

SGI™ Origin 3000 Series Owner's Guide

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CONTRIBUTORS

Written by Carolyn Curtis, Francisco Razo, and Linda Rae Sande

Illustrated by Dan Young and Carolyn Curtis

Edited by Connie Boltz

Production by Karen Jacobson and Rena Patel

Engineering contributions by Don Adams, Rich Altmaier, Weston Bielby, Dick Brownell, Michael T. Brown, Tom Crapisi, Dave Deherder,

Vince Duperron, Kim Gustafson, Nancy Heller, Jill Hietpas, Greg Howard, Bill Kellerman, Christopher Lindahl, Tom McGee, Robert Novak, James Passint, Craig Schultz, Addison Snell, Gary Spilde, and Michael Wright.

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

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About This Guide

This guide introduces the SGI Origin 3000 series of server products, which are servers whose functionality is divided into distinct functional units called “bricks.” Bricks allow ease of customization to meet your computing needs. This guide also shows you how to operate and maintain your server. Specifically, it provides the following information:

- Introduction to the SGI Origin 3000 server series (the SGI Origin 3200 server, the SGI Origin 3400 server, and the SGI Origin 3800 server). The introduction includes descriptions of all the items that compose a server, including the bricks and the racks, and a list of the server features.
- Instructions for connecting a console and for adding and replacing PCI cards and disk drives to your server.



Warning: For your safety and for the protection of your server system, only add or replace those items designated in this guide as to be added or replaced by a customer. Contact your SGI system service engineer (SSE) to add or replace any items in this guide.

- Instructions for powering on and powering off your server.
- Instructions for using the L1 and L2 controllers to monitor and control your server system and lists of L1 and L2 controller commands.
- Descriptions of the components, functions, connectors, and LEDs of the C-brick, I-brick, P-brick, X-brick, D-brick, R-brick, and system power. These descriptions include instructions for installing and replacing PCI cards and disk drives.
- Instructions for maintaining and troubleshooting your server system.
- Specifications for rack enclosures and individual bricks.

Audience

This guide is written for owners, system administrators, and users of the SGI Origin 3000 server series. It presumes general knowledge of computers and computer operation.

Notes, Cautions, and Warnings

Throughout this document you will find notes, cautions, and warnings:

- A note provides information to help you in setting up, using, or maintaining your server.
- A caution provides you with information to avoid damaging your server.
- warnings provide you with information to avoid harming yourself and possibly damaging the server.



As a general warning, you are asked to have your SGI system support engineer (SSE) perform all the set up, addition or replacement of parts, cabling, and service of your SGI Origin 3000 server with the exception of the following items that you can perform yourself:

- connecting a system console to your server.
- 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 cards as described in this guide.
- adding and replacing disk drives in the D-brick as described in this guide.
- using the On/Off switch and other switches (the reset and non-maskable interrupt (NMI) switches on the C-bricks) on the front panel of your server bricks.
- using the ESI/ops panel (operating panel) on the D-brick.

Chapter Descriptions

This guide consists of the following:

- Chapter 1, “Introducing the SGI Origin 3000 Series,” describes the primary features of the SGI Origin 3000 server models available and the bricks and rack enclosures that compose the SGI Origin 3000 server.
- Chapter 2, “System Configuration and Operation,” explains how to configure your system hardware to meet your computing needs, and how to operate your server system.
- Chapter 3, “System Control,” describes the function and interaction of the L1, L2, and L3 controllers used to monitor and control the function of the SGI Origin 3000 servers.
- Chapter 4, “C-brick,” describes the compute brick, including its connectors.
- Chapter 5, “I-brick,” describes the I-brick’s function as the base I/O for the server, its removable components, its I/O panel, and its connectors.
- Chapter 6, “P-brick,” describes the brick that provides additional PCI slots and explains how to add and replace PCI boards in the brick.
- Chapter 7, “X-brick,” describes the brick that houses XIO boards.
- Chapter 8, “D-brick,” describes the D-brick chassis, panel, and disk drive modules, and explains how to install and replace disk drive modules.
- Chapter 9, “R-brick,” describes the R-brick (router) that is included in rack systems (SGI Origin 3400 server, and SGI Origin 3800 server).
- Chapter 10, “System Power,” describes the power system components of the SGI Origin 3000 servers.
- Chapter 11, “Maintenance and Troubleshooting,” describes maintenance and troubleshooting that can be performed on the SGI Origin 3000 server series.
- Appendix A, “Technical Specifications,” contains specifications for the short 17U rack and the tall 39U rack enclosures and physical and power specifications for each brick.
- Appendix B, “System Controller Commands,” explains the L1 and L2 commands.
- Appendix C, “Controller Status and Error Messages,” describes the status and error messages received through your L1 and L2 controllers, and explains how to proceed, if some action is required.
- Appendix D, “Regulatory Specifications,” describes the regulatory specifications for the SGI Origin 3000 server series.

Information Sources

The SGI Origin 3000 server series include the following sources of information, as shown in Figure i.

- *SGI Origin 3000 Series Owner's Guide* (this book, which you are reading) (hard copy)
- *IRIX Admin Software Installation and Licensing Guide* (hard copy)
- *SGI Onyx3000 Series Graphics System Hardware Owner's Guide* (optional)
- *Silicon Graphics 230 Visual Workstation User's Guide* (optional)
- SGI documentation available on World Wide Web

The following information sources require an SGI workstation running IRIX software to use. (Those of you without IRIX software can access pdf files of the following documentation through our <http://techpubs.sgi.com/library> website):

- IRIS InSight online documentation and help
- Man pages (online)
- *IRIX Release Notes* (on CD)

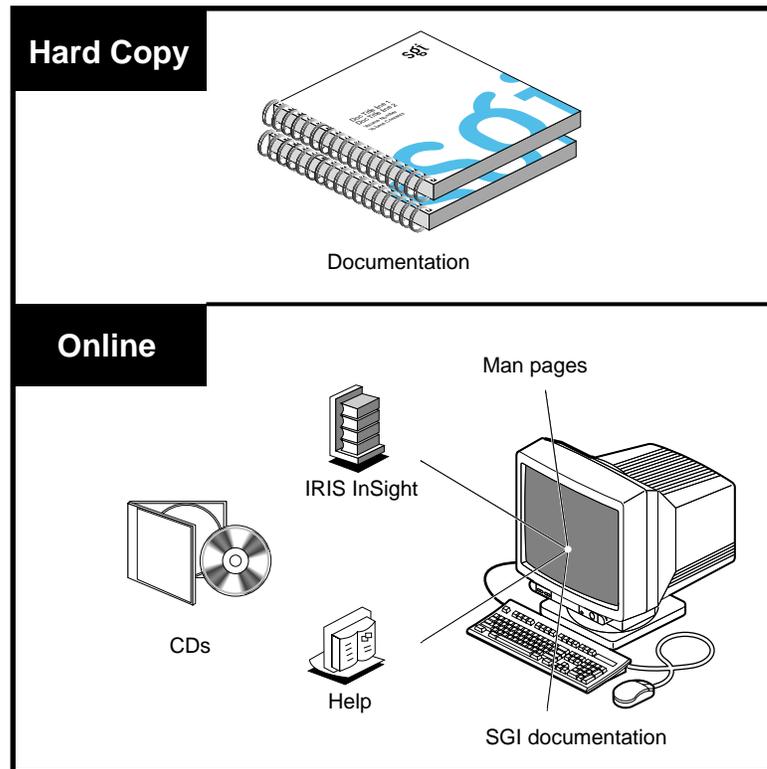


Figure i Information Sources for the SGI Origin 3000 Series System

The following sections describe information sources that can help you get your system up and running and help you become productive quickly.

SGI Origin 3000 Series Owner's Guide

See this guide (see Figure ii) to get acquainted with your server system and to learn how to operate, monitor (through various LEDs, alarms, and displays), maintain, and troubleshoot it. In addition, this guide contains basic information on installing and replacing PCI cards and disk drives.



Figure ii SGI Origin 3000 Series Owner's Guide



Warning: For your safety and the protection of your server system, only the items designated in this guide as to be added or replaced by a customer can be added or replaced by customers. Contact your SGI system service engineer (SSE) to install any hardware items not designated in this guide as items to be added or replaced by customers.

IRIX Admin: Software Installation and Licensing Guide

IRIX Admin: Software Installation and Licensing Guide is the complete reference guide on using the installation program, *inst*, to install software. For information on using the Software Manager to install software, see the online *Personal System Administration Guide*.



Figure iii IRIX Admin Guide

SGI Onyx3000 Series Graphics System Hardware Owner's Guide (optional)

This guide describes how to install and operate the SGI Onyx3000 Series Graphics system (also known as the G-brick), which can be added to your server system.

Silicon Graphics 230 Visual Workstation User's Guide (optional)

This guide describes how to set up and use the Silicon Graphics 230 Visual Workstation, which you can use as the console for your SGI Origin 3000 server.

IRIS InSight Online Documentation and Help

The online documentation package is called *IRIS InSight*. The InSight icon is shown in Figure iv. To view the manuals, go to the Help toolchest on your console and select **Online Books**. You will see bookshelves for end-user, developer, and administration manuals that are included online with the system. Double-click on a book to open it.

For descriptions of the manuals that are available to purchase in hard copy, double-click on **Documentation Catalog**.

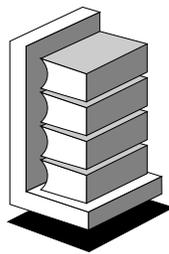


Figure iv IRIS InSight Icon

Online Man Pages

Your system includes a set of IRIX man pages, formatted in the standard UNIX “man page” style. These are found online on the internal system disk (or CD-ROM) and are displayed using the man command. For example, to display the man page for the `Add_disk` command, enter the following command at a shell prompt:

```
man Add_disk
```

Important system configuration files and commands are documented on man pages. References in the documentation to these pages include the name of the command and the section number in which the command is found. For example, “`Add_disk(1)`” refers to the `Add_disk` command and indicates that it is found in section 1 of the IRIX reference.

For additional information about displaying reference 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, enter the following command at a shell prompt:

```
apropos disk
```

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

Release Notes

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

relnotes Text-based viewer for online release notes.

grelnotes Graphics viewer for online release notes.

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

```
relnotes
```

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

SGI Documentation on World Wide Web

SGI manuals are available in various formats on the World Wide Web (WWW). Using your Web browser, open the following URL:

```
http://techpubs.sgi.com/library
```

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.
<i>variable</i>	Italic typeface denotes variable entries and words or concepts being defined.
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.

Product Support

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

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

Reader Comments

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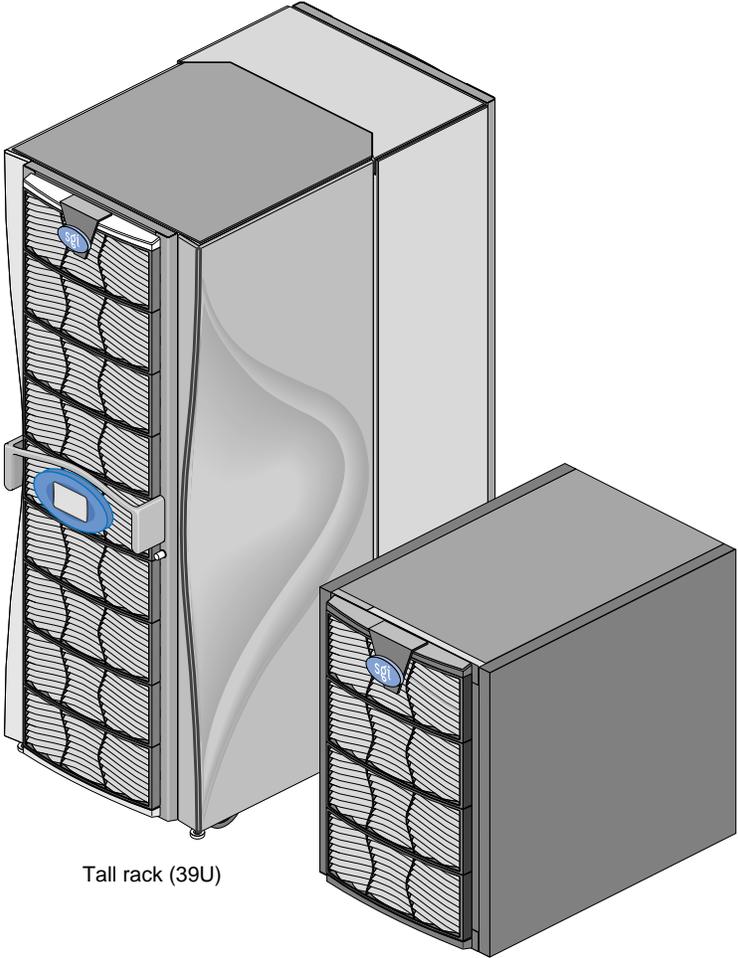
Introducing the SGI Origin 3000 Series

This chapter introduces you to the SGI Origin 3000 series of server products in the following sections:

- “Product Description” on page 1
- “SGI Origin 3000 Series Models” on page 13
- “Server System Features” on page 19

Product Description

The SGI Origin 3000 Series is a family of modular computer server systems. The various internal components of the various SGI Origin 3000 servers and their functions are divided into separate units called “bricks” for easy system customization to meet your computing needs. These bricks are housed in short or tall rack enclosures (depending on the model you have chosen) like those shown in Figure 1-1.



Tall rack (39U)

Short rack (17U)

Figure 1-1 SGI Origin 3000 Series Servers

Bricks

SGI's 3rd generation of ccNUMA architecture is known as NUMA3 and is integral to the design of the SGI Origin 3000 series of servers. The NUMA3 architecture is the basis for building a server that is highly flexible and resilient to failure.

Modular building blocks representing separate functional parts of the server are used to configure a server that matches your application environment. These individual ccNUMA building blocks are referred to as "bricks," and are covered individually in this section.

Table 1-1 lists the various bricks available with an SGI Origin 3000 series server. Each brick has a dedicated chapter in this guide that explains the brick's function in detail.

Table 1-1 Bricks

Brick	Provided Function	Described In
C-brick	Processing and memory	Chapter 4, "C-brick"
I-brick	Base system I/O	Chapter 5, "I-brick"
P-brick	PCI bus interfaces	Chapter 6, "P-brick"
X-brick	XIO interface	Chapter 7, "X-brick"
D-brick	Storage modules	Chapter 8, "D-brick"
R-brick	Interconnect fabric (routers)	Chapter 9, "R-brick"
G-brick	Graphics subsystems	<i>SGI Onyx3000 Series Graphics System Hardware Owner's Guide</i>
Power bay	Power supplies and control	Chapter 10, "System Power"

Interactions Among Bricks

The C-brick performs the computing function for the server system; it contains two or four processors (each with 4 or 8 MB of private secondary cache), memory, and a crossbar switch used as a memory controller.

This switch acts as a channel between the internal processors and local memory. The R-brick (router) is used to connect to other C-bricks. The I/O interface bricks (I-brick, P-brick, X-brick) connect to individual C-bricks.

A D-brick and G-brick can be optionally added to your server. The D-brick is used to provide storage modules to your server.

The G-brick (also known as the SGI Onyx3000 series graphics subsystem) can be installed to provide your system with sophisticated graphics capabilities. See *SGI Onyx3000 Series Graphics System Hardware Owner's Guide* for details.

Note: The G-brick is not available with the SGI Origin 3200 server system.

See Figure 1-2 for an illustration of how the bricks are interconnected to create your server system.

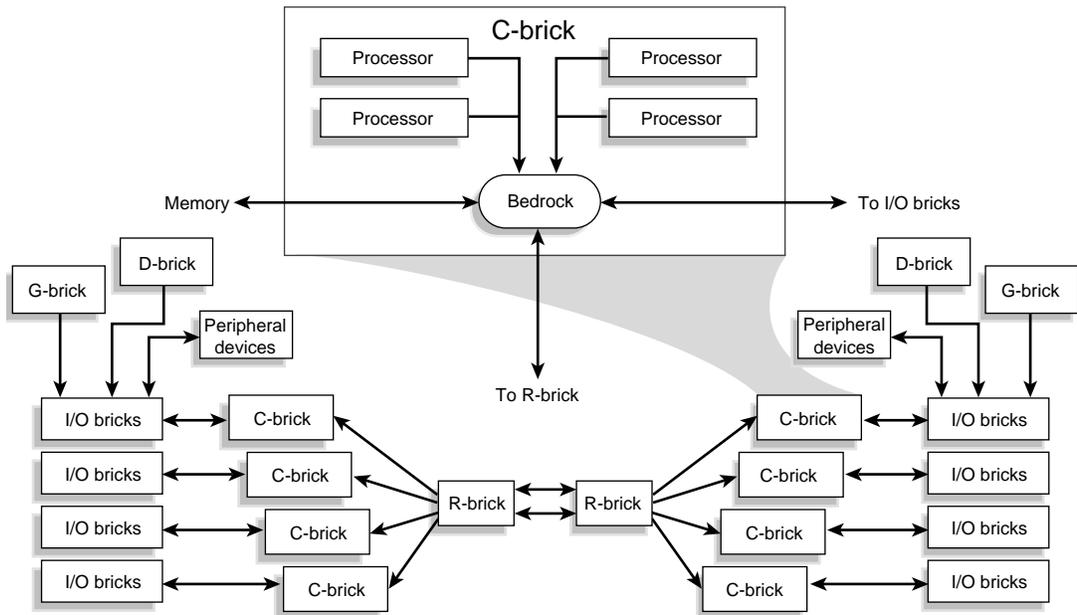


Figure 1-2 Interaction Between SGI Origin 3000 Server Series Bricks

Brick Cooling and Fans

The bricks are air-cooled devices; airflow is from the front of the brick to the rear. All bricks (except the R-brick) have three fans at the front.

