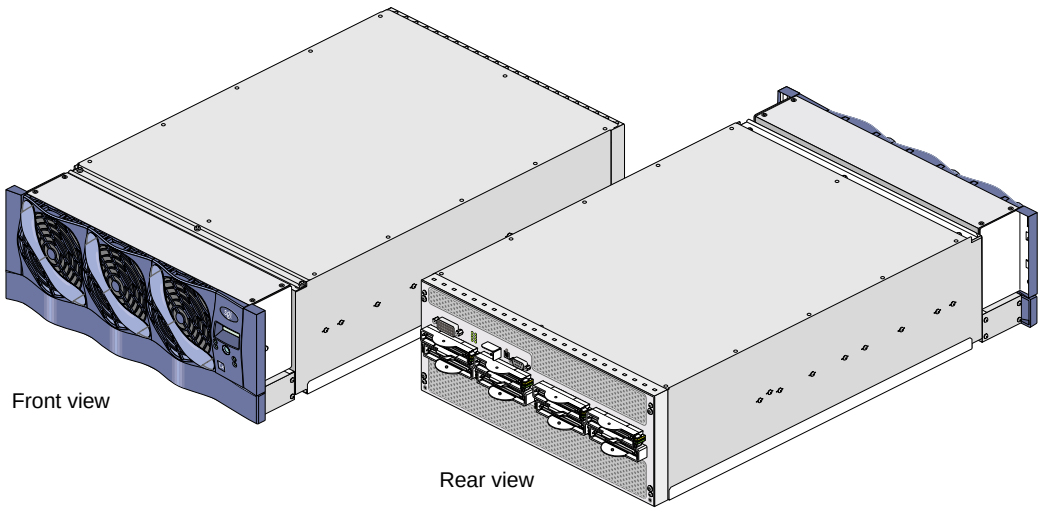

Figure 3-1 Front and Rear Views of Cx-brick

The Cx-brick has the same modular features of the current Origin 3000 series bricks and is fully compatible with the 3000 series architecture. For example, the Cx-brick has the following characteristics:

- Uses the same fans and L1 display as the Origin 3000 series bricks
- Is rack mountable in an Origin 3000 series rack
- Uses the same Bedrock and router ASICs
- Supports MIPS processors

Note: The Cx-brick does not support Intel processors.

- Receives power (48 VDC) from a power bay
- Uses the same control system (L1 and L2 controllers)
- Supports partitioning
- Is compatible with SGI's current graphics product line offerings: InfiniteReality and InfinitePerformance
- Uses the IRIX operating system (versions 6.5.18 or greater)

Table 3-1 lists some of the differences between the Cx-brick and the C- and R-bricks.

Table 3-1 Brick Comparison Chart

Characteristic	Cx-brick	C-brick	R-brick
Processors	0 to 16	2 or 4	N/A
Processor boards	4 IP53 node boards	2 PIMMs	N/A
Memory	1 GB to 32 GB	1 GB to 8 GB	N/A
DIMMs	8 per node board	8 per brick	N/A
NUMAlink ports	4 internal and 4 external	1 external	8 external
XIO ports	1 to 4 external (1 per IP53 node board)	1	0

The following sections provide more detail about the components that make up the Cx-brick (see Figure 3-2):

- "IP53 Node Boards" on page 56
- "Router Board" on page 57
- "Power Entry Module" on page 57

Warning: To prevent personal injury, or damage to your system, only trained SGI system support engineers (SSEs) can service the internal components of the Cx-brick.

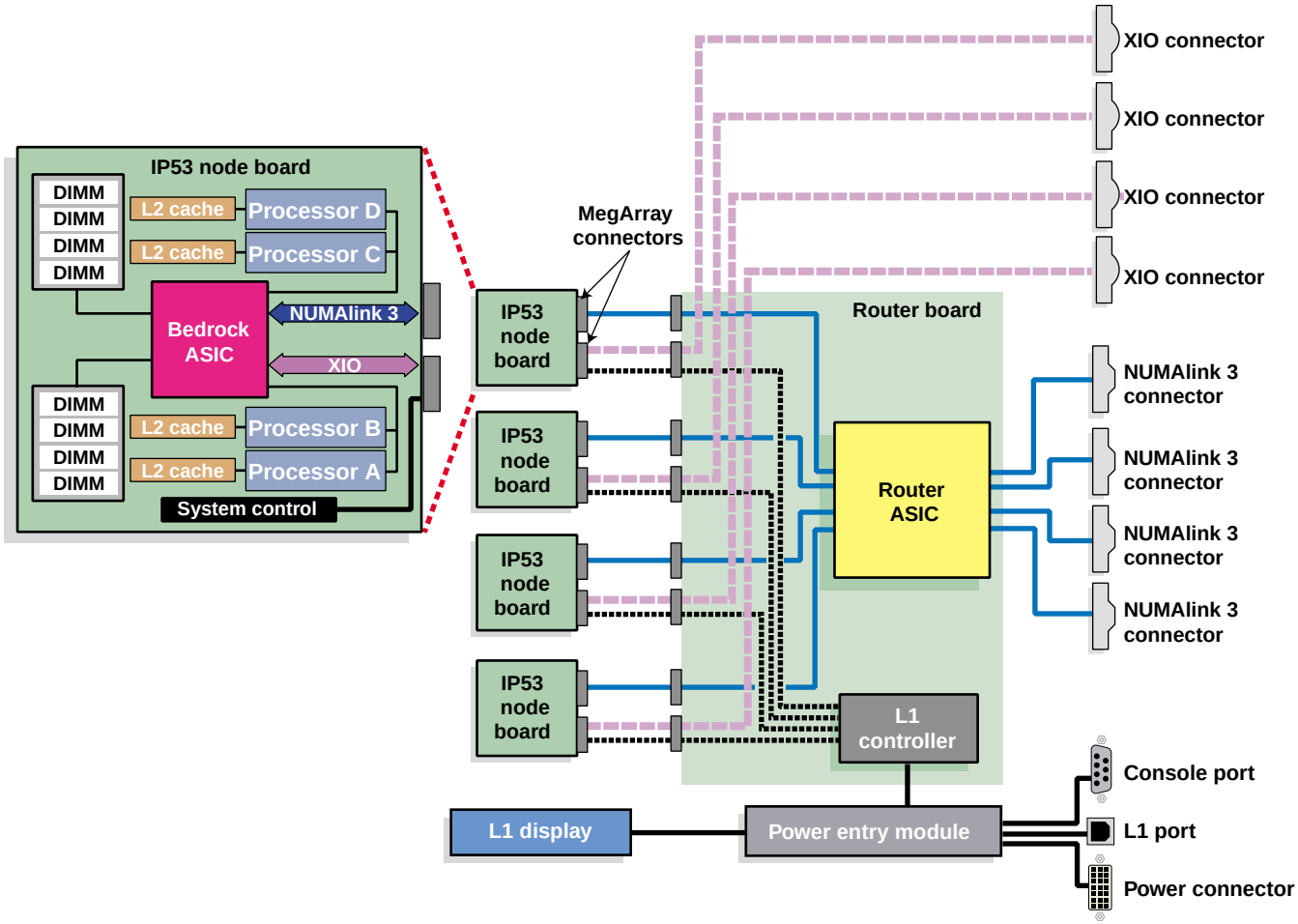

Figure 3-2 Cx-brick Block Diagram

IP53 Node Boards

The Cx-brick consists of one to four IP53 node boards. Each IP53 node board has the following components:

- 1 Bedrock application-specific integrated circuit (ASIC) that enables communication between the processors, memory, network, and I/O devices.
- 0 or 4 processors (labeled A, B, C, and D in Figure 3-2).
- 8 MB of L2 cache for each processor to reduce memory latency.
- 2 MegArray connectors (1 XIO and 1 NUMAlink 3) to connect the IP53 node board to the router board.
- 2, 4, 6, or 8 dual-inline memory modules (DIMMs) that provide from 1 GB to 8 GB of local memory. The Cx-brick supports 512 MB and 1 GB single DIMM sizes (see Table 3-2).

Table 3-2 Memory DIMM Specifications

Memory Kit	Single DIMM Size	DDR SDRAM Technology
1 GB with premium integrated directory memory	512 MB	128 Mbits
2 GB with premium integrated directory memory	1 GB	256 Mbits

Your SGI support service engineer (SSE) can increase or decrease the size of memory by adding or removing DIMM pairs.

Router Board

The router board of the Cx-brick contains the following components:

- Router ASIC (same ASIC as used in the R-brick) that makes up the NUMAlink 3 interconnect. The NUMAlink 3 interconnect routes messages between the compute nodes in the system.
- L1 controller that monitors and manages your Cx-brick, and generates status and error messages that appear on the liquid crystal display (LCD) located on the Cx-brick front panel (see Figure 3-3 on page 59).
- Four NUMAlink 3 connectors that connect to router boards in other Cx-bricks or to R-bricks.
- Two internal XIO connectors. Each internal XIO connector connects to a separate XIO jumper board that has two external XIO connectors. The two XIO jumper boards provide a total of four external XIO connectors for the Cx-brick.
- Four sets of MegArray connectors (one set for each IP53 node board). Each set of connectors consists of one XIO connector and one NUMAlink 3 connector.
- One 48V-to-2.5V converter for the router ASIC.

Power Entry Module

The Cx-brick contains a power entry module (also known as the inlet board) that receives 48 VDC power from the power bay and converts it to 12 VDC (for the node boards). The power entry module, which controls fan speed, also contains the following items:

- Four sets of 48V-to-12V converters (one set for each IP53 node board).
- Power switch to power on and power off the Cx-brick.
- Power connector to connect the Cx-brick to the power bay.
- Console serial port (DB-9 connector) for the system console connection.
- L1 port (USB connector) for the L1-to-L2 controller connection.
- Connector that connects the power entry module to the L1 display.
- Eight power LEDs (described in “External Components” on page 58).

External Components

The Cx-brick is a 4U-high brick that contains the following front-panel items (see Figure 3-3):

- **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 button with LED** enables you to manually power on and power off the Cx-brick.
- **LEDs:**
  - **On/Off button 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 Cx-brick is still operating.
  - **Failure LED** illuminates red to indicate that a failure has occurred and the Cx-brick is down.
- **Reset switch** resets the Cx-brick internal processors and ASICs. This reset will cause a memory loss. (See non-maskable interrupt [NMI] to perform a reset without losing register data.)
- **NMI switch** resets the Cx-brick internal processors and ASICs and writes the contents of the registers and memory to a `/var/adm/crash` file. (This switch is not used by the memory-only Cx-brick.)
- **Three fans** provide N+1 redundant cooling for the brick.

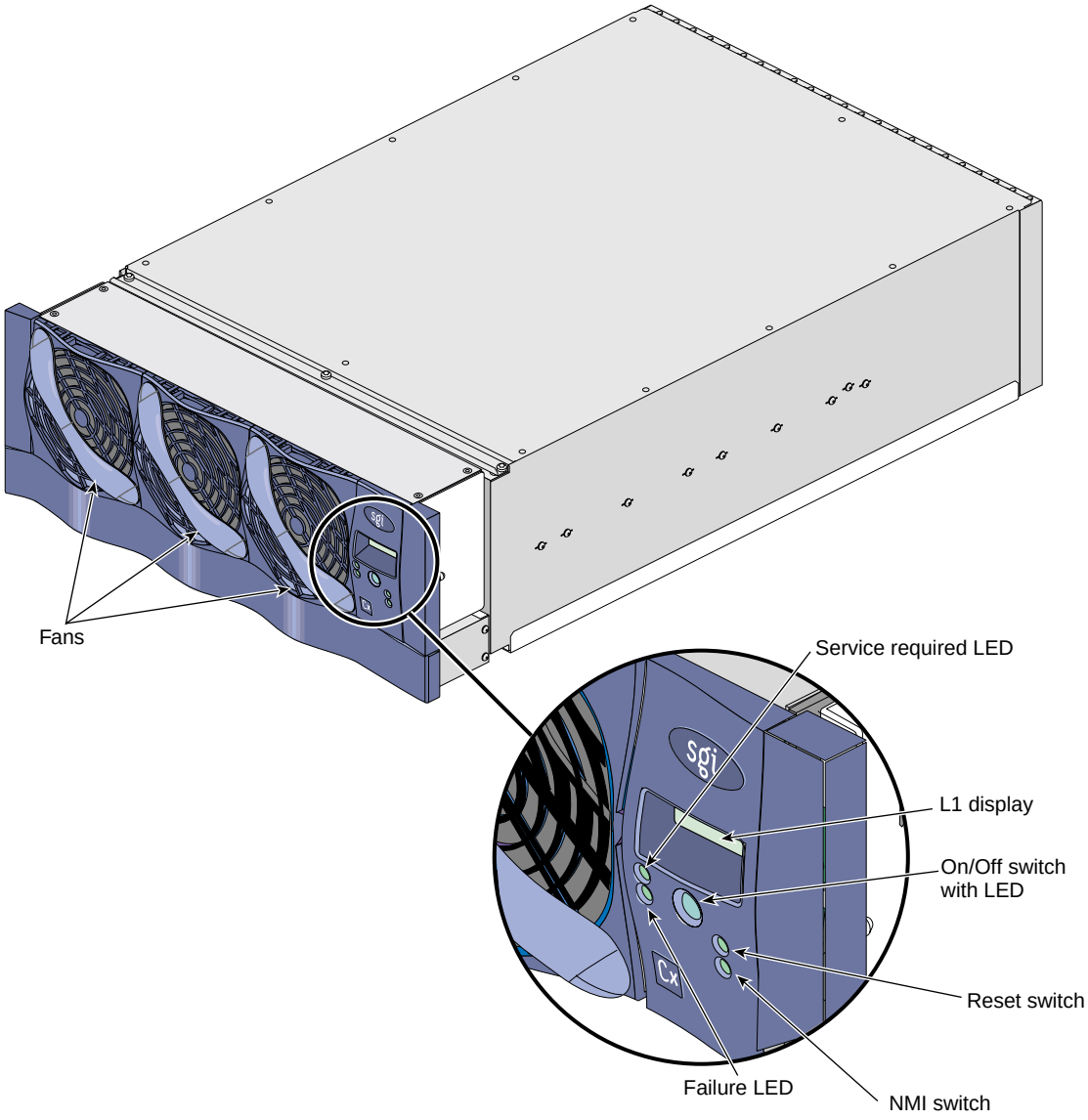

Figure 3-3 Front View of Cx-brick

The Cx-brick has the following rear-panel items (see Figure 3-4):

- **Four NUMAlink connectors** connect the Cx-brick to other Cx-bricks and/or R-bricks. NUMAlink 6 (port F) and NUMAlink 1 (port A) connect to another Cx-brick. NUMAlink 7 (port G) and NUMAlink 8 (port H) connect to R-bricks.

Note: For a system that contains four Cx-bricks, all four NUMAlink ports connect to Cx-bricks.

  Each NUMAlink connector has two LEDs: one LED illuminates yellow to indicate that the Cx-brick and the brick to which it is connected are powered on and the other LED illuminates green to indicate that the link is established between the Cx-brick and the brick to which it is connected.

- **Four XIO connectors** can connect the Cx-brick to IX-, PX-, and/or X-bricks. The XIO connector numbers indicate the IP53 node board to which it connects; for example, XIO0 connects to IP53 node board 0. XIO1 connects to IP53 node board 1, and so on.

  Each XIO connector has two LEDs: one LED illuminates yellow to indicate that the IP53 node board and the brick to which it is connected are powered on and the other LED illuminates green to indicate that the link is established between the IP53 node board and the I/O brick to which it is connected.

- **One power connector** connects the Cx-brick to a power bay via a DC power cable.
- **One power switch** powers on the L1 controller when moved to the **1** position; moving it to the **0** position powers off the L1 controller.
- **One L1 port** connects the Cx-brick's L1 controller to the L2 controller.
- **One Console port** connects the Cx-brick's L1 controller to a system console.
- **Sixteen heartbeat LEDs**: each IP53 node board has four LEDs that indicate processor activity. (For example, N0 A is the LED for processor A of IP53 node board 0.)
- **Four INT LINK LEDs** indicate that the connections between the four Bedrock ASICs and the router board are okay. (For example, INT LINK 0 is the LED for the connection between the Bedrock ASIC on IP53 node board 0 and the router board.)
- **Eight Power OK LEDs**:
  - One LED for 12-V power illuminates green when the power switch is in the On (**1**) position and the power bay supplies 12 VDC to the brick.
  - One LED for 48-V power illuminates green when the power bay supplies 48 VDC to the brick at the request of the L1 controller.

- One LED for the router board indicates that the router board is receiving its required power.
- One LED for the power inlet module (also referred to as the power entry module) indicates that the inlet board is receiving its required power.
- Four LEDs, one for each IP53 node board, indicate that each IP53 node board is receiving its required power.

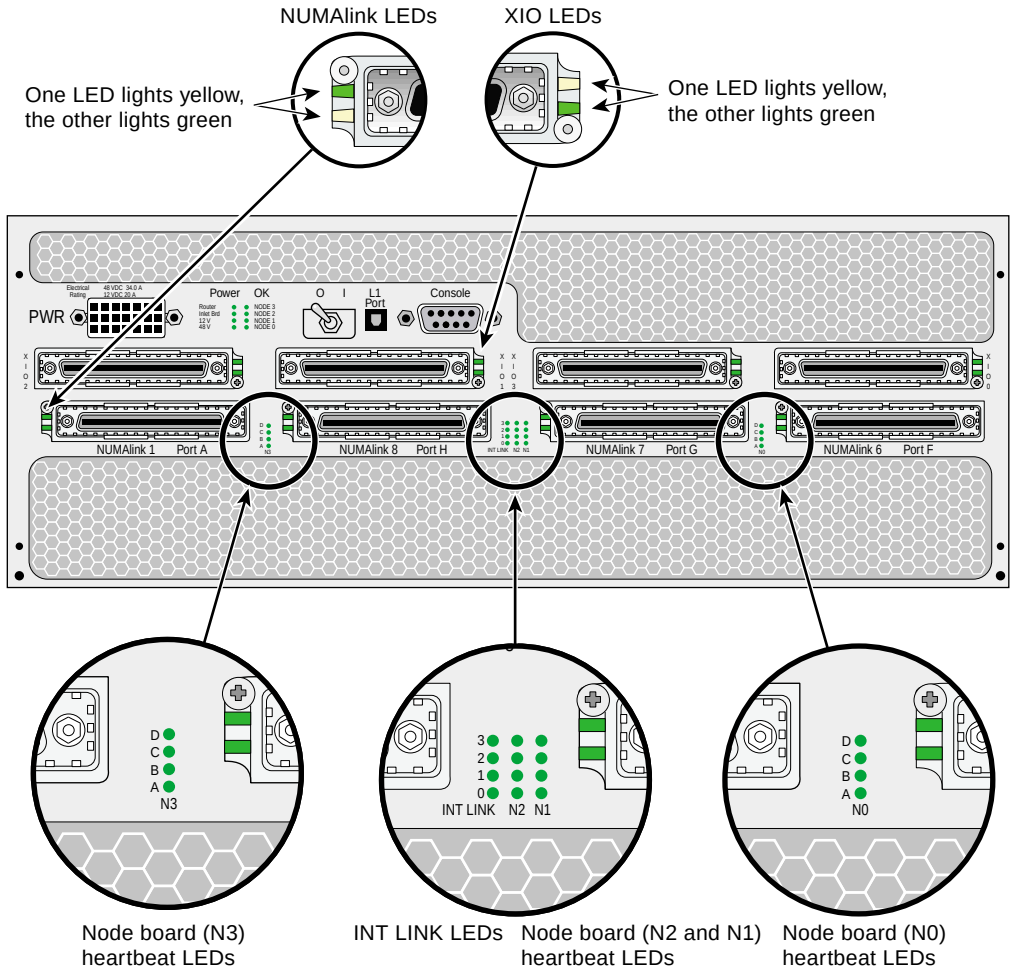

Figure 3-4 Rear View of Cx-brick

The IP53 node boards have the following node address space identifier (NASID) assignment (see Figure 3-5):

- IP53 node board 1 is NASID n
- IP53 node board 2 id NASID n+1
- IP53 node board 0 id NASID n+2
- IP53 node board 3 id NASID n+3

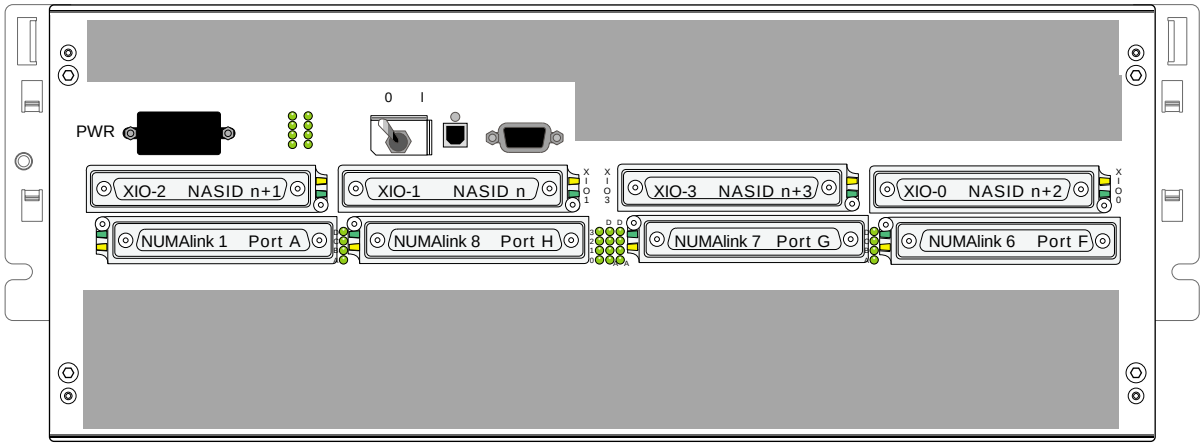

Figure 3-5 NASID Assignment

Technical Specifications

Table 3-3 lists the technical specifications of the Cx-brick.

Table 3-3 Cx-brick Technical Specifications

Characteristic	Specification
Height	6.8 in. (172.72 mm)
Width	17.5 in. (444.5 mm)
Depth	27.5 in. (698.5 mm)
Weight	70 lb (31.75 kg)
DC input power	+48 VDC (~1100 Watts DC)

Table 3-4 lists the specifications of the Cx-brick ports.

Table 3-4 Cx-brick Port Specifications

Port	Quantity	Specification
NUMAlink 3	4	1.6 GB/s each direction
XIO	4	1.2 GB/s each direction

Product Options

You can configure the Cx-brick to match your computational needs. Table 3-5 lists the configurable components of the Cx-brick and the available options.

Table 3-5 Configurable Items of Cx-brick

Configurable Component	Option
IP53 node board	Number of boards per Cx-brick: 1, 2, 3, or 4 Number of processors per board: 0 or 4
Memory	Number of DIMMs per IP53 node board: 2, 4, 6, or 8 Size of DIMMs: 512 MB or 1 GB

Important Notes

The following rules apply to the Cx-brick:

- The number of available XIO ports is equivalent to the number of IP53 node boards.
- The two DIMMs that compose a DIMM pair must be the same capacity; however, each of the bank pairs can differ in memory capacity.
- The four processors contained on an IP53 node board must be the same speed; however, the IP53 node boards within a Cx-brick can contain processors of varying speeds.
- When the Cx-brick contains four 0-processor node boards, it is referred to as a memory-only Cx-brick. This brick must have a direct connection via ports A and F to another Cx-brick that contains at least four processors.

IX-brick

The IX-brick is an I/O expansion subsystem that connects I/O devices to your server by using either the PCI or PCI-X protocol. The PCI-X protocol enables I/O devices to operate at clock speeds of up to 133 MHz, or 1 GB/s. This protocol also enables I/O devices to operate more efficiently, thereby providing a higher sustained bandwidth at any clock frequency. By supporting this protocol, the IX-brick addresses the need for increased bandwidth of PCI devices.

The IX-brick also has the components (SCSI disk drives and DVD-ROM) that are required to install your operating system and other software applications.

This chapter describes the function and physical components of the IX-brick. Specifically, it includes the following information:

Note: Throughout this chapter, the term "PCI card" refers to cards with PCI or PCI-X capabilities. When necessary, distinctions between the cards are noted.

Note: For information about installing or replacing a PCI card, see "Installing or Replacing PCI or PCI-X Card" on page 202.

Note: For information about installing or replacing a SCSI disk drive, see "Installing or Replacing Disk Drives in IX-brick" on page 211.

Product Overview

The 4U-high IX-brick, shown in Figure 4-1, provides 12 PCI-X slots that support up to 12 PCI or PCI-X cards. The 12 slots are configured as six 2-slot buses.

Note: You can install PCI cards in 11 of the 12 PCI slots. One slot (the leftmost slot) is reserved for an IO9 PCI card. This card is required for the base I/O functions.

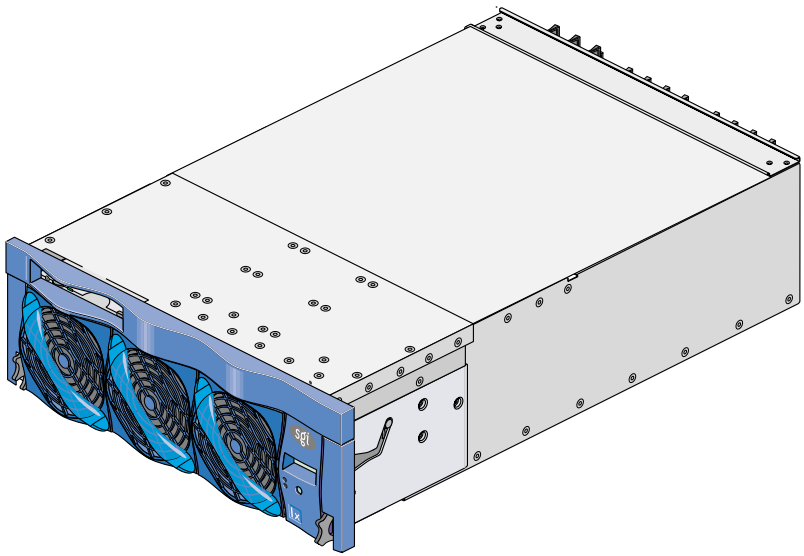

Figure 4-1 Front View of IX-brick

The IX-brick is the follow-on product of the I-brick. Compared to the I-brick, the IX-brick offers the following enhancements:

- The IX-brick supports both PCI and PCI-X cards.
- The IX-brick can have two or four serial ports. The first two serial ports are standard components of the IX-brick (similar to the I-brick). The third and fourth serial ports reside on a daughtercard that you can purchase as an optional component.

  Note: The serial-port daughtercard requires the space of one PCI-X slot, but it does not connect to the PCI-X bus.

Three PIC (PCI interface chip) ASICs are key components of the IX-brick architecture. These ASICs support two 1200- or 800-MB/s Xtown2 XIO ports and six PCI-X buses (see Figure 4-2). Each bus has two card slots in which you can install PCI cards. (Slot 1 of bus 1, however, seats the IO9 card.)

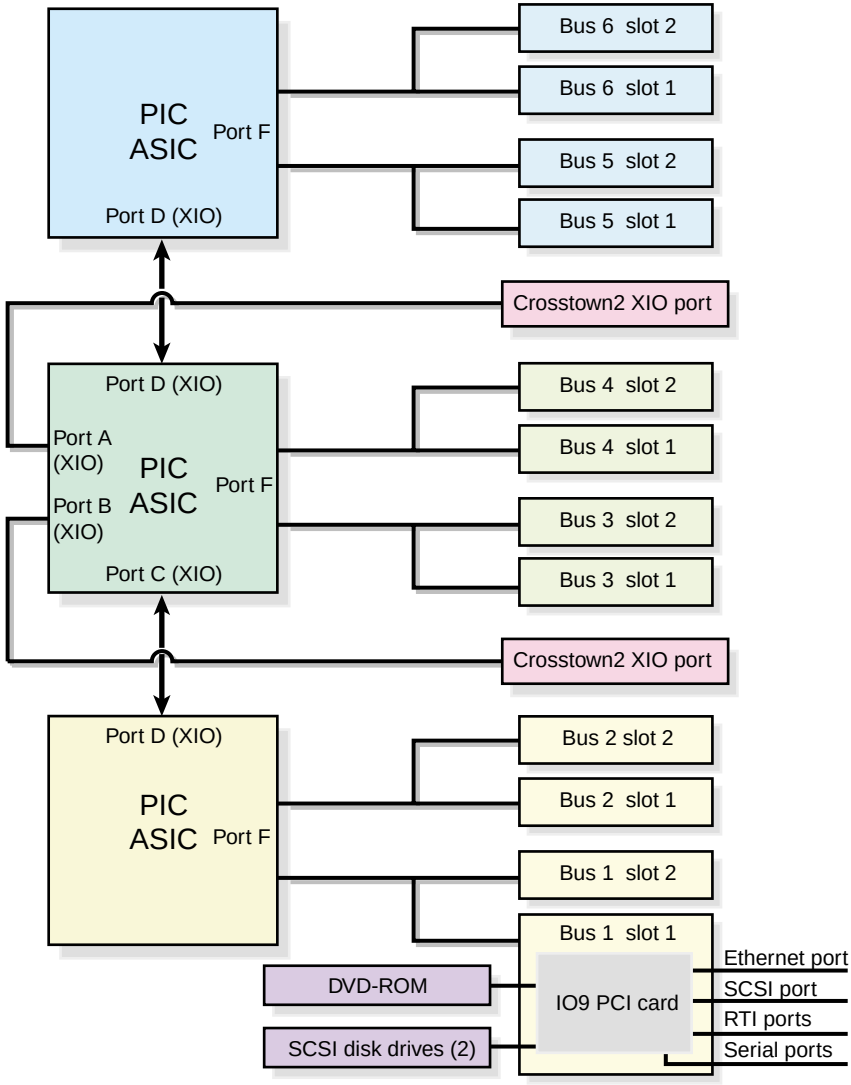

Figure 4-2 IX-brick Block Diagram

Also important to the IX-brick architecture is the IO9 PCI card. This card contains logic that controls the DVD-ROM and internal SCSI disk drives, and it provides the following connectors (see Figure 4-3):

- External VHDCI SCSI port connector.
- Internal SCSI port connector that connects to two SCSI disks.
- Gigabit Ethernet RJ45 connector.
- Two RT interrupt stereo jack connectors (one input connector labeled **RTI**, and one output connector labeled **RTO**).
- Two RS-232 DB-9 serial port connectors. (These two connectors are not located on the IO9 PCI card; instead, they are located on the right side of the IX-brick rear panel [see Figure 4-5 on page 73].)
- You can also add an optional daughtercard to the IO9 card that adds two additional RS-232 DB-9 serial port connectors to the IX-brick.

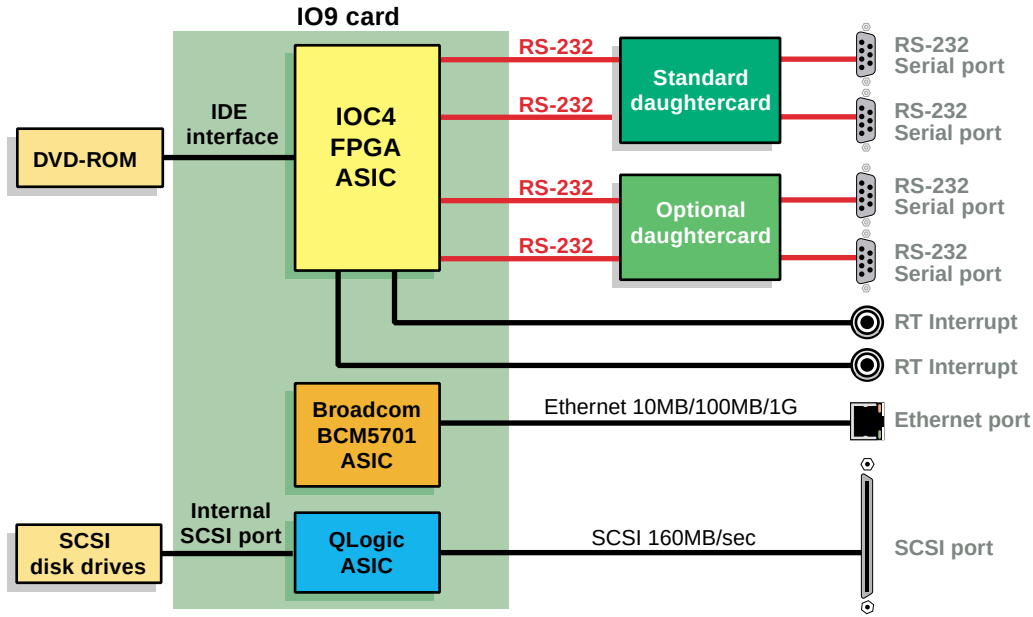

Figure 4-3 IO9 Card and Daughtercard Block Diagram

External Components

This section describes the external components that are located on the front and rear panels of the IX-brick.

Front Panel Components

The IX-brick has the following front-panel components (see Figure 4-4):

- **Two SCSI disk drives.** These customer-removable, sled-mounted SCSI disk drives are used to store your operating system and other application software. (See "Installing or Replacing Disk Drives in IX-brick" on page 211) for instructions for installing or removing the SCSI disk drives.
- **DVD-ROM device.** This device loads software onto your IX-brick. (It is used for text reading only in CD-ROM mode.)
- **L1 controller display.** This liquid crystal display (LCD) displays status and error messages that the L1 controller generates.

  Note: For more information about the L1 controller, see the *SGI L1 and L2 Controller Software User's Guide*.

- **On/Off switch with LED.** Press this button to turn on the internal components of the IX-brick. Alternatively, you can turn on the internal components at the L2 controller touch display or at a system console.
- **LEDs:**
  - **On/Off switch LED.** This green LED illuminates when 48-VDC power is applied to the internal components of the IX-brick.
  - **Service required LED.** This LED illuminates yellow to indicate that a component is broken or is not operating properly (for example, if a fan is off), but the IX-brick is still operating.
  - **Failure LED.** This LED illuminates red to indicate that a system failure has occurred and the IX-brick is not operating.
- **Fans.** Three hot-swappable fans provide the required cooling for your IX-brick.

Warning: To prevent personal injury, or damage to the IX-brick, the hot-swappable fans can be installed only by a trained SGI system support engineer (SSE).

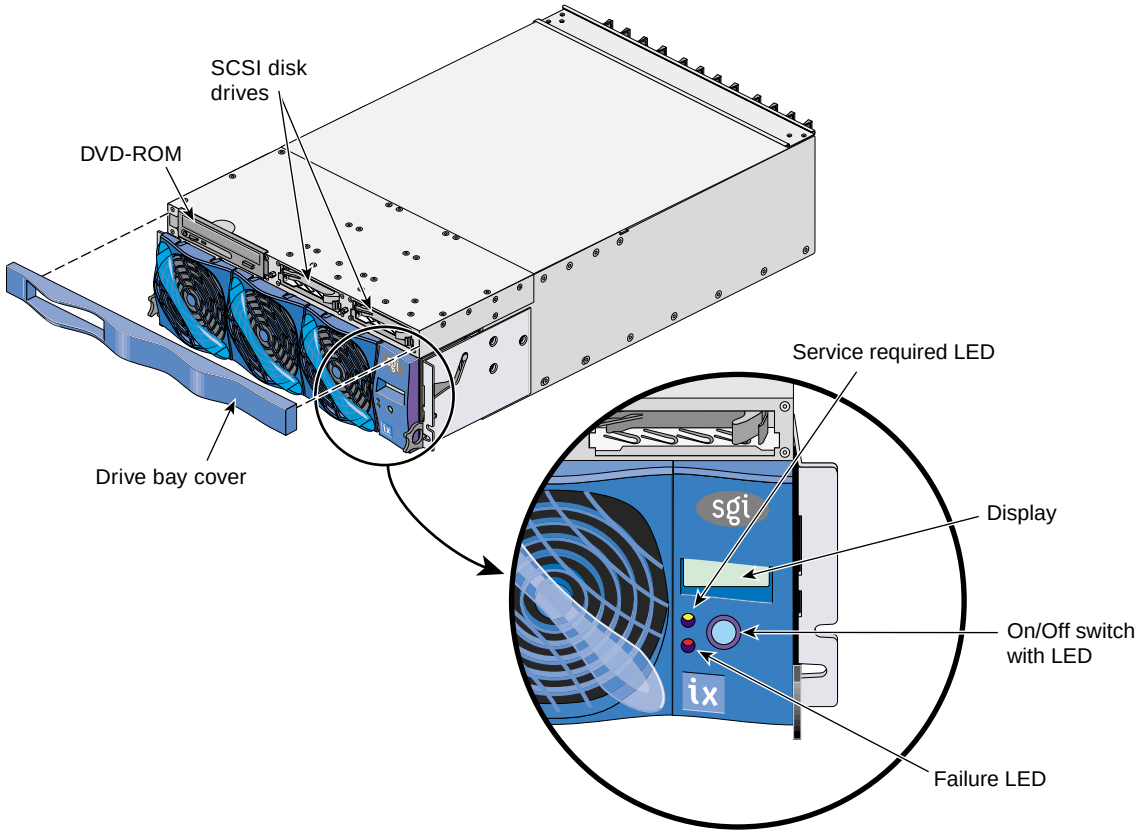

Figure 4-4 Front Panel of IX-brick

Rear Panel Components

The IX-brick has the following rear-panel components (see Figure 4-5):

- **Power switch.** Moving the power switch to the **1** position powers on the L1 controller of the IX-brick, and moving it to the **0** position powers off the L1 controller.
- **12-VDC LED.** The 12-VDC LED illuminates green when the L1 controller is powered on.
- **48-VDC LED.** The power switch must be in the ON (**1**) position for this LED to light. The 48-VDC LED illuminates green when the rest of the IX-brick internal components are powered on.
- **PWR (power) connector.** This connector connects to a power bay, which provides power to the IX-brick.
- **PCI-X slots.** These slots seat the PCI cards. The card slots are numbered bus 1 through bus 6. Each bus has two slots, labeled 1 and 2, as shown in Figure 4-6.
- **PCI-X slot LEDs.** Each PCI-X slot has the following LEDs:
  - **PWR (power) LED.** This LED illuminates green when the PCI card is installed securely and is getting power.
  - **Fault LED.** This LED illuminates yellow when a fault occurs with the PCI card.
- **XIO 10 and XIO 11 connectors.** Each connector can connect the IX-brick to one IP53 node board. As an option, the second connector can connect to another IP53 node board to create a dual-ported IX-brick, which provides greater bandwidth.
- **XIO 10 and XIO 11 connector LEDs.** Each XIO connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the IX-brick and the IP53 node board to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the IX-brick and the IP53 node board to which it connects.