The fans run at variable speeds; the speed is controlled by the brick's L1 controller, which monitors and controls the brick's operating temperature. The R-brick fans are smaller than other brick fans and run at a single speed.

All fans are N+1 redundant and can be hot-swapped by a qualified SGI system support engineer (SSE). If a fan fails, the remaining functional fans run at higher speeds to compensate, and error messages are issued.

Bricks and Controllers

The C-brick, R-brick, I-brick, P-brick, and X-brick have L1 controllers that monitor the activities of their brick. The L1 controller generates status and error messages for the brick that are displayed on the L1 controller display located on the brick's front panel.

The L2 controller comes with all tall racks with C-bricks (L2 controller is optional for the short racks). The L2 controller has a display unit located on the front door of the rack. The L2 controller displays the status and error messages generated by the L1 controllers and generates and displays the status and error messages for the power bay and the rack chassis. The L1 and L2 controller messages can in turn be displayed in a server system console connected to your server system. Your console can include L3 controller software, which provides your console with the boundary scan diagnostic tool.

With the L2 and L3 controller systems, you can also enter L1 and L2 commands to control activity in your server system. For details about the L1, L2, and L3 controllers, see Chapter 3, "System Control." For a list of L1 and L2 commands, see Appendix B.

The D-brick has an ESI/ops panel module with a microcontroller for monitoring and controlling all elements of the D-brick.

See *SGI Onyx3000 Series Graphics System Hardware Owner's Guide* for details on monitoring and controlling the activity of the G-brick.

Racks

Two rack sizes are used in the SGI 3000 server series. The short rack (17U) shown in Figure 1-3 is used for SGI Origin 3200 server model, and the tall rack (39U) shown in Figure 1-4 is used for both the SGI Origin 3400 server and SGI Origin 3800 server models.

Short Rack (17U)

The short rack (shown in Figure 1-3) has the following features and components:

- **Front door and rear door.** Both doors have keylocks that prevent unauthorized access to the system.
- **Visible L1 controller display and visible brick LEDs** with the doors closed.
- **Cable entry/exit area** at the bottom of the rack. Cables are attached at the rear of the rack. The rack is mounted on four casters; the rear two casters swivel. The base of the rack has leveling pads, a ground strap, and seismic tie-downs.
- **Power distribution strip (PDS).** The PDS has six connectors to connect to the power bay, one outlet connector, and a circuit breaker switch.
- **L2 controller (optional).** Used to monitor and generate status and error messages displayed for rack chassis items such as the power bay. The L2 controller also displays the individual brick's status and error messages generated by each brick's L1 controller.
- **Single power bay.**

Note: The short rack is used to house the SGI Origin 3200 server model.

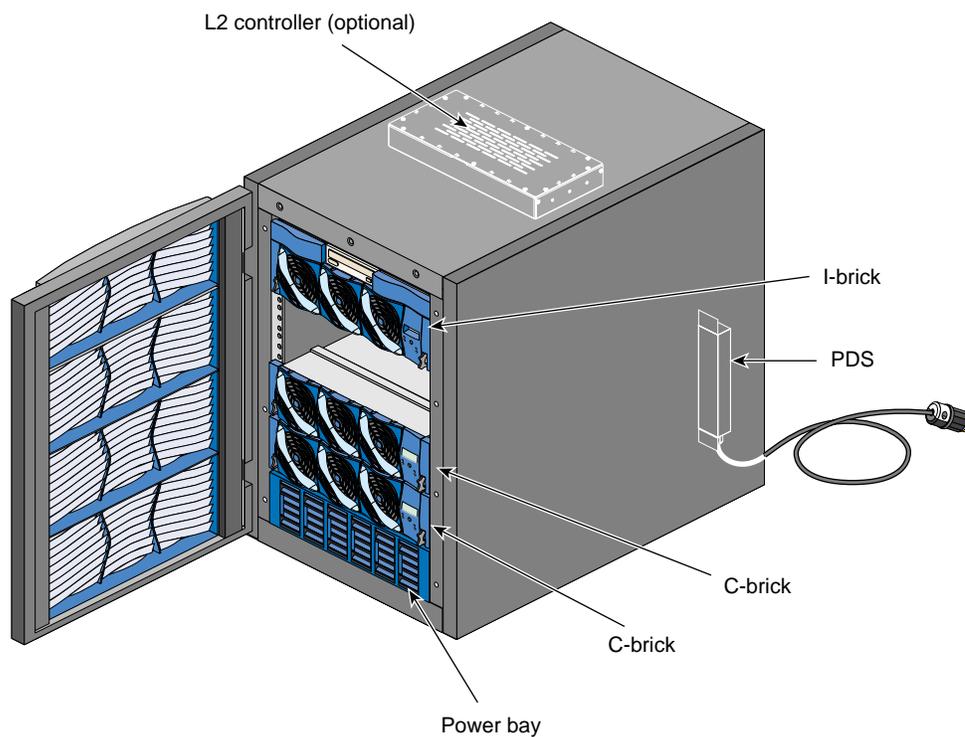


Figure 1-3 Front View of the Short Rack

Tall Rack (39U)

The tall rack shown in Figure 1-4 has the following features and components:

- **Front door and rear door.** Both doors have keylocks that prevent unauthorized access to the system.
- **Visible L2 controller touch display, L1 controller display, and brick LEDs** with the doors closed.
- **Cable entry/exit area** at the bottom of the rack. Cables are attached at the rear of the rack. The rack is mounted on four casters; the two rear casters swivel. The base of the rack has leveling pads, a ground strap, and seismic tie-downs.

The tall rack also has cable entry/exit areas at the top, bottom, and sides of the rack. I/O and power cables pass through the bottom of the rack. NUMALink cables pass through the top and sides of the rack. Cable management occurs in the rear of the rack.

- **L2 controller.** Used to monitor and generate status and error messages for rack chassis items such as the power bay. The L2 controller can also display the individual brick's status and error messages generated by each brick's L1 controller. The L2 controller touch display is located on the rack's front door.
- **One or two power bays,** depending on your computing needs.
- **One PDU per each power bay** in the rack. The PDU can be a single-phase or three-phase power distribution unit (PDU). The single-phase PDU has two openings with three cables coming out of each opening to connect to the power bay. The three-phase PDU has two openings with six cables coming out of each opening to connect to power bays. The PDU also has two power-plug cables (one-per-opening). The PDU also has a single outlet connector and a circuit breaker switch.

Note: The tall racks are used primarily to house a combination of bricks that compose SGI Origin 3400 servers and SGI Origin 3800 servers, although the tall rack can also be used to house additional I/O bricks (I-bricks, P-bricks, and X-bricks) and D-bricks for an SGI Origin 3200 server.

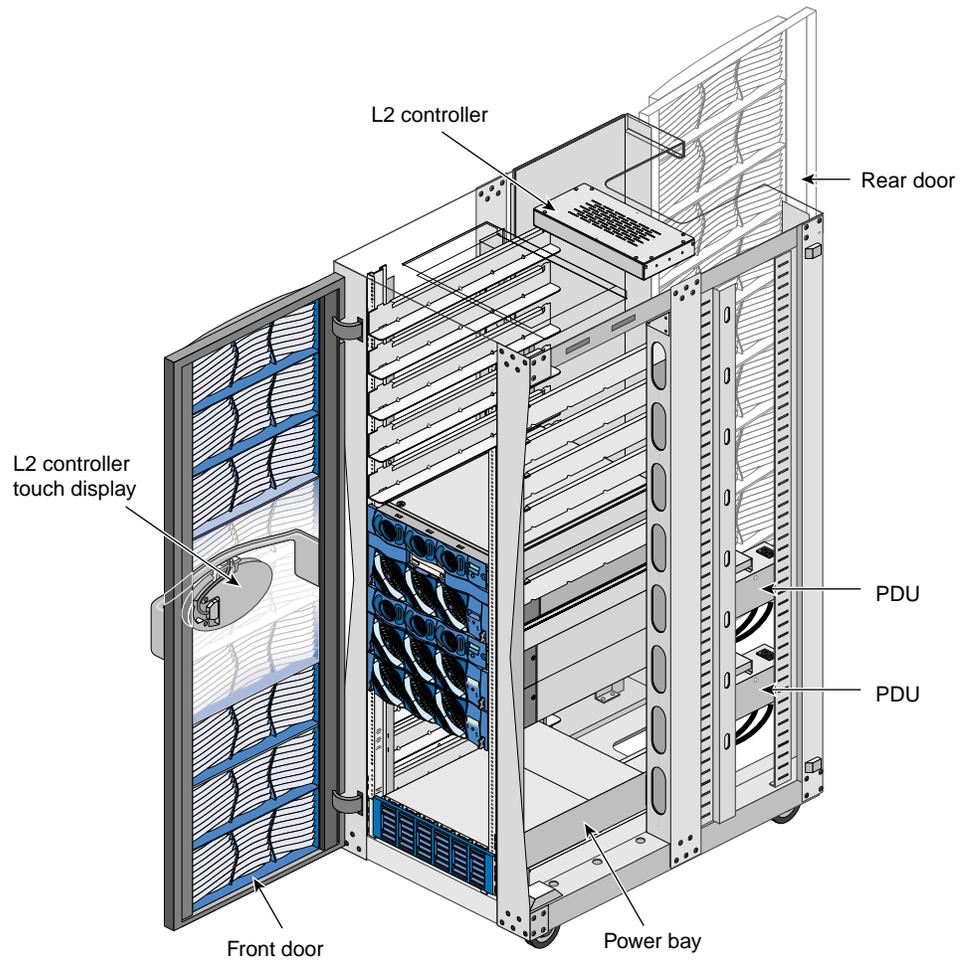


Figure 1-4 Front View of the Tall Rack (With Side Covers Removed)

Measuring Racks and Bricks

The racks are measured in EIA standard units; one SU or unit (U) is equal to 1.75 in. (4.445 cm)

Figure 1-5 illustrates the size in standard units of each brick type available with an SGI Origin 3000 server, except for the G-brick. The G-brick (also known as the SGI Onyx3000 Series Graphics system) is 18 units in size. If you have a G-brick, see *SGI Onyx3000 Series Graphics System Hardware Owner's Guide* for details.

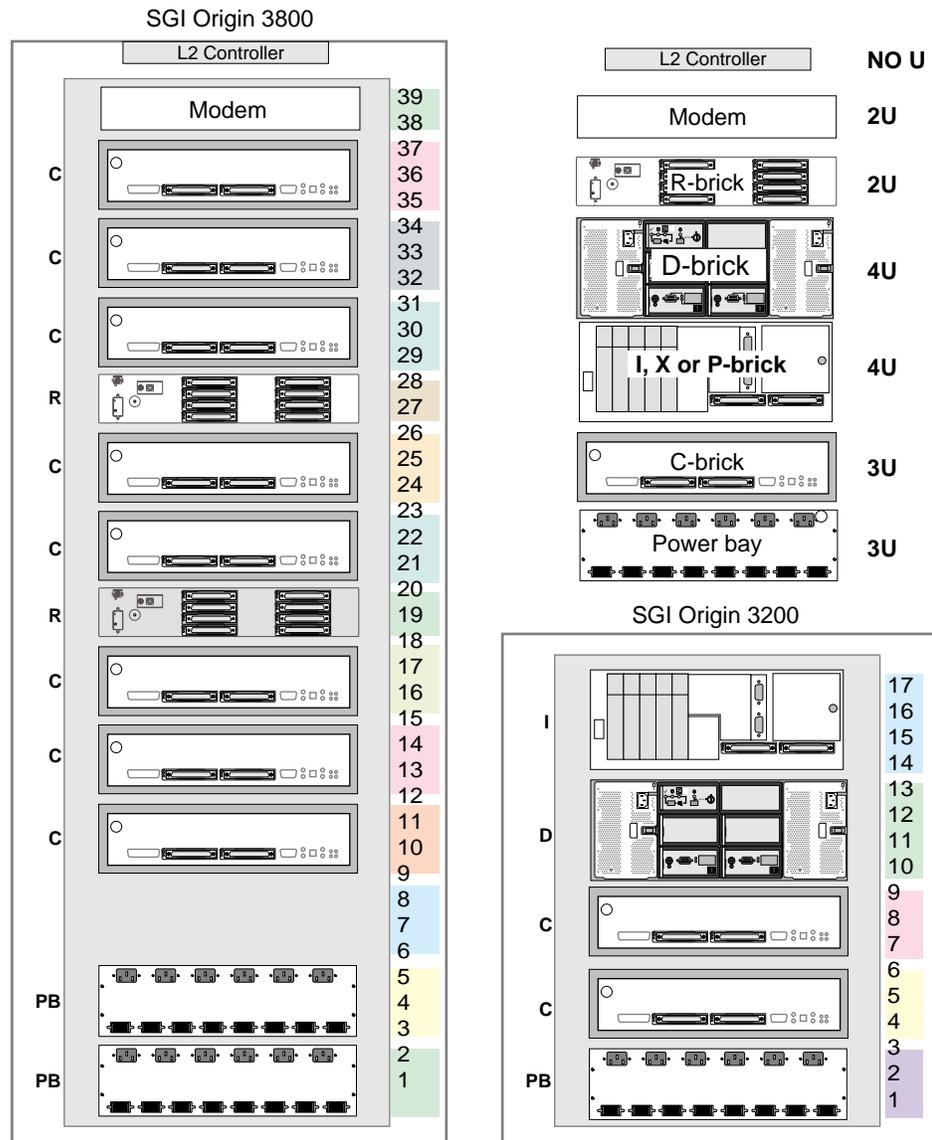


Figure 1-5 Rack and Brick Measurements

Bay (Unit) Numbering

Bays in the racks are numbered using standard units, as shown in Figure 1-5. The illustration also identifies the size (in units) of the different brick types.

Because bricks require multiple standard units to fit in a rack, brick locations within a rack are identified by the bottom unit (U) in which the brick resides. For example, in a tall 39U rack, the C-brick positioned in U10, U11, and U12 is identified as C10. In a short 17U rack, an I-brick positioned in U10, U11, U12, and U13 is identified as I10.

These identifiers or bay locations are represented as decimal numbers in the hardware graph path. The hardware graph path has the following form:

```
/hw/module/rrrTuu
```

where rrr = rack, T= brick type, and uu = location in rack.

Below is an example of `hinv` output identifying the rack and bay numbers:

```
$ hinv  
/hw/module/001c10  
/hw/module/002r19
```

Rack Numbering

A rack is numbered with a three-digit number. A compute rack (designated for C-bricks) is numbered sequentially beginning with 001. An I/O rack (designated for I-bricks, P-bricks, X-bricks, and D-bricks) is numbered sequentially and by the physical quadrant in which the I/O rack resides.

In a single-rack configuration (for all 3200 server configurations and some 3400 server configurations), the compute rack is numbered 001 even if it contains an I/O brick or D-brick.

Figure 1-6 shows the rack numbering scheme for single-rack and multiple-rack server systems. (The single rack shown is an SGI Origin 3200 server in a short (17U) rack; rack numbering for an SGI Origin 3400 server system in a tall (39U) rack is the same.)

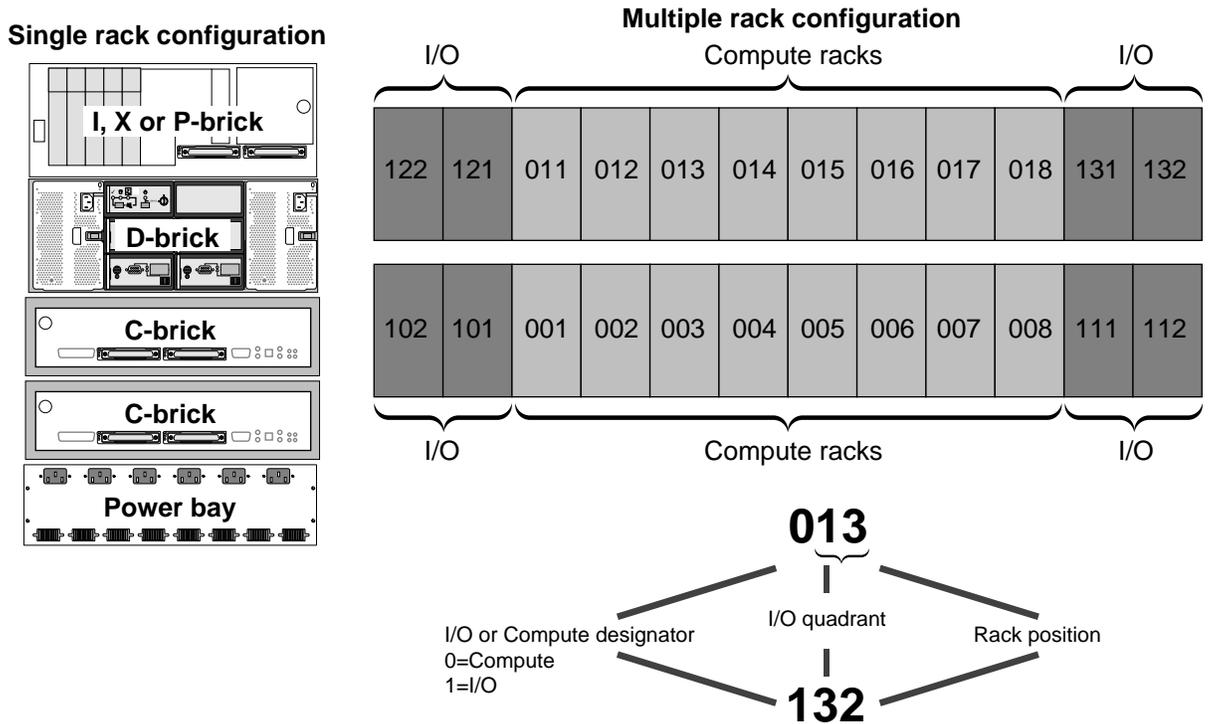


Figure 1-6 Rack Numbering

Rack numbers are represented as decimal numbers in the hardware graph path, for example:

```
$ hinv
/hw/module/001C10
```

SGI Origin 3000 Series Models

The C-brick contains the processors (two or four processors per C-brick) for the server system. The number of processors and the combination of functional bricks you have in your server system determines the SGI Origin 3000 server model. The following are the models available: the SGI Origin 3200 server, the SGI Origin 3400 server, and the SGI Origin 3800 server.