The leftmost PCI-X slot (bus 1, slot 1) seats an IO9 card that has the following connectors:

- **SCSI 68-pin VHDCI connector.** This external SCSI port connects to SCSI devices.
- **Ethernet RJ45 connector.** This autonegotiating 10/100/1000BaseT Ethernet port connects the system to an Ethernet network.
- **RTO and RTI stereo jack connectors.** RTO (output) enables a Cx-brick to interrupt an external device. RTI (input) enables an external device to interrupt a Cx-brick.

The IO9 card also connects to a daughtercard (standard component) that has the following connectors:

- **Two DB-9 RS-232 serial port connectors.** These ports can be used as COM ports to connect to modems or other serial devices.

Note: An optional serial port daughtercard can be attached to your IO9 card by an SGI system support engineer (SSE). This card adds two additional serial ports to the IX-brick.

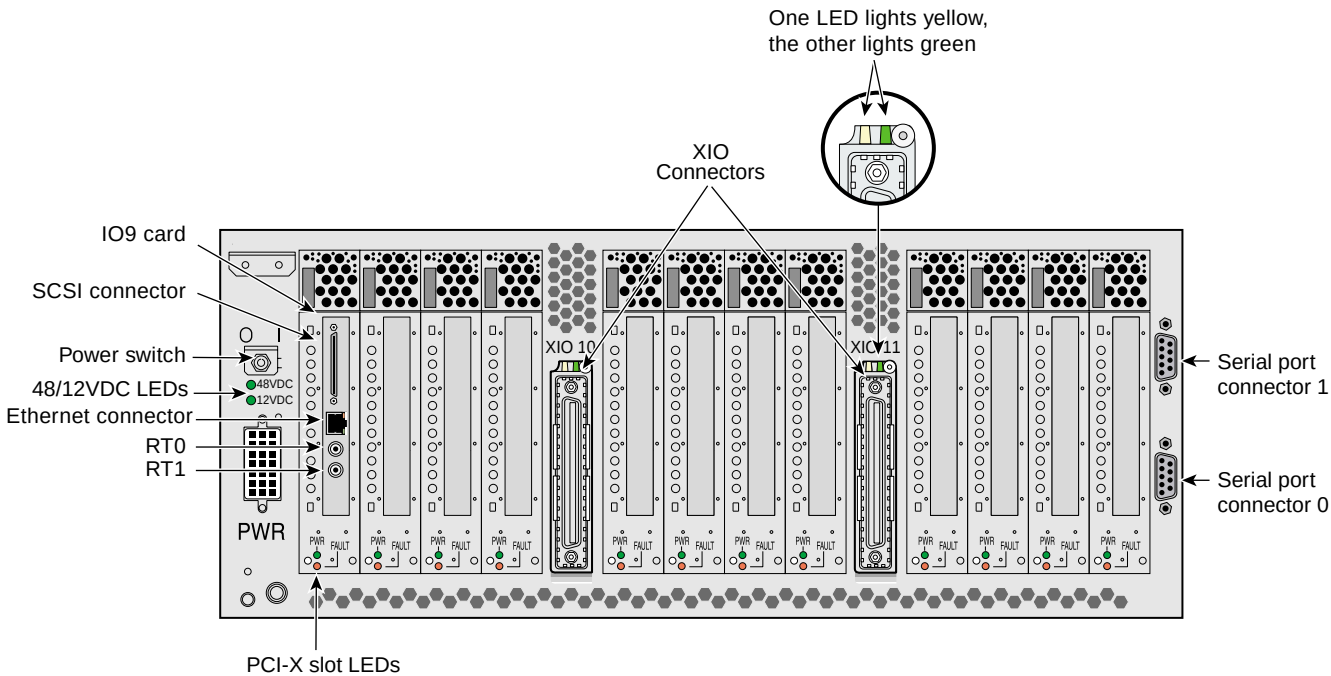

Figure 4-5 Rear Panel of IX-brick

PCI and PCI-X Card Configuration Guidelines

The PCI-X slots are numbered bus 1 through bus 6. Each bus has two slots, labeled 1 and 2, as shown in Figure 4-6. Separate buses enable the IX-brick to run cards of different frequencies at the same time. For example, bus 1 can have one 133-MHz card, bus 2 can have two 66-MHz cards, bus 3 can have two 33-MHz cards, and so on. Each PCI-X bus supports 32-bit and 64-bit PCI or PCI-X cards at the same time.

For maximum bandwidth, PCI cards are distributed across all six buses when they are integrated at the factory.

This section contains the following information:

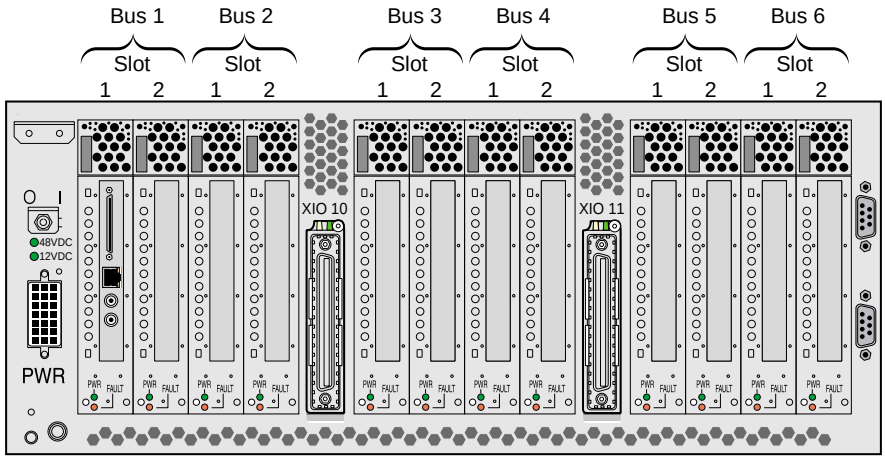

Figure 4-6 Numbering of IX-brick PCI-X Slots

Important Installation Considerations

To maximize the operating efficiency of the PCI cards, consider the following configuration guidelines before you install the cards:

- You can place one or two PCI cards on one bus, or one or two PCI-X cards on one bus.
- You should avoid mixing cards that operate at different frequencies or in different modes. If you have two cards of different speeds on the same bus, both cards operate at the lower speed. If a PCI card and PCI-X card are on the same bus, both cards operate in PCI mode. Note the following examples:
  - When one 133-MHz PCI-X card resides on a bus, the card operates at 133 MHz in PCI-X mode.
  - When two 133-MHz PCI-X cards reside on a bus, the cards operate at 100 MHz in PCI-X mode.
  - When two 66-MHz PCI-X cards reside on a bus, the cards operate at 66 MHz in PCI-X mode.
  - When two 66-MHz PCI cards reside on a bus, the cards operate at 66 MHz in PCI mode.
  - When one 66-MHz PCI card and one 66 MHz PCI-X card reside on a bus, the cards operate at 66 MHz in PCI mode.
  - When two 33-MHz PCI cards reside on a bus, the cards operate at 33 MHz in PCI mode.
  - When one 66-MHz PCI card and one 33-MHz PCI card reside on the same bus, the cards operate at 33 MHz in PCI mode.

Note: When installing a PCI card, you need to shut down the operating system and power off the IX-brick before installing the card.

Supported PCI Cards

SGI supports various PCI cards. These cards can be purchased from SGI or another manufacturer. Ask your SGI sales representative for a current list of PCI cards that SGI supports.

PCI Card Carrier

Each PCI card is mounted on a carrier so that you can slide the cards into and out of the brick. This carrier supports most PCI cards; it can be adjusted to accommodate cards of different sizes. (To learn how to adjust a carrier, see "Installing or Replacing PCI or PCI-X Card" on page 202.)

When the IX-brick is shipped, any card that was ordered is installed with a carrier, and any unoccupied slot is populated with an empty carrier. A carrier must be present in an unpopulated slot to maintain an even airflow through the brick and to protect against electromagnetic interference (EMI).

Technical Specifications

Table 4-1 lists the physical specifications of the IX-brick.

Table 4-1 Physical Specifications of the IX-brick

Characteristics	Specifications
Height	6.64 in. (168.65 mm)
Width	17.5 in. (444.5 mm)
Depth	27.74 in. (704.59 mm)
Weight	65 lb (29.5 kg)
Input Power	+48 VDC (250 watts)

Table 4-2 shows the port specifications of the IX-brick.

Table 4-2 Port Specifications of the IX-brick

Port	Quantity	Connector Type
Power entry	One	21-pin Foxcon
XIO	Two	Proprietary 100-pin dual row
The following connectors are located on the IO9 card:		
SCSI	One external	68-pin VHDCI
Ethernet	One	RJ-45
RT interrupt input and output	One input and one output	Stereo jack
The following connectors are located on the standard IO9 daughtercard (on the right side of the rear panel):		
RS-232 serial	Two	DB-9
The following connectors are located on an optional IO9 daughtercard:		
RS-232 serial	Two	DB-9

PX-brick

The PX-brick is a PCI-X based I/O expansion subsystem that connects I/O devices to your server. The PX-brick supports both PCI and PCI-X protocol. PCI-X protocol enables I/O devices to operate at clock speeds of up to 133 MHz, or 1 GB/s. This protocol also enables I/O devices to operate more efficiently, thereby providing a higher sustained bandwidth at any clock frequency.

This chapter describes the function and physical components of the PX-brick, and it provides guidelines for configuring PCI cards in the brick. Specifically, it includes the following information:

Note: Throughout this chapter, the term "PCI card" refers to cards with PCI or PCI-X capabilities. When necessary, distinctions between the cards are noted.

Note: For information about installing or replacing a PCI card, see "Installing or Replacing PCI or PCI-X Card" on page 202.

Product Overview

The 4U-high PX-brick shown in Figure 5-1 provides 12 card slots to support up to 12 PCI or PCI-X cards. The 12 slots are configured as six 2-slot buses.

Compared to the P-brick, the PX-brick offers the following enhancements:

- The PX-brick supports both PCI cards and PCI-X cards.
- The PX-brick can connect an InfiniteReality graphics pipe to a Cx-brick.

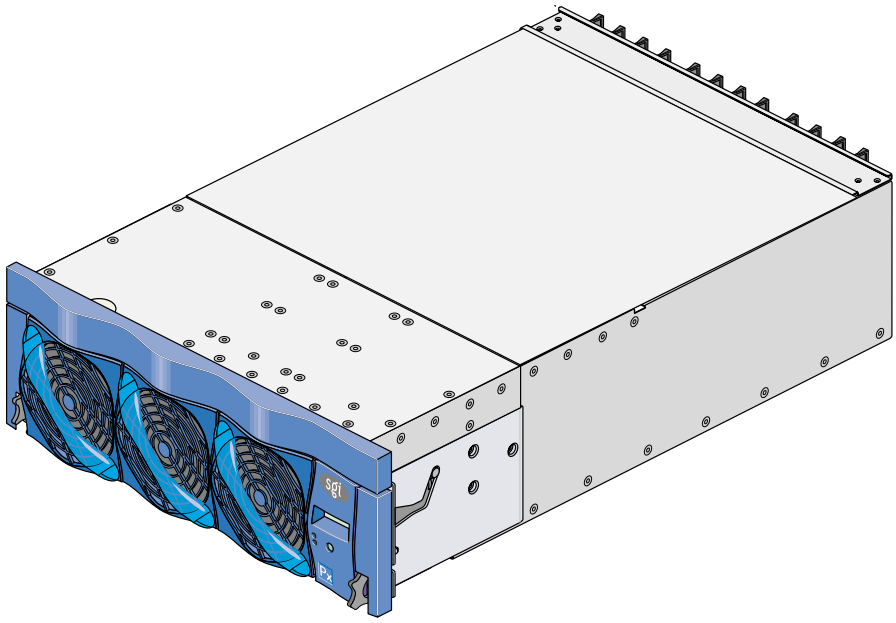

Figure 5-1 Front View of PX-brick

Three PIC (PCI interface chip) ASICs are key components of the PX-brick architecture. The PIC ASICs support the following (see Figure 5-2):

- Two 1200- or 800-MB/s Xtown2 XIO ports. (You can select the MB/s setting with the L1 controller command `XIO`. For more information, see the *SGI L1 and L2 Controller Software User's Guide*.)
- Six PCI/PCI-X buses. Each bus has two card slots in which you can install PCI or PCI-X cards.

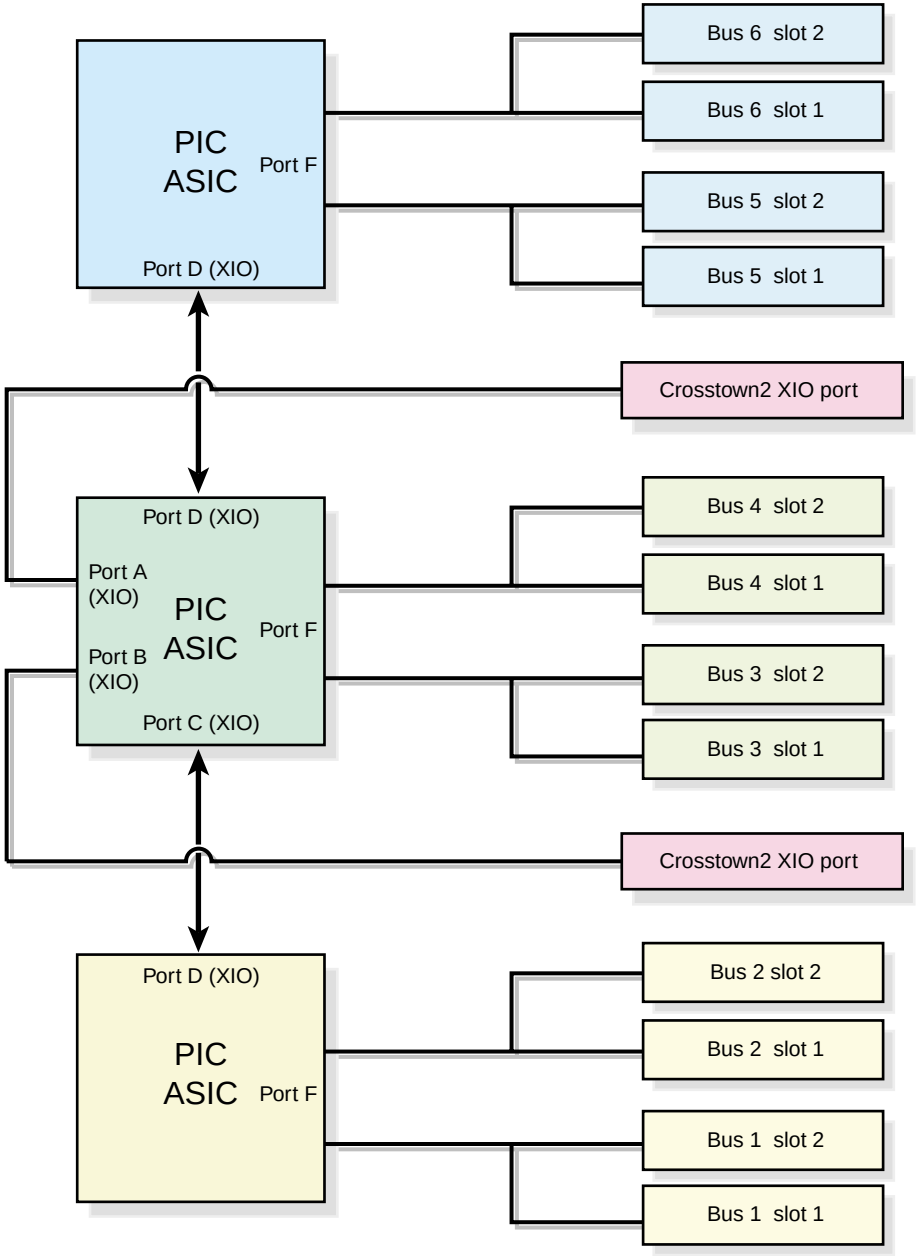

Figure 5-2 PX-brick Block Diagram

External Components

This section describes the external components located on the front and rear panels of the PX-brick.

Front Panel Components

The following are the front-panel components of the PX-brick (see Figure 5-3):

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

  Note: For more information about the L1 controller, see the *SGI L1 and L2 Controller Software User's Guide*.

- **On/Off switch with LED.** Press this button to turn on the internal components of the PX-brick. Alternatively, you can turn on the internal components at an L2 controller touch display or at a system console.
- **LEDs:**
  - **On/Off switch LED.** This green LED illuminates when 48-VDC power is applied to the internal components of the PX-brick.
  - **Service required LED.** This LED illuminates yellow to indicate that a component is broken or is not operating properly (for example, if a fan is off), but the PX-brick is still operating.
  - **Failure LED.** This LED illuminates red to indicate that a system failure has occurred and the PX-brick is not operating.
- **Fans.** Three hot-swappable fans provide the required cooling for your PX-brick.

Warning: To prevent personal injury, or damage to the PX-brick, the hot-swappable fans can be installed only by a trained SGI system support engineer (SSE).

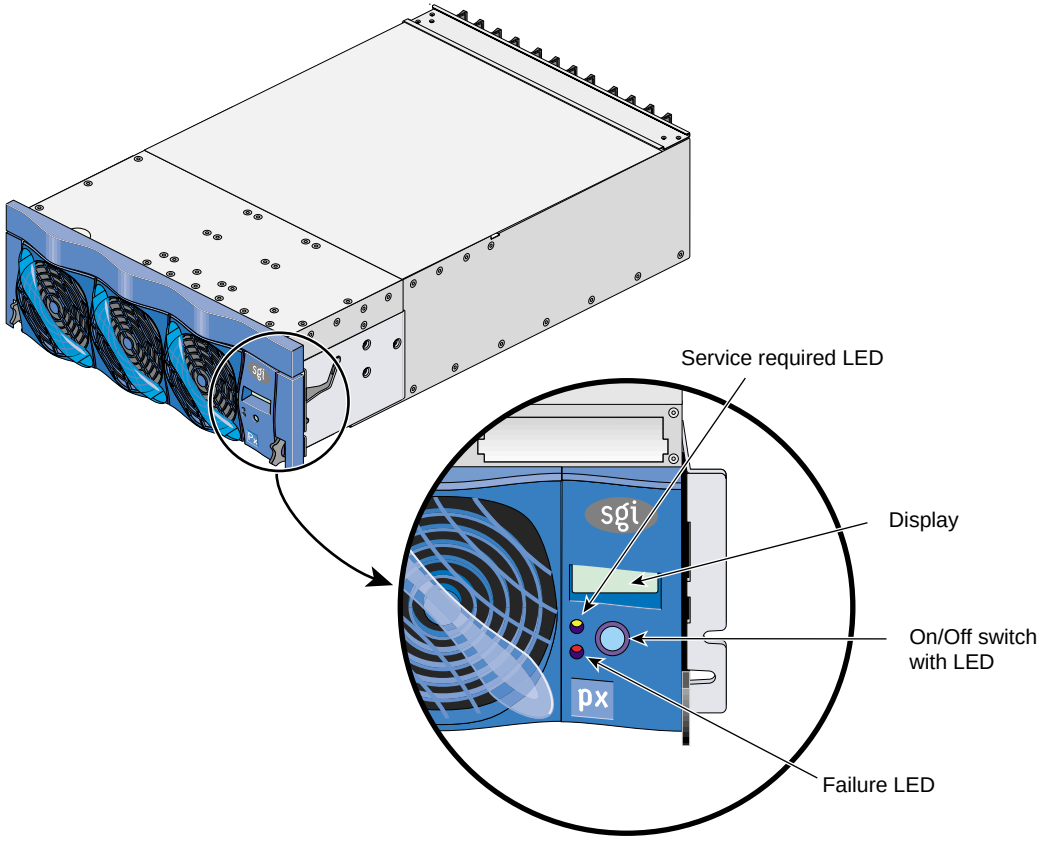

Figure 5-3 Front Panel of PX-brick

Rear Panel Components

The PX-brick has the following rear-panel components (see Figure 5-4):

- **Power switch.** Moving the power switch to the **1** position powers on the L1 controller of the PX-brick, and moving it to the **0** position powers off the L1 controller.
- **12-VDC LED.** The 12-VDC LED illuminates green when the L1 controller is powered on.
- **48-VDC LED.** The power switch must be in the ON (**1**) position for this LED to illuminate. The 48-VDC LED illuminates green when the rest of the PX-brick internal components are powered on.
- **PWR (power) connector.** This connector connects to a power bay, which provides power to the PX-brick.
- **PCI/PCI-X slots.** These slots support PCI or PCI-X cards. The card slots are numbered bus 1 through bus 6. Each bus has two slots, labeled 1 and 2, as shown in Figure 5-5.
- **PCI-X Slot LEDs.** Each slot has the following LEDs:
  - **PWR (power) LED.** This LED illuminates green when the PCI card carrier is installed securely and is receiving power.
  - **Fault LED.** This LED illuminates yellow when a fault occurs with the PCI card.
- **XIO 10 and XIO 11 connectors.** Each connector can connect the PX-brick to one IP53 node board. As an option, the second connector can connect to another IP53 node board to create a dual-ported PX-brick, which provides greater bandwidth.
- **XIO 10 and XIO 11 connector LEDs.** Each connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the PX-brick and the IP53 node board to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the PX-brick and the IP53 node board to which it connects.

Figure 5-4 shows the location of the rear-panel components of the PX-brick.

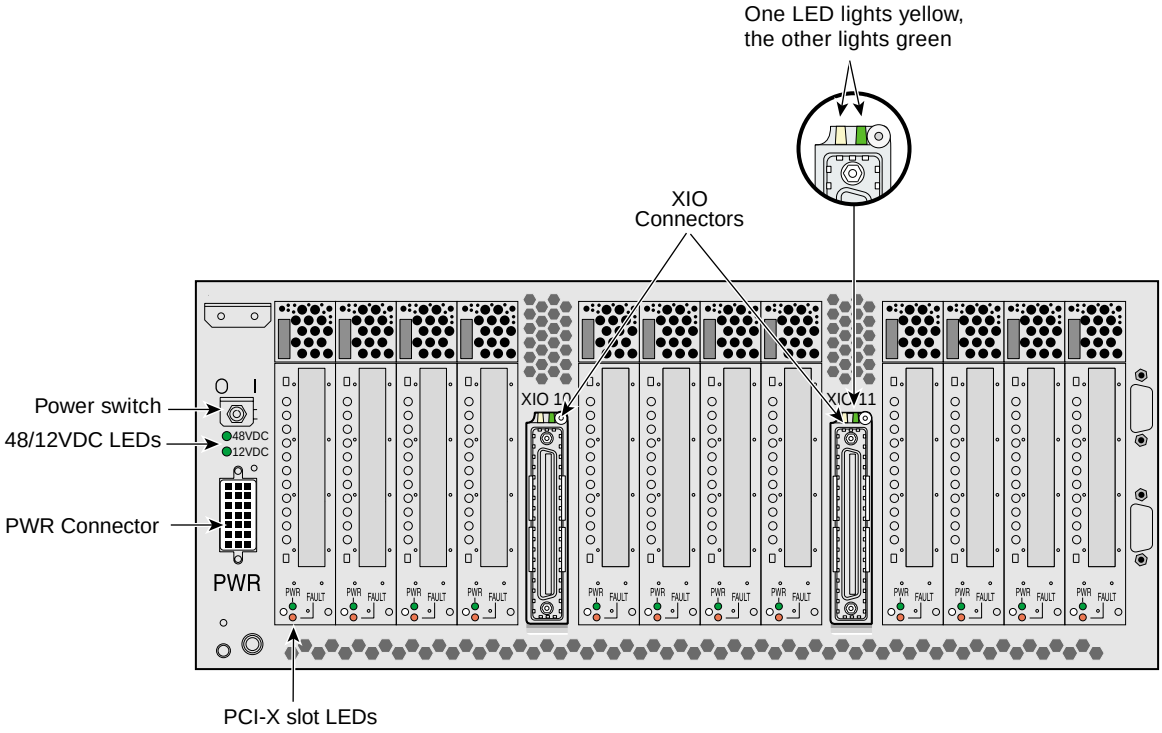

Figure 5-4 Rear Panel of PX-brick

PCI and PCI-X Card Configuration Guidelines

The PCI and PCI-X card slots are numbered bus 1 through bus 6. Each bus has two slots, labeled 1 and 2, as shown in Figure 5-5. Separate buses enable the PX-brick to run cards of different frequencies at the same time. As a result, the same PX-brick can run 133-MHz, 100-MHz, 66-MHz, and 33-MHz cards at the same time.

Each PCI/PCI-X bus supports 32-bit and 64-bit PCI or PCI-X cards at the same time.

For maximum bandwidth, PCI/PCI-X cards are distributed across all six buses when they are integrated at the factory.

This section contains the following information:

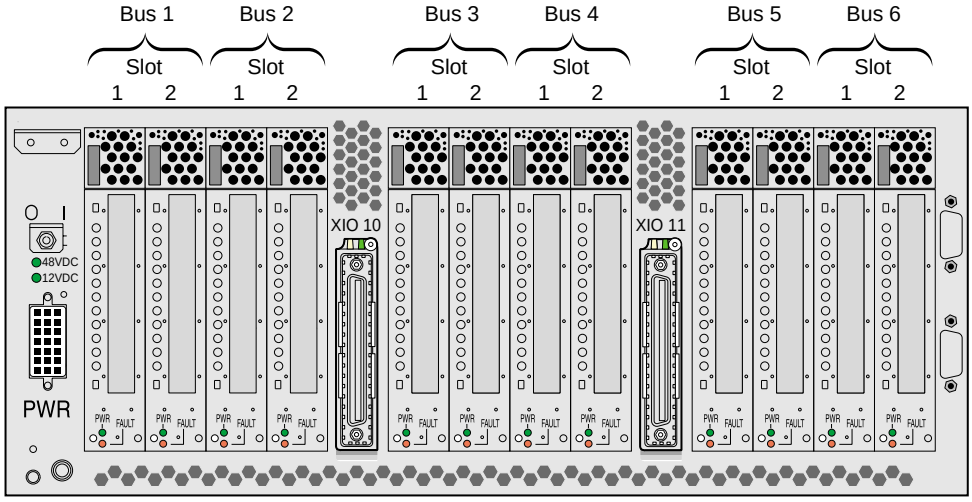

Figure 5-5 Numbering of PX-brick PCI-X Slots

Important Installation Considerations

To maximize the operating efficiency of the PCI cards, consider the following configuration guidelines before you install the cards:

- You can place one or two PCI cards on one bus, or one or two PCI-X cards on one bus.
- You should avoid mixing cards that operate at different frequencies or in different modes. If you have two cards of different speeds on the same bus, both cards operate at the lower speed. If a PCI card and a PCI-X card are on the same bus, both cards operate in PCI mode. Note the following examples:
  - When one 133-MHz PCI-X card resides on a bus, the card operates at 133 MHz in PCI-X mode.
  - When two 133-MHz PCI-X cards reside on a bus, the cards operate at 100 MHz in PCI-X mode.
  - When two 66-MHz PCI-X cards reside on a bus, the cards operate at 66 MHz in PCI-X mode.
  - When two 66-MHz PCI cards reside on a bus, the cards operate at 66 MHz in PCI mode.
  - When one 66-MHz PCI card and one 66 MHz PCI-X card reside on a bus; the cards operate at 66 MHz in PCI mode.
  - When two 33-MHz PCI cards reside on a bus, the cards operate at 33 MHz in PCI mode.
  - When one 66-MHz PCI card and one 33-MHz PCI card reside on the same bus, the cards operate at 33 MHz in PCI mode.

Note: When installing a PCI card, you need to shut down the operating system and power off the PX-brick before installing the card.

Supported PCI and PCI-X Cards

SGI supports various PCI and PCI-X cards. These cards can be purchased from SGI or another manufacturer. Ask your SGI sales representative for a current listing of PCI and PCI-X cards supported by SGI.

PCI Card Carrier

Each PCI card is mounted on a carrier so that you can slide the cards into and out of the brick. This carrier supports most PCI cards; it can be adjusted to accommodate cards of different sizes. (To learn how to adjust a carrier, see "Installing or Replacing PCI or PCI-X Card" on page 202.)

When the PX-brick is shipped, any card that was ordered is installed with a carrier, and any unoccupied slot is populated with an empty carrier. A carrier must be present in an unpopulated slot to maintain an even airflow through the brick and to protect against electromagnetic interference (EMI).

Technical Specifications

Table 5-1 lists the physical specifications of the PX-brick.

Table 5-1 Physical Specifications of PX-brick

Characteristic	Specification
Height	6.64 in. (168.65 mm)
Width	17.5 in. (444.5 mm)
Depth	27.74 in. (704.59 mm)
Weight	60 lb (27.2 kg)
Input power	+48 VDC (225 watts)

Table 5-2 shows the port specifications of the PX-brick.

Table 5-2 Port Specifications of the PX-brick

Port	Quantity	Connector Type
Power entry	One	21-pin Foxcon
XIO	Two	Proprietary 100-pin dual row

X-brick

This chapter describes the function and physical components of the X-brick in the following sections:

Overview

The 4U X-brick is an I/O expansion brick that provides an XIO interface for your SGI Origin 3900 server. This brick has four XIO slots (labeled 1, 2, 3, and 4) that support a variety of XIO adapter cards.

Note: Ask your SGI sales representative for a current listing of XIO cards supported by SGI.

Each XIO slot can support one card with maximum power levels of 50 W.

Warning: Only qualified SGI system support engineers (SSEs) can install and replace XIO cards.

The X-brick also contains two Crosstown2 ports and an Xbridge ASIC. Each Crosstown2 port can connect the X-brick to an IP53 node board. The Xbridge ASIC is the interface between the X-brick's two Crosstown2 ports and the slots for the XIO cards, as shown in Figure 6-1.

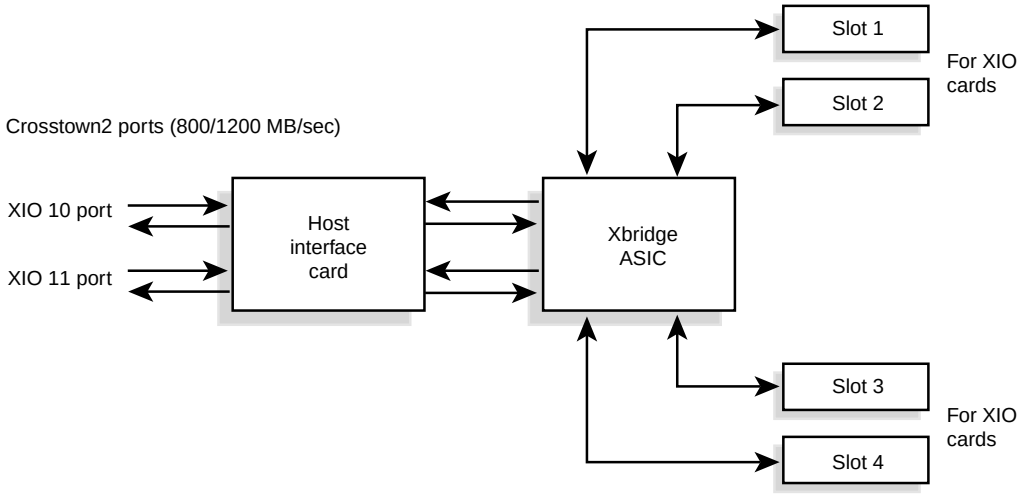

Figure 6-1 X-brick Block Diagram

External Components

This section describes the external components located on the front and rear panels of the X-brick.

Front Panel Components

The X-brick has the following front-panel components (see Figure 6-2):

- **L1 controller display.** This liquid crystal display (LCD) displays status and error messages that the L1 controller generates.
- **On/Off switch with LED.** Press this button to turn on the X-brick internal components. Alternatively, you can turn on the X-brick internal components at a system console.

- **L1 controller switches and LEDs:**
  - **On/Off switch LED.** Illuminates green when the internal components are on.
  - **Service required LED.** Illuminates orange to indicate that an item is broken or not operating properly, but the X-brick is still operating.
  - **Failure LED.** Illuminates red to indicate that a system failure has occurred and the X-brick is not operating.
- **Fans.** Three hot-swappable fans provide the required cooling for the X-brick.

Warning: To prevent personal injury, or damage to the X-brick, the fans can be installed only by a trained SGI system support engineer (SSE).

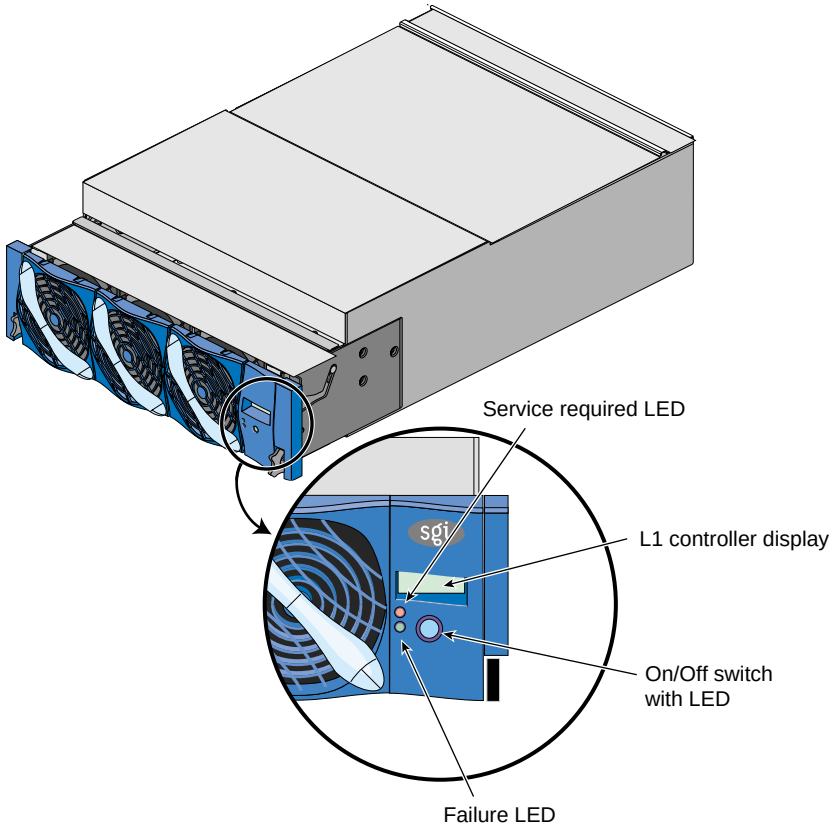

Figure 6-2 Front Panel of X-brick

Rear Panel Components

The X-brick has the following rear-panel components (see Figure 6-3).