SGI Origin 3200 Server

SGI Origin 3200 server system has up to 8 processors, a minimum of one I/O brick (an I-brick), no routers, and a single power bay. The system is housed in a short 17U rack enclosure with a single power distribution system (PDS). An L2 controller is optional with the SGI Origin 3200 server.

Additional racks containing D-bricks and I/O bricks (I-bricks, P-bricks, and X-bricks) can be added to your SGI Origin 3200 server system.

Figure 1-7 shows an example of one possible SGI Origin 3200 server system configuration.

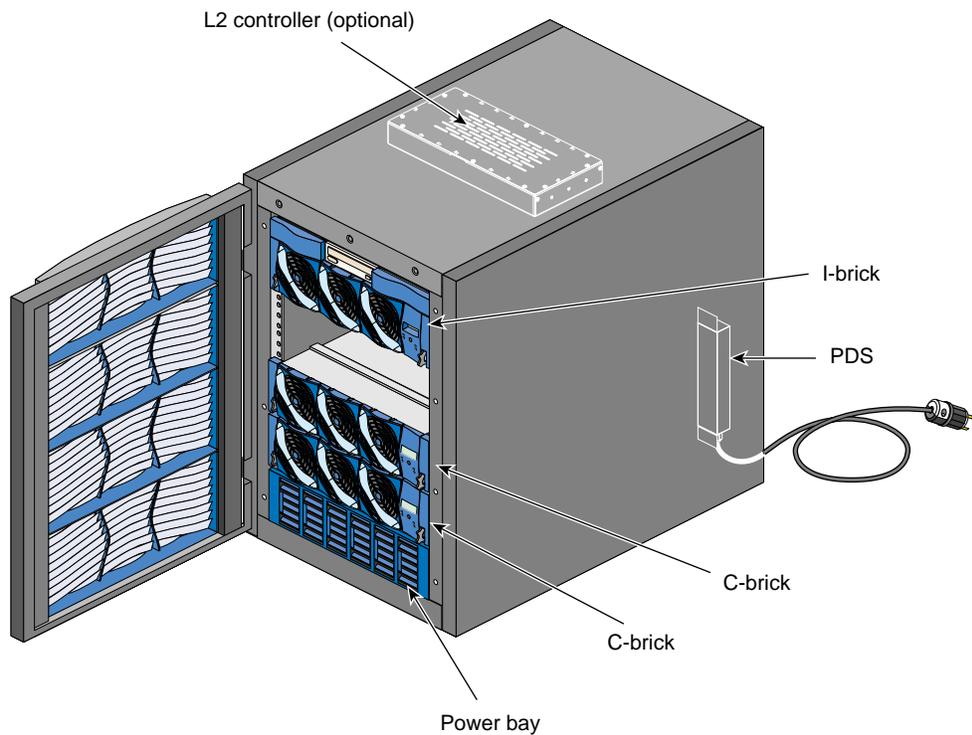


Figure 1-7 SGI Origin 3200 Server System

SGI Origin 3400 Server

The SGI Origin 3400 server system has up to 32 processors, a minimum of one I/O brick (an I-brick), at least two 6-port routers, and at least one power bay. The system needs at least one tall 39U rack enclosure with one power distribution unit (PDU) per power bay. Each tall rack enclosure containing C-bricks comes with an L2 controller and an L2 controller data display.

Figure 1-8 shows an example of one possible SGI Origin 3400 server system configuration.

The system can be expanded to include a second tall rack to add D-bricks, and I/O bricks (I-bricks, P-bricks, and X-bricks) to your server system.

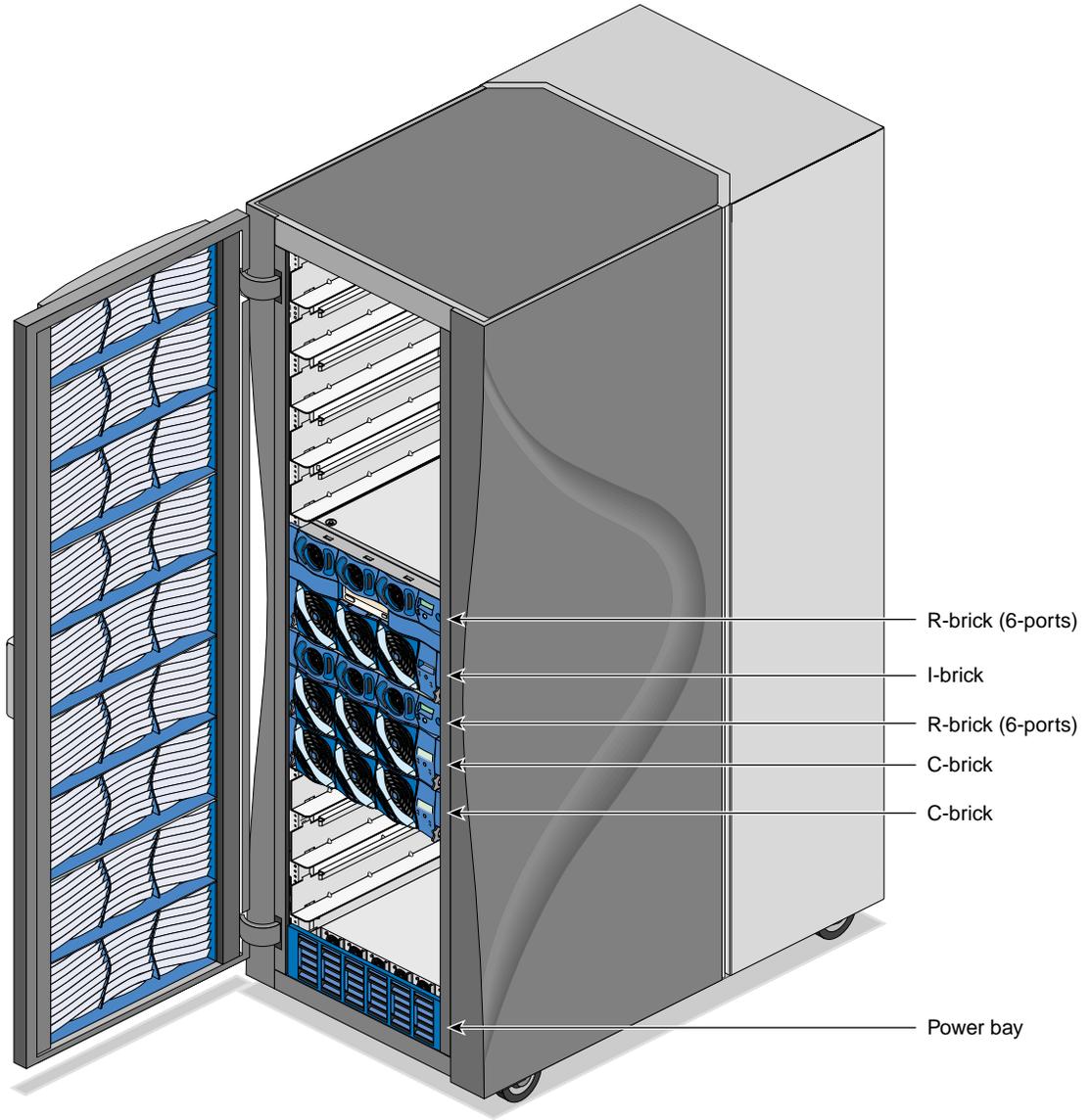


Figure 1-8 SGI Origin 3400 Server System

SGI Origin 3800 Server

The SGI Origin 3800 server system has up to 512 processors, a minimum of one I-brick, one P-brick, and two 8-port routers. The system needs a minimum of two tall rack enclosures, with at least one power bay per rack and one PDU per power bay. Each tall rack enclosure containing C-bricks comes with an L2 controller and an L2 controller data display.

Figure 1-9 shows an example of a possible SGI Origin 3800 server configuration.

Additional racks containing D-bricks and I/O bricks (I-bricks, P-bricks, and X-bricks) can be added to your server system.

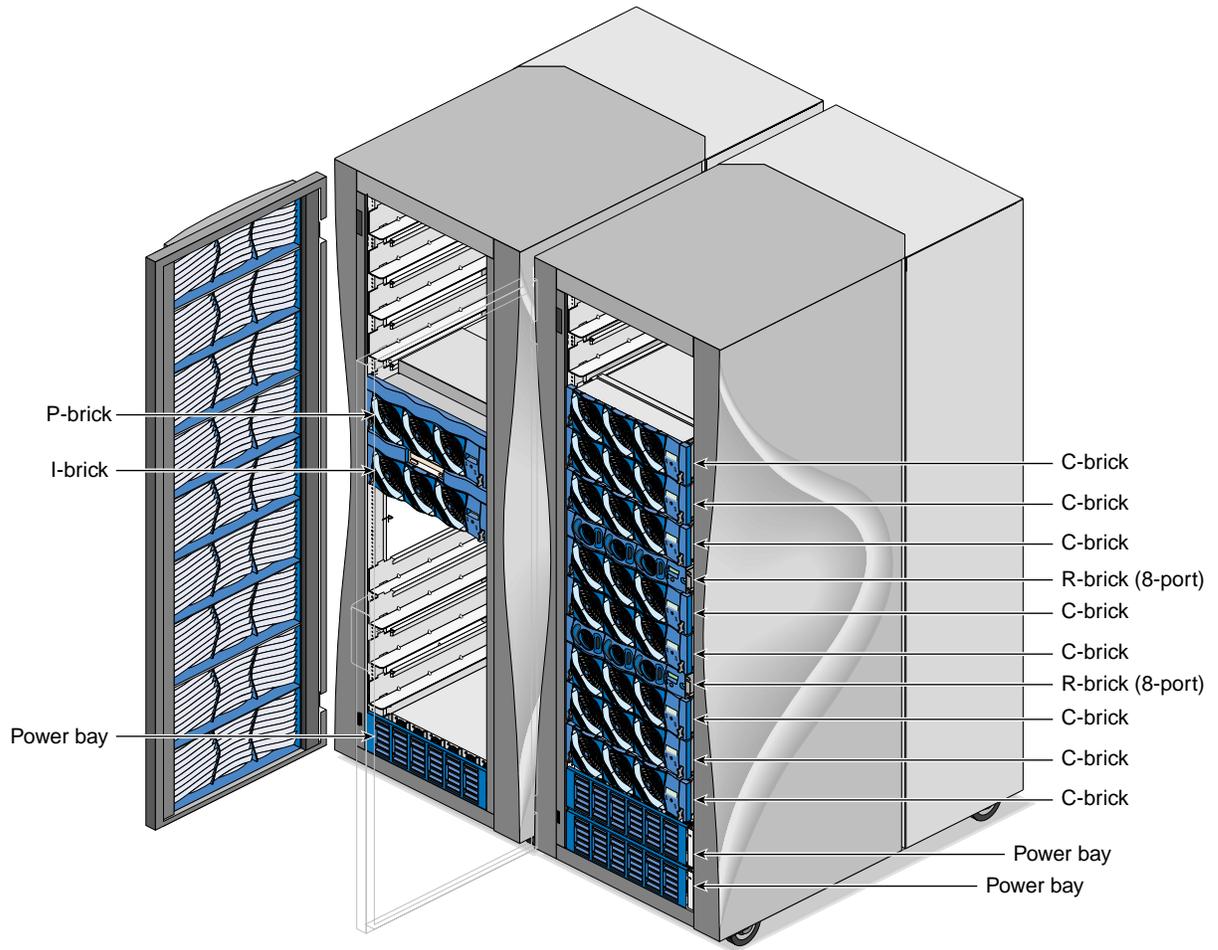


Figure 1-9 SGI Origin 3800 Server System

Server System Features

The following sections introduce the main features of the SGI Origin 3000 series server systems:

- “Modularity and Scalability” on page 19
- “Distributed Shared Memory (DSM)” on page 19
- “Distributed Shared I/O” on page 20
- “Cache-Coherent Non-uniform Memory Access (ccNUMA) Architecture” on page 20
- “Reliability, Availability, and Serviceability (RAS)” on page 21

More than 3600 third-party software applications are available for the SGI Origin 3000 server series systems. For a current list of applications, see the following URL:

<http://www.sgi.com/Products/appsdirectory.html>

Modularity and Scalability

The SGI Origin 3000 server series systems are *scalable* systems with the ability to independently scale processors and memory, I/O bandwidth, and storage. Furthermore, the SGI Origin 3000 server series systems can be clustered to increase the number of processors from 512 to thousands of processors.

The SGI Origin 3000 server series system’s functions (such as computing, I/O, and storage) are divided into separate components housed in building blocks called *bricks*. These bricks can be independently added to a system to achieve the desired system configuration. As bricks are added to a system, the bandwidth and performance scale in a manner that is almost linear, without significantly affecting system latencies.

Distributed Shared Memory (DSM)

In the SGI Origin 3000 server series, memory is physically distributed among the C-bricks (compute nodes); however, it is accessible to and shared by all compute nodes. When a processor accesses memory that is physically located on a compute node, this is referred to as the node’s *local memory*. The total memory within the system is referred to as *global memory*.

When processors access memory located in other C-bricks, the memory is referred to as *remote memory*.

The memory latency, which is the amount of time it takes for a processor to retrieve data from memory, is lowest when a processor accesses memory that is local to its compute node.

Distributed Shared I/O

Like DSM, I/O devices are distributed among the compute nodes (each compute node has an I/O port that can connect to an I/O brick) and are accessible by all compute nodes through the NUMALink interconnect fabric.

Cache-Coherent Non-uniform Memory Access (ccNUMA) Architecture

As the name implies, the ccNUMA architecture has two parts: *cache coherency* and *nonuniform memory access*.

Cache Coherency

The SGI Origin 3000 server series use caches to reduce memory latency. Although data exists in local or remote memory, copies of the data can exist in various processor caches throughout the system. Cache coherency keeps the cached copies consistent.

To keep the copies consistent, the ccNUMA architecture uses directory-based coherence protocol. In directory-based coherence protocol, each block of memory (128 bytes) has an entry in a table that is referred to as a directory. Like the blocks of memory that they represent, the directories are distributed among the compute nodes. A block of memory is also referred to as a cache line.

Each directory entry indicates the state of the memory block that it represents. For example, when the block is not cached, it is in an unowned state. When only one processor has a copy of the memory block, it is in an exclusive state. And when more than one processor has a copy of the block, it is in a shared state; a bit vector indicates which caches contain a copy.

When a processor modifies a block of data, the processors that have the same block of data in their caches must be notified of the modification. The SGI Origin 3000 server

series use an invalidation method to maintain cache coherence. The invalidation method purges all unmodified copies of the block of data and the processor that wants to modify the block receives exclusive ownership of the block.

Non-uniform Memory Access (NUMA)

In DSM systems, memory is physically located at various distances from the processors. As a result, memory access times (latencies) are different or “non-uniform.” For example, it takes less time for a processor to reference its local memory than it does to reference remote memory.

In a NUMA system, program performance is based on proper placement of important data structures. In general, data should be located close to the processor that will access it. IRIX provides a services to enable applications to achieve this.

Reliability, Availability, and Serviceability (RAS)

The SGI Origin 3000 server series components have the following features to increase the reliability, availability, and serviceability (RAS) of the systems.

- **Power and cooling:**
 - Power supplies are redundant and can be hot-swapped.
 - Bricks have overcurrent protection.
 - Fans are redundant and can be hot-swapped.
 - Fans run at multiple speeds: in all bricks except the R-brick, speed increases automatically when temperature increases or when a single fan fails.
- **System monitoring:**
 - System controllers monitor the internal power and temperature of the bricks, and automatically shut down bricks to prevent overheating.
 - Memory and secondary cache are protected by single-bit error correction and double-bit error detection (SECDED).
 - The NUMALink3 interconnect network is protected by cyclic redundancy check (CRC).
 - The primary cache is protected by parity.

- Each brick has failure LEDs that indicate the failed part; LEDs are readable via the system controllers.
- Systems support Embedded Support Partner (ESP), a tool that monitors the system; when a condition occurs that may cause a failure, ESP notifies the appropriate personnel.
- Systems support remote console and maintenance activities.
- **Power-on and boot:**
 - Automatic testing occurs after you power on the system (power-on self-tests or POST; these tests are also referred to as power-on diagnostics or POD).
 - Processors and memory are automatically deallocated when a self-test failure occurs.
 - Boot times are minimized.
- **Further RAS features:**
 - Systems support partitioning.
 - PCI cards and disk drive modules can be added to the system without powering off the brick (hot-pluggable).
 - IRIX has enhanced reliability.
 - Systems have a local field-replaceable unit (FRU) analyzer.
 - All system faults are logged in files.
 - Memory can be scrubbed when a single-bit error occurs.
 - Hot-pluggable disk drives.
 - System level boundary scan capability.

System Configuration and Operation

This chapter describes how to configure and operate your SGI Origin 3000 server. Specifically, it shows how to do the following:

- “Connecting a Console to Your Server System” on page 23
- “Adding or Replacing Server System Parts” on page 28
- “Powering On and Off” on page 31
- “Monitoring Your Server” on page 58

Connecting a Console to Your Server System

Connecting a console to your SGI Origin 3000 server enables you to do the following:

- To monitor your server system by reading the individual brick’s status and error message information generated by the brick’s L1 controller, and the status and error message information generated by the L2 controller for your server system’s rack enclosure or the L2 controllers of more than one rack.
- To enter L1 and L2 controller commands to monitor or change particular server system functions. You can, for example, monitor the speed of fans for a particular brick. Please see Appendix B, “System Controller Commands” for descriptions of the L1 and L2 controller commands you can use.
- To power on or power off individual bricks or all the bricks in your server system.
- If you connect a console running L3 controller software to your server system, you can perform all the previous functions listed and have boundary scan on your console so that an SGI system support engineer (SSE) can test the performance and functioning of your system.

You have the following options in connecting your console to a server system. The option you choose may be determined by which server you have. Table 2-1 shows the various console connection options:

- If you have a server without an L2 controller (such as a smaller SGI Origin 3200 server), you can connect a dumb terminal to the C-brick's console port connector. (Figure 2-1 shows the console port connector pinouts.)

Optionally, you can also connect a Silicon Graphics 230 Visual Workstation running L3 controller software on the Linux operating system to the C-brick's L1 port (USB) connector as shown in Figure 2-2. The console should be running in dumb-terminal-emulator mode.

If you have multiple C-bricks, connect your console to the bottom-most C-brick in the rack.

- If you have a server with an L2 controller, always connect your console to the L2 controller. If your console is a Silicon Graphics 230 Visual Workstation running L3 controller software on the Linux operating system, connect the console to the L2 controller's Ethernet port connector as shown in Figure 2-3. Use this option for a server system with a single L2 controller.

Optionally, you can connect a dumb terminal to the L2 controller's console (RS-232) connector.

- If you have a server with multiple L2 controllers, you can connect as a console a Silicon Graphics 230 Visual Workstation running L3 controller software on the Linux operating system to a connector on an Ethernet hub to which are connected the multiple L2 controllers from multiple racks, as shown in Figure 2-4.

The Ethernet hub, in turn, can be daisy-chained to another Ethernet hub. (If you daisy-chain to a second Ethernet hub, the eighth port on the first Ethernet hub cannot be used.) This is a good solution for an SGI Origin 3800 server system model, as you would have multiple tall (39U) racks, where each rack with C-bricks would have its own L2 controller.

Table 2-1 Console Connection Options

Console Types	Servers with no L2 Controller (Connect to C-brick)	Servers with no L2 Controller (Connect to C-brick)	Servers with L2 Controller (Connect to L2 Controller)	Servers with L2 Controller (Connect to L2 Controller)	Servers with Multiple L2 Controllers (Connect to Ethernet Hub)
	Console (RS-232) Connector	Ethernet Connector	Console (RS-232) Connector	Ethernet Connector	Ethernet Connector
Dumb Terminal or Terminal Emulator	Preferred Connection	N/A	Preferred Connection	N/A	N/A
Silicon Graphics 230 Visual Workstation Running L3 Controller software	Optional Connection	Preferred Connection	Optional Connection	Preferred Connection	Preferred Connection

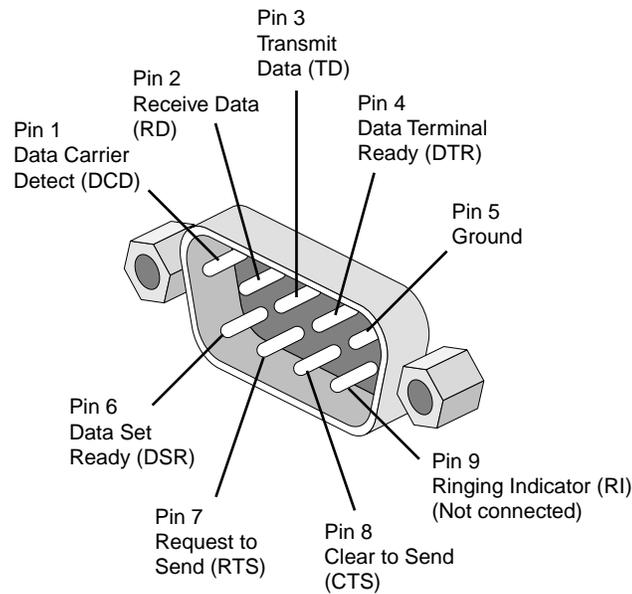


Figure 2-1 Console Port Pin Assignments

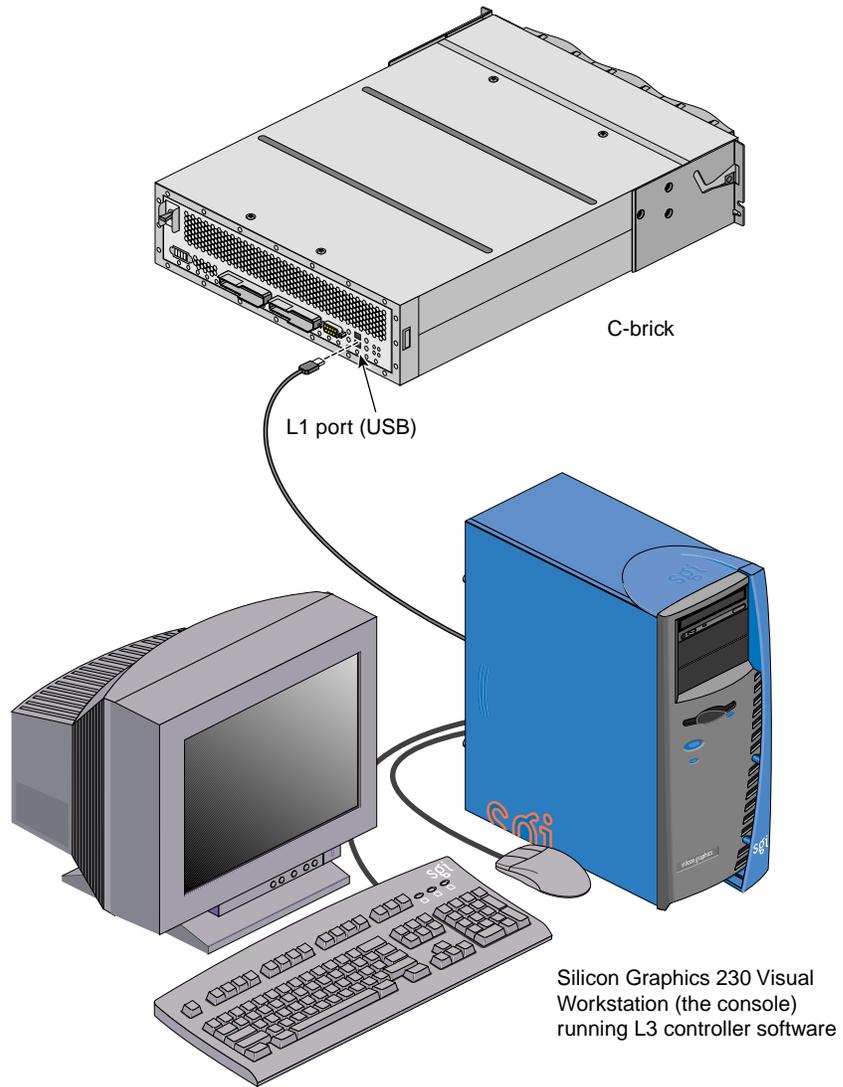


Figure 2-2 Connecting Console to C-brick LI Port (USB) Connector

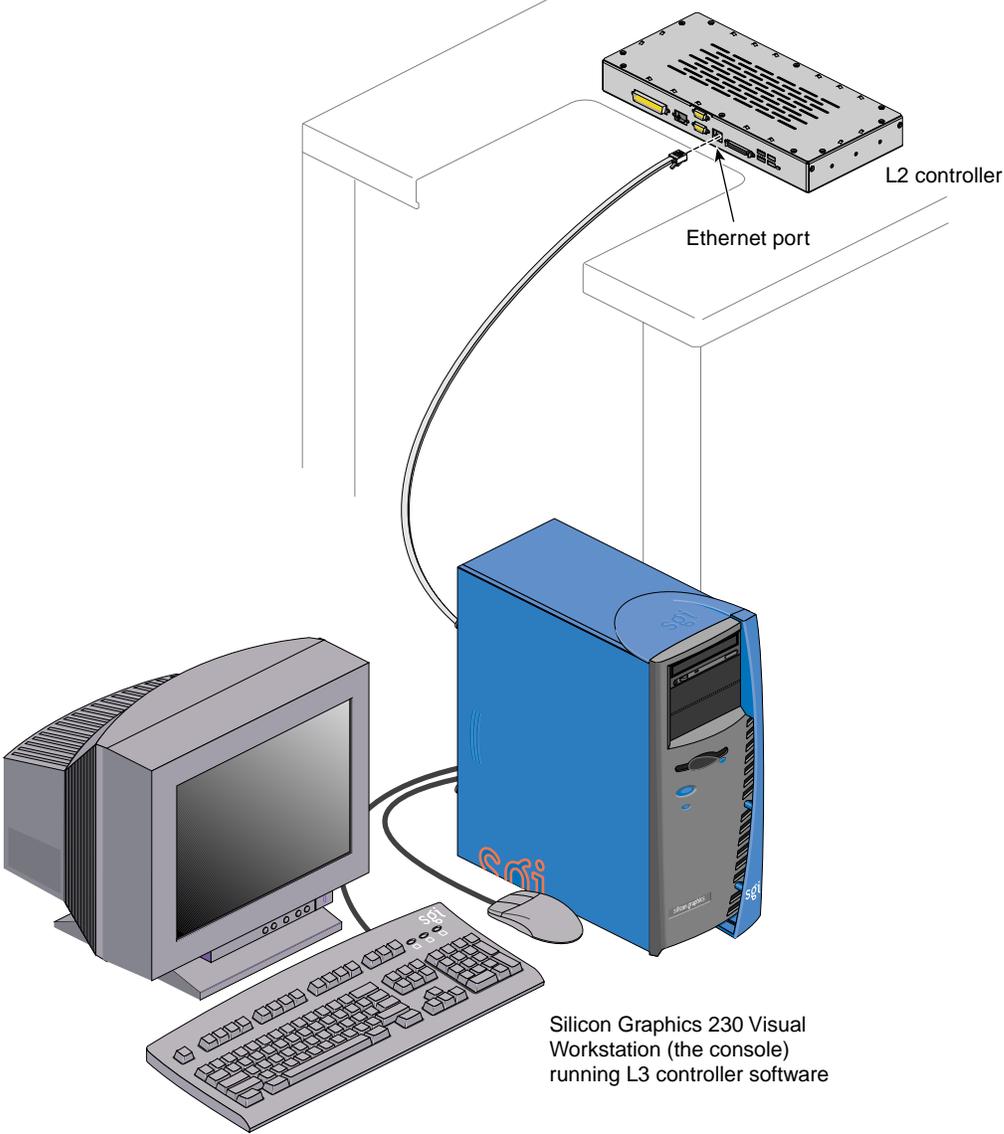


Figure 2-3 Connecting Console to an L2 Controller Ethernet Port

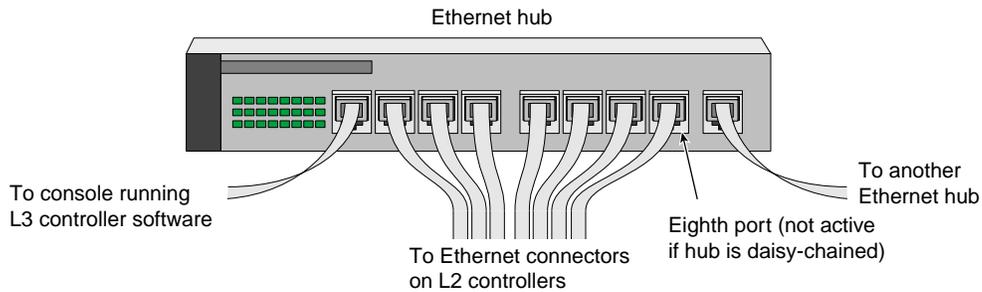


Figure 2-4 Connecting Console to an Ethernet Hub

Adding or Replacing Server System Parts

Besides the system console described in the previous section, you can add or replace the following hardware items on your SGI Origin 3000 server system:

- Peripheral component interface (PCI) cards into your I-brick or P-brick.
- Disk drives to your D-brick.

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

Adding or Replacing PCI Cards

The PCI-based I/O system, an industry standard for connecting peripherals to a processor, is the primary I/O system for the SGI Origin 3000 servers.

The I-brick and P-brick subsystems provide PCI support for the SGI Origin 3000 server systems. The I-brick provides five PCI slots. Normally, one of the five slots is reserved for a system PCI card.

If additional PCI slots are required beyond the I-brick's four remaining slots, a P-brick is configured into the system. The P-brick supports 12 PCI slots. Table 2-2 summarizes the maximum number of PCI slots available in the SGI Origin 3200, SGI Origin 3400, and SGI Origin 3800 server systems.

Table 2-2 PCI Slots Available

System	I/O Bricks	Maximum Available PCI Slots
SGI Origin 3200 server	1 I-brick, 1 P-brick	16
SGI Origin 3400 server	1 I-brick, 7 P-bricks	88
SGI Origin 3800 server	1 I-brick, 63 P-bricks	760

Table 2-3 shows the PCI cards supported and installable in your I-brick and P-brick.

Table 2-3 PCI Cards Supported

Marketing Code	Description
PCI-SCSI-SE-2P	Ultra SCSI single-ended 2-port
PCI-SCSI-DF-2P	Ultra SCSI high-voltage differential 2-port
PCI-SCSI-LVD-2P	Ultra2 SCSI low-voltage differential 2-port (5 V)
PCI-FC-1POPT-A	Fibre channel with fiber optic cable, 66 MHz
PCI-FC-1PCOP-A	Fibre channel with copper cable, 66 MHz
PCI-ATMOC3-1P	ATM OC3
PCI-ATMOC12-1P	ATM OC12
PCI-GIGENET-C	Gigabit Ethernet (copper)
PCI-GIGENET-OR	Gigabit Ethernet (optical)
PCI-AUD-D1000	Digital audio

See “PCI Card Description and Installation” on page 136 for detailed instructions for installing a PCI card.

Adding or Replacing Disk Drives

The D-brick is a fibre-channel-based disk storage enclosure used to provide JBOD (just a bunch of disks) mass storage for all SGI Origin 3000 series server models.

See “Adding and Replacing Disk Drive Modules” on page 168 for detailed instructions for installing disk drive modules in the D-brick.

Powering On and Off

The following subsections describe how to power on and power off individual bricks or your entire SGI Origin 3000 server.

- “Powering On” on page 31
- “Powering Off” on page 45

For servers with an L2 controller, you can power on and power off individual bricks and the entire system at the L2 controller touch display located on the front door of the server rack.

For servers with a system console, you can power on and power off individual bricks and the entire system at the system console.

If you are running the L3 controller (on Linux operating system) on your console, besides powering on and powering off a brick or your system, you can have boundary scan on your console so that an SGI system support engineer (SSE) can test your server’s functioning and performance.

Caution: To avoid damage to your system, only an SGI SSE should run the boundary scan diagnostic tool on your server.

This section also includes the following related subsection that describes the Embedded Support Partner (ESP) program. The ESP program enables you and your SGI system support engineer (SSE) to monitor your server remotely so as to resolve issues before they become problems.

Powering On

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

- L2 controller touch display
- System console

Preparing to Power On

Do the following to prepare to power on your system:

1. Check to assure that the cabling between the PDU or PDS and the wall power-plug receptacle is secure.
2. Make sure that the PWR (power) switch on each individual brick that you want to power on is set to the 1 (On) position, as shown in Figure 2-5 for the I-brick. This will start the L1 controller for the brick(s) when the brick(s) is powered on. The 12 VDC LED on the individual brick lights green when the powering on of the L1 controller has occurred successfully. If a power switch in one of the bricks you want to power on is set to Off, contact your SGI system support engineer (SSE) so that he or she can set the switch to the On position.

Caution: To avoid damage to your system, only your SGI system support engineer (SSE) can set the power switch to On or Off.