- **Power switch.** Moving the power switch to the **1** position powers on the L1 controller of the X-brick, and moving it to the **0** position powers off the L1 controller.
- **12-VDC LED.** The 12-VDC LED illuminates green when the L1 controller is powered on.
- **48-VDC LED.** The power switch must be in the ON (**1**) position for this LED to illuminate. The 48-VDC LED illuminates green when the rest of the X-brick internal components are powered on.
- **PWR (power) connector.** This connector connects to a power bay, which provides power to the X-brick.
- **XIO card slots.** These slots seat the XIO cards. The slots are numbered 1 through 4 as shown in Figure 6-3. Each slot can seat one XIO card with power levels up to 50 W.

Warning: To avoid personal injury or damage to your system, only qualified SGI system support engineers (SSEs) can install and replace XIO cards.

- **XIO 10 and XIO 11 connectors.** Each connector can connect the X-brick to one IP53 node board. As an option, the second connector can connect to another IP53 node board to create a dual-ported X-brick, which provides greater bandwidth.
- **XIO 10 and XIO 11 connector LEDs.** Each connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the X-brick and the IP53 node board to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the X-brick and the IP53 node board to which it connects.

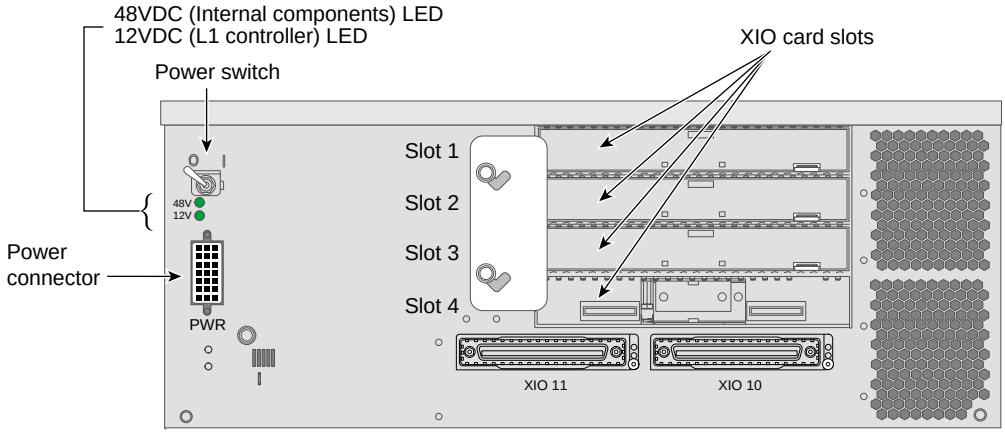

Figure 6-3 Rear Panel of X-brick

Technical Specifications

Table 6-1 lists the technical specifications of the X-brick.

Table 6-1 X-brick Technical Specifications

Characteristic	Specification
Height	6.64 in. (168.65 mm)
Width	17.5 in. (444.5 mm)
Depth	27.74 in. (698.50 mm)
Weight	69 lb (31.29 kg)
Input power	48 VDC (~225 W)

R-brick

This chapter describes the function and physical components of the R-brick in the following sections:

Overview

The R-brick (also referred to as a router brick or metarouter) is a high-speed switch that routes network packets between Cx-bricks. The R-brick consists of eight ports that can connect to Cx-bricks or to other R-bricks.

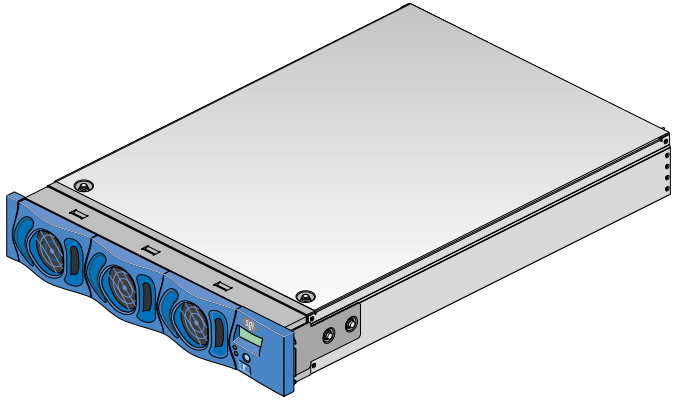

Figure 7-1 R-brick

The R-brick has the following features:

- An 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 7-2). The NUMAlink channels operate at 1.6 GB/s (each direction).
- One USB port for system controller support.
- One L1 controller and LCD display.
- Two hot-pluggable cooling fans.

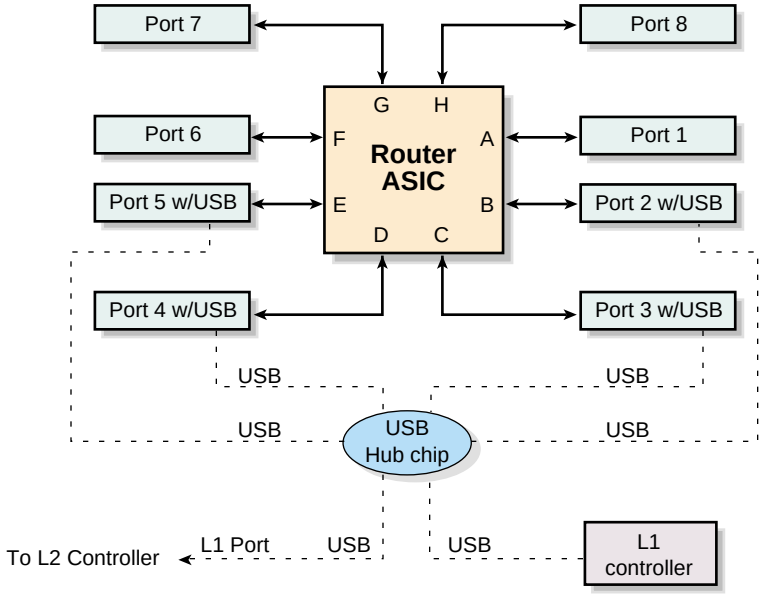

Figure 7-2 R-brick Block Diagram

External Components

This section describes the external components that are located on the front and rear panels of the R-brick.

Front Panel Components

The R-brick contains the following front-panel components (see Figure 7-3):

- **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.
- **On/Off switch with LED.** Press this button to turn on the R-brick internal components. You can also turn on the R-brick internal components at a system console or at the L2 controller touch display.
- **Three LEDs:**
  - On/Off switch LED. This LED illuminates green when the R-brick internal components are on.
  - 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 R-brick is still operating.
  - Failure LED. This LED illuminates red to indicate that a system failure has occurred and the R-brick is not operating.
- **Fans.** Two hot-swappable fans provide N+1 redundant cooling.

Warning: To prevent personal injury, or damage to the R-brick, the hot-swappable fans can be installed only by a trained SGI system support engineer (SSE).

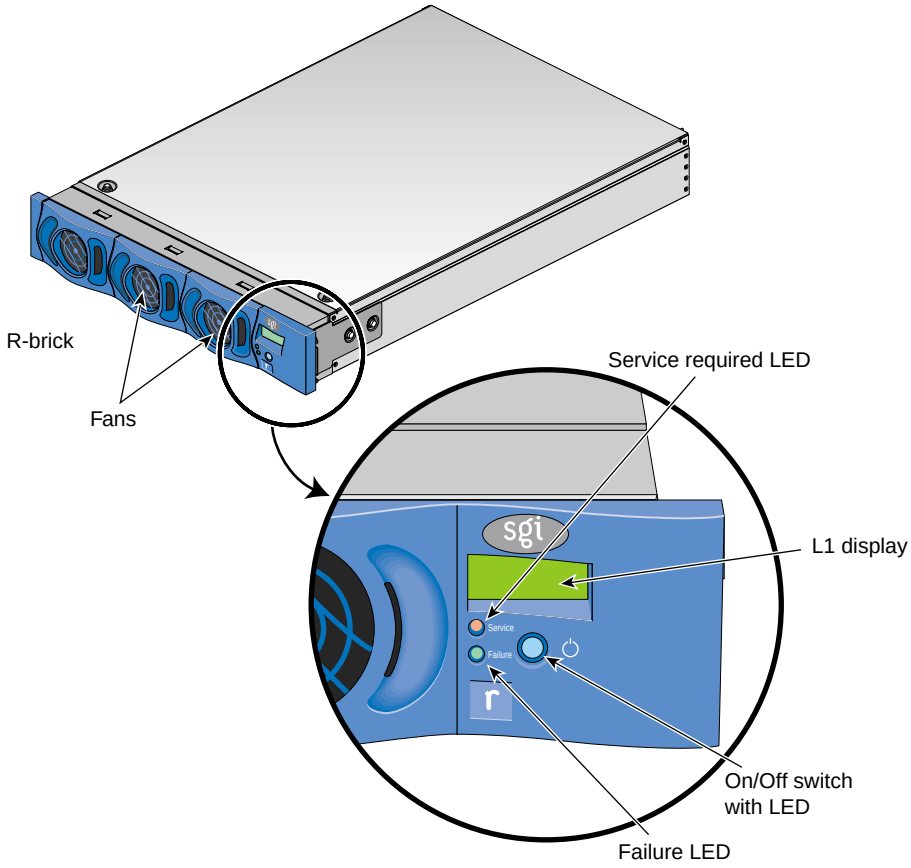

Figure 7-3 Front View of R-Brick

Rear Panel Components

The R-brick has the following rear-panel components (see Figure 7-4):

- **PWR (power) connector.** This connector connects the R-brick to a power bay, which provides 12-VDC and 48-VDC power to the R-brick.
- **Power switch.** Move the power switch to the **1** position to power on the L1 controller within the R-brick, and to the **0** position to power off the L1 controller.
- **48-VDC and 12-VDC LEDs.** The power switch must be in the ON (**1**) position for these LEDs to be on. The 12-VDC LED illuminates green when the L1 controller is powered on. The 48-VDC LED illuminates green when the rest of the R-brick internal components are powered on.
- **Links R TO R connectors** (1, 6, 7, and 8, or A, F, G, and H). These link connectors connect the R-brick to other R-bricks or Cx-bricks in the network fabric.
- **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 R-brick to other R-bricks or Cx-bricks in the network fabric.
- **Link connector LEDs.** Each NUMAlink connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the R-brick and the brick to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the R-brick and the brick to which it is connected.
- **L1 port connector.** This connector connects the internal USB hub of the R-brick 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 internal L1 controller of the R-brick.

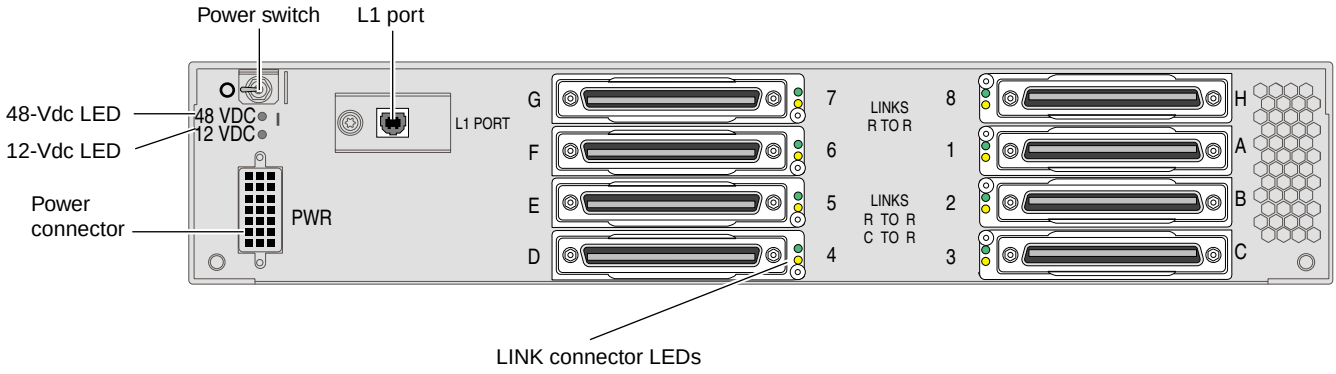

Figure 7-4 Rear View of R-Brick

Technical Specifications

Table 7-1 lists the technical specifications of the R-brick.

Table 7-1 R-brick 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	48 VDC (~ 60 W)

Table 7-2 lists the specifications of the R-brick ports.

Table 7-2 R-brick Port Specifications

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

System Control

The Origin 3900 server has two levels of control, as follows:

- **L1 controller.** The L1 controller is a brick-level controller. All Origin 3900 bricks have an L1 controller with the exception of the TP900 and D-brick2 storage modules. The functionality of the L1 controller varies slightly by brick.
- **L2 controller.** The L2 controller is a rack-level controller for racks that contain Cx-bricks and/or R-bricks. The L2 controller allows remote maintenance, controls resource sharing, controls the L1 controllers in the system, and maintains controller configuration and topology information between itself and other L2 controllers.

The L1 controllers, which are located within the bricks, are slave devices to the L2 controller.

Note: The D-brick2, which is not monitored by the L2 controller, has its own ESI/ops panel module with a microcontroller for monitoring and controlling all elements of the D-brick2.

This chapter describes the functions of system controllers, in the following sections:

The controllers communicate with each other in the following ways:

- An L1 controller of an I/O brick (for example, IX-, PX-, X-, N-, or V-brick) communicates with an L2 controller via a Cx-brick.
- An L1 controller of a Cx-brick can communicate with the L2 controller in the following ways:
  - Via the L1 port directly or via the L1 port and a USB hub.
  - Via Port F; this port connects to a Cx-brick that connects to the L2 controller.
- An L1 controller of a G-brick communicates with the L2 controller via the L1 port and a USB hub.
- An L1 controller of an R-brick communicates with the L2 controller directly or via a USB hub.
- An L2 controller communicates with other L2 controllers via an Ethernet hub.

Figure 8-1 illustrates the connections between the L1 and L2 controllers.

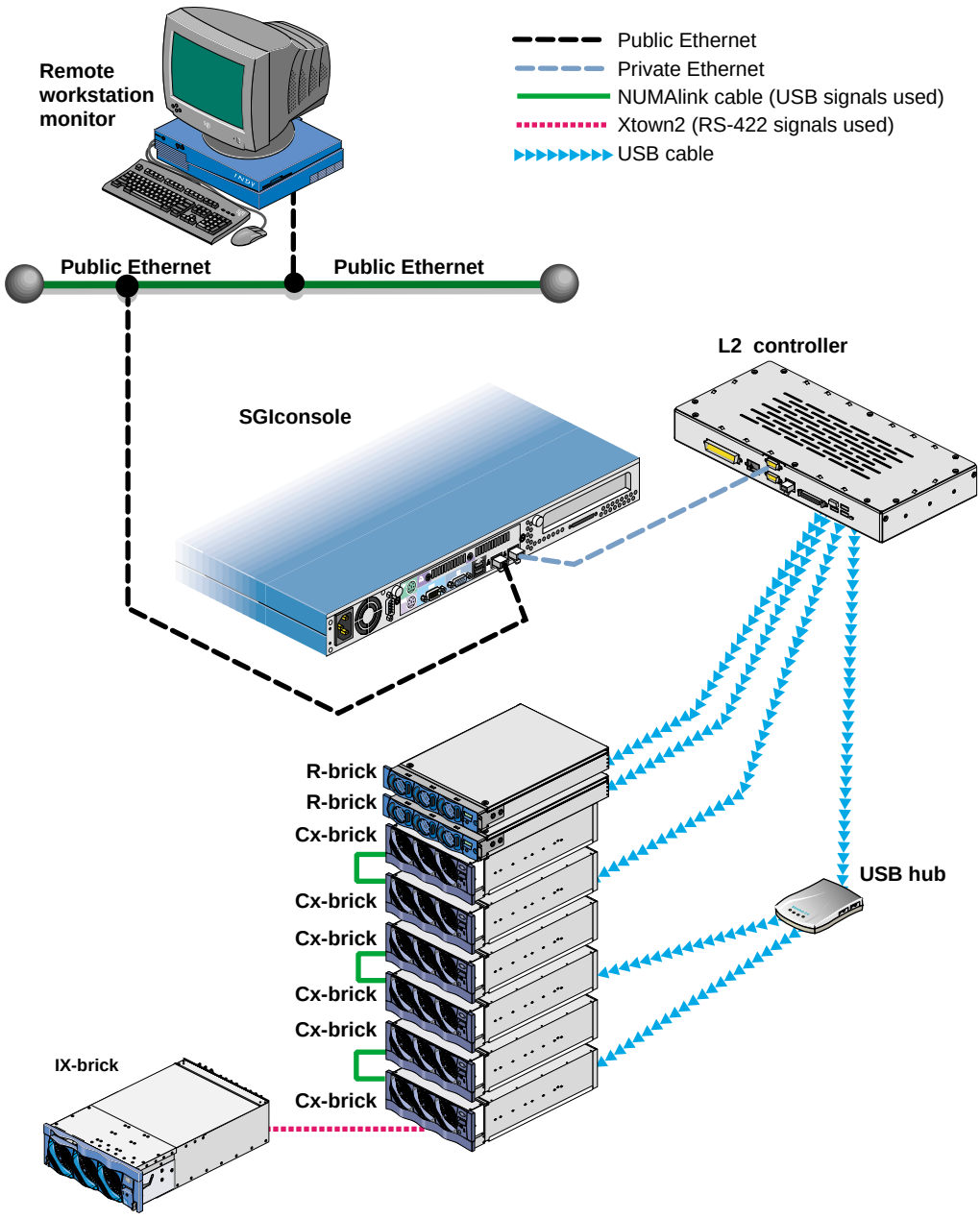

Figure 8-1 Origin 3900 System Control Network (Example)

L1 Controller

All bricks except TP900 storage modules and D-brick2 storage modules have L1 controllers. The following subsections describe the basic features of all L1 controllers:

- "L1 Controller Functions" on page 106
- "L1 Front Panel Display" on page 108

Note: For L1 controller commands, see the *SGI L1 and L2 Controller Software User's Guide* (007-3938-*xxx*).

L1 Controller Functions

Table 8-1 summarizes the control and monitoring functions that the L1 controller performs. Many of the L1 controller functions are common across all brick types; however, some functions are applicable to a specific brick type.

Table 8-1 L1 Controller Functions

Function	Cx-brick	R-brick	I/O bricks (IX, PX, X)	Graphics bricks (G, N, V)
Controls voltage regulator modules (VRMs).	X	X	X	X
Controls voltage margining within the brick.	X	X	X	X
Controls and monitors fan speed.	X		X	X
Monitors voltage and reports failures.	X	X	X	X
Monitors and reports operating temperature and status of 48-VDC input power.	X	X	X	X
Monitors and controls LEDs.	X	X	X	X
Reads system identification (ID) PROMs.	X	X	X	X
Monitors the On/Off power switch.	X	X	X	X
Monitors the reset switch and the nonmaskable interrupt (NMI) switch.	X			
Reports the population of the PCI or XIO cards and the power levels of the card slots.			X	
Powers on the card slots and their associated LEDs.			X	

L1 Front Panel Display

The front panel display of the L1 controller contains the following items (see Figure 8-2):

- 2 x 12 character liquid crystal display (LCD). The display uniquely identifies the brick, shows system status, warns of required service, and identifies a failed component.
- On/Off switch with LED (button with light-emitting diode [LED]). This button enables you to manually power on and power off the brick. The LED illuminates when the brick is powered on.
- Service required LED. This LED illuminates orange to indicate that an item is not functioning properly (for example, a fan is off), but the brick is still operating.
- Failure LED. This LED illuminates red to indicate that a failure has occurred and the brick is down.
- Reset switch. This switch resets the Cx-brick internal processors and ASICs. This reset will cause a memory loss.
- Non-maskable interrupt (NMI) button switch. This switch resets the Cx-brick internal processors and ASICs and writes the contents of the registers and memory to a `/var/adm/crash` file.

Note: The reset and NMI switches are available on the Cx-brick only.

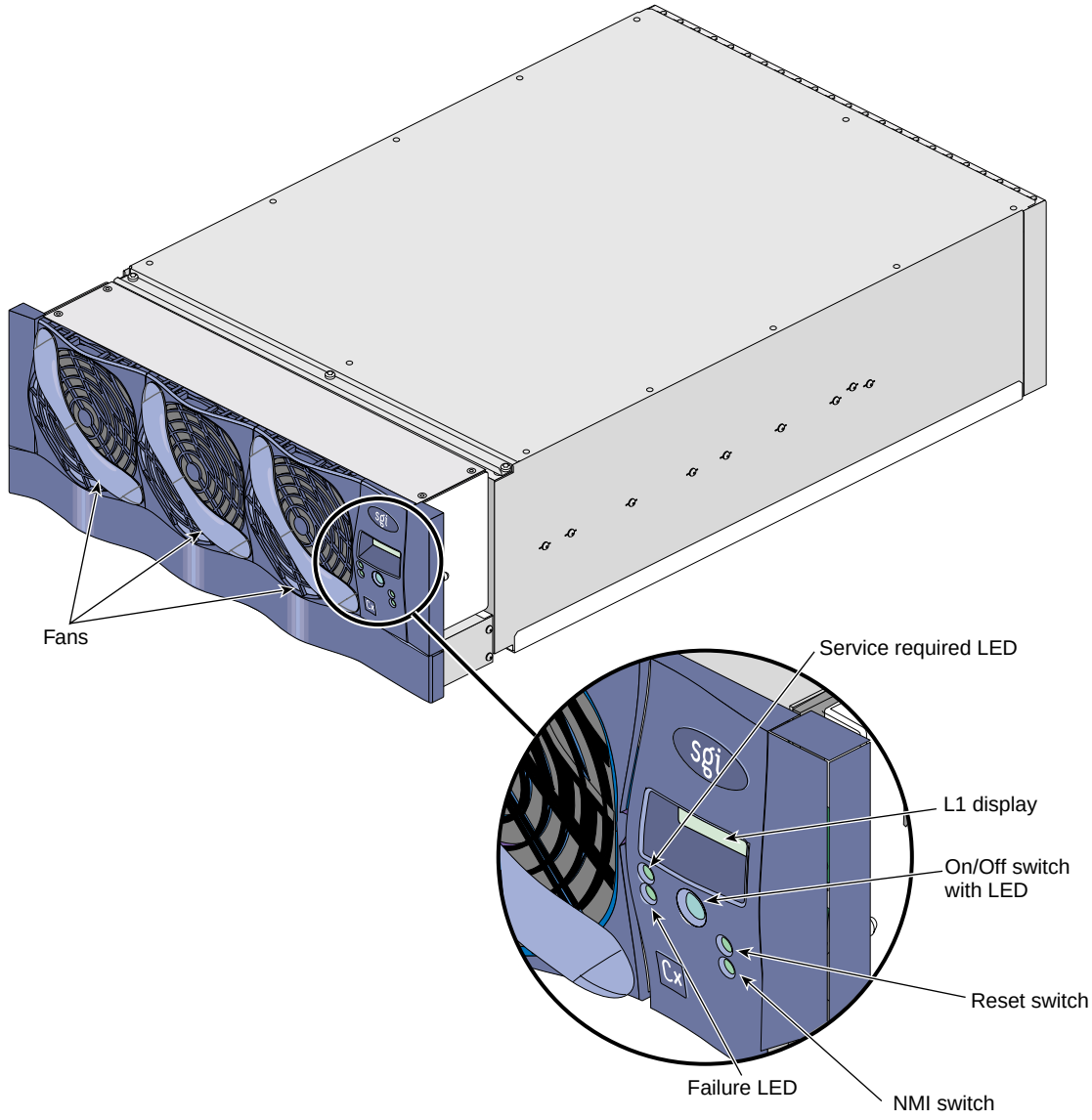

Figure 8-2 Front Panel of L1 Controller

Operating L1 Controller

The L1 controller operates in one of two modes: L1 mode or console mode. In L1 mode, the L1 prompt is visible and all input is directed to the L1 command processor. In console mode, the output from the system is visible and all input is directed to the system.

Note: Console mode is supported only if the system console is connected directly to the console port of a Cx-brick. Under normal conditions, the system console is connected to the L2 controller.

L1 Mode

If you see a prompt of the following form, the L1 is ready to accept commands.

```
001c07-L1>
```

Common operations are discussed in the following sections:

- "Viewing System Configuration" on page 111
- "Targeting Commands" on page 112
- "Viewing Information, Warnings, and Error Messages" on page 112
- "Powering On, Powering Off, and Resetting Brick" on page 113

Viewing System Configuration

An L1 controller has limited knowledge of the system configuration. A Cx-brick only has information about its attached I/O brick and, if another Cx-brick is attached to it, information about that Cx-brick and its attached I/O brick. An I/O brick only has information about its attached Cx-brick. An R-brick only has information about itself.

You can view a brick's configuration information with the `config` command:

```
001c07-L1> config
:0 - 001c07
:1 - 001i23
:2 - 001p11
001c07-L1>
```

This example is a system with one Cx-brick and two I/O-bricks. The <*number*> that follows the colon (0, 1, 2, and 3, from top to bottom in this example), refers to the L1 connection relative to the local brick. (The local brick is the brick that is processing the command.) For example, ":0" is the local brick. A number greater than 0 indicates that it is attached directly to or indirectly to the local brick.

Targeting Commands

All commands entered affect only the local brick. You can target a command to all bricks (including the local brick) by prefixing the command with an asterisk (*).

```
001c07-L1> * version
001c07:
L1 0.7.37 (Image A), Built 11/24/2001 14:59:42 [2MB image]
001i23:
L1 0.7.37 (Image A), Built 11/24/2001 14:59:42 [2MB image]
001c11:
L1 0.7.37 (Image A), Built 11/24/2001 14:59:42 [2MB image]
001x15:
L1 0.7.37 (Image A), Built 11/24/2001 14:59:42 [2MB image]
001c07-L1>
```

You can target commands to a single brick by using its rack and slot number in the form '<rack>.<slot> <command>':

```
001c07-L1> 1.11 version
001i23:
L1 0.7.37 (Image A), Built 05/24/2001 14:59:42 [2MB image]
```

You can also target commands to a single attached brick with either the `nia, nib, iia, or iib` command:

```
001c07-L1> iia version
001i23:
L1 0.7.37 (Image A), Built 05/24/2001 14:59:42 [2MB image]
```

Viewing Information, Warnings, and Error Messages

All information, warnings, and error messages generated by any of the system controllers are in the following form:

```
001c07 ERROR: invalid arguments for 'ver' command, try "help ver"
```

The general format of the message includes a brick identification (this is not present if the command was sent to the local brick only), type of message, and the message. These messages can be the result of an invalid command (as shown in the example) or from tasks running on the L1 controller, such as the environmental monitor.

Each L1 controller has a log of local events. Use the L1 command `log` to view the event on any of the L1 controllers.

Powering On, Powering Off, and Resetting Brick

You can power on, power off, or reset a brick with L1 commands. The L1 command to power on a brick is power up or pwr u. The L1 command to power off a brick is power down or pwr d. The L1 command to reset a brick is reset.

When you prefix the power up, power down, or reset command with an asterisk (*), you can power on, power off, or reset the entire system.

```
001c07-L1> * power up
001c07-L1>
```

Note: These commands can require from several seconds to several minutes to complete.

Console Mode

In console mode, output from the system is visible and all input is directed to the system.

To enter console mode, press `Ctrl+D` at the L1 prompt:

```
001c07-L1> Ctrl+D
entering console mode 001c07 console, <CTRL-T> to escape to L1
.
<system output appears here>
.
```

To return to L1 mode, press `Ctrl+T`:

```
Ctrl+T
escaping to L1 system controller
001c07-L1>
```

While in L1 mode, you can enter any L1 command. Once the command is executed, the L1 returns to console mode:

```
re-entering console mode 001c07 console, <CTRL-T> to escape to L1
```

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

```
Ctrl+T
escaping to L1 system controller
001c07-L1> l1
L1 command processor engaged, <CTRL-D> for console mode.
001c07-L1>
```

Console Selection

The brick with which the L1 controller communicates in console mode is the system console or global master, and you can view and set it with the `select` command. By default, the Cx-brick attempts to communicate with its local CPUs when console mode is entered. If the system has been powered on and one of the bricks receives a request to be the system console, then the Cx-brick attempts to communicate with that brick. The `select` command by itself shows the current console mode settings:

```
001c07-L1> select
console input: 001c07 console0
console output: not filtered.
```

The following common subchannels are associated with console communications:

- Subchannel 0A specifies Node 0, CPU A.
- Subchannel 0B specifies Node 0, CPU B.
- Subchannel 0C specifies Node 0, CPU C.
- Subchannel 0D specifies Node 0, CPU D.
- Subchannel 1A specifies Node 1, CPU A.
- Subchannel 1B specifies Node 1, CPU B.
- Subchannel 1C specifies Node 1, CPU C.
- Subchannel 1D specifies Node 1, CPU D.
- Subchannel 2A specifies Node 2, CPU A.
- Subchannel 2B specifies Node 2, CPU B.
- Subchannel 2C specifies Node 2, CPU C.
- Subchannel 2D specifies Node 2, CPU D.
- Subchannel 3A specifies Node 3, CPU A.
- Subchannel 3B specifies Node 3, CPU B.
- Subchannel 3C specifies Node 3, CPU C.
- Subchannel 3D specifies Node 3, CPU D.
- Node 0 console subchannel.
- Node 1 console subchannel.
- Node 2 console subchannel.
- Node 3 console subchannel.

The output `console input: 001c07 console0` shows that the L2 controller will send console input to brick 001c07 and the subchannel to be used is the console subchannel on node 0.

To change system console from one Cx-brick to another, use the `select` <rack> <slot> command:

```
001c07-L1> select r 2 s 7
console input: 002c07 console0
console output: not filtered.
001c07-L1>
```

To change the subchannel used on the selected brick, use the `select` command followed by the subchannel number or the word `console` followed by a node number:

```
001c07-L1> select sub 0A
console input: 001c07 CPU 0A
console output: not filtered.
001c07-L1>
```

Note: See the bulleted list in "Console Selection" on page 114 for valid subchannels.

During the boot process on a multi-rack system, there is a window of time in which all Cx-bricks are producing output. This output can produce a somewhat jumbled output at the L1 controller. However, you can filter the console output so that the L1 controller shows output from only the brick chosen to receive console input. You can turn filtering on and off with the `select filter` command.

If you attempt to communicate with a brick that is not responding, a time-out condition results:

```
001c07-L1>

entering console mode 001c07 console, <CTRL-T> to escape to L1
no response from 001c07 junk bus console UART:UART_TIMEOUT
```

When this time-out condition occurs, either the brick is hung or the subchannel is incorrect.

L2 Controller

The L2 controller, which is a standard component of the Origin 3900 server, is a single-board computer that runs an embedded operating system out of flash memory. It performs the following functions:

- Controls resource sharing.
- Controls all L1 controllers.
- Maintains controller configuration and topology information between the L1 and L2 controllers.
- Routes data between upstream devices and downstream devices.

  Upstream devices (for example, rack display, console, and modem) 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, the USB hub of the R-brick, and L1 controllers of the bricks) 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.
- Allows remote maintenance via a modem.

In a system with more than one L2 controller, all L2 controllers are peers. Each L2 controller monitors its associated L1 controllers and propagates this information to the other L2 controllers via the Ethernet.

Note: For L2 controller commands, see the *SGI L1 and L2 Controller Software User's Guide* (007-3938-*xxx*).

The printed circuit assembly (PCA) of the L2 controller is housed in a sheet metal box that is 1U high and is located at the top of the rear of the racks that contain Cx-bricks and/or R-bricks. (It does not use configurable rack space.) The L2 controller has the following connectors:

- **Power connector** connects to a power bay.
- **RS-485 connector** is not used.
- **Two RS-232 ports** (DB-9): one port can connect to a console and the other port can connect to a modem.
- **10BaseT Ethernet port** can connect to an Ethernet hub.
- **Rack display port** can connect the rack display.
- **Four USB ports** can connect to R-bricks and/or Cx-bricks (directly or via USB hubs).

Figure 8-3 shows the connectors at the rear of the L2 controller.

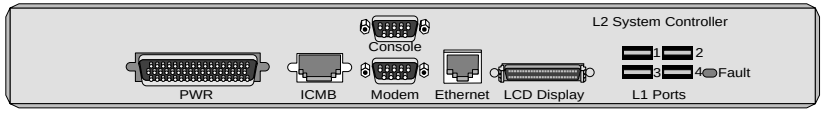

Figure 8-3 L2 Controller Connectors

The L2 controller connects to a modem through the RS-232 connector that is labeled Modem on the back of the L2 controller. This connection provides a means of connecting remote support hardware to the system.

The preferred method of connecting remote support hardware to a system is via an Ethernet hub. The Ethernet hub provides eight Ethernet connectors. Figure 8-4 shows sample connections between the Ethernet hub, L2 controllers, and an SGIconsole.

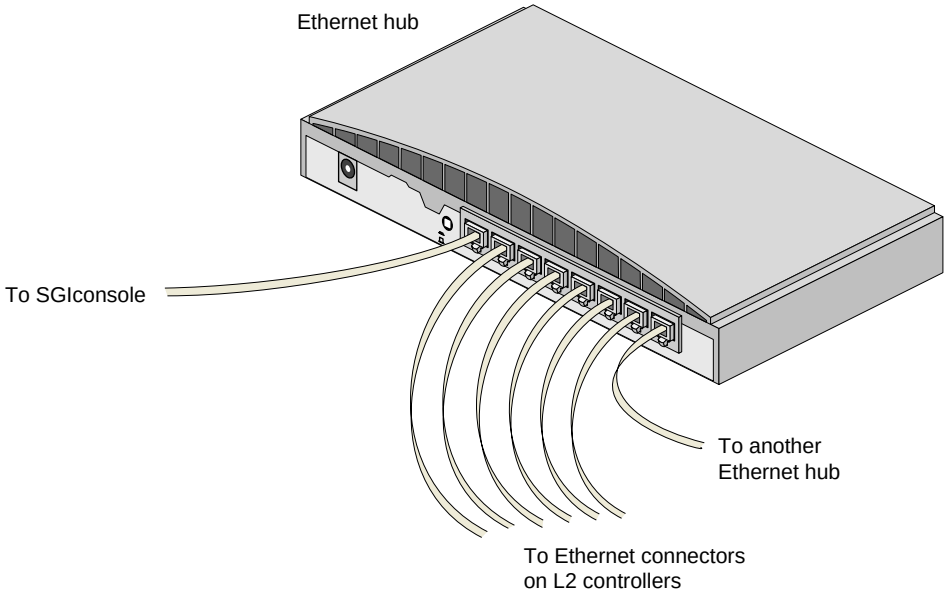

Figure 8-4 Ethernet Hub Connections (Example)

The L2 controller also consists of a touch display that is located on the front door of rack 001. This display (see Figure 8-5) is a touch-pad LCD (liquid crystal display) screen display. The L2 controller's touch-screen translates what the user touches into commands and displays the results of the commands.

The display has a contrast control that enables you to increase or decrease the contrast of the displayed information. Sliding the contrast control to the right increases the contrast.

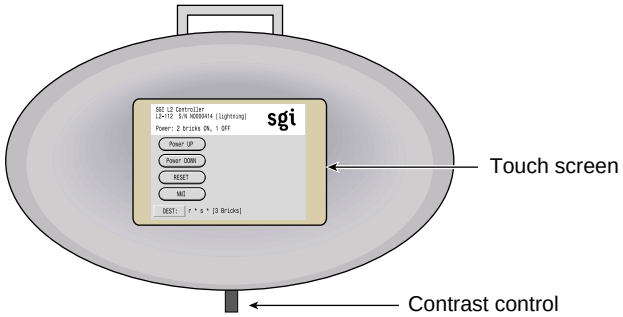

Figure 8-5 L2 Touch Display

The L2 controller touch display provides a simple graphical interface that enables you to perform basic functions, including the following:

- Power up selected bricks or the entire system
- Power down selected bricks or the entire system
- Reset the system
- Send a non-maskable interrupt (NMI) to the system
- Select target destination(s)

The display consists of several different windows, which are discussed in the following sections:

Home Window

The home window of the L2 controller touch display, shown in Figure 8-6, includes five buttons: **Power UP**, **Power DOWN**, **RESET**, **NMI**, and **DEST:**.

Power UP Button

The **Power UP** button powers on a single brick, multiple bricks, a partition, multiple partitions, or an entire system. The DEST: field indicates which bricks are powered on. See "Power Up Confirmation Window" on page 122 for information on using the **Power UP** button.

Power DOWN Button

The **Power DOWN** button powers off a single brick, multiple bricks, a partition, multiple partitions, or an entire system. The DEST: field indicates which bricks are powered off. See "Power Down Confirmation Window" on page 123 for information on using the **Power DOWN** button.