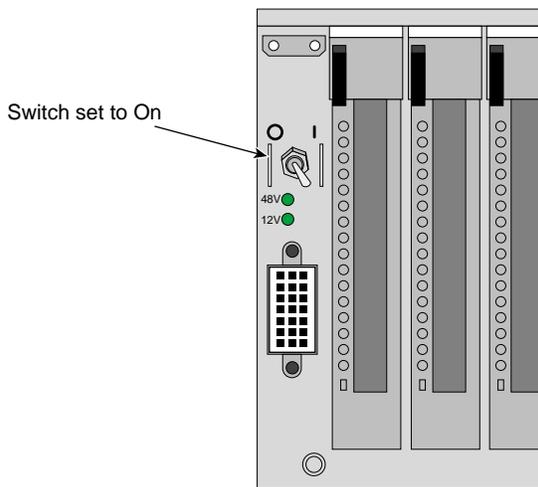


Figure 2-5 Assuring the Power Switch Is Set to 1 (On) for Each Brick

3. If you plan to power on a D-brick or the entire server, which includes a D-brick, make sure that the D-brick's Run/Service key switch on the ESI/Ops panel is set to RUN, as shown in Figure 2-6.

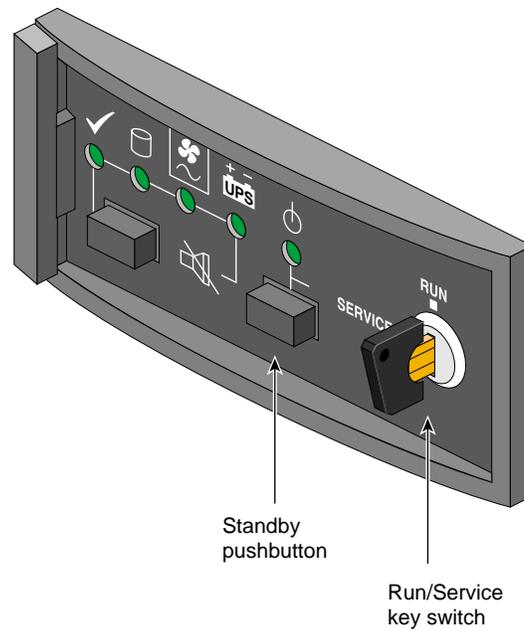


Figure 2-6 Setting D-brick's Run/Service Key Switch to RUN

4. Make sure that the PDU or PDS circuit breaker switch shown in Figure 2-7 is turned on to give power to the server system when the server is powered on.

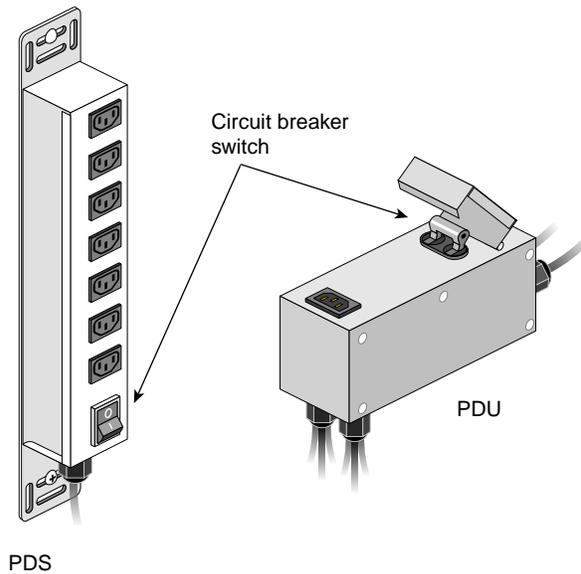


Figure 2-7 Assuring PDU or PDS Circuit Breaker Switches Are Turned On

Note: Check that the LEDs turn on and light green and that your controllers display that the system is powered on for each segment of the procedure, which indicates that the powering on procedure is proceeding properly. If you have a problem during powering on and an error message appears on the L1 controller, the L2 controller rack display, or the system console, see your online log files and Appendix C, “Controller Status and Error Messages” to learn what the error message indicates and what steps will resolve the problem.

Powering On at the L2 Controller Touch Display

This section describes how to power on individual bricks or the entire system from your L2 controller touch display (rack display) shown in Figure 2-8, which is located on the front door of your server. If you have multiple racks, you can power on at any L2 controller touch display on your server.



Figure 2-8 L2 Controller Touch Display

For instructions on navigating through the L2 controller touch display, see “Using the L2 Controller Touch Display” in Chapter 3.

To power on selected bricks or the entire server, do the following:

1. Select **Power** from the **Home** window shown in Figure 2-9.

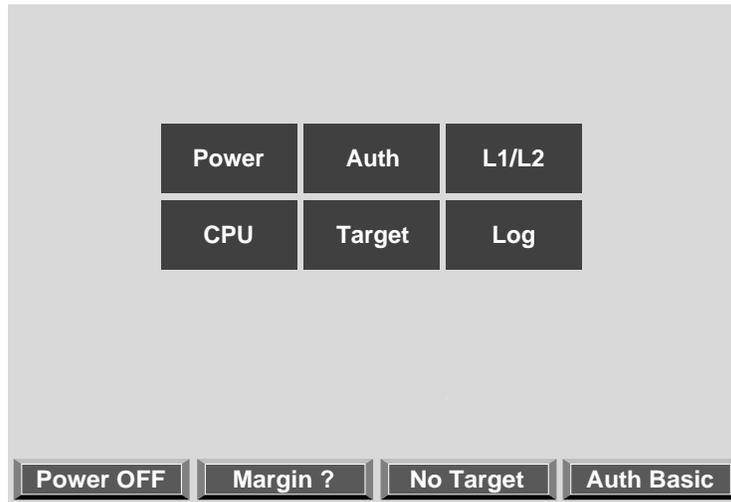


Figure 2-9 Home Window

The **Power** window appears, as shown in Figure 2-10.

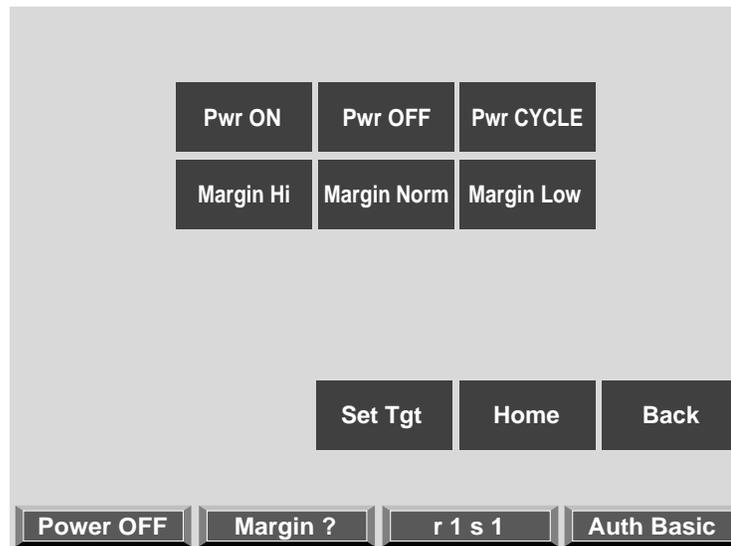


Figure 2-10 The Power Window

2. Select **Set Tgt** from the **Power** window to select the bricks you want to power on. The **Target Select** window appears, as shown in Figure 2-11.

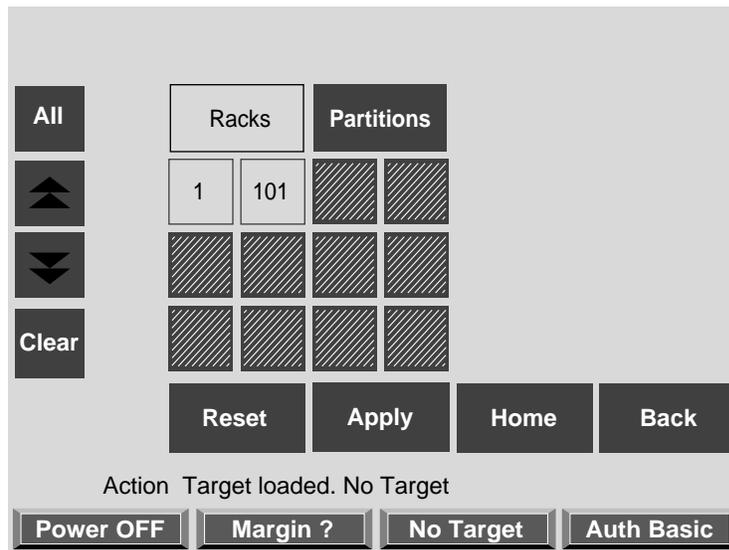


Figure 2-11 Target Select Window

3. The bricks are selected by their rack and slot/bay (unit position) number. Select **All** in the upper left hand corner of the display if you want to power on all the bricks in all the racks and slots in the server. If you want to select individual bricks to power on, select the rack from which you want to select bricks from the **Racks** segment of the display. For example, if you select rack 1, a section on the window with all the bricks in rack 1 will appear, as shown in Figure 2-12.

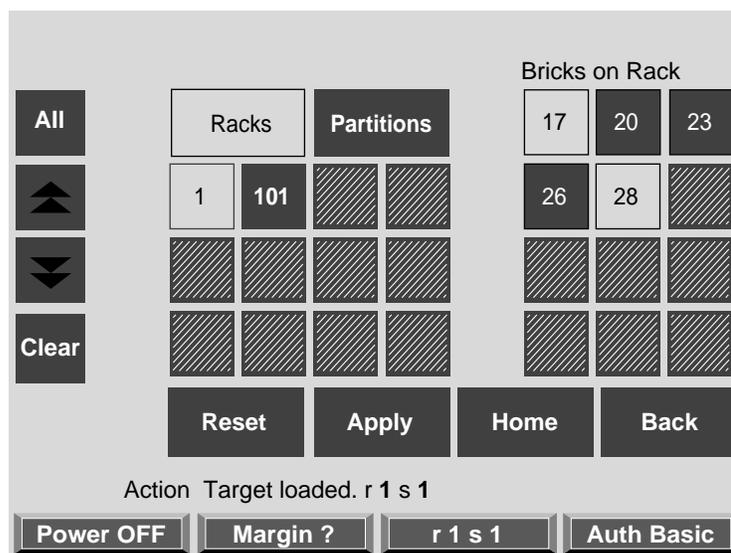


Figure 2-12 Bricks on the Rack Section

- From the **Bricks on Rack** segment of the display, touch your brick selections. For example, touch 17 and 28. After you have made your brick selections, touch **Apply**. Your selection will be reflected in the target indicator across the bottom of the display as shown in Figure 2-13. The target will show “r 1 s 17, 28,” which indicates that you have selected slots (bricks) 17 and 28 from rack 1 on your server to power on.

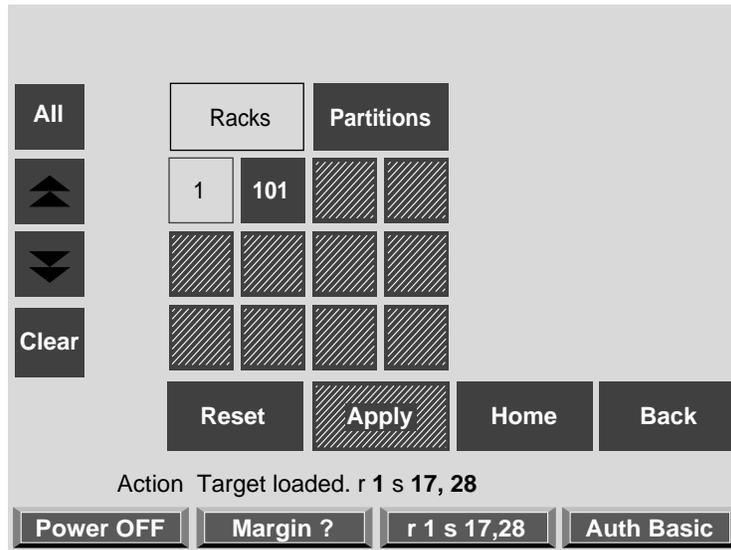


Figure 2-13 Target Indicator at Bottom of Display

5. After you have selected the bricks you want to power on, select **Back** to return to the Power window. The bottom of the display will show which bricks you have selected as your target. Select **Pwr On** at the Power window to power on the bricks selected.
6. When you select **Pwr On**, a Command Confirmation window appears, as shown in Figure 2-14. This window shows the target items (the bricks to be powered on, for example) and command that will be executed on those target items. Select **Execute** from this window. The Command Confirmation window will stay open until the command is executed successfully.

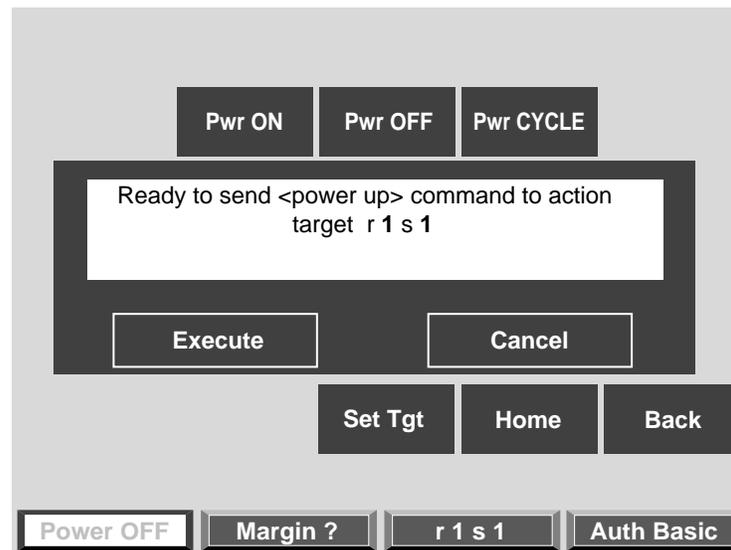


Figure 2-14 Command Confirmation Window

7. If the command you enter is not executed successfully, a Command Error/Timeout window appears, which shows the error as shown in Figure 2-15. Press **Return** and then return to the Home window. Select **Log** to see the Log window, which displays an explanation of the error.

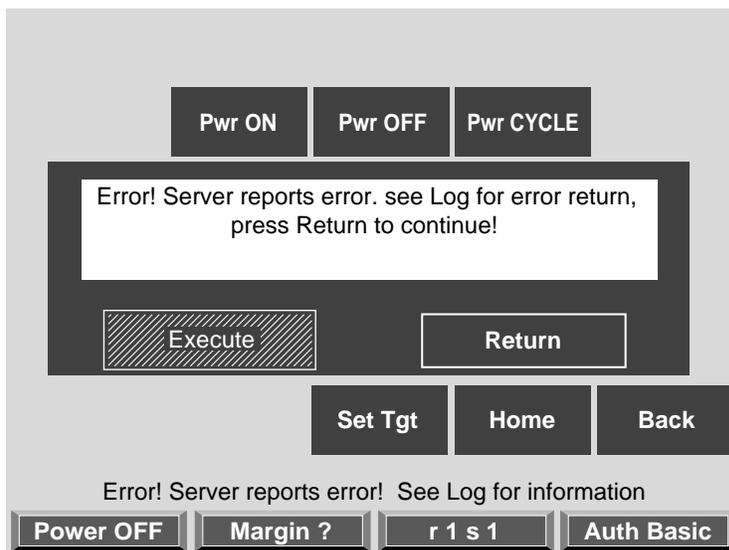


Figure 2-15 Command Error/Timeout Window

Powering On at the System Console

The powering on procedure at a system console varies with your server setup:

- If you have a system console running L3 software, you have L2 software, which enables you to enter L2 commands even without a hardware L2 controller. With L2 software, you can enter commands to toggle between L2, L1, and console mode. This means you can power on your server with L1 or L2 controller commands, and monitor the power-on activity by changing to the console mode.
- If you have a system console connected to a server with a hardware L2 controller, you have access to L2 software. This means you can toggle between L2, L1, and console mode, and power on your server with L1 or L2 controller commands, and monitor the power-on activity by changing to the console mode.
- If you have a system console connected to a server without L3 software or a hardware L2 controller, you can toggle between L1 and console mode. This enables you to power on your server with L1 commands and view the activity by changing to the console mode.

For detailed instructions on using a system console running L2 software, see “About the L2 Software” in Chapter 3. For detailed instructions on using the L2 mode, see “Operating L2” in Chapter 3. For detailed instructions on using a system console using the L1 mode, see “Operating L1” in Chapter 3.

The following sections describe how to power on your system using the L2 mode and the L1 mode.

Powering On in the L2 Mode

To power on your system while in the L2 mode, do the following:

1. If you have a system console running L3 software, get into the L2 mode (L2 software) by entering the following command:

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

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 the next step.)

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

For example, to power on a C-brick in rack 1, slot 10, enter the following:

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

The slot number is the unit position number located on the rack, slightly above where the bottom of the brick sits. Each rack unit position number is located toward the top of the two lines that mark off the unit position that the number represents. For example, the rack numbering for a brick located in slot 10 would appear on the left front side of the rack as shown in Figure 2-16:

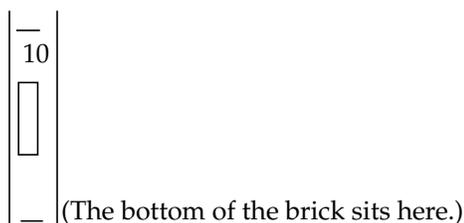


Figure 2-16 Rack Numbering

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 10 for rack 4, enter the following:

```
L2> r 4 s 7,10 pwr u
```

If you want to power on a brick for several racks, you must enter the number of the racks followed by the slot number of the brick you want to power on for all the racks. For example, to power on the brick in slot 10 for racks 3 and 4, enter the following:

```
L2> r 3, 4 s 10 pwr u
```

Note: To avoid problems with your system, do not try to power on several slots for several 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 system and each brick's system controller address.