RESET Button

The **RESET** button resets partitions. If you issue a `reset` command to a partition, the main memory is cleared and the registers are set to default values in all bricks within the targeted partition(s). For systems that contain multiple partitions, single or multiple partitions can be reset without affecting the entire system. If you issue a `reset` command to a single brick within a partition, the entire partition is reset. See "Reset Confirmation Window" on page 124 for information on using the **RESET** button.

NMI Button

The **NMI** button issues a non-maskable interrupt command to a brick, multiple bricks, a partition, or multiple partitions. When the system hangs, you can send the affected brick or partition an NMI interrupt via the L2 console. The interrupt goes to PROM and causes the CPU state to be captured for each targeted Cx-brick. This information is saved in flash PROM and the system log. This information assists SGI technicians in debugging system hangs and customer problems. See "NMI Confirmation Window" on page 125 for information on using the **NMI** button.

DEST: Button

The **DEST:** button sets the target destinations for the `power up`, `power down`, `reset`, and `nmi` commands. The text to the right of the **DEST:** button shows the current target destination. The target destination in Figure 8-6 is all racks and all slots (r * s *). Therefore, a `power up`, `power down`, `reset`, or `nmi` command is sent to all bricks in the system. The text ([57 Bricks]) indicates the number of bricks that will be affected by the command. See "Destination Selection Window" on page 127 for information on using the **DEST:** button.

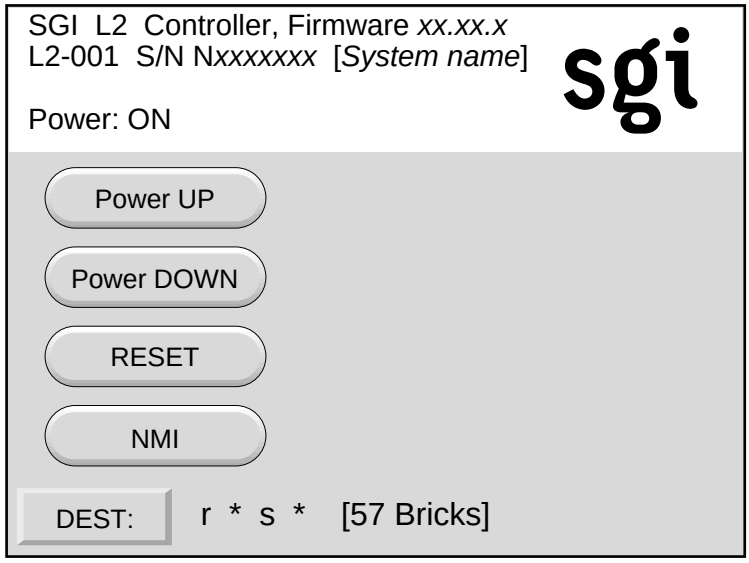

Figure 8-6 Home Window

Power Up Confirmation Window

If you press the **Power UP** button in the home window, the power up confirmation window appears, as shown in Figure 8-7.

To initiate the `power up` command, press the **OK** button. To terminate the command, press the **Cancel** button. The confirmation window stays visible until the command is successfully executed. An unsuccessful command results from an L1/L2 error in processing the command or a time-out while waiting for a response.

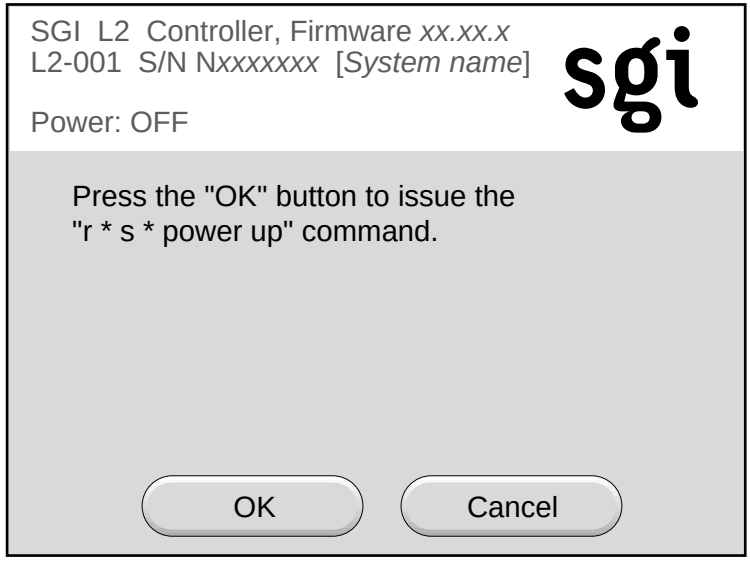

Figure 8-7 Power Up Confirmation Window

The `power up` command affects only the list of bricks identified in the destination field. To set or change the target list, press the **Cancel** button to return to the home window. Then press the **DEST:** button to change the target list. See "Destination Selection Window" on page 127 for instructions on using the **DEST:** button.

Power Down Confirmation Window

If you press the **Power DOWN** button in the home window, the power down confirmation window appears, as shown in Figure 8-8.

To initiate the `power down` command, press the **OK** button. To terminate the command, press the **Cancel** button. The confirmation window stays visible until the command is successfully executed. An unsuccessful command results from an L1/L2 error in processing the command or a time-out while waiting for a response.

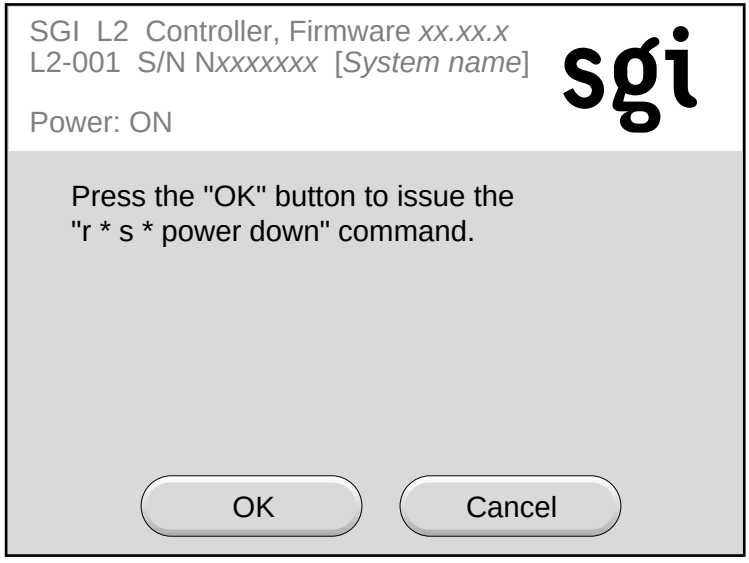

Figure 8-8 Power Down Confirmation Window

The `power down` command affects only the list of bricks identified in the destination field. To set or change the target list, press the **Cancel** button to return to the home window. Then press the **DEST:** button to change the target list. See "Destination Selection Window" on page 127 for instructions on using the **DEST:** button.

Reset Confirmation Window

If you press the **RESET** button in the home window, the reset confirmation window appears, as shown in Figure 8-9.

To initiate the `reset` command, press the **OK** button. To terminate the command, press the **Cancel** button. The confirmation window stays visible until the command is successfully executed. An unsuccessful command results from an L1/L2 error in processing the command or a time-out while waiting for a response.

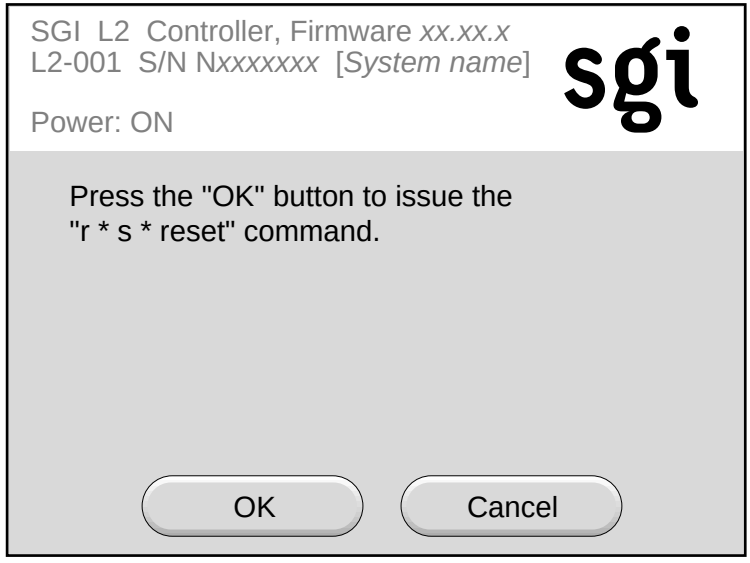

Figure 8-9 Reset Confirmation Window

Note: The `reset` command affects all bricks in the targeted partition(s). The target list is not enforced during the processing of a `reset` command.

NMI Confirmation Window

If you press the **NMI** (non-maskable interrupt) button in the home window, the NMI confirmation window appears, as shown in Figure 8-10.

To initiate the `nmi` command, press the **OK** button. To terminate the command, press the **Cancel** button. The confirmation window stays visible until the command is successfully executed. An unsuccessful command results from an L1/L2 error in processing the command or a time-out while waiting for a response.

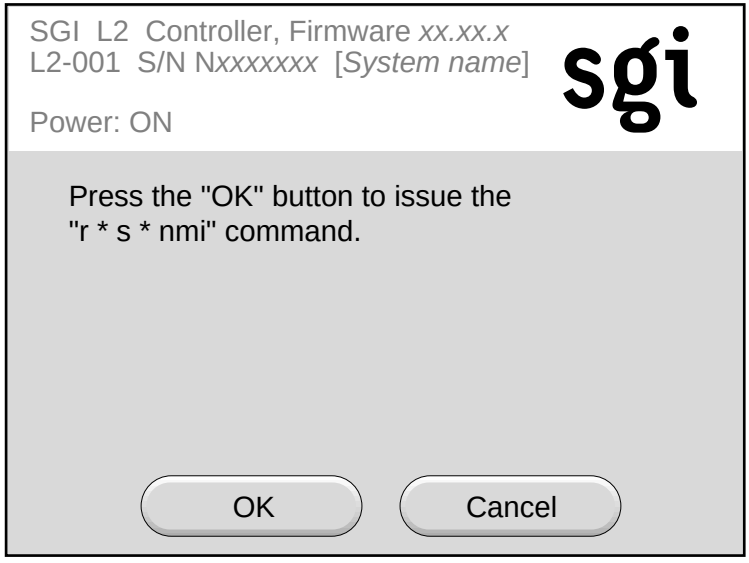

Figure 8-10 NMI Confirmation Window

Command Error/Timeout Window

The command error/time-out window, shown in Figure 8-11, appears when an unsuccessful command results in an L1/L2 error in processing the command or a time-out occurs while waiting for a response. The command error/timeout window appears in the main body of a command confirmation window. The content of the error message varies, depending on the type of error.

Figure 8-11 Command Error/Timeout Window

Destination Selection Window

If you press the **DEST:** button in the home window, the destination selection window appears, as shown in Figure 8-12. Use this window to select which bricks in the system will be affected by a command initiated from the home window. A brick is referenced by its rack and slot (unit) number.

Targeting all Racks and All Bricks

To select all racks and all slots, press the **ALL** button. To scroll the rack list and brick list (not shown in Figure 8-12), press the arrow buttons below the **Partition** button on the display. The scroll buttons are active only when the number of racks exceeds the available space to display them.

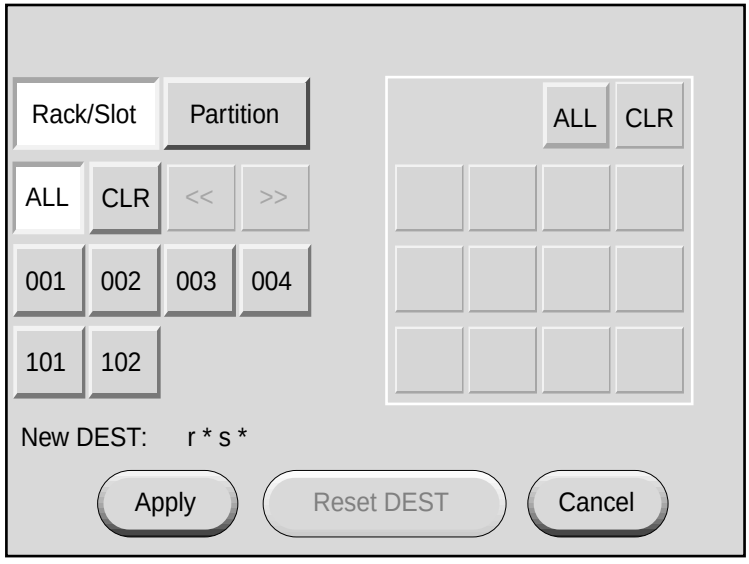

Figure 8-12 Targeting All Bricks in System

Once you have selected the bricks, press the **Apply** button to set the new destinations. The home window will then reappear. The new destinations are reflected in the destination field across the bottom of the home window display. See Figure 8-6 on page 121.

Before pressing the **Apply** button to set the new destinations, you can reset the destination window to the last applied state by pressing the **Reset DEST** button. The destination selection window will then revert back to the last applied status.

Targeting Single Brick

To select a single brick within a rack, see Figure 8-13 and follow these steps:

1. Press the **Rack/Slot** button.
2. Press the button for the rack (for example, Figure 8-13 shows rack 001 selected).
3. Press the button for the slot (for example, Figure 8-13 shows the brick in slot 031 selected).

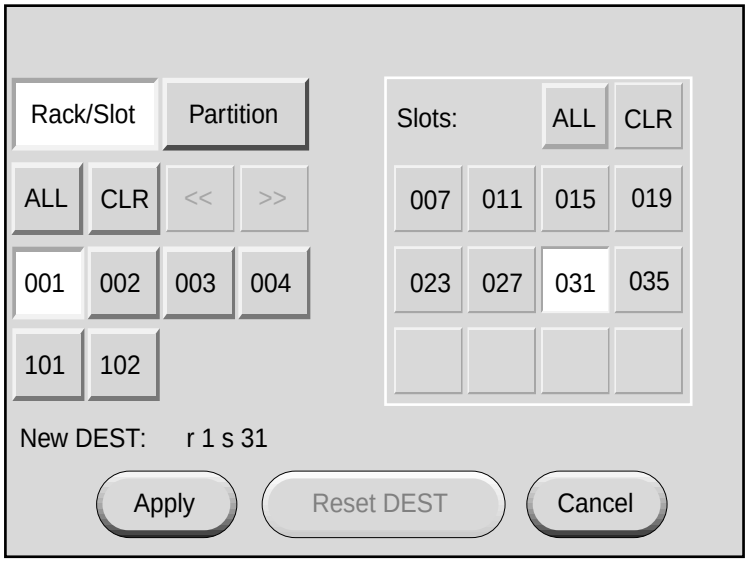

Figure 8-13 Targeting Single Brick

The new destination is reflected in the destination field near the bottom of the display window. For example, Figure 8-13 shows rack 001, slot 031 (r1 s31) as the destination.

Once you have selected the bricks, press the **Apply** button to set the new destinations. The home window will then reappear. The new destinations are reflected in the destination field across the bottom of the home window display.

Targeting Range of Bricks

To select multiple bricks within a rack, see Figure 8-14 and follow these steps:

1. Press the **Rack/Slot** button.
2. Press the button for the rack (for example, Figure 8-14 shows rack 001 selected).
3. Press the buttons for the desired slots (for example, Figure 8-14 shows the bricks in slots 015, 019, and 031 selected).

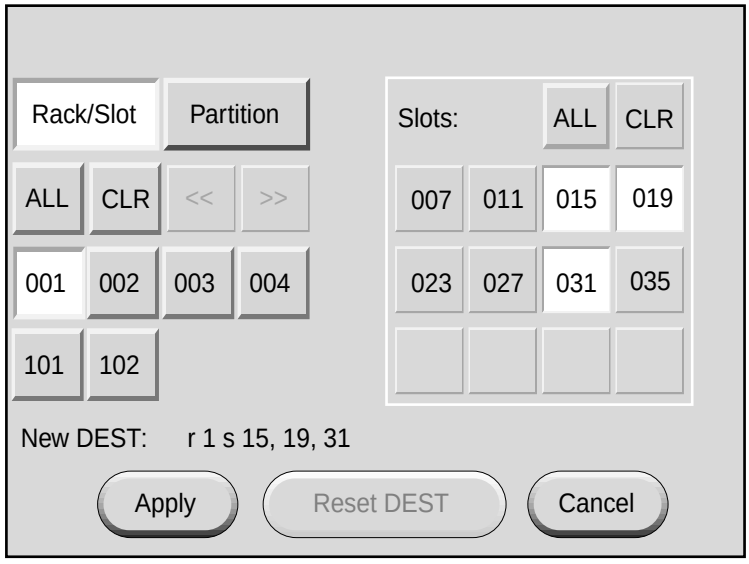

Figure 8-14 Targeting Multiple Bricks in Rack

The new destination is reflected in the destination field near the bottom of the display window. For example, Figure 8-14 shows rack 001, slots 015, 019, and 031 (r1 s15, 19, 31) as the destination.

Once you have selected the bricks, press the **Apply** button to set the new destinations. The home window will then reappear. The new destinations are reflected in the destination field across the bottom of the home window display.

Targeting All Bricks Within Rack

To select all bricks within a rack, see Figure 8-15 and follow these steps:

1. Press the **Rack/Slot** button.
2. Press the button for the rack (for example, Figure 8-15 shows rack 001 selected).

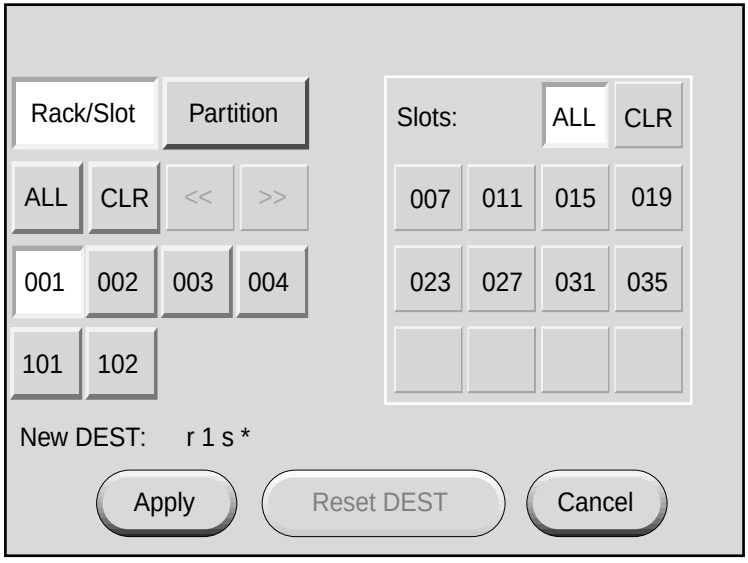

Figure 8-15 Target Selection Window

The new destination is reflected in the destination field near the bottom of the display window. For example, Figure 8-15 shows all slots in rack 001 (r1 s *) as the destination.

Once you have selected the rack, press the **Apply** button to set the new destinations. The home window will then reappear. The new destinations are reflected in the destination field across the bottom of the home window display.

Targeting Partition

To select all bricks within a partition, see Figure 8-16 and follow these steps:

1. Press the **Partition** button.
2. Press the button for the partition number (for example, Figure 8-16 shows partition 001 selected).

Note: The buttons that were the rack numbers before are now the partition numbers.

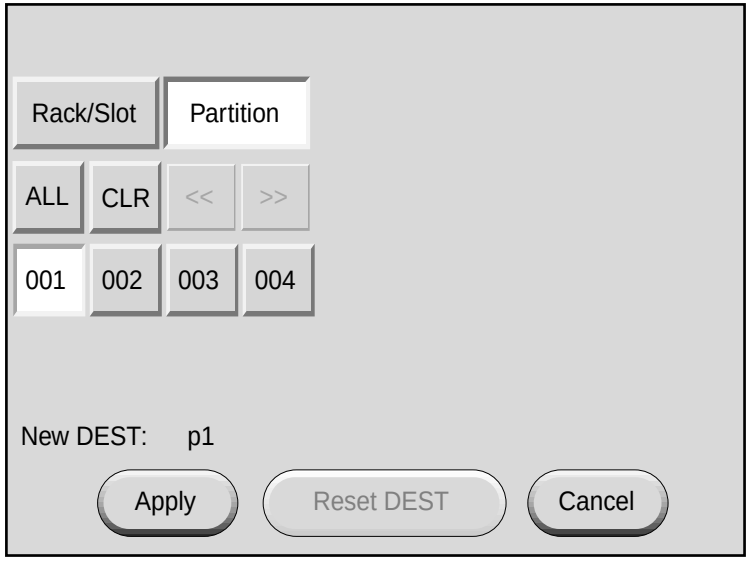

Figure 8-16 Targeting Partition

The new partition target is reflected in the destination field near the bottom of the display window. For example, Figure 8-16 shows partition 001 (p1) as the destination.

Once you have selected the partition, press the **Apply** button to set the new partition target. The home window will then reappear. The new partition target is reflected in the destination field across the bottom of the home window display.

Use the same procedure to select multiple partitions. Press **ALL** to select all partitions. If you select the **Partition** button, the command is sent to all bricks within the selected partition(s).

Operating L2 Controller

The L2 controller hardware includes L2 controller firmware. To access the L2 controller firmware, you must connect a console such as the SGIconsole to the L2 controller. For instructions on how to connect a console to the L2 controller, see "Connecting System Console" on page 4.

The L2 firmware is always running as long as power is supplied to the L2 controller. If you connect a system console to the L2 controller's console port, the L2 prompt appears.

The L2 firmware operates in one of three modes, each of which is discussed in the sections that follow.

- **L2 mode.** The L2 prompt is visible and all input is directed to the L2 command processor.
- **Console mode.** Output from the system is visible and all input is directed to the system.
- **L1 mode.** The prompt from a single L1 controller is visible, and all input is directed to that L1 command processor.

L2 Mode

After the connection to the L2 controller is established, the following prompt appears, indicating that the L2 controller is ready to accept commands:

```
L2>
```

Common operations are discussed in the following sections:

- "Viewing System Configuration" on page 133
- "Targeting Commands" on page 134
- "Viewing Information, Warnings, and Error Messages" on page 137
- "Powering On, Powering Off, and Resetting System" on page 137

Viewing System Configuration

You can use the L2 `config` command to view the current system configuration from a brick level:

```
L2> config
L2 127.0.0.1: - 001 (LOCAL)
L1 127.0.0.1:0:5  - 001c19
L1 127.0.0.1:0:0  - 001c15
L1 127.0.0.1:1:5  - 001c11
L1 127.0.0.1:1:0  - 001c07
L1 127.0.0.1:1:1  - 001i23
L2>
```

As shown above, `config` produces a list of bricks and their locations in the system and the system controller address of each brick. This is similar to the output from using the `config` command on the L1 controller with the addition of the IP address of the L2 controller and USB port number. The structure of the brick's address is as follows:

```
a.b.c.d:x:y
```

where:

a.b.c.d — is the IP address of the L2 controller. (In the example above, the IP address is 127.0.0.1.)

x — is the USB port number.

y — is the L1 index, as follows:

0 is the local brick (the brick to which the USB cable is attached).

A number greater than 0 indicates that the brick is attached to the local brick. For example, an I/O brick that connects to an XIO port of the local Cx-brick has a number of 1, 2, 3, or 4. The Cx-brick that connects to the local Cx-brick via ports A and F has a number of 5.

A brick is identified by its rack, type, and slot (001c07). The structure of the brick location is as follows:

rrrbss.p

where:

rrr	is the rack number.
b	is the brick type.
ss	is the slot location of the brick.
p	is the partition of the brick (not present if the system is not partitioned). R-bricks are not associated with a partition.

In the example shown above, 001c07 is a Cx-brick in rack 001 and slot position 07.

Targeting Commands

If a command is not understood by the L2 controller, it is passed to the L1 controllers. The destination determines which L1 controllers receive the command. A destination, specified by the following, is a range of racks and slots:

`rack` *<rack list>* `slot` *<slot list>*

The <rack list> specifies a list of racks. This can be a list delimited by commas, such that 2,4,7 specifies racks 2, 4, and 7. You can use a dash to specify a range of racks, such that 2-4 specifies racks 2, 3, and 4. Both nomenclatures can be combined, such that 2-4,7 specifies racks 2, 3, 4, and 7.

You can specify the *<slot list>* using the same nomenclature. The slot number is the lowest unit number that the brick occupies. This number is located on the rack rail slightly above where the bottom of the brick sits. For example, in Figure 8-17, the slot number of the brick is 11.

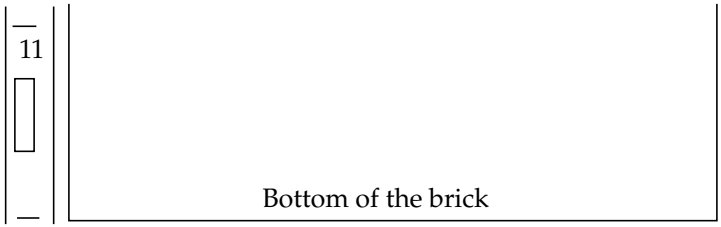

Figure 8-17 Rack Numbering

The slot <*slot list*> is optional; if not given, then all slots in the specified rack(s) are implied. You should avoid specifying a rack list and a slot list that includes multiple racks and slots, such as `rack 2-4,7 slot 1-8,11,13`. Generally, you specify a rack and slot together to specify an individual brick.

You can use the aliases `r` and `s` to specify `rack` and `slot`, respectively. You can use the alias `all` or * in both the <*rack list*> and the <*slot list*>, or by themselves, to specify all racks and all slots.

To send a command to all bricks in a partition, enter the following:

```
partition <partition> <cmd>
```

The default destination of a command when the L2 controller is first initiated is all racks and all slots. You can change the default destination by using the `destination` command:

```
L2> destination
all racks, all slots
L2>
```

The following command sets the destination as all slots in racks 2 and 3:

```
L2> r 2,3 destination
2 default destination(s) set
L2>
```

The following example shows what bricks are found in the default destination. If you enter a command not understood by the L2 controller, the command is sent to these bricks.

Note: In the current implementation, if you add a brick to either rack 2 or 3, it would not be automatically included in the default destination. You would need to reset the default destination.

```
L2> destination
002c07 (127.0.0.1:0:2)
003c07 (127.0.0.1:0:0)
L2>
```

The following command resets the default destination to all racks and all slots:

```
L2> destination reset
default destination reset to all racks and slots
L2>
```

The current destination of a command is a range of racks and slots included with the command. For example, the following command sends the command `<L1 command>` to all bricks in racks 2, 3, 4, and 7:

```
L2> r 2-4,7 <L1 command>
```

This is a one-time destination.

Some L2 commands are the same as the L1 commands. In many cases, this is intentional because the L2 controller provides sequencing that is necessary for a command to function correctly.

When L1 and L2 commands are similar, you can ensure that an L1 command is entered for the bricks in the current destination by preceding the command <`L1 command`> with the `l1` command:

```
L2> r 2-4,7 l1 <L1 command>
```

This is a one-time destination.

Viewing Information, Warnings, and Error Messages

All information, warnings, and error messages generated by any of the system controllers are in the following form:

```
001c07 ERROR: invalid arguments for 'ver' command, try "help ver"
```

The general format includes a brick identification and the type of message, followed by the message. A message may be the result of an invalid command, as shown in the example, or the result of tasks running on the L1 controller, such as the environmental monitor.

Each L1 controller has a log of local events. Use the L1 command `log` to view events on any of the L1 controllers.

Powering On, Powering Off, and Resetting System

You can power on and power off the system with the `power` command. This command is interpreted by the L2 controller, because the bricks must be powered on in a specific order.

```
L2> power up
L2>
```

Depending on the size of the system, the `power` command may require several seconds to several minutes to complete. In the example above, all racks and slots in the default destination are affected. Any errors or warnings are reported as described above in "Viewing Information, Warnings, and Error Messages."

To power on or power off a specific brick, specify a current destination:

```
L2> r 2 s 7 power up
L2>
```

To power on or power off all bricks in a partition, enter the following:

```
L2> partition <partition number> <power up or power down>
```

To reset the system, enter the following:

```
L2> reset
L2>
```

This command restarts the system by resetting all registers to their default settings and rebooting the system controllers. Resetting a running system will cause the operating system to reboot and all memory will be lost.

Console Mode

In console mode, all output from the system is visible and all input is directed to the system.

To enter console mode from L2 mode, press `Ctrl+D` at the L2 prompt and observe the response:

```
L2> Ctrl+D
entering system console mode (001c07 console0),
<CTRL_T> to escape to L2
.
<system output appears here>
.
```

To return to L2 mode from console mode, press `Ctrl+T`:

```
Ctrl+T
escaping to L2 system controller
L2>
```

At this point, you can enter any L2 or L1 command. When the command completes, the L2 returns to console mode:

```
Re-entering system console mode (001c07 console0),
<CTRL_T> to escape to L2
```

To permanently engage the L2 mode, press `Ctrl+T` and then enter the `l2` command:

```
Ctrl+T
escaping to L2 system controller
L2> l2
L2 command processor engaged, <CTRL_D> for console mode.
L2>
```

Console Selection

When in console mode, the L2 communicates with the Cx-brick that is the system console or global master. All input from the console is directed to the Cx-brick. You can set and view the system console with the `select` command.

The L2 controller chooses the Cx-brick as the default console in the following priority order:

- The Cx-brick in the lowest numbered rack and slot, which has produced console output, and has an attached IX-brick.
- The Cx-brick in the lowest numbered rack and slot, which has an attached IX-brick.
- The Cx-brick in the lowest numbered rack and slot.

The `select` command by itself shows the current console mode settings:

```
L2> select
known system consoles (non-partitioned)

       001c07-L2 detected

current system console

console input: 001c07 CPU 0A
console output: not filtered
```

The following common subchannels are associated with console communications:

- Subchannel 0A specifies Node 0, CPU A.
- Subchannel 0B specifies Node 0, CPU B.
- Subchannel 0C specifies Node 0, CPU C.
- Subchannel 0D specifies Node 0, CPU D.
- Subchannel 1A specifies Node 1, CPU A.
- Subchannel 1B specifies Node 1, CPU B.
- Subchannel 1C specifies Node 1, CPU C.
- Subchannel 1D specifies Node 1, CPU D.
- Subchannel 2A specifies Node 2, CPU A.
- Subchannel 2B specifies Node 2, CPU B.
- Subchannel 2C specifies Node 2, CPU C.
- Subchannel 2D specifies Node 2, CPU D.

- Subchannel 3A specifies Node 3, CPU A.
- Subchannel 3B specifies Node 3, CPU B.
- Subchannel 3C specifies Node 3, CPU C.
- Subchannel 3D specifies Node 3, CPU D.
- Node 0 console subchannel.
- Node 1 console subchannel.
- Node 2 console subchannel.
- Node 3 console subchannel.

The output `console input: 001c07 console0` shows that the L2 controller will send console input to brick 001c07 and the console0 subchannel will be used.

To change the brick that will be the system console, use the `select <rack>.<slot>` command, where `<rack>` is the rack and `<slot>` is the slot where the brick is located:

```
L2> select 3.7
console input: 003c07 console
console output: no filtered
console detection: L2 detected
```

To change the subchannel used on the selected brick to be the system console, use the `select subchannel <0A|0B|0C|0D|1A|1B|1C|1D|2A|2B|2C|2D|3A|3B|3C|3D>` command. (Use the `select subchannel console` to select the current console as the subchannel of the brick to be the system console.) For example, to select the subchannel that corresponds to CPU A of node 1, enter the following:

```
L2> select subchannel 1A
console input: 003c07 console CPU1A
console output: no filtered
```

Note: See the bulleted list in "Console Selection" on page 114 for valid subchannels.

During the boot process on a multibrick system, there is a window of time in which all Cx-bricks are producing output. This can result in a somewhat jumbled output at the L2 controller. However, you can filter console output so that the L2 controller shows output from only the brick chosen to receive console input. You can turn on and off filtering with the `select filter on` and `select filter off` commands.

If you attempt to communicate with a brick chosen to receive console input but that is not responding, a time-out condition results:

```
L2> Ctrl+D
entering console mode 001c07 CPU1A, <CTRL_T> to escape to L2

no response from 001c07 Junk bus CPU1A system not responding
no response from 001c07 Junk bus CPU1A system not responding
```

When this time-out condition occurs, either the brick is hung or the subchannel is not correct.

L1 Mode

In L1 mode, the prompt from a single L1 controller is visible, and all input is directed to that L1 command processor.

To enter L1 mode, enter the rack and a slot followed by `l1:`

```
L2> r 2 s 7 l1
enterling L1 mode 001c07, <CTRL-T> to escape to L2

001c07-L1>
```

To return to L2 mode, press `Ctrl+T`:

```
001c07-L1> Ctrl+T
escaping to L2 system controller, <CTRL-T> to send escape to L1
L2>
```

At this point, you can enter any L2 command. Once the command is executed, the L2 controller returns to L1 mode:

```
re-entering L1 mode 001c07, <CTRL-T> to escape to L2

001c07-L1>
```

To permanently engage the L2 mode, press `Ctrl+T` and enter the `l2` command:

```
001c07-L1> Ctrl+T
escaping to L2 system controller, <CTRL-T> to send escape to L1
L2> l2
L2 command processor engaged, <CTRL-T> for console mode.
L2>
```

Upgrading L1/L2 Firmware

The L1/L2 firmware is currently distributed as part of the `snxsc_firmware` package.To determine which version of the package is installed on your system console, enter the following command:

```
$> rpm -q snxsc_firmware
```

If the package is installed, the full package name (including the revision) is returned:

```
snxsc_firmware-1.18.3-1
```

The L1 and L2 firmware binary and the utilities used to update it are stored in `/usr/cpu/firmware/sysco`.

Upgrading L1 Firmware

The L1 firmware consists of three parts:

- Boot image
- A image
- B image

At boot time, the boot image validates the A and B image, and if it is not instructed otherwise, it executes the newer of the two images. Because the L1 controller is running one of the two images, the image not in use is the image that will be overwritten when the firmware is upgraded. You need to re-boot any L1 controller either by power-cycling the brick or by using the L1 command `reboot_l1`.

Typically, you will upgrade the firmware through the network connection from the SGIconsole to the L2 controller:

```
$> /usr/cpu/firmware/sysco/flashsc --12 10.1.1.1 -p
/usr/cpu/firmware/sysco/l1.bin all
```

This updates all the bricks in the system. The `-p` at the end of the first line instructs the firmware to flash the proms in parallel.

You can update individual bricks by replacing *all* with a rack and slot number:

```
$> /usr/cpu/firmware/sysco/flashsc --12 10.1.1.1
/usr/cpu/firmware/sysco/l1.bin 1.19
```

This updates only the brick in rack 1, slot 19.

Upgrading L2 Firmware

The L2 firmware consists of two parts:

- Boot image
- Kernel image

Typically, you will upgrade the firmware through the network connection from the SGIconsole to the L2 controller:

```
$> /usr/cpu/firmware/sysco/flashsc --12 10.1.1.1
/usr/cpu/firmware/sysco/l2.bin local
```

Once this command is executed, you must power-cycle the L2 controller to run the new image. You can also do this with the L2 command `reboot_l2`.

Unlike the L1 controller, if the L2 update fails, a second image is not available to use as a back-up copy. However, the L2 controller will not run the kernel image if it is not valid. If the L2 update fails, you can update it through its console port:

```
$> /usr/cpu/firmware/sysco/flashsc --l2recover /usr/cpu/firmware/sysco
/l2.bin <device>
```

Output will indicate that the firmware image is being erased and then rewritten. The flash image is quite large (almost 2 MB), so updating the flash image takes several minutes. You must power-cycle the L2 controller to run the new image. You can also do this with the L2 command `reboot_l2`.

Identifying Bricks

Bricks are referenced by their racks and slot or unit locations. These values are stored in non-volatile memory on the L1 controller. Virtually all system controller communications require that each brick have a valid and unique rack and slot.