The L1 controller display for each brick should display `L1 running` once the power on procedure starts.

Note: If you have a problem during powering on and an error message appears on your L1, L2, or L3 controller display, see Appendix C, "Controller Status and Error Messages" to learn what the error message indicates and what steps will resolve the problem.

Powering On in the L1 Mode

The only time you would want to power on from the L1 mode is when you do not have L2 software available on your system.

To power on your system while in the L1 mode, do the following:

1. The prompt on your system will be the rack and slot number of the C-brick to which you have connected your console. If you want to power on the C-brick (003c01 in our example) indicated in the prompt, enter the following command. (If you want to power on the bricks connected to the C-brick, proceed to the next step.)

```
003c01-L1> power up
```

2. If you want to power on the bricks connected to the C-brick, enter the following command:

```
003c01-L1> * power up
```

(* indicates all)

3. From the L1 prompt, display the brick configuration information by entering the following command:

```
003c01-L1> config
```

In L1 mode, you can obtain only limited information about the system configuration. A C-brick only has information about its attached I/O brick and, if another C-brick is attached to the I/O brick, information about that C-brick and its attached I/O brick. An I/O brick only has information about its attached C-brick and an R-brick only has information about itself.

The L1 controller display for the brick should display `L1 running` once the power on procedure starts.

Powering Off

Individual bricks and your entire server system can be powered off from the L2 controller display located on the front door of the system or from the server system console.

Preparing to Power Off

Follow these steps to prepare to power off:

1. Check to assure that the cabling between the PDU or PDS and the wall power-plug receptacle is secure.

Note: Check that the LEDs turn off and that your controllers display that the system is powering off for each segment of the procedure, which indicates that the powering off procedure is proceeding properly. If you have a problem during powering off and an error message appears on your L2 controller touch display or your console, see your system's online log files and Appendix C, "Controller Status and Error Messages" to learn what the error message indicates and what steps will resolve the problem.

2. If you are going to power off the D-brick or the entire system, make sure that the D-brick's Run/Service key switch on the ESI/Ops panel is set to Service, as shown in Figure 2-17.

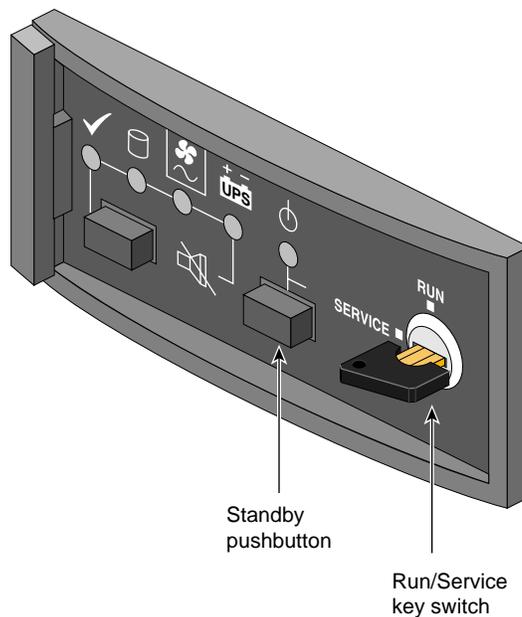


Figure 2-17 Setting the Run/Service Key Switch to Service

Powering Off at the L2 Controller Touch Display

This section describes how to power off individual bricks or the entire system from the L2 controller touch display located in the front door of your server rack. If you have multiple racks, you can power off from any L2 controller touch display on your server.

For instructions on navigating through the L2 controller touch display, see the “Using the L2 Controller Touch Display” section in Chapter 3, “System Control.”

To power off an individual brick or your entire server, do the following:

1. Select **Power** from the home window shown in Figure 2-18.

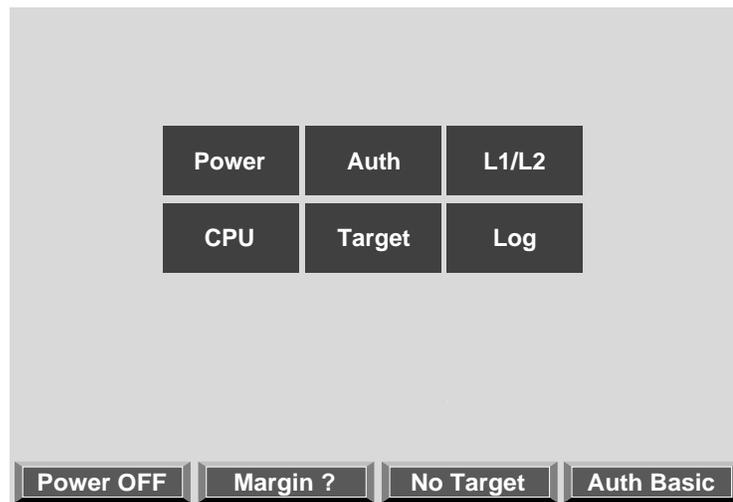


Figure 2-18 Home Window

The Power window appears, as shown in Figure 2-19.

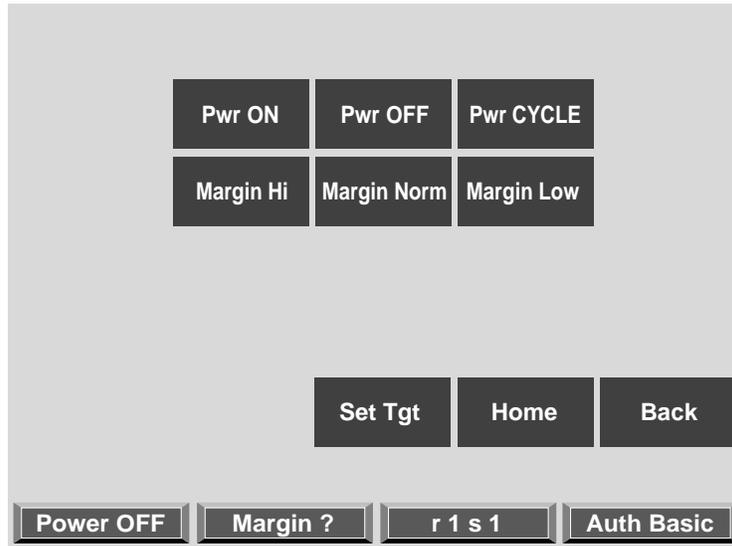


Figure 2-19 Power Window

2. Select **Set Tgt** from the window to select the bricks you want to power off. The Target Select window appears, as shown in Figure 2-20.

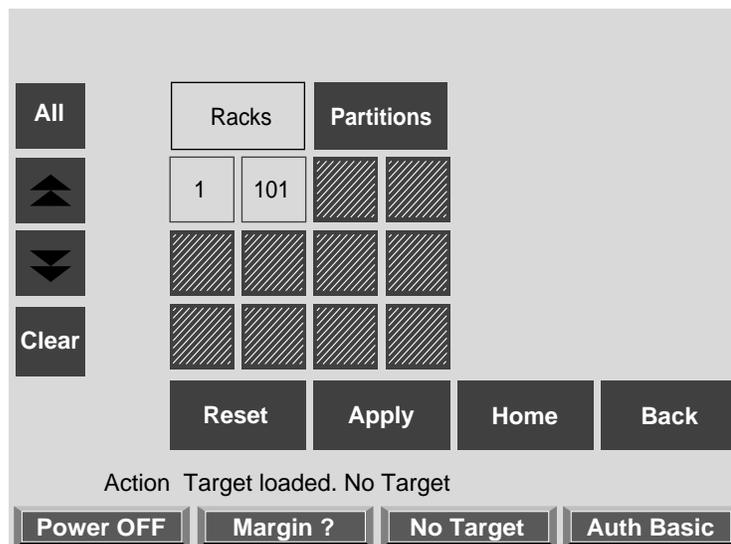


Figure 2-20 Target Select Window

3. The bricks are selected by their rack and slot/bay (unit position) number. Select **All** in the upper left-hand corner of the display if you want to power off all the bricks in all the racks and slots in the server. If you want to select individual bricks to power off, first select the rack(s) from which you want to select bricks. For example, if you select rack 1, a section on the window with all the bricks in rack 1 will appear, as shown in Figure 2-21.

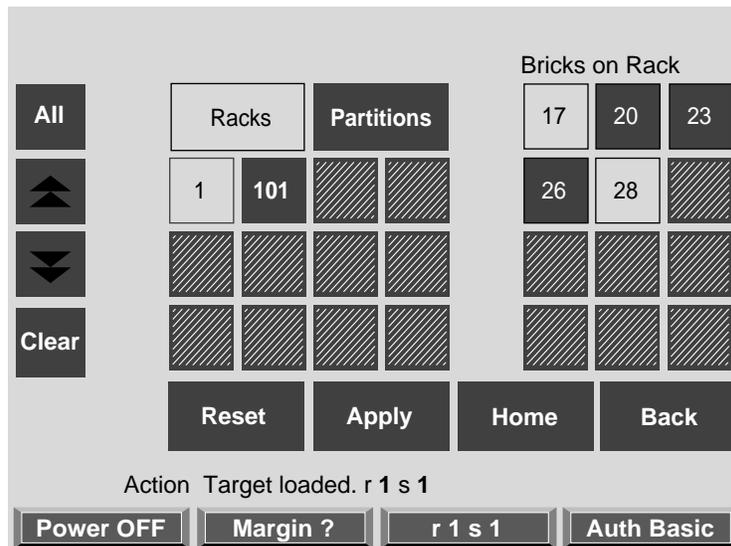


Figure 2-21 Bricks on the Rack Section

4. From the “Bricks on Rack” segment of the display, touch your brick selections. For example, touch 17 and 28. After you have made your brick selections, touch **Apply**. Your selection will be reflected in the target indicator across the bottom of the display, as shown in Figure 2-22. The target will show “r 1 s 17, 28,” which indicates that you have selected slots (bricks) 17 and 28 from rack 1 on your server to power off.

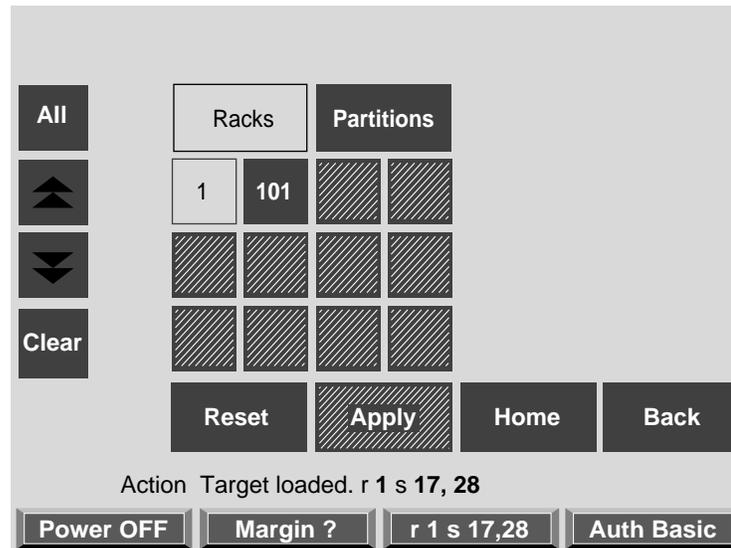


Figure 2-22 Target Indicator at Bottom of Display

5. After you have selected the bricks you want to power off, select **Back** to return to the Power window. The bottom of the display will show which bricks you have selected as your target. Select **Pwr Off** at the Power window to power off the bricks selected.
6. Selecting **Pwr Off** brings up a Command Confirmation window as shown in Figure 2-23. This window shows the target items (the bricks to be powered off, for example) and command (should be “powered off,” in this case) that will be executed on those target items. Select **Execute** from this window. The Command Confirmation window will stay open until the command is executed successfully.

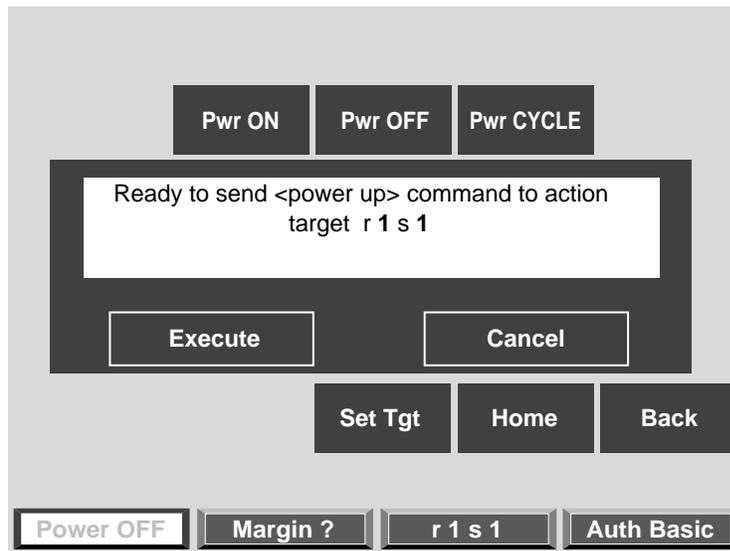


Figure 2-23 Command Confirmation Window

7. If the command you enter is not executed successfully, a Command Error/Timeout window appears, which displays the error as shown in Figure 2-24. Press **Return** and then return to the Home window. Select **Log** to get to the Log window, which displays an explanation of the error.

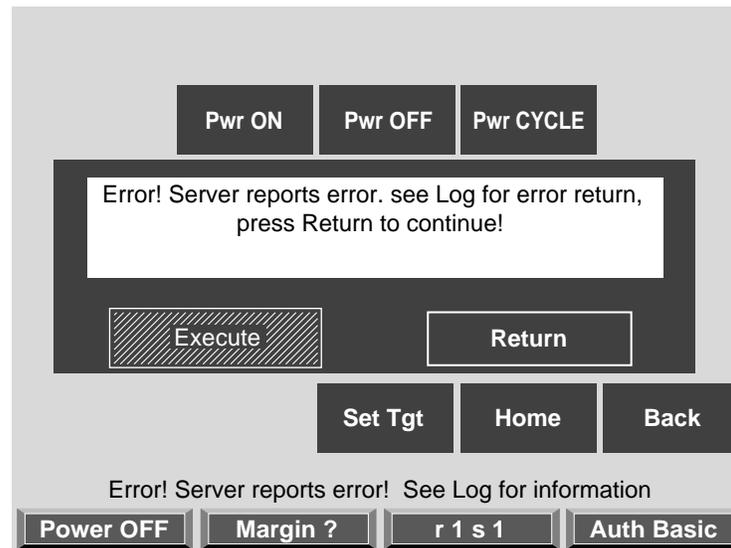


Figure 2-24 Command Error/Timeout Window

Powering Off at the System Console

The powering off procedure at a system console varies with your server setup:

- If you have a system console running L3 software, you have L2 software, which enables you to enter L2 commands even without a hardware L2 controller. With L2 software you can enter commands to toggle between L2, L1, and console mode. This means you can power off your server with L1 or L2 controller commands, and monitor the power-off activity by changing to the console mode.
- If you have a system console connected to a server with a hardware L2 controller, you have access to L2 software. This means you can toggle between L2, L1, and console mode, power off your server with L1 or L2 controller commands, and monitor the power-off activity by changing to the console mode.
- If you have a system console connected to a server without L3 software or a hardware L2 controller, you can toggle between L1 and console mode. This enables you to power off your server with L1 commands and view the activity by changing to the console mode.

For detailed instructions on using a system console running L2 software, see “About the L2 Software” in Chapter 3. For detailed instructions on using the L2 mode, see “Operating L2” in Chapter 3. For detailed instructions on using a system console in the L1 mode, see “Operating L1” in Chapter 3.

The following sections describe how to power off your system in the L2 mode and the L1 mode.

Powering Off in the L2 Mode

To power off your system while in the L2 mode, do the following:

1. If you have a system console running L3 software, get into the L2 mode (L2 software) by entering the following command:
`$> /stand/sysco/bin/12`
2. From the L2 prompt (L2>), power off an individual brick by entering 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 C-brick in rack 1, slot 10, enter the following:

`L2> r 1 s 10 pwr d`

The slot number is the unit position number located on the rack, slightly above where the bottom of the brick sits. Each rack unit position number is located toward the top of the two lines that mark off the unit position the number represents. For example, the rack numbering for a brick located in slot 10 would appear on the left front side of the rack as shown in Figure 2-25:

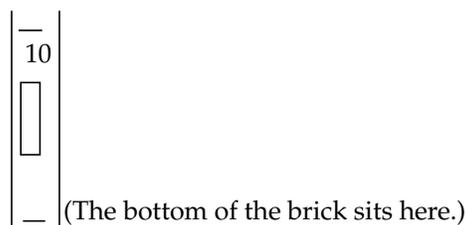


Figure 2-25 Rack numbering

If you want to power off 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 off. For example, to power off bricks in slots 7 and 10 for rack 4, enter the following:

```
L2> r 4 s 7,10 pwr d
```

If you want to power off a brick for several racks, you must enter the number of the racks followed by the slot number of the brick you want to power off for each rack. For example, to power off the brick in slot 10 for racks 3 and 4, enter the following:

```
L2> r 3, 4 s 10 pwr d
```

Note: To avoid problems with your system, do not try to power off several slots for several racks at the same time.