If a brick is not set with its rack and slot number, it appears in the output of an L2 `config` command, as shown in the following example:

```
L2> config
137.38.88.82.1.0 ---c-- (no rack/slot set)
L2>
```

To set the rack and slot for a brick, address it by its IP address, USB port, and L1 controller index. Note the following example:

```
L2> 137.38.88.82:1:0 brick rack 1
L2> 137.38.88.82:1:0 brick slot 11
L2> 137.38.88.82:1:0 reboot_l1
INFO: closed USB /dev/sgil1_0
INFO: opened USB /dev/sgil1_0
L2>config
137.38.88.82:1:0 001c11
L2.
```

To set the rack and slot from the L1 prompt, simply use the `brick rack` and `brick slot` commands. To set the rack and slot on one of the attached bricks (an attached I/O brick, Cx-brick, or Cx-brick's I/O brick), use the L1 targeting commands `nia`, `nib`, `iia`, or `iib`.

```
001c07-L1> config
:0 - 001c07
:1 - ---i--
001c07-L1> iia brick rack 1
---i--:
brick rack set to 001.
001c07-l1> iia brick slot 23
---i--
brick slot set to 23
001c07-l1> iia reboot_l1
001c07 ERROR: no response from ---i--
001c07-L1> config
:0 - 001c05
:1 - 001i23
001c07-L1>
```

The number after the ":" indicates the following:
0 = local brick
1 = IIA
2 = IIB
3 = IIC
4 = IID

To obtain a detailed configuration explanation from the L1 perspective, enter the following:

```
001c07-L1> config verbose
```

Power Components

The Origin 3900 server uses the following power components: power distribution units (PDUs), power distribution strips (PDSs), and power bays. This chapter describes the function and physical aspects of these power components in the following sections:

Power Bay

The power bay, which is a 3U-high enclosure, can monitor, control, and supply AC power to as many as six hot-swappable distributed power supplies (DPSs). The number of power supplies depends on the rack type. For example, in an I/O rack, the power bay has four power supplies. In racks that house Cx-bricks and/or R-bricks, the power bay has six power supplies.

Each DPS inputs single-phase AC voltage and outputs 950 W at 48 VDC and 42 W at 12 VDC. The outputs of the DPSs are bused together. For example, when the power bay contains six DPSs, the DPSs are bused together to provide approximately 5,380 W of 48-VDC power and 282 W of 12-VDC power.

External Components

This section describes the external components located on the front and rear panels of the power bay.

The front of the power bay seats the distributed power supplies (see Figure 9-1). When the power bay contains four power supplies, the supplies reside in locations 3, 4, 5, and 6 (the four supplies on the right).

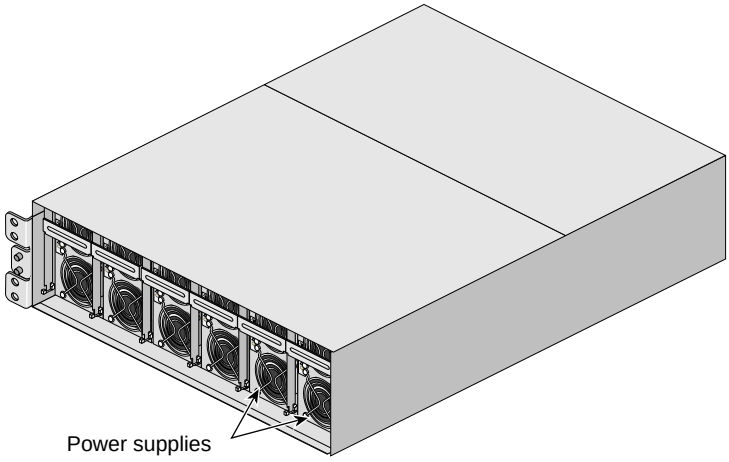

Figure 9-1 Front View of Power Bay

The rear of the power bay has eight DC output connectors (see Figure 9-2). A power cord connects one output connector to a Cx-brick, R-brick, or I/O brick. This connection provides 12-VDC standby power, 48-VDC power, and monitoring signals.

Note: The L1 controller of a connecting module can monitor the status and enable the output ports of the power bay.

The power bay module also has six AC input connectors, one for each power supply location. For example, when the power bay contains four power supplies, connectors 3, 4, 5, and 6 (the four connectors on the left) connect to the power distribution unit (PDU). When the power bay contains six power supplies, connectors 1 and 2 also connect to the PDU.

The reset button resets the power bay when a fault condition occurs.

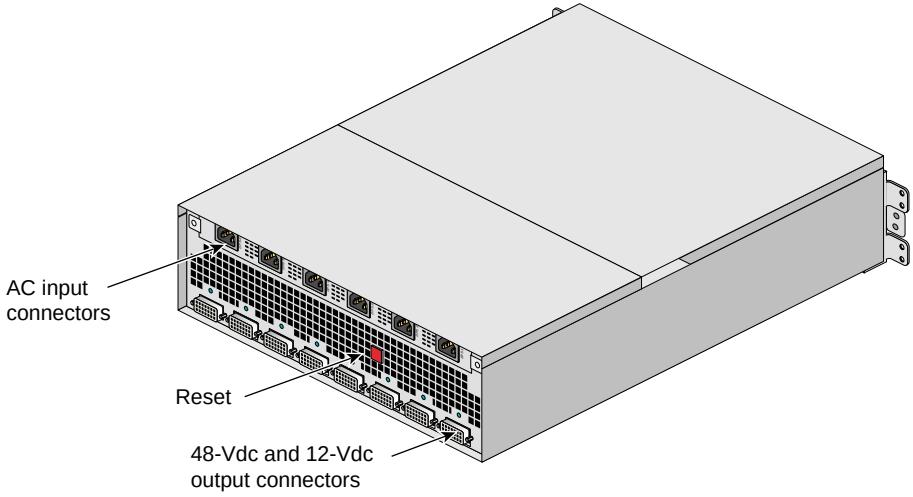

Figure 9-2 Rear View of Power Bay

Distributed Power Supplies

The distributed power supplies (DPSs) are air-cooled devices; each DPS has two fans that move air from the front of the rack to the rear of the rack. Figure 9-3 shows the front view of a DPS.

Each DPS has the following LEDs:

- Power
- Predictive fan fail (PFAIL)
- Power supply fail (FAIL)

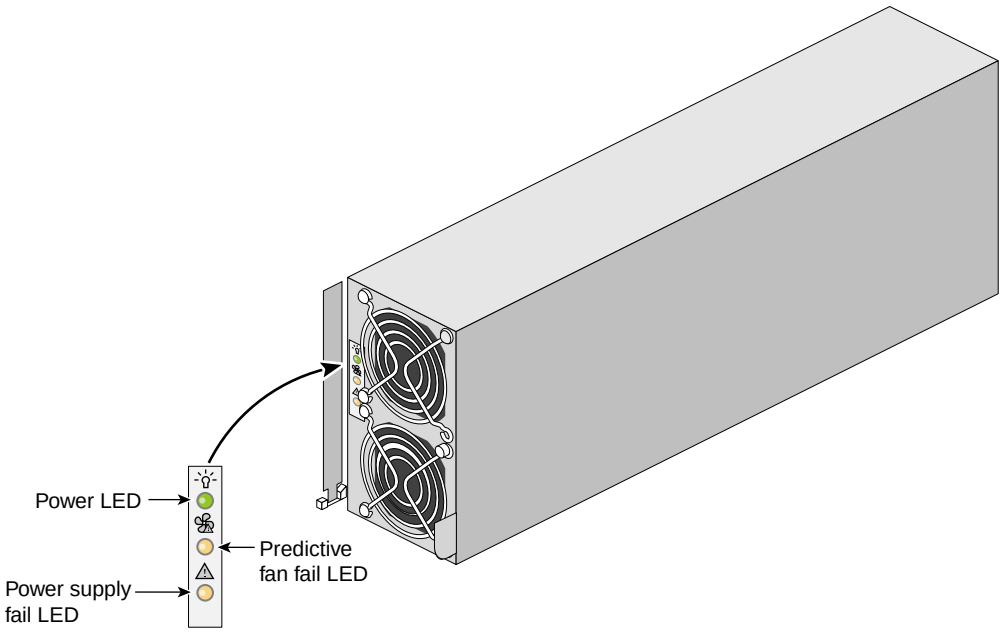

Figure 9-3 Front View of DPS

Table 9-1 lists conditions of the power supplies and the corresponding states of the LEDs.

Table 9-1 Power Supply LED States

Power Supply Condition	LED States		
	Power (Green)	**PFAIL (Amber)**	**FAIL (Amber)**
AC voltage not applied to all power supplies	Off	Off	Off
AC voltage not applied to this power supply	Off	Off	On
AC voltage present; standby voltage on	Blinking	Off	Off
Power supply DC outputs on	On	Off	Off
Power supply failure	Off	Off	On
Current limit reached on 48-VDC output	On	Off	Blinking
Predictive failure	On	Blinking	Off

Each power supply also contains a serial ID EEPROM that identifies the model and serial number of the supply. The L1 controller of a connecting module reads this information.

Technical Specifications

Table 9-2 lists the specifications of the power bay.

Table 9-2 Power Bay Technical Specifications

Characteristic	Specification
Height	5.12 in. (130.04 mm)
Width	17.5 in. (444.5 mm)
Depth	23.87 in. (606.3 mm)
Weight (with five power supplies)	64.5 lb (29.26 kg)
Input voltage	220 VAC
Output voltage	12 VDC and 48 VDC

Table 9-3 lists the specifications of the distributed power supplies.

Table 9-3 Power Supply Technical Specifications

Characteristic	Specification
Height	5 in. (127 mm)
Width	2.8 in. (71.12 mm)
Depth	13 in. (330.2 mm)
Weight	7.5 lb (3.40 kg)
Input voltage	220 VAC
Output voltage	12 VDC and 48 VDC

Power Distribution Unit (PDU)

A PDU filters input power, protects against over-current conditions, and provides a power switch to remove power from a rack.

The Origin 3900 server supports a single-phase and a three-phase PDU. A system that uses single-phase power requires one single-phase PDU for each power bay (see Figure 9-4). A system that uses three-phase power requires one three-phase PDU per rack.

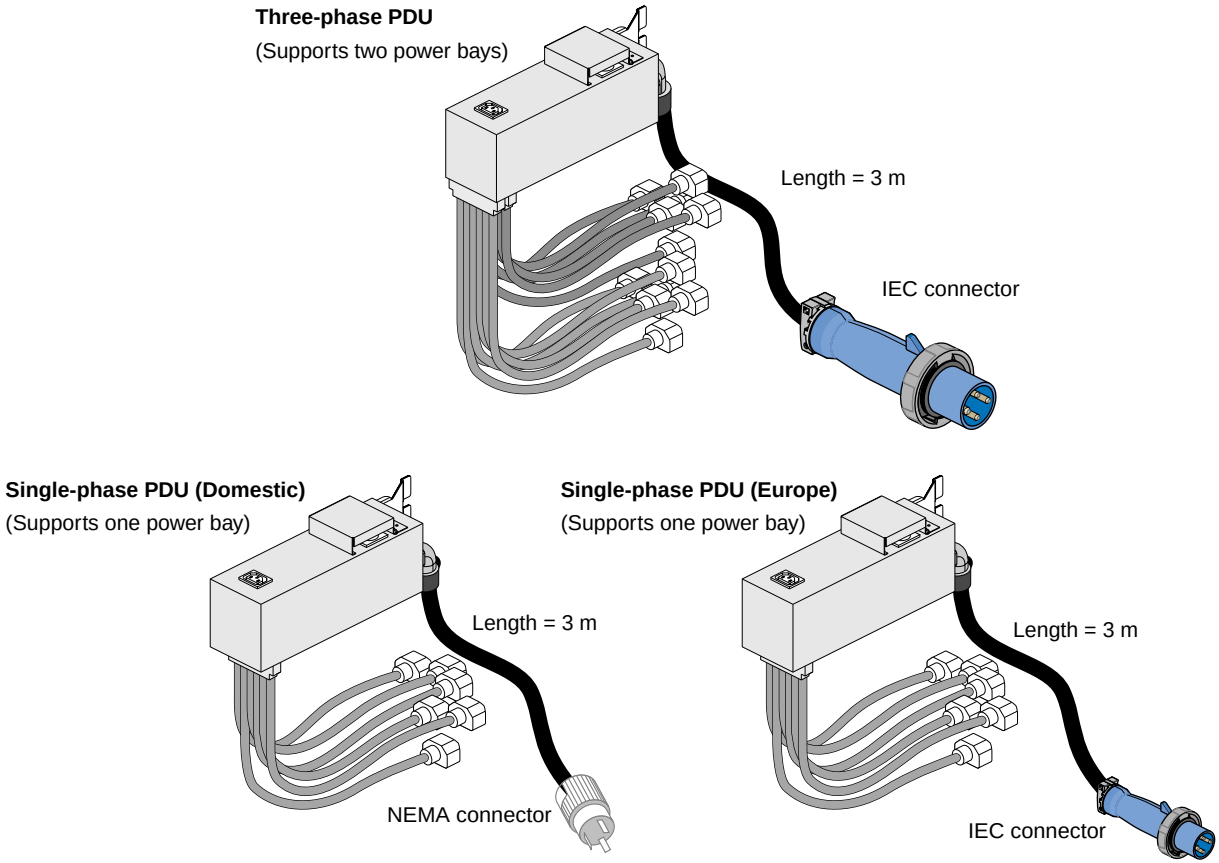

Figure 9-4 Power Distribution Units

Power Distribution Strip (PDS)

The power distribution strip has six output power receptacles, one input power receptacle, and one 10-A circuit breaker. This strip is required when there are components within the rack that need 220 VAC (for example, disk storage modules). The power strip has a rating of 200 - 250 VAC.

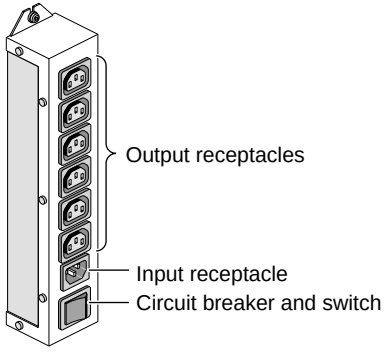

Figure 9-5 Power Distribution Strip

SGI TP900 Storage Module

This chapter describes the function and physical components of the SGI TP900 storage module in the following sections:

Overview

The SGI TP900 storage unit is a 2U-high 8-drive storage system that provides compact, high-capacity, high-availability JBOD (just a bunch of disks) storage. The enclosure backplane connects the 8 drives on one SCSI bus. As an option, the storage unit can also be configured on two SCSI buses (two strings of four drives).

This storage unit has the following features:

- Mounts in a standard 19-in. rack; available in factory-installed configurations with the Origin 3900 servers.
- 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.
- Supports 36 GB and 146 GB drive capacities.

Note: For more information about the TP900 storage module, see the *SGI Total Performance 900 Storage System User's Guide*.

External Components

This section describes the external components located on the front and rear panels of the TP900 storage module.

Front Panel Components

The front of the SGI TP900 storage module consists of 8 drive bays that contain either disk drive carrier modules or dummy carrier modules. The storage module is 4 bays wide by 2 bays high. The bays are numbered 1 and 2 from top to bottom, and 1 to 4 from left to right. See Figure 10-1.

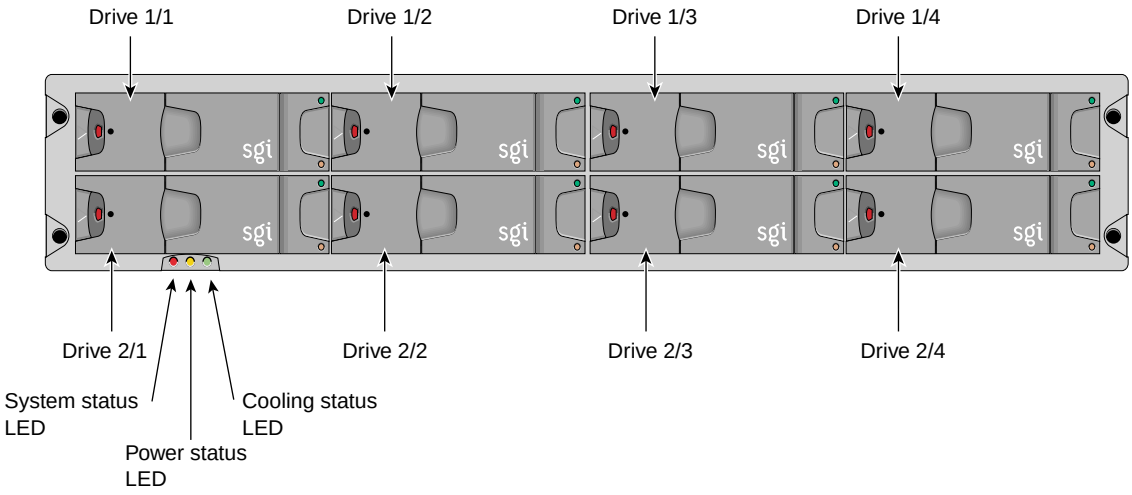

Figure 10-1 Front View of TP900 Storage Module

The disk drive carrier module is a die-cast aluminum carrier that houses a single 1.0-in. high, 3.5-in. wide disk drive. This carrier has a handle that enables you to insert and remove the carrier from the drive bay. The handle also has an anti-tamper lock that locks the handle in place; therefore, the carrier cannot be accidentally removed from the drive bay. When the handle is locked, a red indicator is visible in the handle. When carrier is unlocked, a white indicator is visible.

Each drive carrier has two LEDs: an upper green LED and a lower amber LED. In normal operation, the green illuminates and flickers as the drive operates. The amber LED illuminates when a fault occurs. See Figure 10-2 for the locations of LEDs.

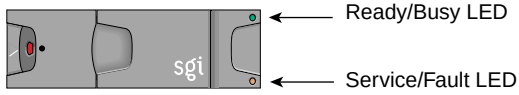

Figure 10-2 Drive Carrier LED Indicators

Dummy carrier modules are provided for installation in all unused drive bays. They are designed as integral drive module front caps with handles. They must be installed in unused drive bays to maintain a balanced airflow.

The front of the chassis also contains three status LEDs that are described in Table 10-1.

Table 10-1 Status LEDs

LED	Status
System status	Green signifies that power is applied to the enclosure. Amber signifies that the ESI processor has failed.
Power status	Green signifies that the power supplies are functioning normally. Amber signifies a power supply failure.
Cooling status	Green signifies that all fans are functioning normally. Amber signifies a fan failure.

Rear Panel Components

The rear of the TP900 storage module contains 6 bays that house power supply, cooling, and SCSI I/O modules. See Figure 10-3. The rear of the TP900 storage module is 3 bays wide by 2 bays high. The bays are numbered 1 and 2 from top to bottom, and 1 to 3 from right to left.

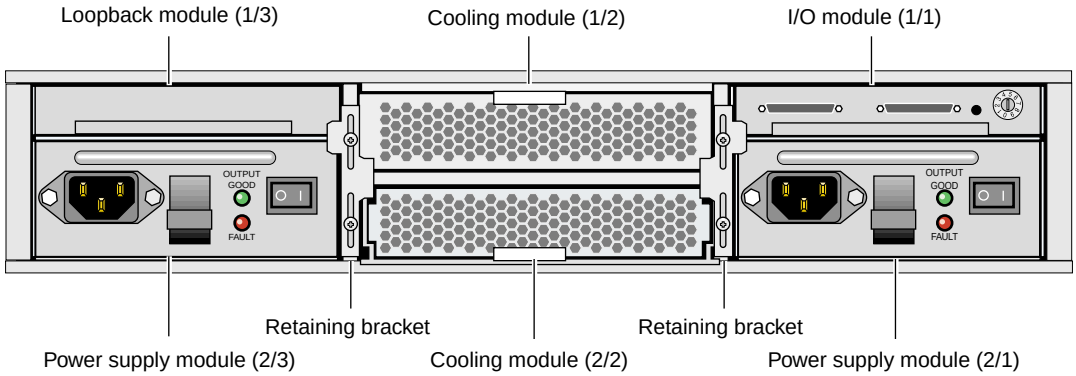

Figure 10-3 Rear View of TP900 Storage Module

The TP900 rear bays house the following components:

- **Power supply module**. The SGI TP900 storage system requires one 350-W power supply module, which is mounted in the rear of the system (location 2/3). Power supply voltage operating ranges are nominally 115 V or 230 V and are selected automatically.

  Optionally, a second power supply module (location 2/1) can be added to the TP900 system to provide n+1 redundant power. In this n+1 redundant configuration, the power supply modules operate together; if one power supply module fails, the other module supplies power until the faulty unit is replaced.

  The power supply module contains two LEDs that are located on the front panel of the power supply. The green LED indicates power output. The amber LED indicates a power supply failure.

  Note: When you order a TP900 storage module with redundant power, it will also have redundant cooling (two cooling modules).

- **Input/output (I/O) module**. The I/O module contains two VHDCI connectors and a switch to set the SCSI ID range. The SGI TP900 storage module supports 1 I/O module for a 1 x 8 configuration and 2 I/O modules for a 2 x 4 configuration. The 1 x 8 configuration creates a SCSI bus structure with 1 string of 8 drives. The 2 x 4 configuration creates a SCSI bus structure with 2 strings of 4 drives.

  Note: When only one I/O module is present in the system, the other I/O module location contains a loopback module that has no external connectors.

- **Loopback module**. The backplane of the TP900 consists of two 4-drive channels. A loopback module is used to connect the two internal drive channels together when the TP900 is configured as one channel with 8 drives.
- **Cooling module**. The cooling module consists of fans that pull warm air from a plenum behind the drive backplane and exhaust the warm air at the rear of the enclosure. The cooling modules connect to the backplane for power and status signal connections.

  The TP900 system requires one cooling module, which is mounted in the rear of the system. Optionally, a second cooling module can be added to the system to provide redundant cooling. In this redundant configuration, the cooling modules operate together; if one module fails, the other module adequately cools the system until the faulty unit is replaced.

  Note: When you order a TP900 storage module with redundant cooling, it will also have redundant power (two power supply modules).

- **Blank module**. Blank modules are placed in all vacant power supply and cooling module bays to maintain proper airflow through the system.
- **Terminator plug**. Each I/O module has two 68-pin VHDCI connectors. A host bus adapter is connected to one of the VHDCI connectors and a terminator plug is placed in the remaining connector. Figure 10-4 shows the terminator plug.

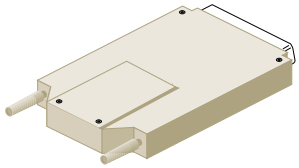

Figure 10-4 SCSI Terminator Plug

Technical Specifications

Table 10-2 lists the specifications of the TP900 storage module.

Table 10-2 TP900 Storage Module Technical Specifications

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

Product Options

Table 10-3 lists the available configurable items for the TP900 storage module.

Table 10-3 Configurable Items

Configurable Item	Options
Disk drive	18 GB (1 minimum, 8 maximum) 73 GB (1 minimum, 8 maximum)
I/O module	1 minimum, 2 maximum
Cooling module	1 minimum, 2 maximum
Power supply module	1 minimum, 2 maximum

D-brick2

This chapter describes the functional and physical components of the D-brick2 in the following sections:

For troubleshooting and additional detailed information on the D-brick2, see *SGI Total Performance 9100 (2Gb TP9100) Storage System User's Guide (P/N 007-4522-00x)*, which is available online at http://docs.sgi.com. For information on how to power on and power off the D-brick2, see Chapter 1, "Operation Procedures". For information on how to replace disk drive modules in the D-brick2, see Chapter 14, "Maintenance and Upgrade Procedures".

Note: If you require RAID storage, ask your SGI sales representative about SGI RAID storage products, such as the SGI 2Gb TP9100 and SGI TP9500 storage systems.

Overview

The D-brick2 module is a high performance, large-scale storage system that provides compact, high-capacity JBOD (just a bunch of disks) storage for your Origin 3900 server. Each enclosure contains a minimum of 2 and maximum of 16 disk drives, and the component modules that handle I/O, power, cooling, and operations. RAID storage systems are available for your system through your SGI sales representative.

The modular design of the D-brick2 expands easily to meet your mass storage needs. It has the following features:

- Maximum configuration of up to 96 drives (six D-brick2 units)
- 1x16 (more storage) and 2x8 (more bandwidth) disk topologies in each brick
- Dual power feeds with dual power supplies
- Redundant cooling
- Non-disruptive component replacement
- Enclosure services interface (ESI) for SCSI enclosure services (SES)

Each D-brick2 is connected to one or more Fibre Channel boards (host bus adapters, or HBAs) in the Origin 3900 server, either separately or in a combination (loop).

Note: The standard configuration for the D-Brick2 is 1 x 16. The D-brick2 can be reconfigured to 2 x 8 on site.

External Components

This section describes the external components located on the front and rear panels of the D-brick2.

Front Panel Components

The front of the D-brick2 consists of drive carrier modules or dummy drive modules (see Figure 11-1). The disk drive carrier module consists of a hard disk drive mounted in a die-cast aluminum carrier (see Figure 11-2). The carrier protects the disk drive from radio frequency interference, electromagnetic induction, and physical damage. It also provides a means for thermal conduction.

Dummy drive carrier modules must be installed in all unused drive bays. Figure 11-2 provides an illustration of this module.

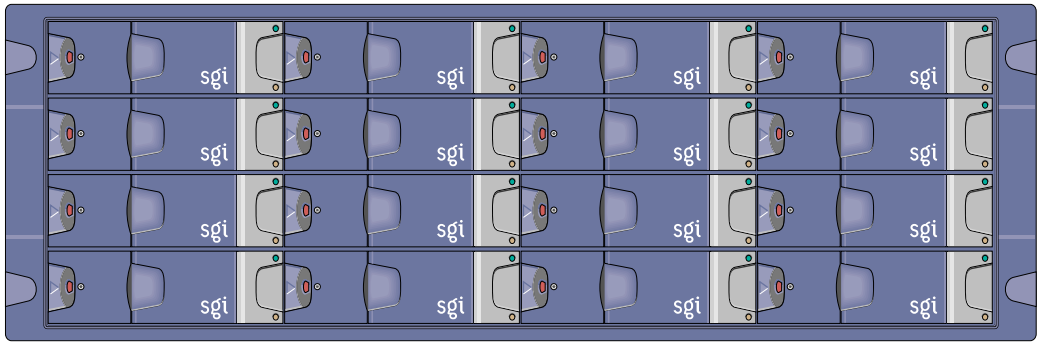

Figure 11-1 Front View of D-brick2

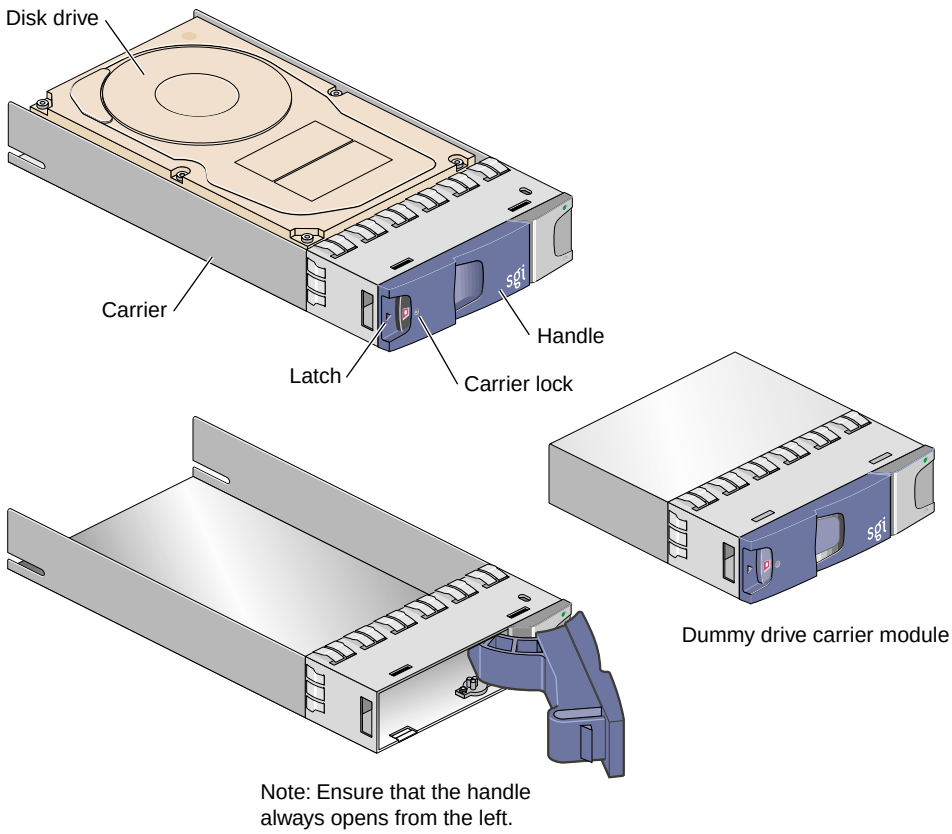

Figure 11-2 Drive Carrier Module and "Dummy" Module

A key (Torx screwdriver), which locks or unlocks the disk drives, is provided with each D-brick2. A red indicator is visible in the center rectangular aperture in the handle if the anti-tamper lock is locked, and a black indicator is visible when the lock is unlocked (see Figure 11-3).

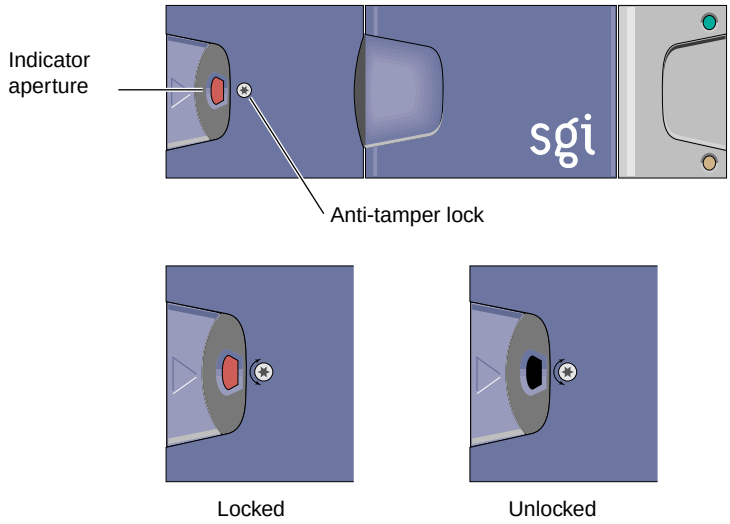

Figure 11-3 Anti-Tamper Locking on D-brick2 Disk Drive

Rear Panel Components

The rear of the D-brick2 consists of the components that are discussed in the following subsections (see Figure 11-4):

- "Power Supply/Cooling Modules" on page 166
- "Operator's Panel" on page 167
- "Loop Resiliency Circuit (LRC) Modules" on page 168

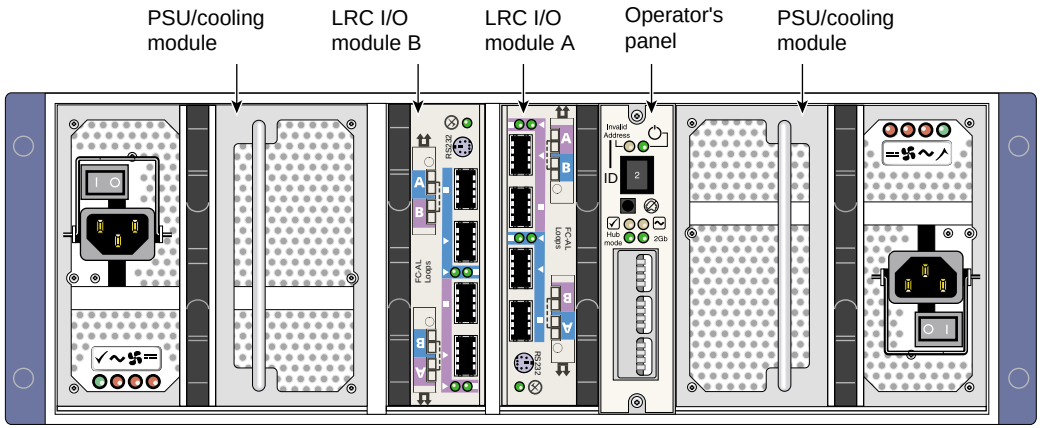

Figure 11-4 Rear View of D-brick2

Power Supply/Cooling Modules

Two power supply/cooling modules (PSUs), which are mounted in the rear of the D-brick2, supply redundant cooling and power to the enclosure. Voltage operating ranges are nominally 115 V or 230 VAC, and are selected automatically. The supplies should be plugged into your SGI rack's power distribution strip (PDS). Four LEDs located on the rear panel of the PSU/cooling module indicate the status of the power supply and the fans (see Figure 11-5).

Note: If a power supply fails, do not remove it from the enclosure until you have a replacement power supply. The cooling fans in the supply will continue to operate.

Caution: You must install a new PSU/cooling module within 10 minutes after removing a faulty one. Otherwise, thermal overload of the D-brick2 can result.

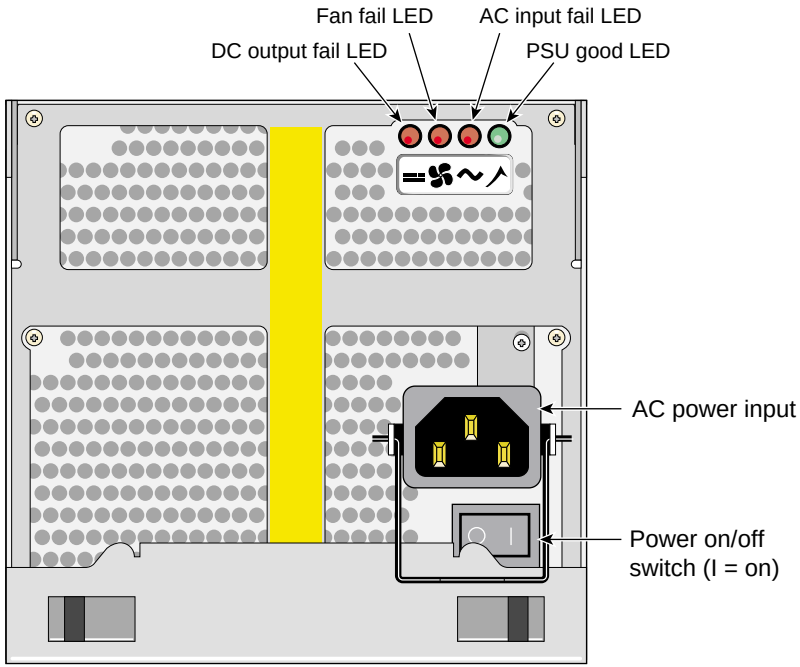

Figure 11-5 Power Supply/Cooling Module

Operator's Panel

The operator's panel (ops panel) contains LEDs that show the status of all modules. The enclosure services processor, located on the LRC modules, control the status LEDs. Also on the operators panel is an audible alarm that indicates a fault state is present, a push-button alarm mute switch, and a thumbwheel enclosure ID address range selector switch. When the D-brick2 is powered on, the audible alarm sounds for one second, and the power-on LED illuminates.

Figure 11-6 identifies all controls and indicators on the ops panel. Note that the operator's panel configuration switches slide left for "on" and right for "off." For detailed descriptions of the LEDs and configuration switch information, see Chapter 5 in the *SGI Total Performance 9100 (2Gb TP9100) Storage System User's Guide* (P/N 007-4522-00*x*).

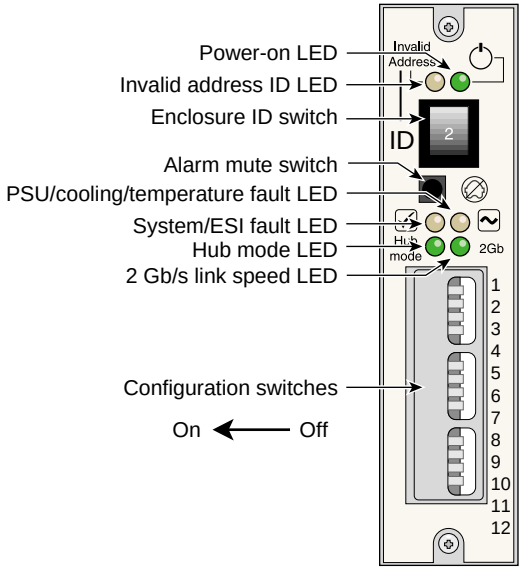

Figure 11-6 Operator's Panel

Note: The valid range for the address switch is 1 through 6. Zero is not valid.

Loop Resiliency Circuit (LRC) Modules

The D-brick2 uses a Fibre Channel arbitrated loop (FC-AL) to interface with your Origin 3900 server. The FC-AL backplane incorporates two independent loops formed by port bypass circuits within the LRC modules.

The enclosure services processor housed on the LRC modules manages the enclosure and provides an interface to devices on the backplane, a PSU/cooling module, and an ops panel to monitor internal functions. These processors operate in a master/slave configuration to allow failover. See the *SGI Total Performance 9100 (2Gb TP9100) Storage System User's Guide* (P/N 007-4522-00x) for details.

Note: The LRC module can address up to 96 disk drives; a maximum of six enclosures can be cabled together.

The enclosure may be configured with either one or two LRC I/O modules (see Figure 11-7). If only one module is installed, an I/O blank module must be installed in the unused bay.