3. If you want to power off the bricks connected to the C-brick, enter the following command:

```
L2> pwr d
```

(The default setting for power down is all racks all slots.)

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

```
L2> config
```

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

The L1 controller display for each brick should display `L1 running` once the power down procedure starts.

Note: If you have a problem during powering on and an error message appears on your L1, L2, or L3 controller display, see Appendix C, "Controller Status and Error Messages" to learn what the error message indicates and what steps will resolve the problem.

Powering Off in the L1 Mode

The only time you would want to power on from the L1 mode is when you do not have L2 software available on your system.

To power on your system while in the L1 mode, do the following:

1. The prompt on your system will be the rack and slot number of the C-brick to which you have connected your console. If you want to power down the C-brick (003c01 in our example) indicated in the prompt, enter the following command. (If you want to power down the bricks connected to the C-brick, proceed to the next step.)

```
003c01-L1> power down
```

2. If you want to power off the bricks connected to the C-brick, enter the following command:

```
003c01-L1> * pwer down
```

(* indicates all)

3. From the L1 prompt, display the brick configuration information by entering the following command:

```
003c01-L1> config
```

In L1 mode, you can obtain only limited information about the system configuration. A C-brick only has information about its attached I/O brick and, if another C-brick is attached to the I/O brick, information about that C-brick and its attached I/O brick.

An I/O brick only has information about its attached C-brick and an R-brick only has information about itself.

Using Embedded Support Partner (ESP)

Embedded Support Partner (ESP) automatically detects system conditions that indicate potential future problems and then notifies the appropriate personnel. This enables you and SGI system support engineers (SSEs) to proactively support systems and resolve issues before they develop into actual failures.

ESP enables users to monitor one or more systems at a site from a local or remote connection. ESP can perform the following functions:

- Monitor the system configuration, events, performance, and availability.

- Notify SSEs when specific events occur.
- Generate reports.

ESP also supports:

- Remote support and on-site troubleshooting.
- System group management, which enables you to manage an entire group of systems from a single system.

Monitoring Your Server

You can monitor your SGI Origin 3000 server from the following sources:

- On the L1 controller's display located at the right-hand corner of each brick (except the D-brick), as shown in Figure 2-26, you can monitor brick items. For example, you can see if the fans on a particular brick are operating properly.

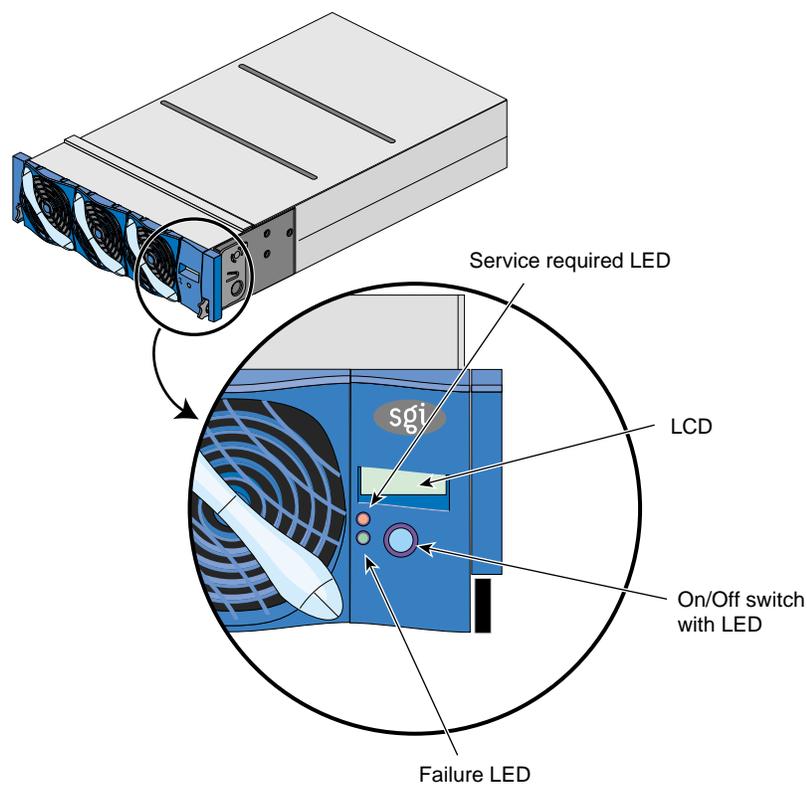


Figure 2-26 L1 Controller Display

- On the L2 controller's display on the front door of the tall rack shown in Figure 2-27, you can see the L1 status and error messages for each brick in the rack. You can also see status and error messages generated by the L2 controller for the chassis items not covered by the L1 controller, such as for the functioning of the power bay.

The L2 controller can connect to other L2 controllers in other racks via its Ethernet port. For details on how to interconnect L2 controllers, see Chapter 3, "System Control."

- If you connect a console running the L3 controller software (with Linux operating system software) to the Ethernet connector on your L2 controller (or to the L1 port [USB] connector on a C-brick if no L2 controller is available; see Figure 2-28), you can view the status and error messages generated by both the L1 controllers and the L2 controller. You can also input L1 and L2 commands to generate specified status and error messages. For explanations of these commands, see Appendix B, "System Controller Commands."

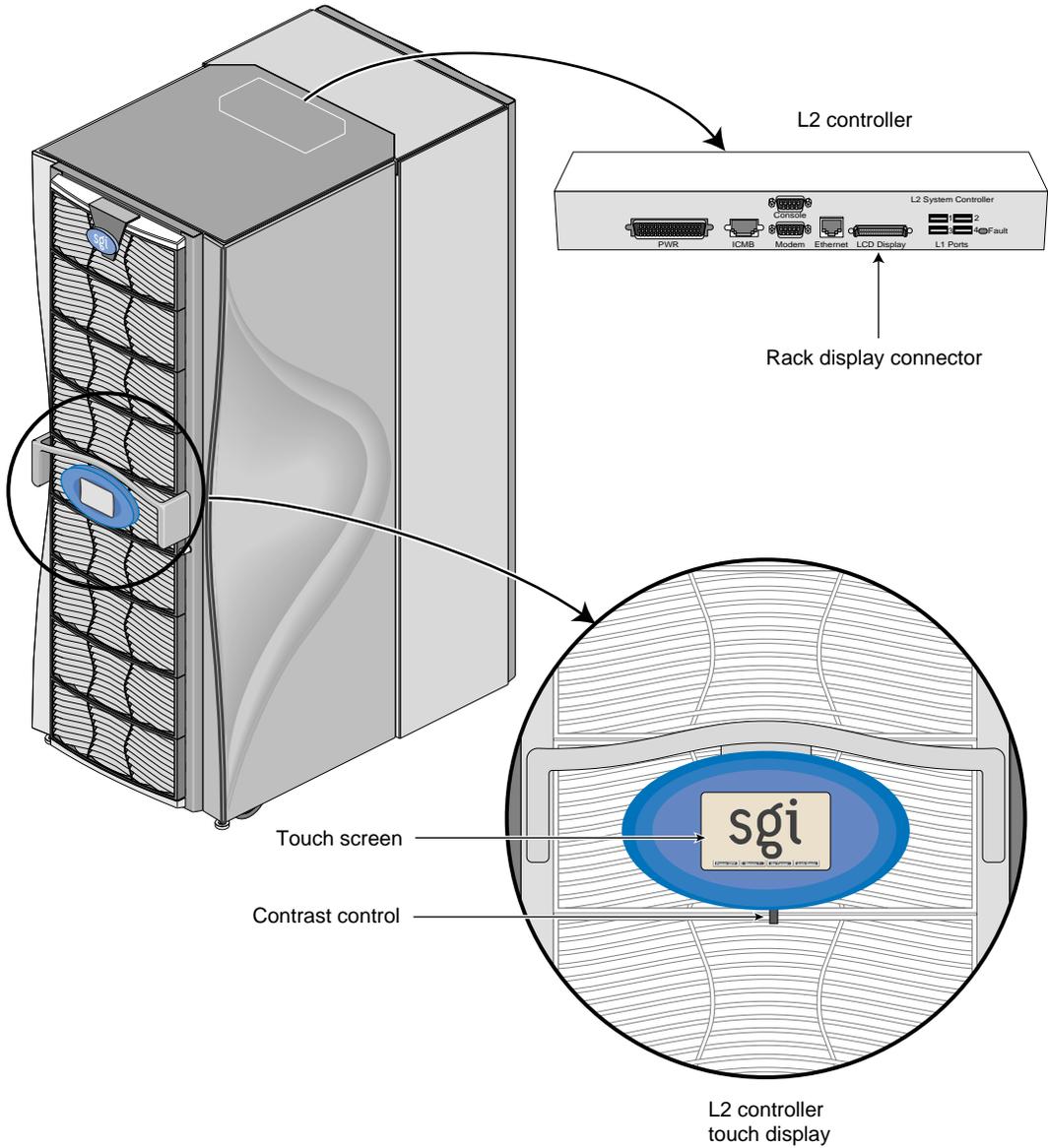


Figure 2-27 L2 Controller Display

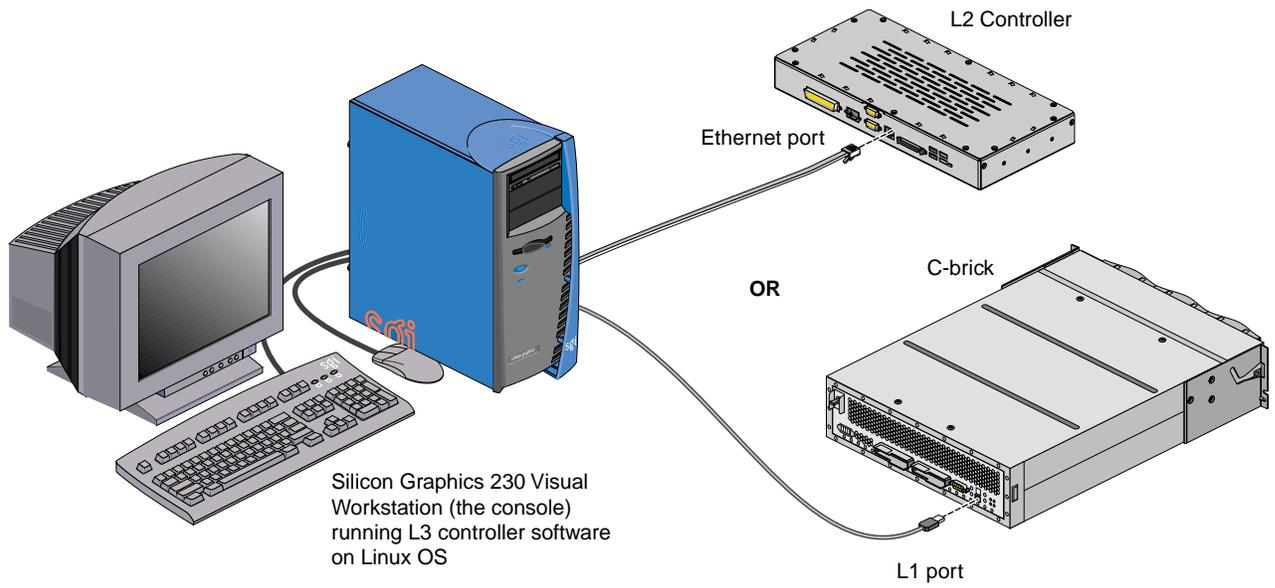


Figure 2-28 L3 Controller Display

System Control

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

- “Three Levels of System Control” on page 63
- “System Controller Interaction” on page 64
- “L1 Controller” on page 67
- “L2 Controller” on page 70
- “L3 Controller” on page 77
- “Using the L2 Controller Touch Display” on page 80
- “About the L2 Software” on page 92
- “Operating L2” on page 92
- “Operating L1” on page 100
- “Upgrading L1/L2 Firmware” on page 105
- “Identifying Bricks” on page 107

Three Levels of System Control

The control systems for the SGI Origin 3000 servers manage power control and sequencing, provide environmental control and monitoring, initiate system resets, store identification and configuration information, and provide console/diagnostic and scan interface. The SGI Origin 3000 server has three levels of control:

- **L1: brick-level system controller.** The L1 system controller is designed into all bricks except the D-brick; controller function varies slightly by brick. The L1 controllers are not configurable.
- **L2: rack-level system controller** (optional in the SGI Origin 3200 server system). This controller is standard in each tall rack containing C-bricks. The L2 allows remote maintenance, controls resource sharing, controls the L1 controllers in the

system, maintains controller configuration and topology information between the L2 and L3 controllers.

- **L3: the L3 controller software** comes in a Silicon Graphics 230 Visual Workstation, running Linux operating system, serving as your server system console. The L3 software requires Linux operating system. The L3 controller allows remote maintenance, provides a console for the L1 and L2 controllers, and provides various control system applications. (The L3 controller software is optional for all SGI Origin 3000 server models.)

System Controller Interaction

In an SGI Origin 3200 server with no L2 controller, the L1 controllers on the C-bricks work as peers in the server system. In all SGI Origin 3400 and 3800 servers, the L1 controllers are slave devices to the L2 controller. The controllers communicate with each other in the following ways.

In any SGI Origin 3000 server:

- An L1 controller of an I/O brick communicates with an L1 controller of a C-brick.
- In an SGI Origin 3200 server system with two C-bricks and no R-brick, the L1 controller of a C-brick communicates with the L1 controller of the other C-brick (not shown in Figure 3-1).

In the SGI Origin 3400 and 3800 server:

- An L1 controller of a C-brick that is connected to an R-brick communicates with the L2 controller via the R-brick. The L3 controller can also connect to the L2 through the L2 controller's Ethernet port connector. If you have multiple L2 controllers, they and the L3 controller can connect to an Ethernet hub.

In the SGI Origin 3800 Server:

- An L2 controller communicates with other L2 controllers or an L3 controller via a private Ethernet network to which they are all connected. The L3 controller can also connect to the L2 through the L2 controller's Ethernet port connector.

Note: The D-brick, 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-brick.

Figure 3-1 diagrams some of the interactions between the L1, L2, and L3 controllers.

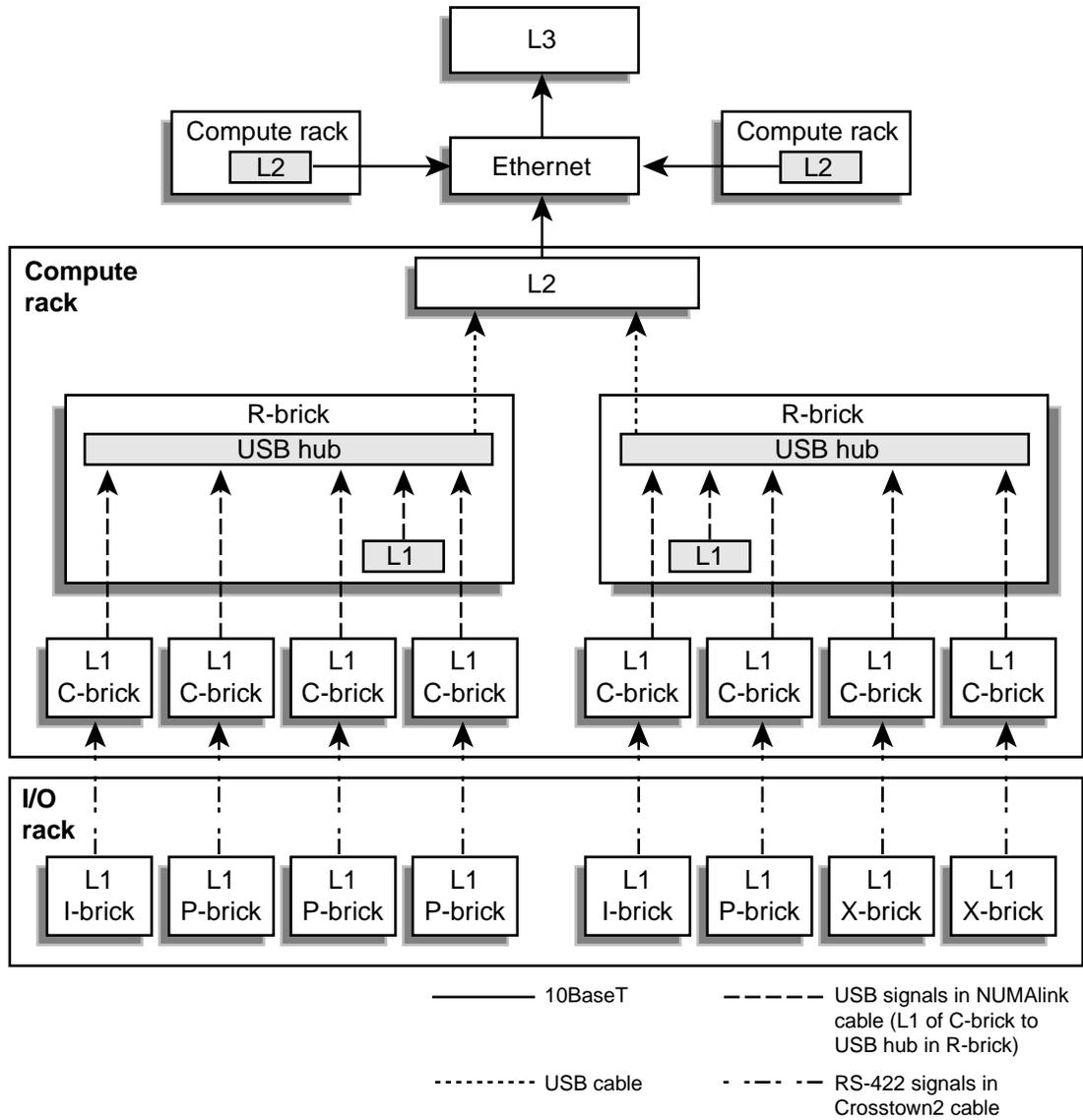


Figure 3-1 Controller Network

L1 Controller

All bricks except D-bricks have L1 controllers. This section describes basic features of all L1 controllers:

- “L1 Controller Functions” on page 67
- “L1 Front Panel Display” on page 69

Note: For L1 controller commands, see Appendix B, “System Controller Commands.”