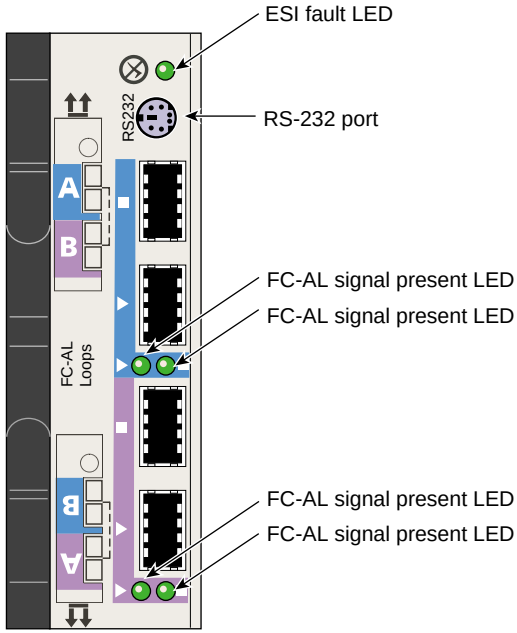

Figure 11-7 D-brick2 Loop Resiliency Circuit (LRC) Module

Technical and Environmental Specifications

Table 11-1 lists the physical specifications of the D-brick2.

Table 11-1 D-brick2 Physical Specifications

Characteristic	Specification
Height	13.4 cm (5.3 in.)
Width	44.6 cm (17.5 in.)
Depth	50 cm (19.7 in.)
Weight:	
Fully populated enclosure	32.3 kg (71 lb)
Empty enclosure	17.9 kg (39.4 lb)
Power supply/cooling module	3.6 kg (7.9 lb)
Disk carrier module with drive	0.88 kg (1.9 lb)
LRC module	1.2 kg (2.6 lb)

Table 11-2 shows the power requirements and specifications of the D-brick2.

Table 11-2 D-brick2 Power Specifications

Specification	Value
Voltage range for rack	200-240 VAC
Voltage range selection	Automatic
Frequency	50-60 Hz
Power factor	>0.98
Maximum power consumption	700 VA
Typical power consumption	400 VA or less
Inrush current (25 °C [77 °F] cold-start 1 PSU)	100 A maximum peak for 4 ms, 25 A thereafter at maximum voltage
Harmonics	Meets EN61000-3-2
Power cord:	
Cord type	SV or SVT, 18 WG minimum, 3 conductor
Plug	250 V, 10 A
Socket	IEC 320 C-14, 250 V, 15 A

Table 11-3 provides temperature and humidity requirements for the D-brick2.

Table 11-3 D-brick2 Ambient Temperature and Humidity Requirements

Factor	Temperature	Relative Humidity	Maximum Wet Bulb
Operating temperature	5 °C to 40 °C (41 °F to 104 °F)	20% to 80% noncondensing	23 °C (73 °F)
Non-operating temperature	0 °C to 50 °C (32 °F to 122 °F)	8% to 80% noncondensing	27 °C (80 °F)
Storage temperature	1 °C to 60 °C (34 °F to 140 °F)	8% to 80% noncondensing	29 °C (84 °F)
Shipping temperature	-40 °C to +60 °C (-40 °F to 140 °F)	5% to 100% nonprecipitating	29 °C (84 °F)

Table 11-4 provides additional environmental specifications for the D-brick2.

Table 11-4 D-brick2 Environmental Requirements

Environmental Factor	Requirement
Altitude, operating	0 to 3047 m (0 to 10,000 ft)
Altitude, non-operating	-305 to 12,192 m (-1000 to 40,000 ft)
Shock, operating	Vertical axis 5 g peak 1/2 sine, 10 ms
Shock, non-operating	30 g 10 ms 1/2 sine
Vibration, operating	0.21 grms 5-500 Hz random
Vibration, non-operating	1.04 grms 2-200 Hz random
Acoustics	Less than 6.0 B LwA operating at 20 °C
Safety and approvals	CE, UL, cUL
EMC	EN55022 (CISPR22-A), EN55024 (CISPR24), FCC-A

InfinitePerformance Graphics Components

An Origin 3900 server with InfinitePerformance graphics delivers up to 141 million triangles per second and 3.8 billion pixels per second of sustained performance to a single display. This performance enables you to interactively manipulate and analyze complex problems. The InfinitePerformance graphics capabilities combined with the high-level compute and I/O capabilities of the Origin 3900 server enables you to complete complex tasks in engineering analysis and scientific visualization in seconds instead of minutes and in hours instead of days.

Note: Your Origin 3900 server can have InfiniteReality graphics capabilities or InfinitePerformance graphics capabilities, but not both.

The InfinitePerformance graphics capabilities are provided by the following components:

- V12 VPro graphics board that provides one graphics pipe.
- V-brick that is a 4U I/O expansion brick with four half-height XIO slots. The V-brick can house one or two VPro V12 graphics boards.
- Compositor that enables multiple V12 VPro graphics pipes to work simultaneously on a single visual application.

This chapter describes the function and physical aspects of these InfinitePerformance graphics components in the following sections:

- "V12 VPro Graphics Board" on page 174
- "V-brick" on page 176
- "Compositor" on page 180

V12 VPro Graphics Board

A VPro V12 graphics board, which is shown in Figure 12-1, provides one InfinitePerformance graphics pipe. You can add 1 to 8 InfinitePerformance graphics pipes to your Origin 3900 server. Each graphics pipe requires two processors and connection to one IP53 node board.

Table 12-1 describes the connectors of the V12 graphics board.

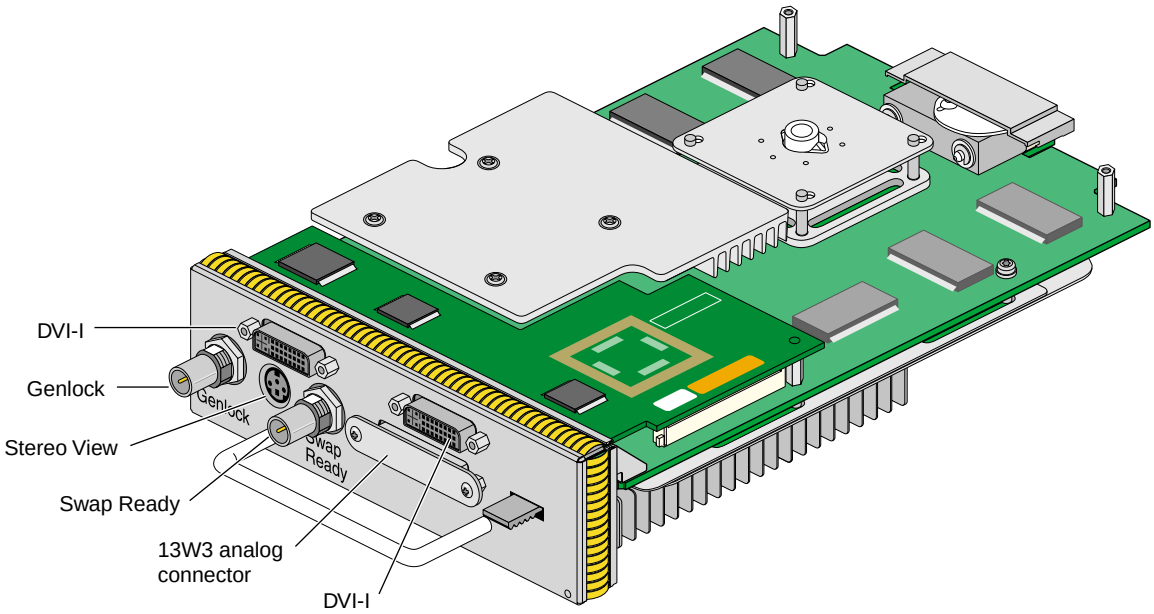

Figure 12-1 VPro V12 Graphics Board

Table 12-1 VPro V12 Connector Descriptions

Connector	Connector Type	Description
DVI-I (2)	DVI-1	Graphics output; outputs either TMDS digital or RGB analog video signals, both DVI ports output the same signal.
Genlock	BNC	Interface to house sync or other pipes (or video mixer); synchronizes multiple V12 boards; required for compositor.
Stereo View	4-pin mini-DIN	Interface to Stereo View device; connects to an emitter to provide stereo effect for LCD shutter glasses.
Swap Ready	BNC	Synchronizes front and rear framebuffer swapping between multiple pipes; synchronizes the swap buffers in order to synchronize two or more V12 boards, up to eight V-bricks and 16 V12 boards.
Analog output	13w3	Not used.

V-brick

The V-brick is a 4U I/O expansion brick that provides four half-height XIO slots. The V-brick can support one or two V12 VPro graphics boards. Each board requires two XIO slots. When the V-brick is configured with one V12 graphics board, the board resides in slots 1 and 2 (the top two slots) and the bottom two slots are covered with blanking plates. When the V-brick contains two V12 VPro graphics boards, the V-brick must be dual ported (each XIO port of the V-brick must connect to an IP53 node board).

Front Panel Components

The V-brick contains the following front-panel components (see Figure 12-2):

- **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.
- **On/Off switch with LED.** Press this button to turn on the V-brick internal components. You can also turn on the V-brick internal components at a system console or at the L2 controller touch display.
- **Three LEDs:**
  - On/Off switch LED. This LED illuminates green when the V-brick internal components are on.
  - 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 V-brick is still operating.
  - Failure LED. This LED illuminates red to indicate that a system failure has occurred and the V-brick is down.
- **Fans.** Three hot-pluggable fans provide N+1 redundant cooling.

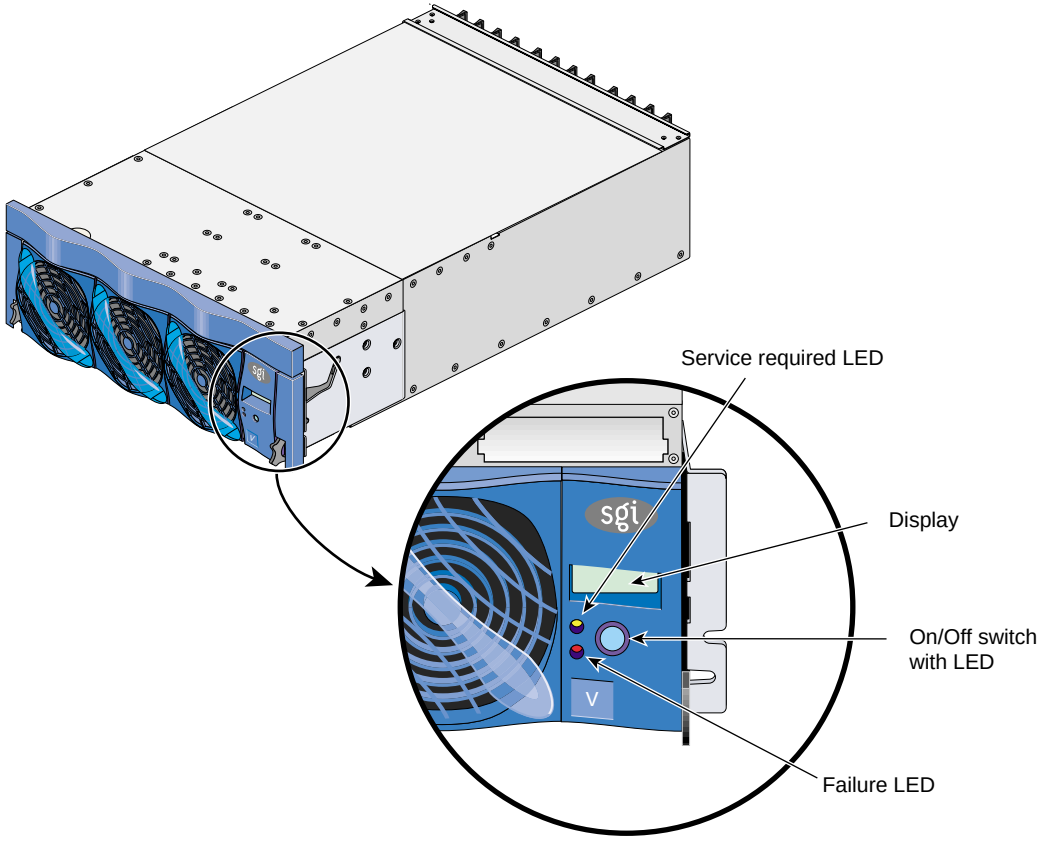

Figure 12-2 Front View of V-Brick

Rear Panel Components

The V-brick has the following rear-panel components (see Figure 12-3):

- **PWR (power) connector.** This connector connects the V-brick to a power bay, which provides 12-VDC and 48-VDC power to the V-brick.
- **Power switch.** Move the power switch to the **1** position to power on the L1 controller within the V-brick, and to the **0** position to power off the L1 controller.
- **48-VDC and 12-VDC LEDs.** The power switch must be in the ON (**1**) position for these LEDs to be on. The 12-VDC LED illuminates green when the L1 controller is powered on. The 48-VDC LED illuminates green when the rest of the V-brick internal components are powered on.
- **XIO slots.** The four XIO slots can seat one or two V12 VPro graphics board. Slots 1 and 2 seat one graphics board and slots 3 and 4 can seat the other graphics board. If the V-brick contains only one graphics board, the board resides in slots 1 and 2. Slots 3 and 4 are covered with blanking plates.

Warning: To avoid personal injury or damage to your system, only qualified SGI system support engineers (SSEs) can install and replace V12 VPro graphics boards.

- **XIO 10 and XIO 11 connectors.** Each connector can connect the V-brick to one IP53 node board. When the V-brick contains two V12 VPro graphics boards, the both XIO connectors must connect to IP53 node boards.
- **XIO connector LEDs.** Each connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the V-brick and the IP53 node board to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the V-brick and the IP53 node board to which it is connected.

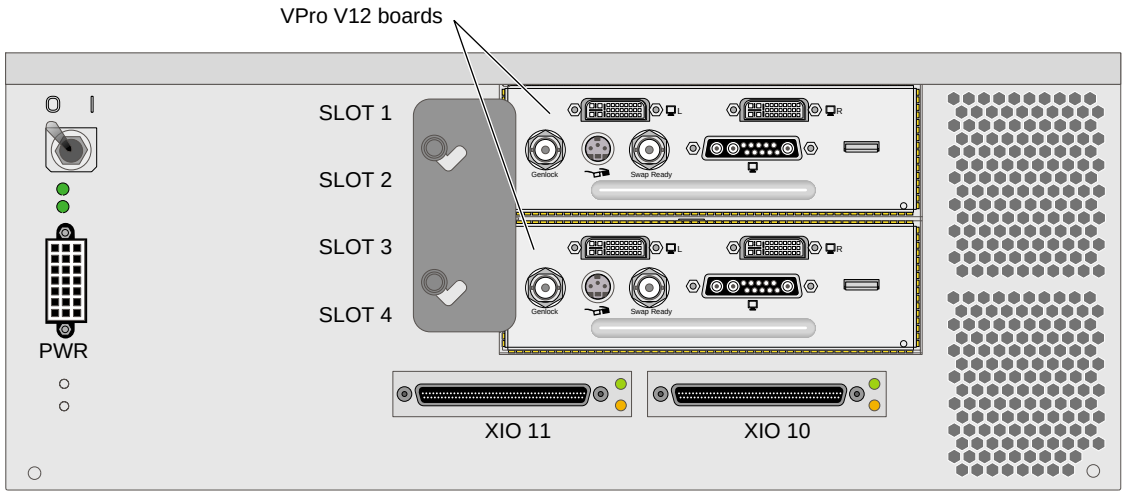

Figure 12-3 Rear View of V-brick

Technical Specifications

Table 12-2 lists the technical specifications of the V-brick.

Table 12-2 V-brick Technical Specifications

Characteristic	Specification
Height	6.64 in. (168.65 mm)
Width	17.5 in. (444.5 mm)
Depth	27.74 in. (698.50 mm)
Weight	69 lb (31.29 kg)
Input power	48 VDC (~300 W)

Compositor

The VPro V12 graphics board can connect to the 2U compositor (also referred to as CBOB) that is shown in Figure 12-4. The compositor provides static spatial composition (2D tiling) of two or four digital (DVI) signals from the V12 graphics board and outputs a single signal in either digital or analog format. Spatial composition enables multiple graphics pipes to contribute to a single graphics output. The area of the screen sent by each graphics pipe can be changed every frame.

The compositor can be configured with one or two V-bricks.

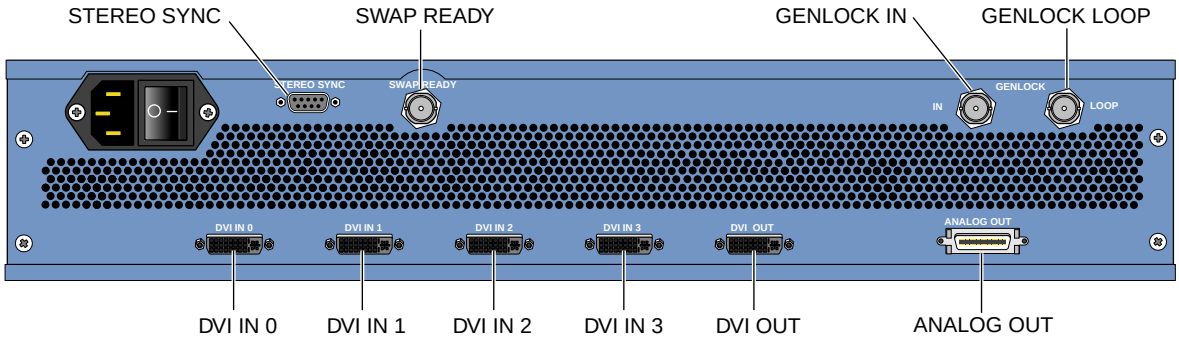

Figure 12-4 Rear View of Compositor

Table 12-3 describes the ports of the compositor.

Table 12-3 Compositor Ports

Feature	Notes
4 single-link, digital video inputs (DVI)	Up to 165-MHz pixel clock per input
1 single-link digital video output	Up to 165-MHz output
1 analog video output	Up to 400-MHz pixel clock video output; RGB; 2000 by 2000 resolution at 120 Hz
1 Swap Ready port	Controls the compositor update with the graphics pipe updates
Genlock input and loopthrough ports	Genlocks the compositor video output to an external source
DB9 stereo port	Controls CrystalEyes style stereo glasses

Table 12-4 lists the specifications of the compositor.

Table 12-4 Compositor Specifications

Characteristic	Description
Height	3.36 in. (85.34 mm)
Width	17.5 in. (444.5 mm)
Depth	20.5 in. (520.7 mm)
Weight	25 lb (11.34 kg)
Acoustic noise	50 dBA approximate
Cooling Requirements	256 Btu / hour
Power Consumption	90 watts maximum
AC input to power supply	100-120/200-240 Vac at 50-60 Hz (autoranging)
Inrush current	5 A maximum

InfiniteReality Graphics Components

An Origin 3900 server with InfiniteReality graphics delivers leadership visualization, computing, and data management power that is required by today's workgroup and departmental computing environments. It combines the revolutionary SGI NUMAflex approach to modular computing with InfiniteReality graphics to deliver realism and interactivity to users throughout the world.

The latest generation of the InfiniteReality graphics family is InfiniteReality4 graphics. InfiniteReality4 graphics integrates 2D, 3D, volumetric, and video data into a seamless visualization environment. It delivers the industry's best image quality through the use of full-scene 8 subsample anti-aliasing, 48-bit RGBA, interactive volume rendering, 1 GB of texture memory, up to 10 GB of frame buffer memory, and a pixel fill performance of over 1.3 G anti-aliased pixels per second per pipeline. Whether you are trying to traverse and analyze unlimited amounts of data, make movies or high-definition on-air graphics, or drive immersive displays, the Origin 3900 server with InfiniteReality4 graphics has the power and versatility to meet your needs.

Note: Your Origin 3900 server can have InfiniteReality graphics capabilities or InfinitePerformance graphics capabilities, but not both.

The InfiniteReality graphics capabilities are provided by the G-brick and the N-brick. The G-bricks contain the graphics pipes and the N-brick is used to connect the G-bricks to the host system. This chapter describes the function and physical aspects of these InfiniteReality graphics components in the following sections:

G-brick

The G-brick is a one- or two-pipe, rackmounted graphics interface that requires 18U of space within a rack. You can add 1 to 16 InfiniteReality graphics pipes to your Origin 3900 server. Each graphics pipe requires at least two processors and connection to one IP53 node board. Figure 13-1 shows the front and rear views of the G-brick.

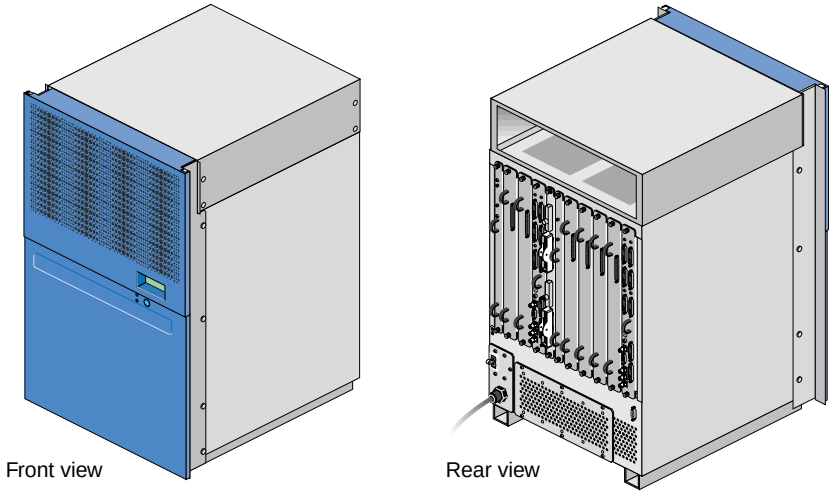

Figure 13-1 Front and Rear Views of G-brick

This section describes the G-brick in the following subsections:

External Components

The G-brick contains the following front-panel components (see Figure 13-2):

- **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 button with LED** enables you to manually power on and power off the brick.
- **L1 controller LEDs** function as follows:
  - **On/Off button LED** illuminates green when the internal components are powered on.
  - **Service required LED** illuminates orange to indicate that an item is not functioning properly, but the G-brick is still operating.
  - **Failure LED** illuminates red to indicate that a failure has occurred and the G-brick is not operating.

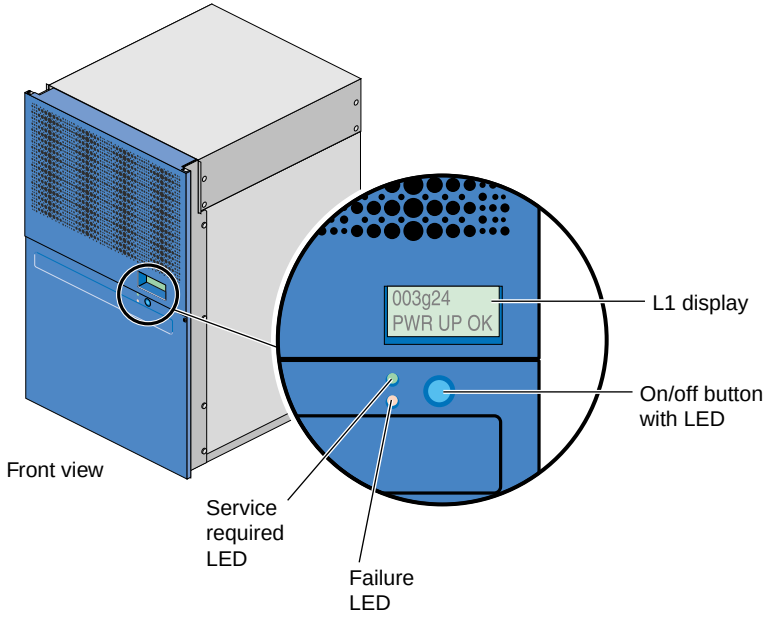

Figure 13-2 Front View of G-brick

The G-brick has the following rear-panel components, as shown in Figure 13-3:

- **Power switch** powers on the L1 controller when moved to the On (**1**) position; moving it to the Off (**0**) position powers off the L1 controller.
- **PWR (power) cord** attaches to an external 220 VAC power receptacle.
- **11 board slots** that house a Ktown2 board and one or two InfiniteReality graphics pipes. As you face the rear panel, the boards are located as follows:
  - **Six rightmost slots (pipe 0)** support a Geometry Engine processor board; one, two, or four raster manager (RM) boards; and a display generator (DG) board.
  - **Four leftmost slots (pipe 1)** support a Geometry Engine processor board, one or two RM boards, and a DG board.
  - **Ktown2 board** is located between pipe 0 and pipe 1. It contains two XIO connectors. The top connector connects pipe 0 (six rightmost slots) to an IP53 node board. The bottom connector connects pipe 1 (four leftmost slots) to an IP53 node board.
- **L1 (USB) connector** attaches the G-brick to the L2 controller.

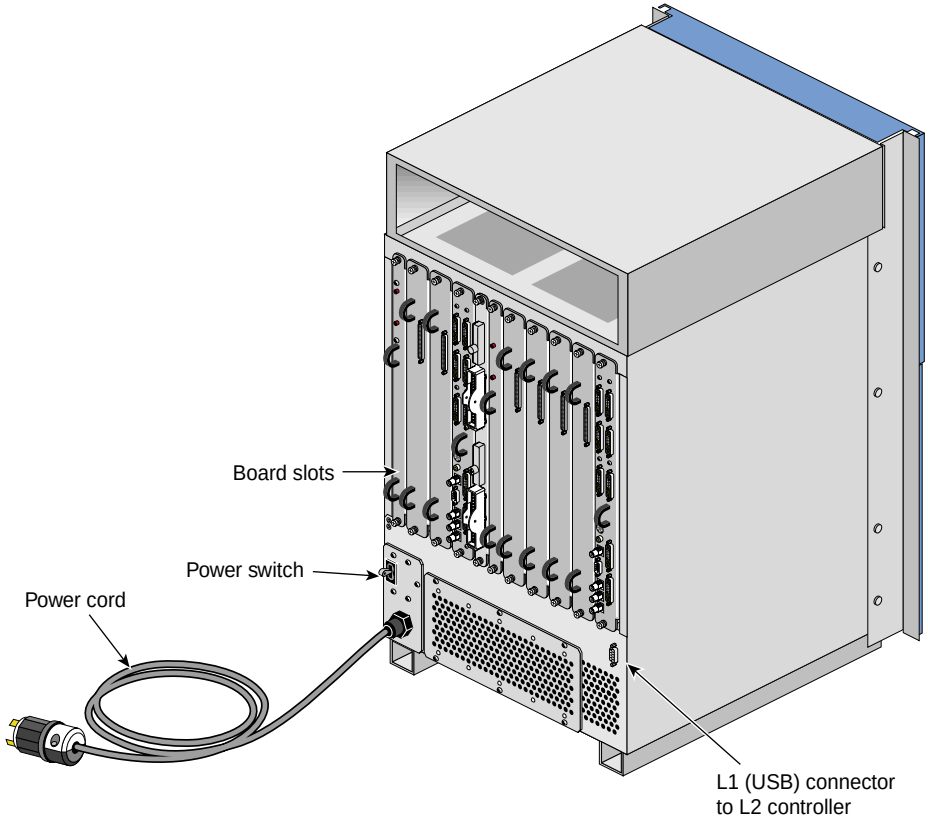

Figure 13-3 Rear View of G-brick

The G-brick contains:

- InfiniteReality board set
- L1 controller
- Power supply
- Midplane

InfiniteReality Board Set

The Origin 3900 server with InfiniteReality graphics supports several different InfiniteReality board sets. All of the InfiniteReality board sets consist of the following board types (see Figure 13-4):

- Ktown2
- Geometry Engine (GE)
- Raster manager (RM)
- Display generator (DG5)

Note: The InfiniteReality board sets are distinguished from each other primarily by the types of GE and/or RM boards that they contain. For example, the InfiniteReality2 board set includes an RM9 board and the InfiniteReality3 board set has an RM10 board.

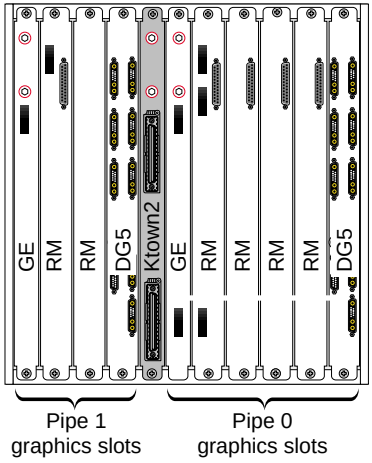

Figure 13-4 InfiniteReality Board Set

The Ktown2 board, which is physically located between the two pipes, provides two Crosstown2 (Xtown2) connections; the top Xtown2 connector is for the right pipe and the bottom Xtown2 connector is for the left pipe (see Figure 13-5). The Xtown2 connectors connect to the XIO port of an IX-, PX-, X-, or N-brick.

Each G-brick requires one Ktown2 board so that the G-brick can convert the data it receives from the host processors to differential signal levels.

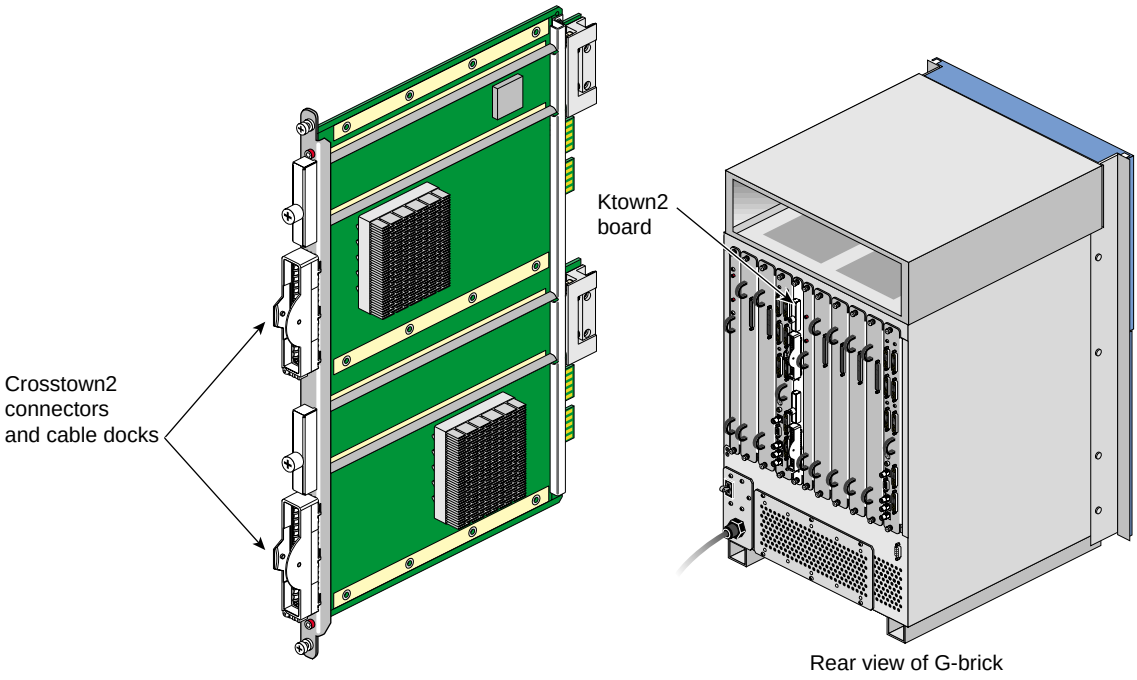

Figure 13-5 Ktown2 Board

The GE (Geometry Engine) board contains four processors that process OpenGL commands and vertex data that the GE board receives from the host processors (see Figure 13-6). Each pipe contains one GE board.

The GE board creates polygons and performs basic geometric transformation, lighting calculations, and other processes that make an image look normal to the human eye. The mathematical processes that occur in the GE board are measured in polygons per second (the unit for the rate at which data moves through the graphics pipe).

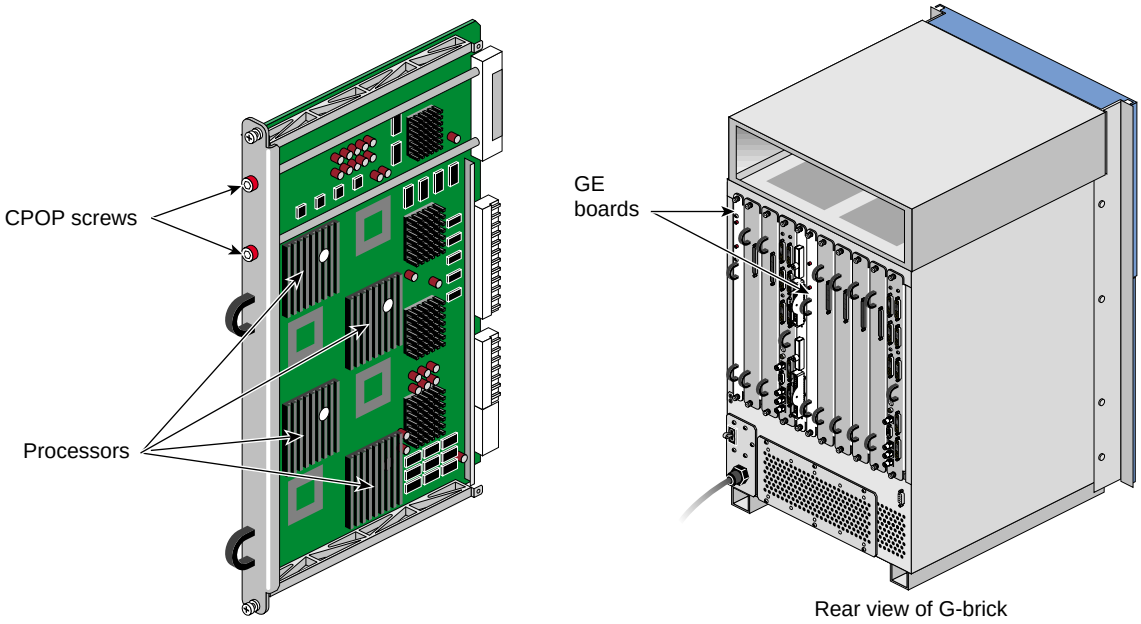

Figure 13-6 GE (Geometry Engine) Board

The RM (raster manager) boards have the following characteristics:

- Contain the main memory of the graphics system
- Provide the frame buffer
- Manage anti-aliasing
- Provide appropriate levels of screen resolution
- Contain texture memory (TM), which contains textures that can be applied to an image

Each G-brick supports two graphics pipes: a 2-RM pipe and a 4-RM pipe. The 2-RM pipe, which is physically located to the left of the Ktown2 board, contains one or two RM boards. The 4-RM pipe, which is physically located to the right of the Ktown2 board, contains one, two, or four RM boards.

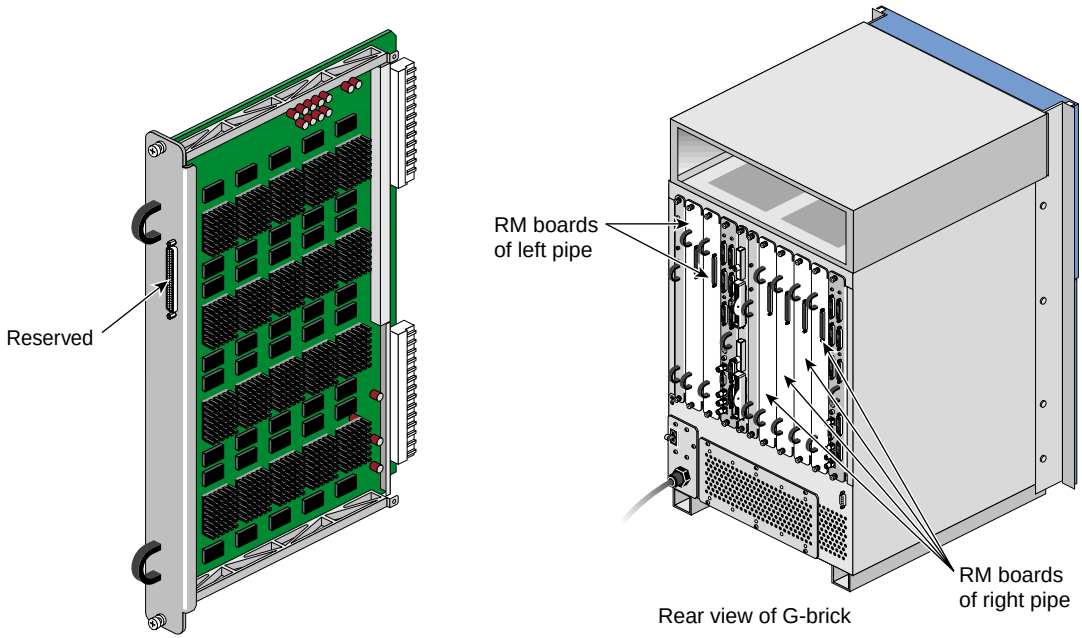

Figure 13-7 RM (Raster Manager) Board

The DG5 (display generator) board formats images so that they can be displayed on a monitor or delivered to other devices. The DG5 board has the following characteristics:

- Converts digital data to analog
- Handles all pixel clocking, genlocking, and cursor display functions
- Performs the role of functional manager
- Connects to the graphics display

  The default monitor resolution supported by the InfiniteReality2 and InfniteReality3 board sets and the SuperWide monitor is 1920 x 1200 at 66 MHz. The maximum output bandwidth is approximately 300 Mpix/s. For two monitors, the transfer rate is approximately 188 Mpix/s. If you connect more than two monitors, you must use a combination of low- and high-resolution monitors that are within the limit of 300 Mpix/s.

Each pipe contains one DG5 board (see Figure 13-8).

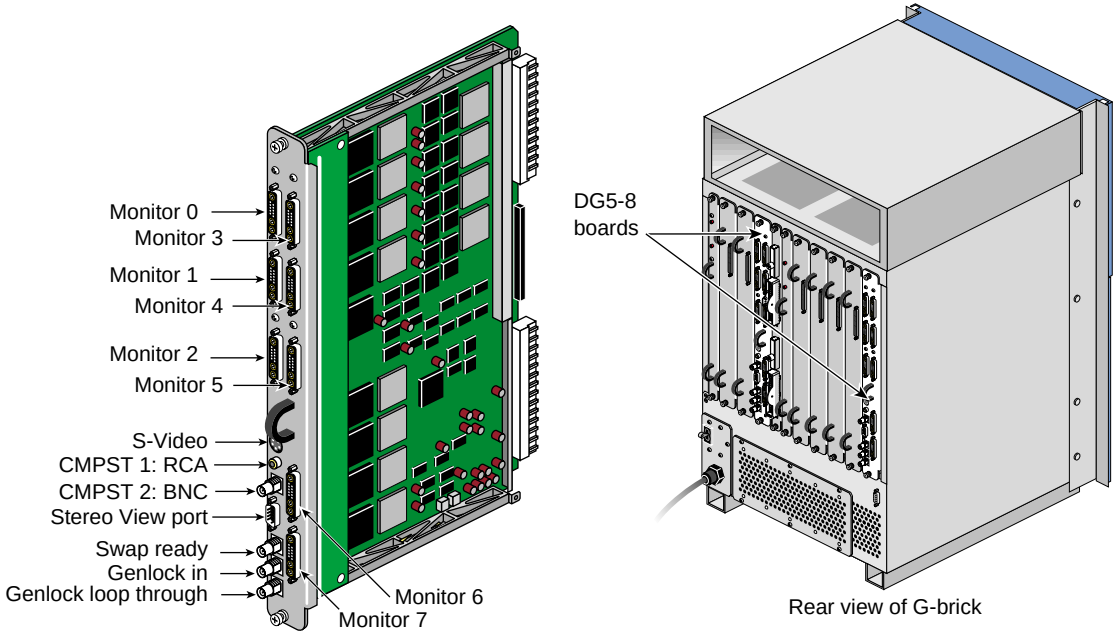

Figure 13-8 DG5 (Display Generator) Board

An Origin 3900 server with InfiniteReality graphics supports the six DG5 options listed in Table 13-1.

Table 13-1 DG5 Options

Option Name	Description
DG5-2	Default DG5 board that is configured with each graphics pipe. It has two high-resolution video outputs that can connect to two monitors. This option does not have a daughtercard.
DG5-2/DPLEX	DG5-2 board with a digital video multiplexer (DPLEX) daughtercard that enables multiplexing of two or more graphics pipes (referred to as a *hyperpipe*). The output of the graphics pipes is sent to a single monitor or other video input device.
DG5-2/GVO	DG5-2 board with a GVO daughtercard that provides real-time graphics-to-video output.
DG5-2/HDGVO	DG5-2 board with a HDGVO daughtercard that provides high-definition real-time graphics-to-video output.
DG5-2/DDO2	DG5-2 board with a DDO2 daughtercard that is used for custom hardware-in-the-loop (HITL) simulations.
DG5-8	DG5 board that has eight high-resolution video outputs that can connect to eight monitors. This option has a VIO5H daughtercard.

The DG5 options have the standard connections that are listed in Table 13-2.

Table 13-2 DG5 Standard Connections

Label	Type	Function
Monitors 0 through X	13W3	Variable high-resolution monitor outputs
S-Video	4-pin mini-DIN	Interface to SVHS VCR or monitor
CMPST 1	RCA jack	Interface to composite monitor or VCR
CMPST 2	BNC	Interface to composite monitor or VCR
Stereo View	9-pin sub-D	Interface to Stereo View goggles
Swap-ready	BNC	Interface to other graphics pipes
Genlock in	BNC	Interface to house sync or other pipes
Genlock loop-through	BNC	Loop-through connection

Technical Specifications

Table 13-4 lists the technical specifications of the G-brick.

Note: The G-brick has its own power supply, which requires an external 220 Vac power receptacle.

Table 13-3 G-brick Specifications

Characteristic	Specification
Height	31.5 in. (800.1 mm)
Width	19 in. (482.6 mm)
Depth	20 in. (508 mm)
Weight	215 lb (98 kg)
Input power	+180-254 VAC (~ 2000 W)

N-brick

The 2U N-brick, which has four pairs of connectors (800 MBytes in each direction), can be used to connect four graphics pipes to four IP53 node boards. A graphics pipe can also connect to an IP53 node board via an IX-, PX-, or X-brick, however, the N-brick is the most cost and space efficient solution when you do not require the additional I/O capability.

External Components

The N-brick contains the following front-panel components (see Figure 13-9):

- **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.
- **On/Off switch with LED.** Press this button to turn on the N-brick internal components. You can also turn on the N-brick internal components at a system console or at the L2 controller touch display.
- **Three LEDs:**
  - On/Off switch LED. This LED illuminates green when the N-brick internal components are on.
  - 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 N-brick is still operating.
  - Failure LED. This LED illuminates red to indicate that a system failure has occurred and the N-brick is not operating.
- **Fans.** Two hot-pluggable fans provide N+1 redundant cooling.

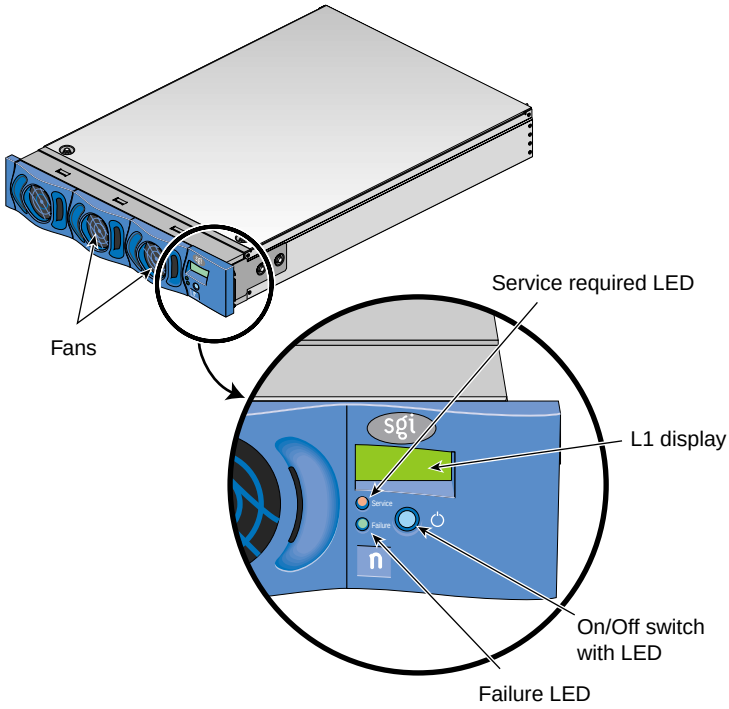

Figure 13-9 Front View of N-Brick

The N-brick has the following rear-panel components (see Figure 13-10):

- **PWR (power) connector.** This connector connects the N-brick to a power bay, which provides 12-VDC and 48-VDC power to the N-brick.
- **Power switch.** Move the power switch to the **1** position to power on the L1 controller within the N-brick, and to the **0** position to power off the L1 controller.
- **48-VDC and 12-VDC LEDs.** The power switch must be in the ON (**1**) position for these LEDs to be on. The 12-VDC LED illuminates green when the L1 controller is powered on. The 48-VDC LED illuminates green when the rest of the N-brick internal components are powered on.
- **Connectors**. Each connector on the left can connect to a graphics pipe via the Ktown2 board of a G-brick. Each connector on the right can connect to an XIO connector of an IP53 node board.

Note: The connectors that are in the same horizontal plane are connector pairs. For example, the two bottom connectors connect to each other internally.

- **Connector LEDs.** Each connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the N-brick and the brick to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the N-brick and the brick to which it is connected.

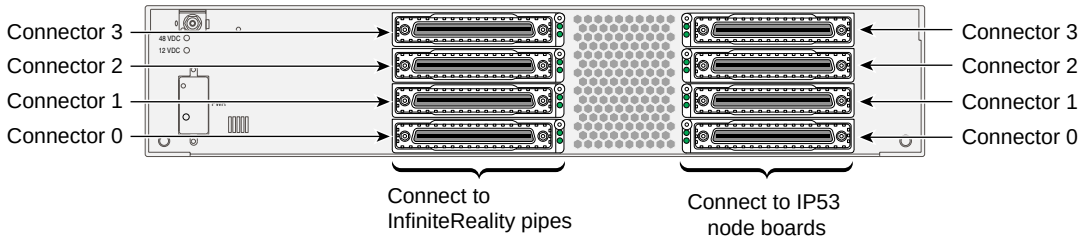

Figure 13-10 Rear View of N-Brick

Technical Specifications

Table 13-4 lists the technical specifications of the N-brick.

Table 13-4 N-brick 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	29 lb (13.15 kg)
Input power	48 VDC (~ 60 W)

Table 13-5 lists the specifications of the N-brick ports.

Table 13-5 N-brick Port Specifications

Port	Quantity	Peak Transfer Rate
XIO	8	800 MBytes in each direction
L1	1	12 Mbits/s

Maintenance and Upgrade Procedures

This chapter provides information about installing or removing components from your Origin 3900 server, as follows:

Maintenance Precautions and Procedures

This section describes how to prepare the server for maintenance and upgrade, protect the components from static damage, and return the server to operation. The following topics are covered:

Preparing Server for Maintenance or Upgrade

To prepare the server for maintenance, follow these steps:

1. If you are logged on to the server, log out.

   At your system console, switch to L2 mode by entering the following command:

   ```
   $> Ctrl+T
   ```

   From the L2 prompt (L2>), power off the server with the following command:

   ```
   L2> pwr d
   ```

2. Locate the PDU(s) in the rear of the rack and turn off the circuit breaker switches on each PDU.

Returning Server to Operation

When you finish installing or removing components, return the server to operation as follows:

1. Turn each of the circuit breaker switches to the “on” position.
2. At your system console, enter the following command:

   ```
   L2> pwr u
   ```

3. To ensure that the power-on procedure is proceeding properly, verify that the LEDs illuminate green and that your controllers display that the server is powered on for each segment of the procedure.

If your server does not boot correctly, see “Troubleshooting Chart” in Chapter 15, for troubleshooting procedures.

Using Grounding Wrist Strap

Caution: The components inside the server are extremely sensitive to static electricity. Always wear a wrist strap when you work with parts inside your server.

To use the wrist strap, follow these steps:

1. Unroll the first two folds of the band.
2. Wrap the exposed adhesive side firmly around your wrist, unroll the rest of the band, and then peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to an exposed electrical ground, such as a metal part of the chassis.

Identifying Customer-replaceable Units

Caution: Do not attempt to install or remove components that are not listed in Table 14-1. Components not listed must be installed or removed by a qualified SGI system support engineer.

Table 14-1 lists the customer-replaceable components and the page on which you can find the instructions for installing or removing the component.

Table 14-1 Customer-replaceable Components and Maintenance Procedures

Component	Procedure
PCI and PCI-X cards	"Installing or Replacing PCI or PCI-X Card" on page 202
IX-brick disk drives	"Installing or Replacing Disk Drives in IX-brick" on page 211
TP900 drive carrier modules	"Installing or Replacing TP900 Drive Carrier Module" on page 216
D-brick2 drive carrier modules	"Installing or Replacing D-brick2 Drive Carrier Module" on page 221

Installing or Replacing PCI or PCI-X Card

Warning: Before installing, operating, or servicing any part of this product, read the "Safety Information" on page 249.

This section provides instructions for installing or replacing a PCI or PCI-X card in the IX-brick or PX-brick. To maximize the operating efficiency of your cards, be sure to read all the introductory matter in the "PCI and PCI-X Card Configuration Guidelines" on page 86 before beginning the installation.

Caution: To protect the PCI cards from ESD damage, SGI recommends that you use a grounding wrist strap while installing or replacing a PCI card.

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

1. Shut down the operating system. (See your software guide if you need instructions to do this.)
2. Power off the I/O brick by following the power-off instructions in the “Powering Off Server” on page 24.
3. To extract a PCI card or empty PCI card carrier from a slot, pull the handle on the selected card carrier straight out, as shown in Figure 14-1.

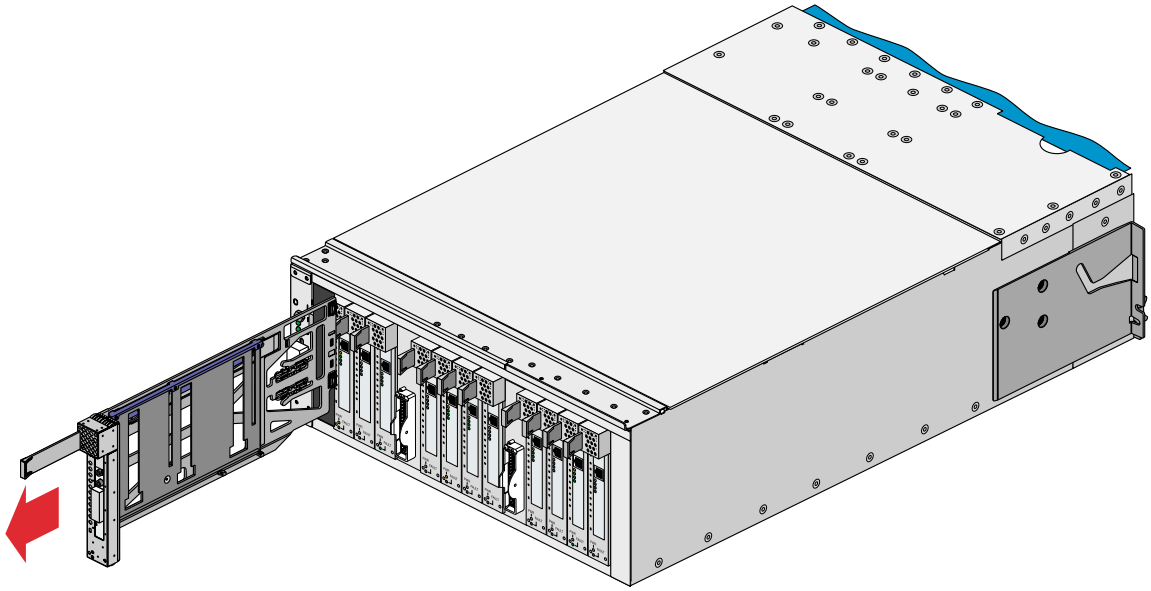

Figure 14-1 Removing Card Carrier

4. If you are replacing a card, carefully remove the existing card from the carrier.

   If you are adding a card, extract the carrier metal filler plate by pushing down on it, as shown in Figure 14-2. This filler plate covers the PCI-card connector area.

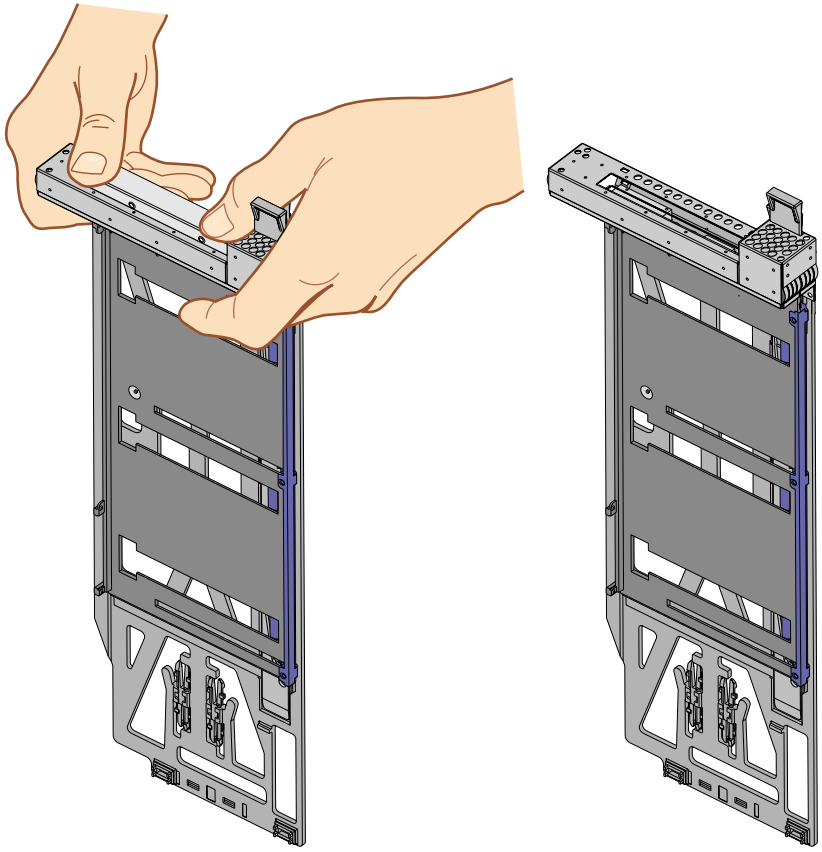

Figure 14-2 Extracting Carrier Metal Filler Plate

Note: If you are adding or replacing a half-height PCI card, skip step 5 and proceed to step 6.

5. If the full-height card that you want to install does not fit in the carrier, follow these steps:

   a. Loosen the three screws on the guide bar with a Phillips screwdriver (if your carrier uses T8 Torx screws, you will need a Torx screw driver).

   b. Adjust the carrier guide bar (also known as the alignment rail) up or down as necessary (see Figure 14-3).

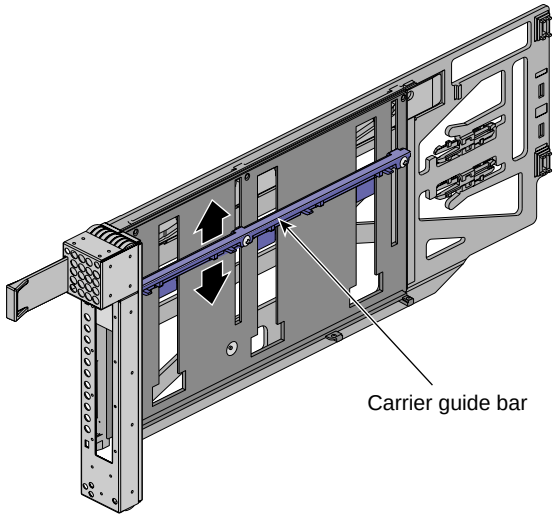

Figure 14-3 Adjusting Carrier Guide Bar

c. Mount the card in the carrier, as shown in Figure 14-4, so that the following occurs:

   – The card connectors protrude through the bulkhead where the metal filler plate was located.

   – The edge connectors fit between the bottom guides of the carrier.

   – The top of the card fits under the clips on the guide bar.

d. Tighten the three screws on the guide bar. Then skip step 6 and proceed to step 7.

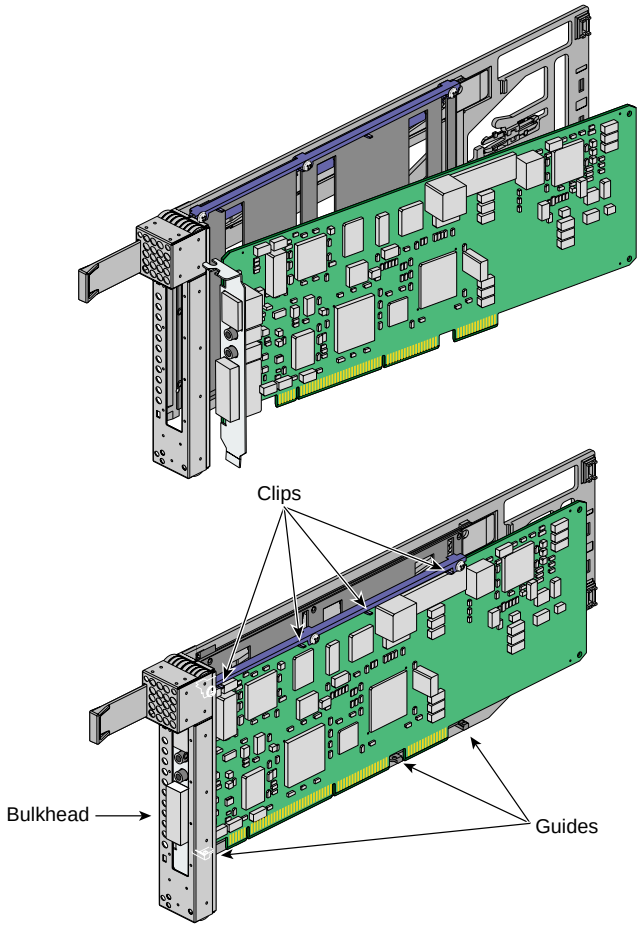

Figure 14-4 Mounting Full-height Card in Carrier

6. To install a half-height PCI card in a carrier, follow these steps:

   a. Remove the two screws from the carrier guide bar, as shown in Figure 14-5.

   Note: Take care not to lose the threaded inserts in the carrier guide bar.

   b. Loosen the third screw of the carrier guide bar.

   c. Place the half-height PCI card in the carrier so that the connector edge of the card rests against the lower guide tab of the carrier (see Figure 14-5).

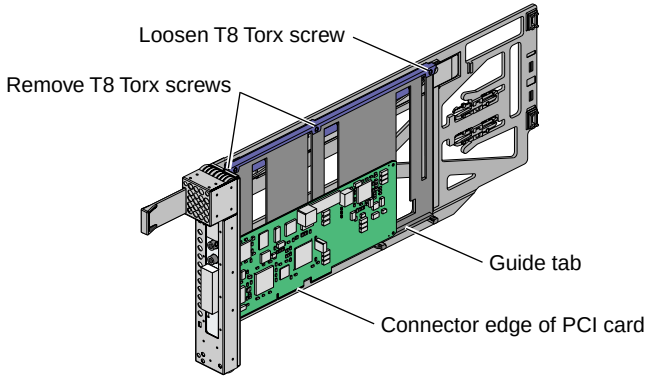

Figure 14-5 Mounting Half-height Card in Carrier

   d. Move the carrier guide bar (adjustment rail) so that it holds the card firmly in place (see Figure 14-6).

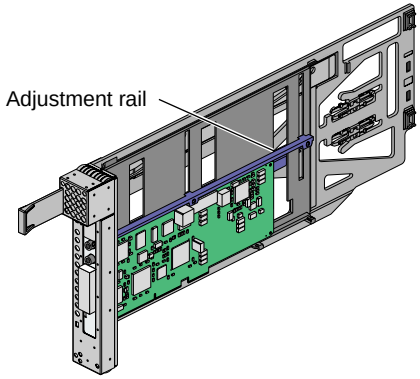

Figure 14-6 Moving Carrier Guide Bar to Secure Half-height Card

e. Place the PCI card bracket so that the screw holes of the bracket align with the empty screw holes of the carrier guide bar, as shown in Figure 14-7.

f. Secure the bracket to the carrier guide bar with two T8 Torx screws.

g. Tighten the screw that you loosened in step 6b.

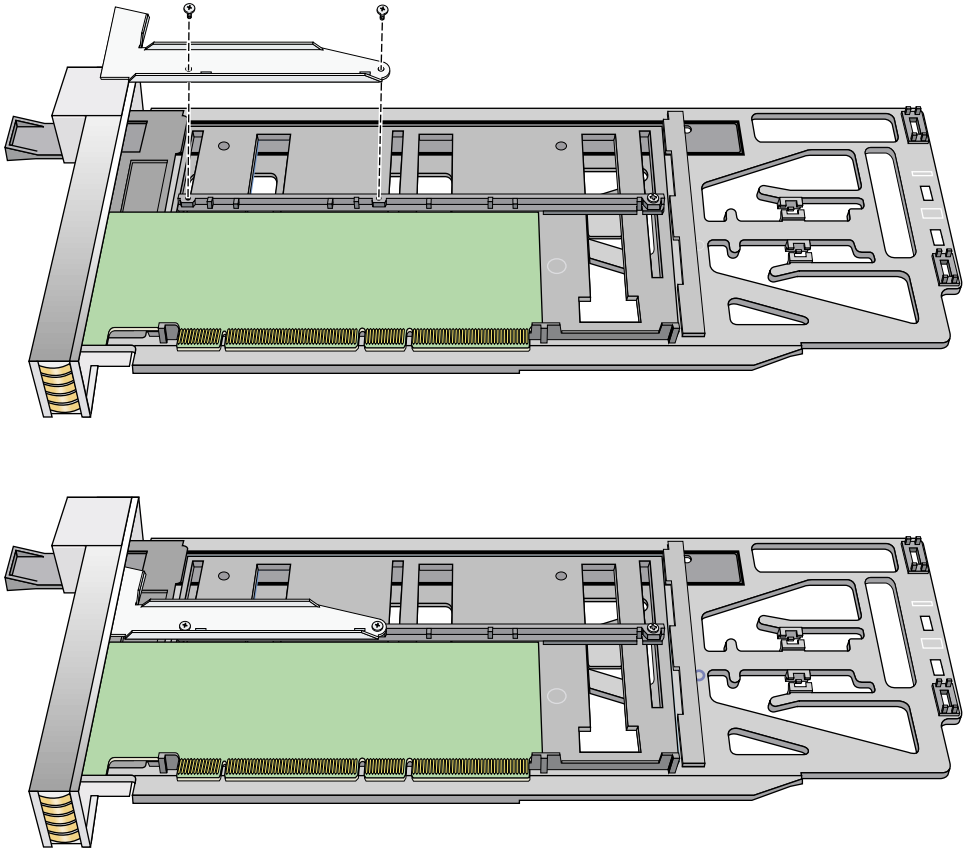

Figure 14-7 Installing Bracket to Secure Half-height Card

7. Insert the carrier-mounted PCI card into the vacant slot, using the slot guide, as shown in Figure 14-8.

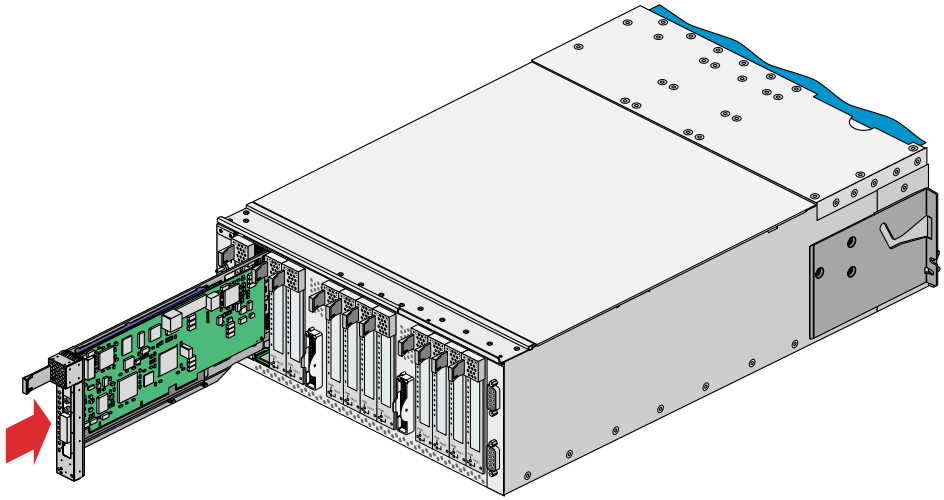

Figure 14-8 Installing Card in Slot

8. Push horizontally on the carrier seating bar, as shown in Figure 14-9, to seat the card securely in the slot.

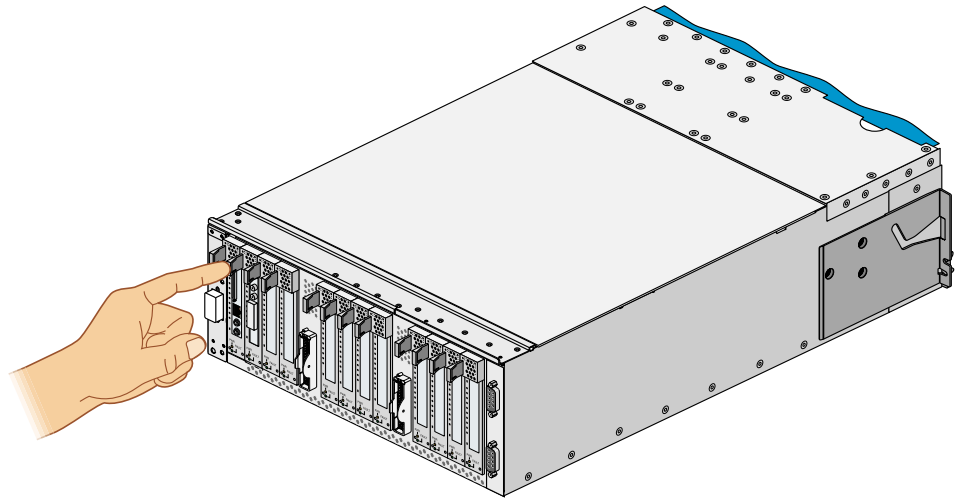

Figure 14-9 Seating Card in Slot

9. Power on the I/O brick by following the power-on instructions in the "Powering On Server" on page 8.
10. Boot your operating system software. (See your software operation guide if you need instructions to boot your operating system.)
11. Run the `hinv` hardware inventory command to verify the installation. This command lists hardware that the operating system discovered during the boot operation.

Installing or Replacing Disk Drives in IX-brick

The IX-brick has two SCSI disk drive bays as shown in Figure 14-10. This section describes how to install or remove SCSI disk drives.

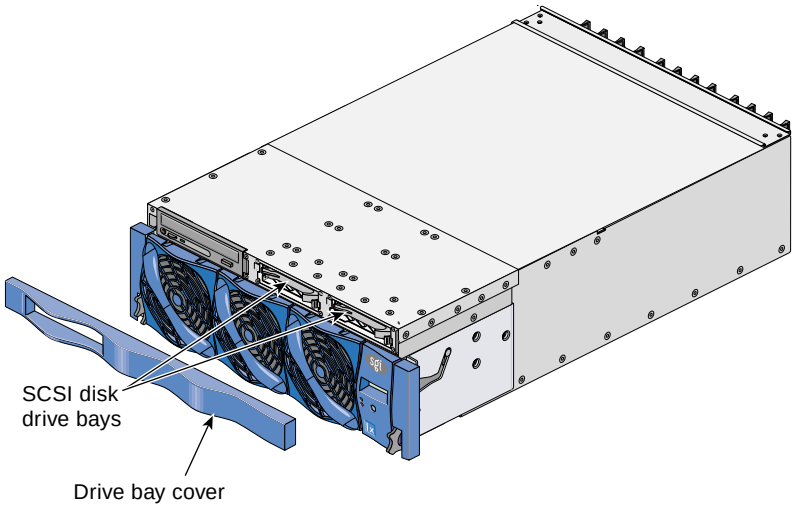

Figure 14-10 Location of SCSI Disk Drive Bays

Installing SCSI Disk Drive

Before you install a SCSI disk drive, you must power off the IX-brick according to the instructions in “Powering Off Server” on page 24.

Caution: To protect the server from ESD damage, SGI recommends that you use a grounding wrist strap while installing the disk drive.

To install a SCSI disk drive, see Figure 14-11 and follow these steps:

1. Remove the drive bay cover to access the two SCSI disk drive bays (see panel 1 in Figure 14-11).

   Note: If you are installing only one SCSI disk drive, install it in the rightmost bay.

2. Position the SCSI drive assembly so that it engages the bay guide rails, and then gently push the drive into the bay. Do not use the locking handle to push the drive into the bay.
3. Swing the locking handle towards the chassis until the locking handle engages the latch.
4. Snap on the drive bay cover.

After you finish installing the SCSI disk drive, power on the IX-brick according to the instructions in “Powering On Server” on page 8.

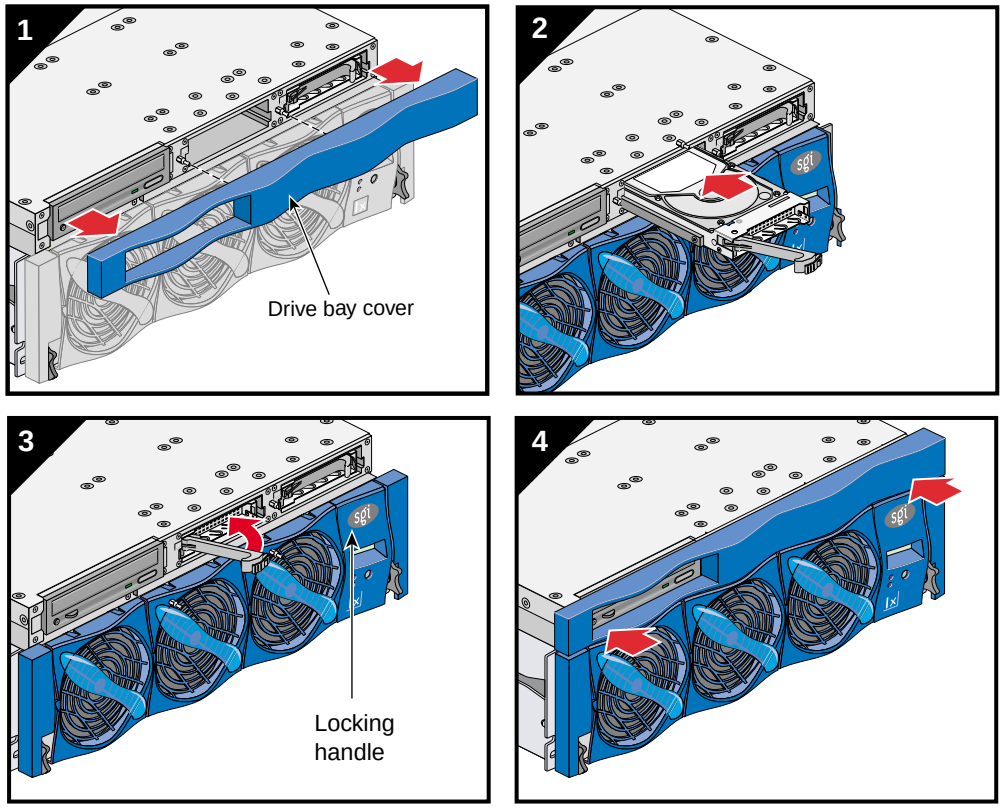

Figure 14-11 Installing SCSI Disk Drive

Removing SCSI Disk Drive

Before you remove a SCSI disk drive, you must power off the IX-brick according to the instructions in “Powering Off Server” on page 24.

To remove a SCSI disk drive, follow these steps (see Figure 14-12):

1. Remove the drive bay cover to access the two SCSI disk drive bays, as shown in panel 1 of Figure 14-12.
2. Remove the disk drive by depressing its handle lock with your thumb and pulling the handle away from the chassis until the handle disengages the disk drive connector from the backplane connector.
3. Carefully slide the disk drive out of the bay and place it on an ESD-safe surface. Do not use the handle to pull the disk drive out of the bay.

Note: When the IX-brick has only one SCSI disk drive, it should reside in the rightmost bay.

---

4. Install the drive bay cover.

After you remove the SCSI disk drive, power on the IX-brick according to the instructions in “Powering On Server” on page 8.

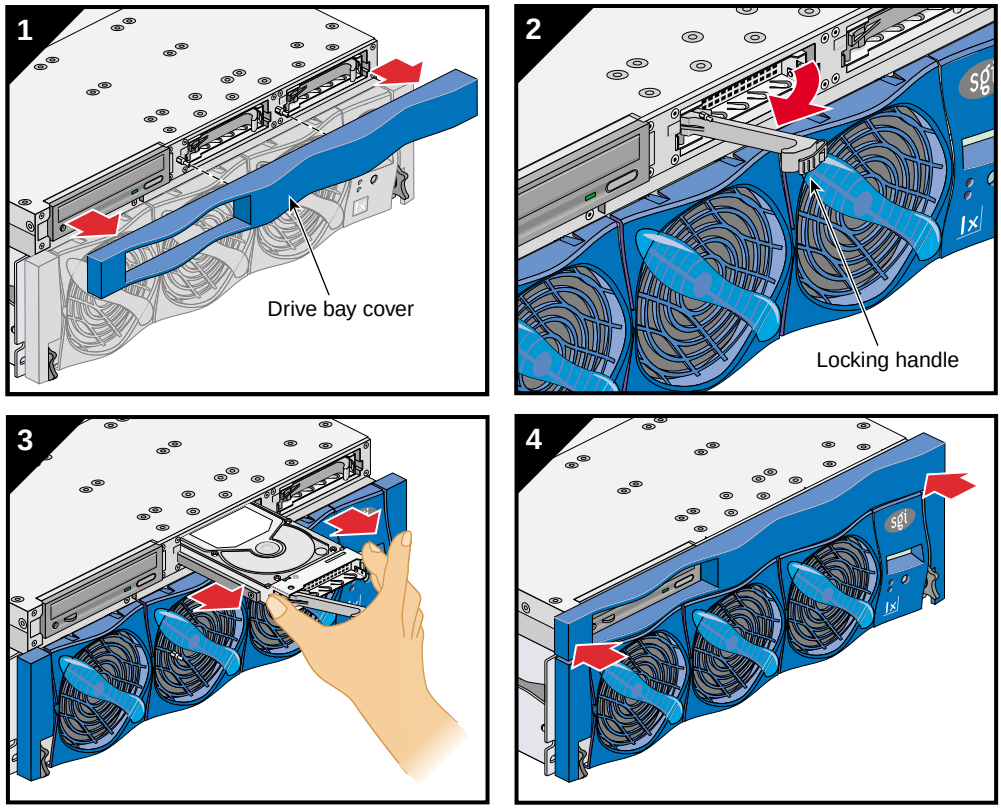

Figure 14-12 Removing SCSI Disk Drive

Installing or Replacing TP900 Drive Carrier Module

This section explains how to install or replace a drive carrier in the TP900 storage module, as follows:

- "Installing TP900 Drive Carrier Module" on page 216
- "Replacing TP900 Drive Carrier Module" on page 219

Caution: Observe all ESD precautions when handling modules and components. Avoid contact with backplane components and module connectors. Failure to observe ESD precautions could damage the equipment.

Caution: Do not remove a drive carrier unless a replacement or dummy carrier can be immediately added. The system must not be run without all modules in place. Any unused drive bays must be fitted with a dummy carrier module.

Installing TP900 Drive Carrier Module

To install a new disk drive module in the TP900 storage system, follow these steps:

1. Ensure that you have enough drive carrier modules and dummy modules to occupy all bays.
2. Carefully open the bag containing the drive carrier module.
3. Place the drive carrier module on an antistatic work surface and ensure that the anti-tamper lock is unlocked. When unlocked, the indicator window is black. If the indicator window is red, the drive is locked and must be unlocked before it can be installed in the TP900 storage module.

   To unlock the drive, insert the Torx screwdriver (included with the disk drive) into the socket in the lower part of the handle trim and turn it 90 degrees counterclockwise until the indicator window is black.

4. Remove the dummy drive carrier module from the target drive bay.

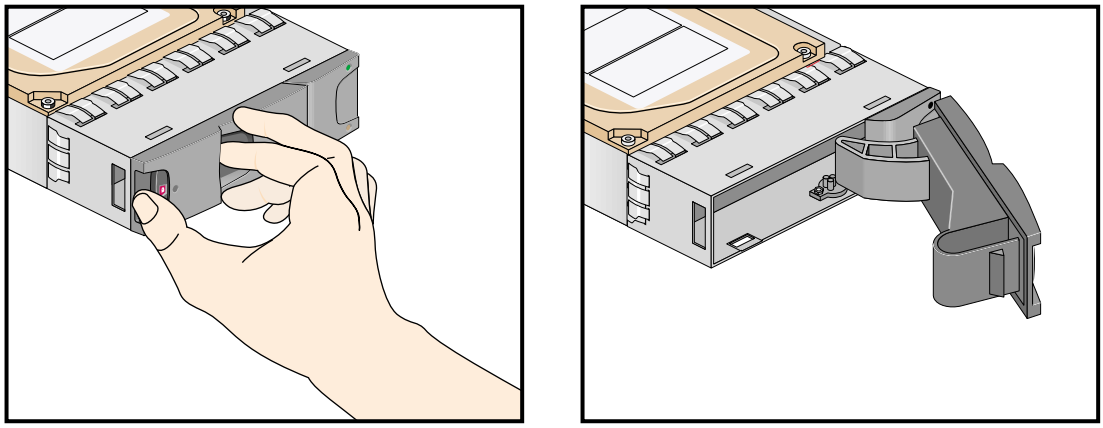

Figure 14-13 Releasing Carrier Handle

5. Release the handle of the replacement carrier by pressing the latch in the handle towards the right, as shown in Figure 14-13. Insert the carrier into the enclosure.

Important: Ensure that the carrier is oriented so that the handle opens from the left.

6. Gently slide the carrier all the way into the enclosure until it is stopped by the camming lever on the right of the carrier, as shown in Figure 14-14.

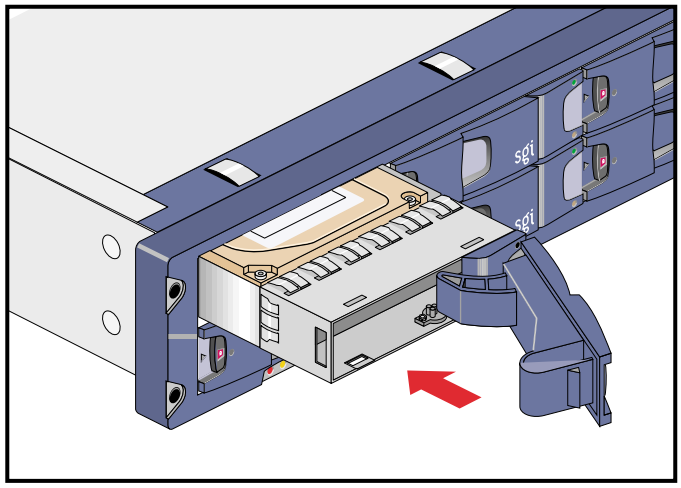

Figure 14-14 Carrier Camming Lever

7. Push the carrier handle into place; the camming foot on the base of the carrier will engage in a slot in the enclosure. Continue to push firmly until the handle fully engages. You should hear a click as the latch engages and holds the handle closed.
8. When you finish installing the drive carrier module(s), lock the drive carrier module(s) in the chassis by inserting the Torx screwdriver in the drive module and turning it 90 degrees clockwise. The indicator in the drive carrier module turns red when the drive is locked.
9. Install dummy drive carrier modules in all empty drive bays. The drive handle and camming mechanisms operate the same as those in a standard drive carrier module.

Replacing TP900 Drive Carrier Module

Caution: Follow electrostatic discharge (ESD) precautions while replacing the drive carriers. Avoid contact with the backplane components and module connectors.

To replace a drive carrier module from the TP900 enclosure, follow these steps:

Caution: Do not remove a drive carrier unless a replacement or a dummy carrier can be immediately added. The system must not be run without all modules in place. Any unused drive bays must be fitted with a dummy carrier module.

1. Using the operating system, spin down the drive prior to removal.

Caution: Damage can occur to a drive if it is removed while still spinning. If you cannot use the operating system to spin down the drives prior to removal, perform all steps of the following procedure to ensure that the drive has stopped prior to removal.

Note: The anti-tamper lock must be unlocked. If the drive module is locked, insert the Torx screwdriver (included with the disk drive) into the socket in the lower part of the handle trim. Then turn it 90 degrees counterclockwise until the indicator window is black. See Figure 14-15.

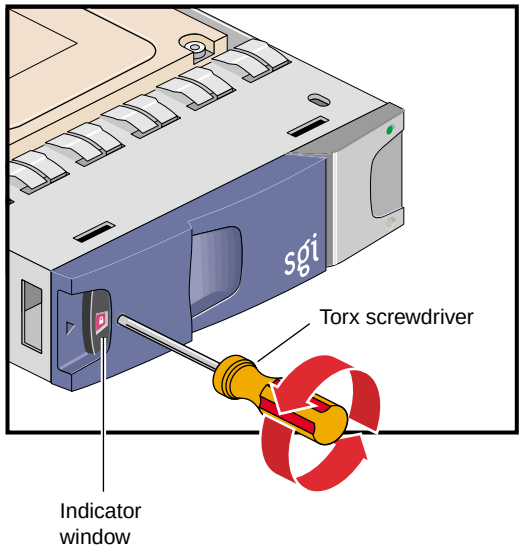

Figure 14-15 Unlocking Anti-Tamper Lock

2. Release the carrier handle by pressing the latch in the handle towards the right.
3. Gently withdraw the drive carrier module approximately 1 inch (25mm), and then wait 30 seconds for the drive to spin down.
4. After 30 seconds, withdraw the module from the drive bay. Replace it immediately; follow the instructions in “Installing TP900 Drive Carrier Module” on page 216.

Installing or Replacing D-brick2 Drive Carrier Module

This section explains how to install or replace a drive carrier in the D-brick2 storage module, as follows:

Caution: Observe all ESD precautions when handling modules and components. Avoid contact with backplane components and module connectors. Failure to observe ESD precautions could damage the equipment.

Caution: Do not remove a drive carrier unless a replacement or dummy carrier can be immediately added. The system must not be run without all modules in place. Any unused drive bays must be fitted with a dummy carrier module.

Installing D-brick2 Drive Carrier Module

Note the following:

- All disk drive bays must be filled with either a drive carrier module or a dummy drive module; no bay should be left completely empty.
- The drives in bays 1/1 and 4/4 of the D-brick2 storage module are required for enclosure management; these bays must always contain disk drives.

To install a new disk drive module in the storage system, follow these steps:

1. Ensure that you have enough drive carrier modules and dummy modules to occupy all bays.
2. Carefully open the bag containing the drive carrier module.

Warning: The disk drive handle might have become unlatched in shipment and might spring open when you open the bag. As you open the bag, keep it a safe distance from your face.

3. Place the drive carrier module on an antistatic work surface and ensure that the anti-tamper lock is unlocked. When unlocked, the indicator window is black. If the indicator window is red, the drive is locked and must be unlocked before it can be installed in the D-brick2 storage module.

   To unlock the drive, insert the Torx screwdriver (included with the disk drive) into the socket in the lower part of the handle trim and turn it 90 degrees counterclockwise until the indicator window is black. See Figure 14-16.

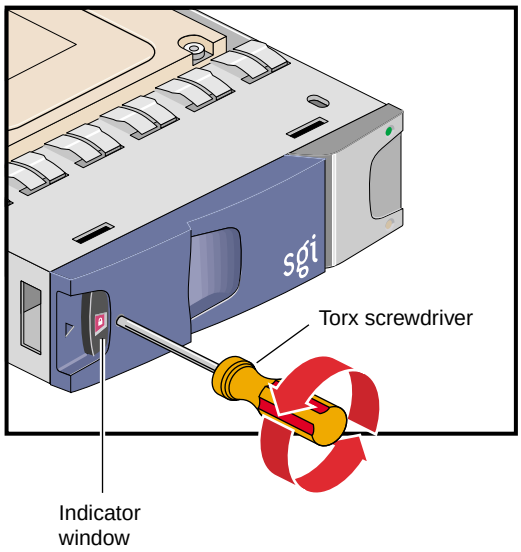

Figure 14-16 Unlocking Drive Carrier Module

4. Open the handle of the replacement carrier by pressing the latch handle towards the right (see Figure 14-17).

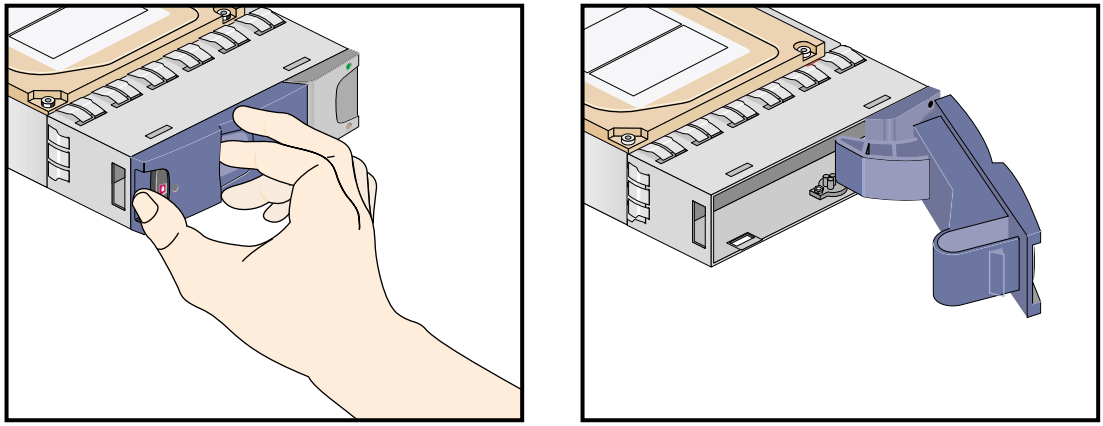

Figure 14-17 Opening Module Handle

5. Remove the dummy drive carrier module from the target drive bay.

6. Orient the new drive carrier module so that the hinge of the handle is on the right. Then slide the drive carrier module into the chassis until it is stopped by the camming lever on the right of the module (see Figure 14-18).

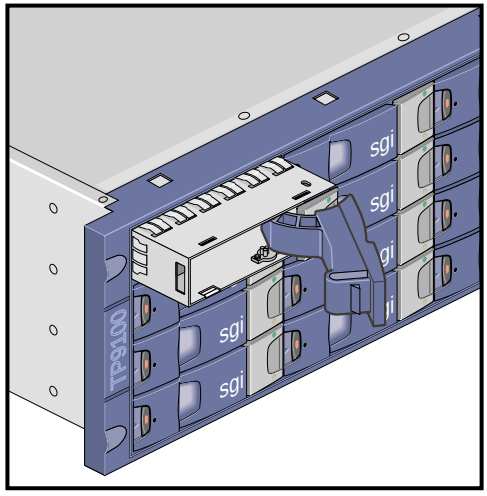

Figure 14-18 Inserting Disk Drive Module in D-brick2

7. Swing the drive handle shut and press it to seat the drive carrier module. The camming lever on the right of the module will engage with a slot in the chassis. Continue to push firmly until the handle fully engages with the module cap. You should hear a click as the latch engages and holds the handle closed.
8. Repeat steps 2 through 7 for all drive modules to be installed.

9. When you finish installing the drive carrier module(s), lock the drive carrier module(s) in the chassis by inserting the Torx screwdriver in the drive module and turning it 90 degrees clockwise. The indicator in the drive carrier module turns red when the drive is locked. See Figure 14-19.

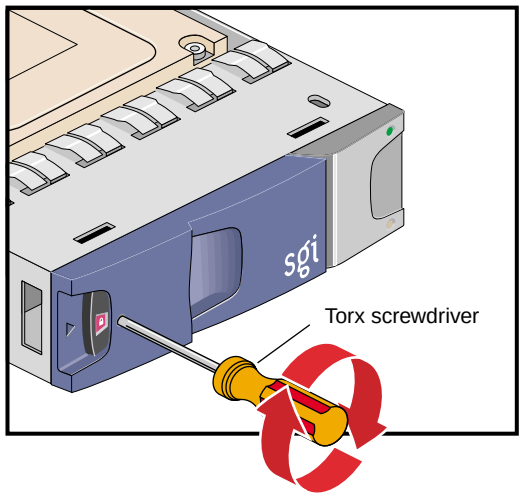

Figure 14-19 Locking Drive Carrier Module

10. Install dummy drive carrier modules in all empty drive bays. The drive handle and camming mechanisms operate the same as those in a standard drive carrier module.

Replacing D-brick2 Drive Carrier Module

This section explains how to replace a drive carrier module.

Caution: Follow electrostatic discharge (ESD) precautions while replacing the drive carriers. Avoid contact with the backplane components and module connectors.

Note: Replace disk drive modules one at a time.

To remove a drive carrier module from the D-brick2 enclosure, follow these steps:

1. Make sure that enough disk drives and dummy drives are available to occupy all bays.
2. Ensure that users are logged off of the affected systems; back up data if necessary.
3. If the drive module is locked, insert the Torx screwdriver into the anti-tamper lock and turn it 90 degrees counterclockwise. The indicator in the drive carrier module turns black when the drive is unlocked. See Figure 14-20.

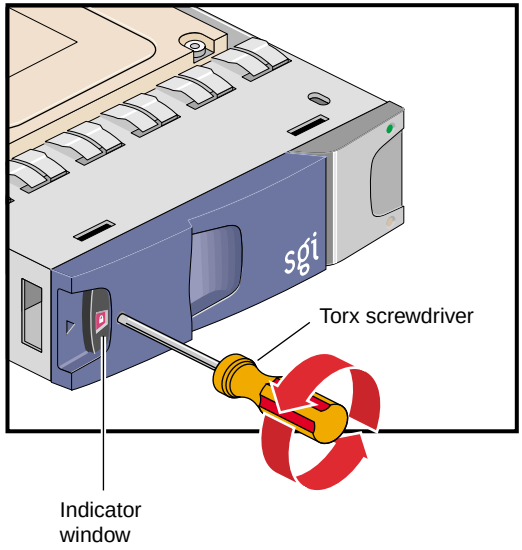

Figure 14-20 Unlocking Disk Drive Module

4. Open the handle by pressing the latch on the module handle towards the right. Then gently slide the module out of the enclosure approximately 1 inch (25 mm), and wait 30 seconds for the drive to stop spinning. See Figure 14-21.

Caution: Damage can occur to a drive if it is removed while still spinning.

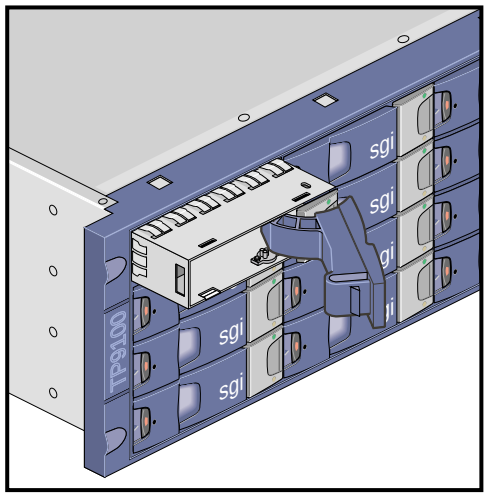

Figure 14-21 Removing Drive Carrier Module

5. After 30 seconds, withdraw the module from the drive bay. Replace it immediately; follow the instructions in “Installing D-brick2 Drive Carrier Module” on page 221.

Troubleshooting

This chapter provides the following sections to help you troubleshoot your Origin 3900 server:

Troubleshooting Chart

Table 15-1 lists recommended actions for problems that can occur. To solve problems that are not listed in this table, use the SGI Electronic Support system or contact your SGI system support engineer (SSE). For more information about the SGI Electronic Support system, see the "SGI Electronic Support" on page 234.

Table 15-1 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 in on, contact your SSE.
An individual brick will not power on.	Ensure that the power switch at the rear of the brick is on (**1** position). View the L1 display; see Table 15-2 if an error message is present. If the L1 controller is not running, contact your SSE. Check the connection between the brick and its power source.
The system will not boot the operating system.	Contact your SSE.
The Service Required LED illuminates on a brick.	View the L1 display of the failing brick; see Table 15-2 for a description of the error message.
The Failure LED illuminates on a brick.	View the L1 display of the failing brick; see Table 15-2 for a description of the error message.
The green or yellow LED of a NUMAlink port is not illuminated.	Ensure that the NUMAlink cable is seated properly on the source and destination bricks.
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.
The System Status LED of the TP900 is amber.	Contact your SSE.

Table 15-1 Troubleshooting Chart **(continued)**

Problem Description	Recommended Action
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 15-2 lists error messages that the L1 controller generates and displays on the L1 display. This display is located on the front of all bricks (except the TP900 and D-brick2 storage modules).

Note: In Table 15-2, 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 15-2 L1 Controller Messages

L1 System Controller Message	Message Meaning and Action Needed
Internal voltage messages:	
ATTN: <*power VRM description*> high fault limit reached @ x.xxV	30-second power-off sequence for the brick.
ATTN: <*power VRM description*> low fault limit reached @ x.xxV	30-second power-off sequence for the brick.
ATTN: <*power VRM description*> high warning limit reached @ x.xxV	A higher than nominal voltage condition is detected.
ATTN: <*power VRM description*> low warning limit reached @ x.xxV	A lower than nominal voltage condition is detected.
ATTN: <*power VRM description*> level stabilized @ x.xxV	A monitored voltage level has returned to within acceptable limits.
Fan messages:	
ATTN: FAN <fan description> fault limit reached @ xx RPM	A fan has failed to spin at its minimum RPM level even after an attempt by the L1 to increase its RPM. Check to see if a fan has failed and replace failed fan. Note: If the ambient air temperature exceeds the bricks warning limit, the brick will be shut down.
ATTN: FAN <fan description> warning limit reached @ xx RPM	A fan has failed to spin at its minimum RPM. The L1 has increased the RPM speed of all fans in the brick to compensate. Replace the faulty fan.

Table 15-2 L1 Controller Messages **(continued)**

L1 System Controller Message	Message Meaning and Action Needed
ATTN: FAN <fan description> stabilized @ xx RPM	The RPM level of a fan has increased to or above its minimum RPM requirement.
Temperature messages: low alt.	
ATTN: <temp sensor description> advisory temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded its warning limit.
ATTN: <temp sensor description> critical temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded its critical limit.
ATTN: <temp sensor description> fault temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded its fault limit.
Temperature stable message:	
ATTN: <temp sensor description> stabilized @ xxC/xxF	The ambient temperature at the brick'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.
Brick appears to have been powered down	The L1 controller has registered a fault and has shut down.

Note: To find a brick's warning, critical, and fault temperature limits use the "env" L1 command.

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 problems.

Figure 15-1 shows the sequence of events that occurs if you use all of the SGI Electronic Support capabilities.

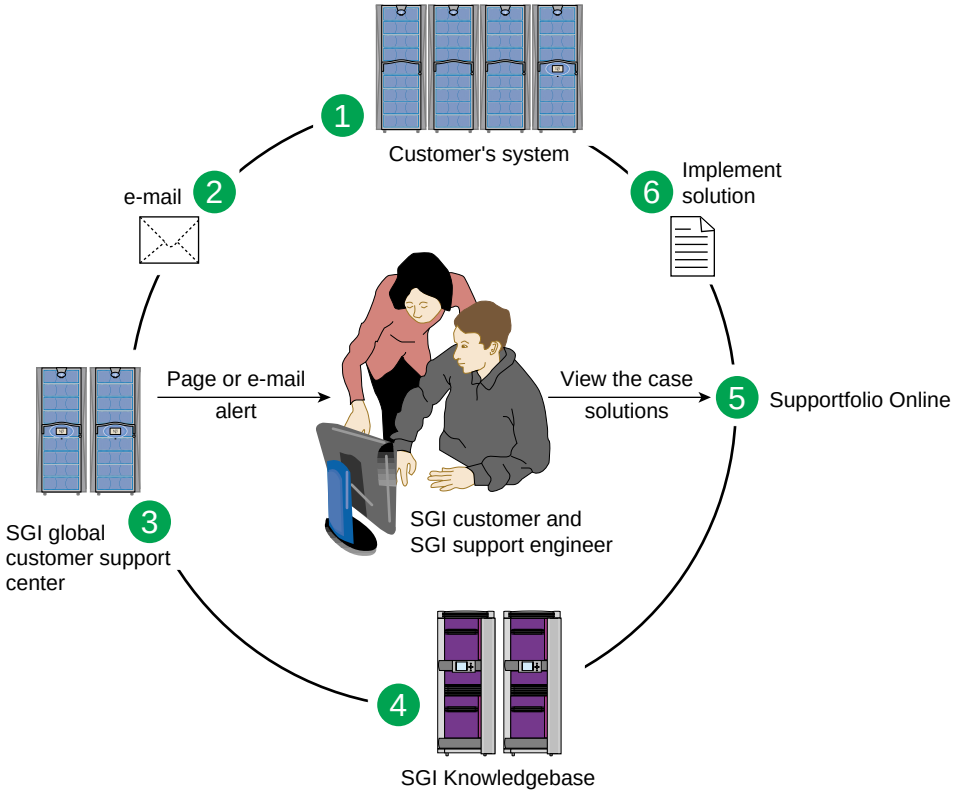

Figure 15-1 Full Support Sequence

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 Web page:

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

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

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

Technical Specifications and Pinouts

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

Configuration Specifications

Table A-1 summarizes the configuration ranges for the Origin 3900 server.

Table A-1 Origin 3900 Server Configuration Ranges

Category	Minimum	Maximum
Processors	4	512
Memory	1 GB (one IP53 node board)	1024 GB (32 Cx-bricks)
I/O bricks	1 IX-brick	8

Environmental Specifications

Table A-2 lists the environmental specifications of the Origin 3900 server.

Table A-2 Environmental Specifications

Feature	Specification
Non-operating environment:	
Temperature	-40 to 140 °F (-40 to +60 °C)
Humidity	10% to 95% non-condensing
Altitude	0 to 40,000 ft maximum
Operating environment:	
Air temperature (0 to 5000 ft)	41 to 95 °F (+5 to +35 °C)
Air temperature (5000 ft to 10,000 ft)	41 to 86 °F (+5 to +30 °C)
Humidity	10% to 95% non-condensing
Altitude	0 to 10,000 ft (0 to 3048 m)
Acoustical noise level (maximum)	Less than 65 dBa
Heat dissipation to air (maximum):	
Compute rack	30.20 Kbtu/hr (8.85 kW)
Router rack	5.46 Kbtu/hr (1.60 kW)
I/O rack	11.53 Kbtu/hr (3.38 kW)
Cooling requirement	Ambient air
Airflow: intake, front; exhaust, rear	Less than 2200 CFM
Non-operating environment:	
Temperature	-40 to 140 °F (-40 to +60 °C)
Humidity	10% to 95% non-condensing
Altitude	0 to 40,000 ft maximum
Operating environment:	
Air temperature (0 to 5000 ft)	41 to 95 °F (+5 to +35 °C)
Air temperature (5000 ft to 10,000 ft)	41 to 86 °F (+5 to +30 °C)
Humidity	10% to 95% non-condensing
Altitude	0 to 10,000 ft (0 to 3048 m)

Power Specifications

Table A-3 lists the power specifications for the server.

Table A-3 Power Specifications

Feature	Specification	
Input voltage:		
Single-phase option	180 - 254 VAC	
Three-phase option	180 - 254 VAC (North America/Japan) or 312 - 440 VAC (international)	
Frequency:	North America / Japan	International
	47-63 Hz	47-63 Hz
Maximum power consumption:		
Compute rack	9.03 kVA (8.85 kW)	
Router rack	1.63 kVA (1.60 kW)	
I/O rack	3.45 kVA (3.38 kW)	
Hold-up time	20 ms	
Total harmonic distortion	Less than 10% THD-Rms at full load	
Power cable	8-ft (2.4-m) pluggable drop cord(s)	
Power receptacle:	North America / Japan	International
Compute, router, or I/O rack (three-phase option)	(1) 60 A, IEC60309, 4 wire	(1) 32 A, IEC60309, 5 wire
Compute or router rack (single-phase option)	(1 or 2) 30 A, NEMA L6-30R	(1 or 2) 32 A, IEC60309
I/O rack (single-phase option)	(1) 30 A, NEMA L6-30R	(1) 32 A, IEC60309
Wall breaker size:		
Single-phase	30 A	
Single-phase (Europe)	32 A	
Three-phase	60 A	

Rack Specifications

Table A-4 lists the mechanical specifications of the 39U rack.

Table A-4 39U Rack Mechanical Specifications

Characteristic	Description
Rack height	74.25 in. (1886 mm)
Rack width	30 in. (762 mm)
Rack depth (less system display)	51.5 in. (1308 mm)
Rack weight (maximum):	
Compute rack	1300 lbs (590 kg)
Router rack	1050 lbs (476 kg)
I/O rack	1300 lbs (590 kg)
Rack shipping weight (maximum):	
Compute rack	1665 lbs (755 kg)
Router rack	1415 lbs (642 kg)
I/O rack	1665 lbs (755 kg)
Rack access requirements:	
Front	48 in. minimum (1219 mm)
Rear	48 in. (1219 mm)
Side	None

Non-proprietary Connector Pinouts

This section contains pinout information for the non-proprietary connectors of your server, as follows:

L1 Port

The Cx-brick and R-brick have one L1 port that connects the brick's L1 controller to the L2 controller. This port uses a USB type B connector (see Figure A-1). Table A-5 lists the pin assignments for the USB type B connector.

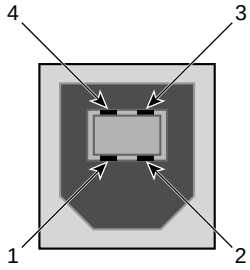

Figure A-1 USB Type B Connector

Table A-5 USB Type B Connector Pin Assignments

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

External SCSI Port

The external SCSI port uses a SCSI 68-pin VHDCI connector (see Figure A-2). This connector is located on the IO9 PCI card in the IX-brick and on the TP900 storage module. Table A-6 shows the SCSI VHDCI pin assignments.

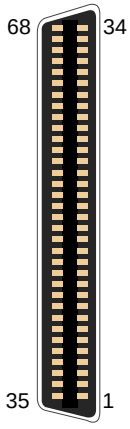

Figure A-2 External SCSI Connector

Table A-6 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)

Table A-6 SCSI VHDCI Pin Assignments **(continued)**

Pin Number	Signal Name	Pin Number	Signal Name
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
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)

Serial and Console Ports

The IX-brick has two standard serial ports. As an option, two additional serial ports can be added to the IX-brick. These ports are capable of transferring data at rates as high as 230 kbps. Other features of the ports include the following:

- Programmable data, parity, and stop bits
- Programmable baud rate and modem control

The Cx-brick has one console port that connects the Cx-brick L1 controller to a system console.

Both the serial and console ports use a DB9 connector (see Figure A-3).

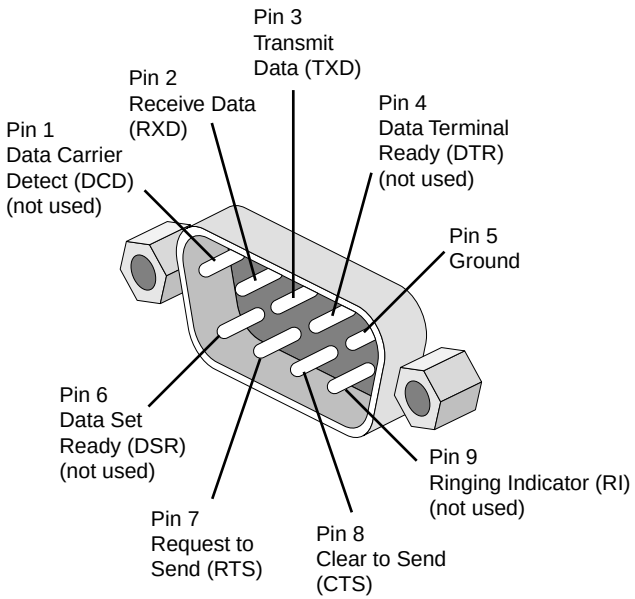

Figure A-3 DB9 Connector

Table A-7 shows pinout assignments for the 9-pin male DB-9 connector.

Table A-7 DB9 Pin Assignment

Pin	Assignment	Description
1	DCD	Data carrier detect
2	RXD	Receive data
3	TXD	Transmit data
4	DTR	Data terminal ready
5	GND	Signal ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator

Ethernet Port

The Ethernet port, which is located on the L2 controller, uses an RJ-45 connector (see Figure A-4).

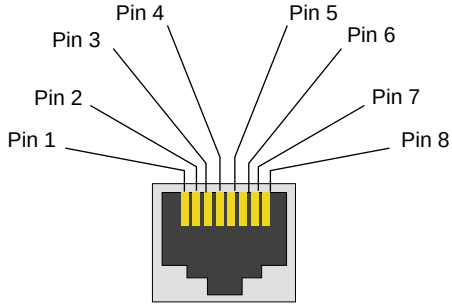

Figure A-4 RJ-45 Connector

Table A-8 shows the cable pinout assignments for the Ethernet port operating in 10/100-Base-T mode and also operating in 1000Base-T mode.

Note: The system auto-selects the Ethernet port speed and type (duplex vs. half-duplex) when the server is booted, based on what it is connected to.

Table A-8 RJ-45 Connector Pin Assignments

Ethernet 10/100Base-T Pinouts		Gigabit Ethernet Pinouts	
Pins	**Assignment**	**Pins**	**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 –

Real Time Interrupt Input and Output

Figure A-5 shows the stereo jack connector conductors that are used for the RT interrupt input and RT interrupt output ports of the IO9 PCI card, which is located in the IX-brick. Table A-9 lists the conductor assignments for the stereo jack connector.

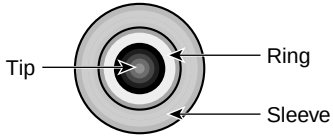

Figure A-5 Stereo Jack Connector Conductors

Table A-9 Stereo Jack Connector Conductor Assignments

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

Safety Information and Regulatory Specifications

This appendix provides safety information and regulatory specifications for your server in the following sections:

Safety Information

Read and follow these instructions carefully:

1. Follow all warnings and instructions marked on the product and noted in the documentation included with this product.
2. Unplug this product before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
3. Do not use this product near water.
4. 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.
5. Slots and openings in the system are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these 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.
6. This product should be operated from 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.
7. Do not allow anything to rest on the power cord. Do not locate this product where people will walk on the cord.
8. Never push objects of any kind into this product through cabinet slots as 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.

9. Do not attempt to service this product yourself except as noted in this guide. Opening or removing covers of node and switch internal components may expose you to dangerous voltage points or other risks. Refer all servicing to qualified service personnel.
10. Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
    - When the power cord or plug is damaged or frayed.
    - If liquid has been spilled into the product.
    - If the product has been exposed to rain or water.
    - If the product does not operate normally when the operating instructions are followed. Adjust only those controls that are covered by the operating instructions since 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 the cabinet has been damaged.
    - If the product exhibits a distinct change in performance, indicating a need for service.
11. If a lithium battery is a soldered part, only qualified SGI service personnel should replace this lithium battery. For other types, replace it only with the same type or an equivalent type recommended by the battery manufacturer, or the battery could explode. Discard used batteries according to the manufacturer's instructions.
12. Use only the proper type of power supply cord set (provided with the system) for this unit.
13. Do not attempt to move the system alone. Moving a rack requires at least two people.
14. Keep all system cables neatly organized in the cable management system. Loose cables are a tripping hazard that cause injury or damage the system.

Regulatory Specifications

The following topics are covered in this section:

The SGI Origin 3900 server conforms to several national and international specifications and European Directives listed on the "Manufacturer's Declaration of Conformity."

Caution: This product 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.

CMN Number

The model number, or CMN number, for the Origin 3900 server is on the system label, which is mounted inside the rear door on the base of the rack.

CE Notice and Manufacturer's Declaration of Conformity

The "CE" symbol displayed on each device 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 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。

Figure B-1 VCCI Notice (Japan Only)

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．

Figure B-2 Chinese Class A Regulatory Notice

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.

Figure B-3 Korean Class A Regulatory Notice

Shielded Cables

The Origin 3900 server is FCC-compliant under test conditions that include the use of shielded cables between the server and its peripherals. Your server and any peripherals 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 need to be shielded.

Optional monitor cables supplied with your system use additional filtering molded into the cable jacket to reduce radio frequency interference. Always use the cable supplied with your server. If your monitor cable becomes damaged, obtain a replacement cable from SGI.

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 your server. 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. 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.

Laser Compliance Statements

The DVD-ROM drive in this server is a Class 1 laser product. The DVD-ROM drive's classification label is located on the drive.

Warning: Avoid exposure to the invisible laser radiation beam when the device is open.

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 Statements

Warning: **If a lithium battery is a soldered part, only qualified SGI service personnel should replace this lithium battery. For other types, replace the battery only with the same type or an equivalent type recommended by the battery manufacturer, or the battery could explode. Discard used batteries according to the manufacturer's instructions.**

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

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

W

X