L1 Controller Functions

The L1 controller performs many functions; some of the functions are common for the C-brick, R-brick, I-brick, P-brick, and X-bricks and some are specific to a brick type. Table 3-1 summarizes some of the functions that the L1 controller performs.

Table 3-1 L1 Controller Functions

Function	C-brick	R-brick	I-brick	P-brick	X-brick
Controls voltage regulator modules (VRMs).	X	X	X	X	X
Monitors voltage and reports failures.	X	X	X	X	X
Controls voltage margining within the brick.	X	X	X	X	X
Controls and monitors fan speed.	X		X	X	X
Monitors and reports operating temperature and status of 48 VDC input power.	X	X	X	X	X
Monitors and controls LEDs.	X	X	X	X	X
Reads system identification (ID) PROMs.	X	X	X	X	X
Monitors the power On/Off switch.	X	X	X	X	X
Monitors the reset switch, and the nonmaskable interrupt (NMI) switch.	X				

Table 3-1 (continued) L1 Controller Functions

Function	C-brick	R-brick	I-brick	P-brick	X-brick
Monitors the power On/Off switch.		X	X	X	X
Provides a USB hub chip that has six master ports: one port connects internally to the R-brick's L1 controller, four ports connect to the L1 controllers of four C-bricks (via the NUMALink3 cable), and a master port connects to the L2 controller.		X			
Reports the population of the PCI cards and the power levels of the PCI slots.			X	X	
Powers on the PCI slots and their associated LEDs.			X	X	
Reports the power levels of the XIO slots.					X
Controls the termination voltage margins of the XIO cards.					X

L1 Front Panel Display

Figure 3-2 shows the L1 controller front panel.

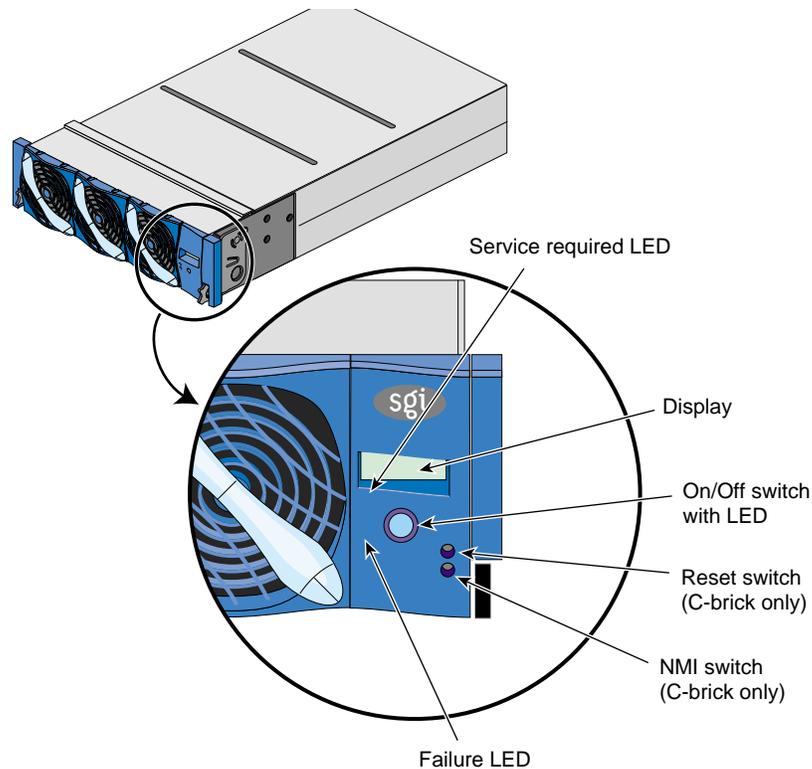


Figure 3-2 L1 Front Panel

The front panel display contains the following items:

- 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]).
- Service required LED.
- Failure LED.

- Reset switch and non-maskable interrupt (NMI) button switch (only on C-bricks).

Note: The reset and NMI switches are not available in the front panel of an I-brick, P-brick, X-brick, or R-brick.

L2 Controller

The L2 controller is a rack-level controller located at the top of the rack; it is a single-board computer that runs an embedded operating system out of flash memory.

The L2 system controller is optional in SGI Origin 3200 server systems, but is standard on all SGI Origin 3400 and SGI Origin 3800 server systems. The L2 system controller is required in a rack when:

- The system contains an R-brick (all SGI Origin 3400 and SGI Origin 3800 server systems) The L2 controller is present in all the server tall racks that contain C-bricks.
- The system has a rack L2 controller touch display. (All SGI Origin 3400 and SGI Origin 3800 server systems have rack L2 controller touch displays.)
- Remote maintenance of the system is required (any SGI Origin 3000 server system).

The L2 controller 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 that are 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 and each propagates configuration information to the other L2 controllers. Each L2 controller monitors its associated L1 controllers and propagates this information to the other L2 controllers.

Figure 3-3 diagrams the L2 controller and its interactions.

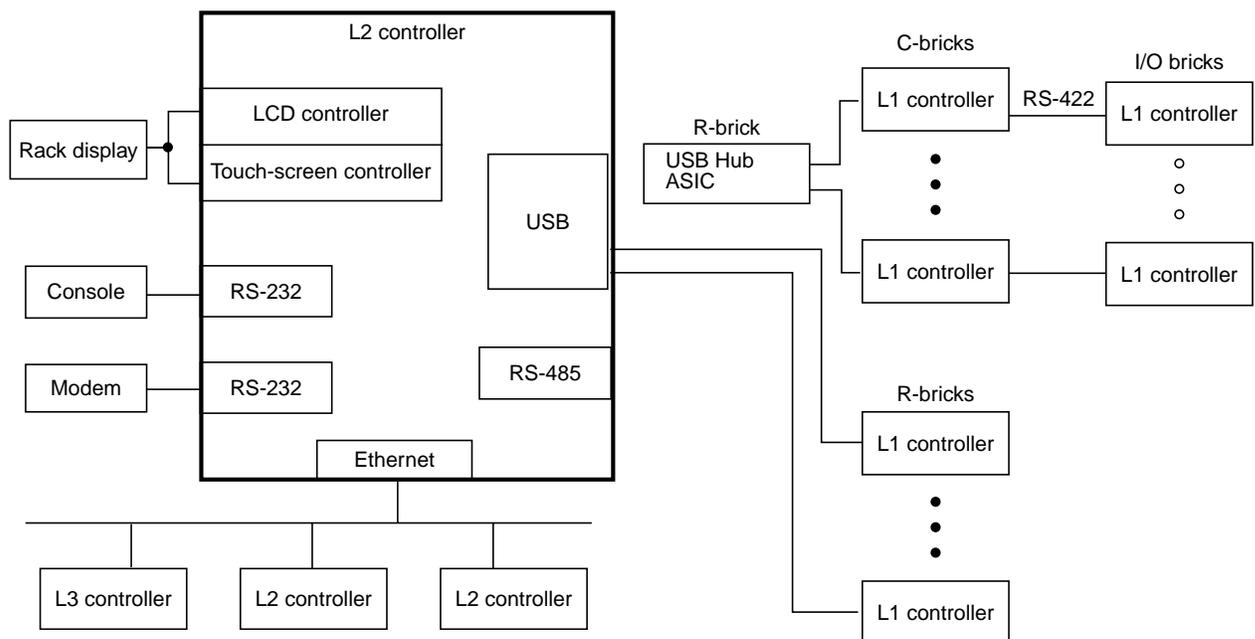


Figure 3-3 L2 Controller Interactions

The L2 controller is mounted in the top of the tall or short rack (optional for short rack); it does not use configurable rack space. Figure 3-4 shows its location in a tall rack.

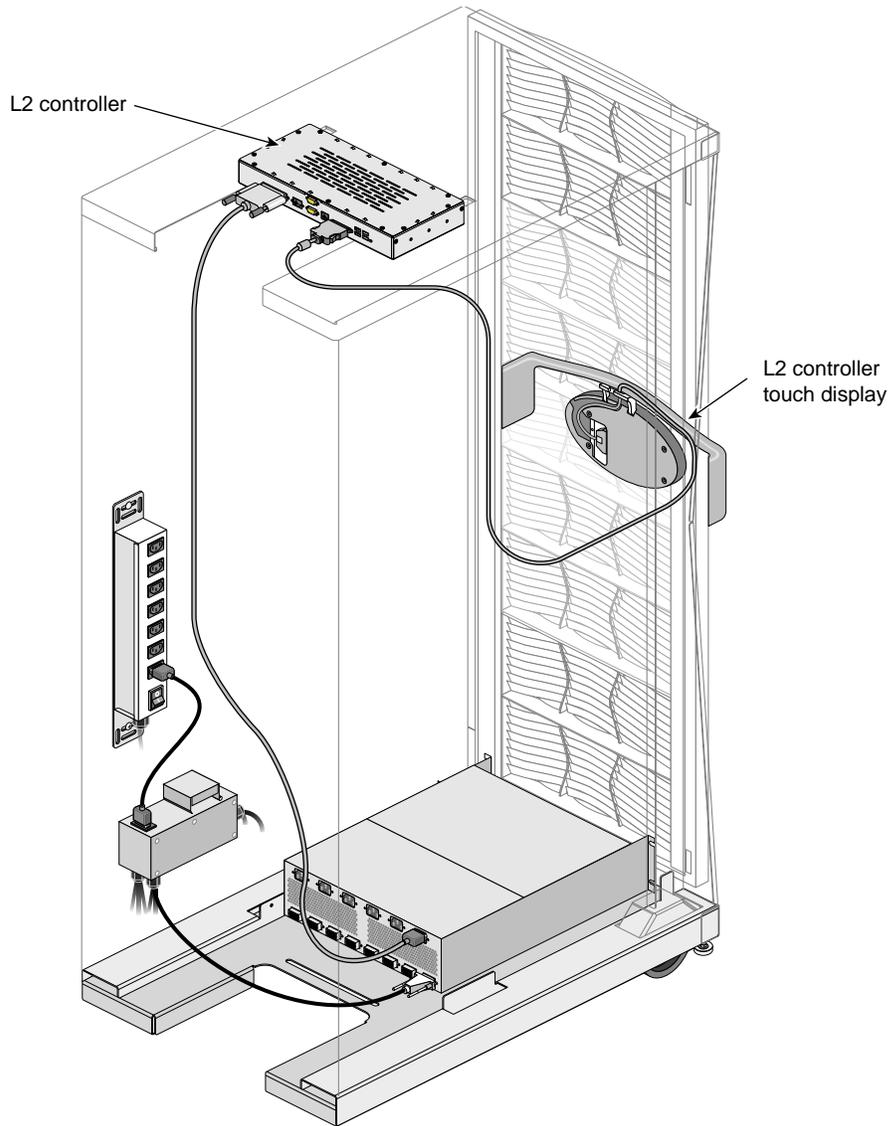


Figure 3-4 Location of L2 Controller in a Tall Rack (Rear View)

The L2 controller consists of touch display controllers, ports, and a software component, which are described in these subsections:

- “L2 Controller Touch Display” on page 73
- “L2 Controller Ports” on page 75

Note: For L2 controller commands, see Appendix B, “System Controller Commands”.

L2 Controller Touch Display

The L2 controller touch display is a 320 x 240 touch-pad LCD screen display. The L2 controller’s touch-screen translates what the user touches into commands and displays the results of the commands.

The L2 controller touch display is located on the front door of the cabinet as shown in Figure 3-5.

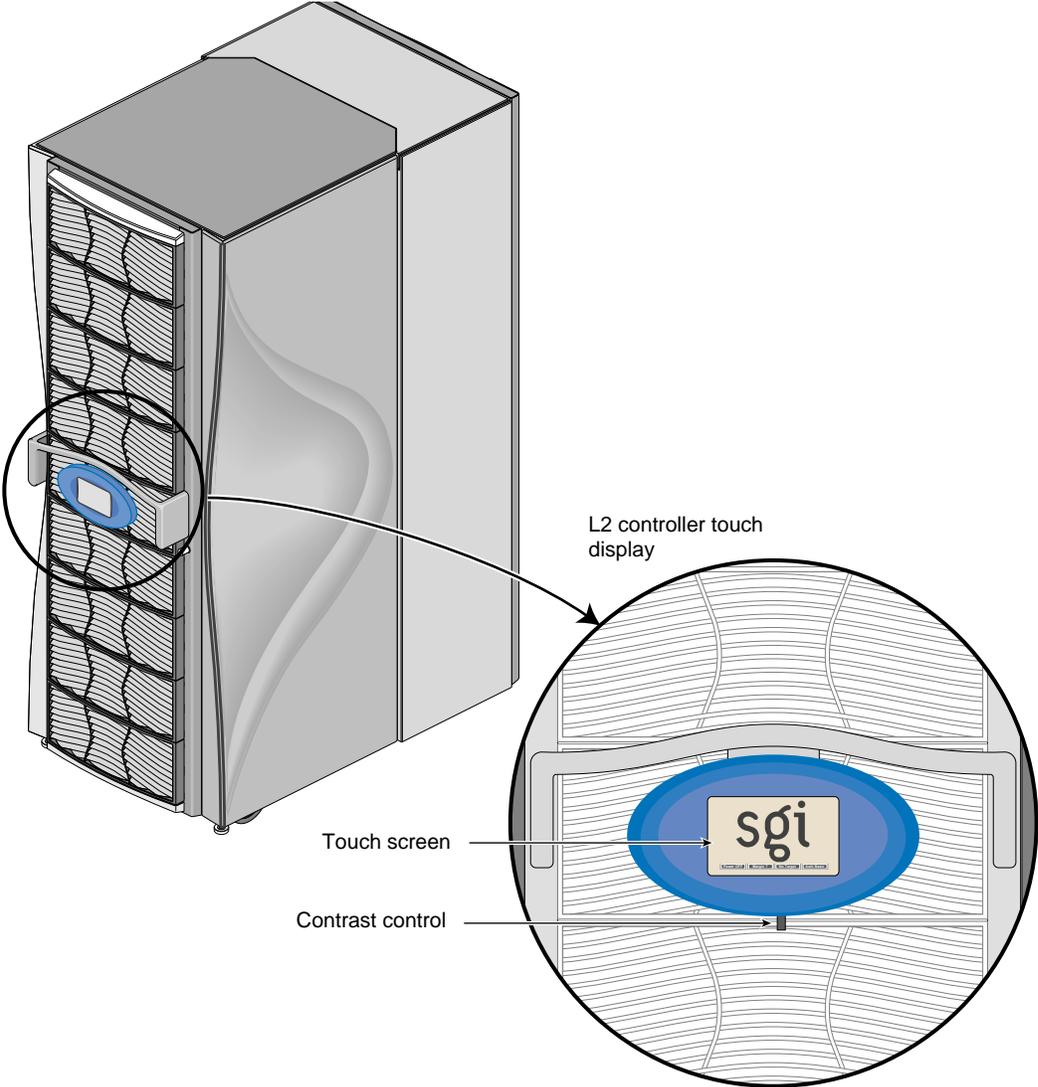


Figure 3-5 L2 Controller Touch Display

L2 Controller Ports

Figure 3-6 shows the ports on the L2 controller.

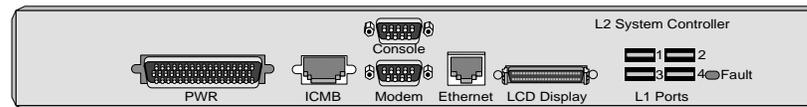


Figure 3-6 L2 Controller Connectors

Table 3-2 summarizes the ports of the L2 controller.

Table 3-2 L2 Controller Ports

Quantity	Port	Connector Label	Connects To	Purpose or Notes
4	Standard downstream USB	L1 port 1 through L1 port 4	USB hubs of R-bricks	In a system with no R-brick, connects to an L1 controller of a C-brick. The USB hub transfers status and control information between the L2 controller, which is the master of the USB port, and the L1 controllers in the attached R-brick or C-bricks.
1	10/100-Base-T Ethernet, RJ45, autonegotiating	Enet	Ethernet hub	Provides a means to connect multiple L2 controllers and to connect multiple L2 controllers to an L3 controller. The Ethernet hub provides eight Ethernet connectors and one cascade connector (see Figure 3-7).
1	RS-232 ports (DB-9; 115 Kbaud)	Console	SGI 230 Visual Workstation	Console and modem ports that allow the user to input text-based commands and to receive text-based results. The console and modem ports operate in one of the following modes:
1		Modem	Modem	<p>L2 mode: L2 controller forwards all commands to the specified L2 controller.</p> <p>L1 mode: L2 controller forwards all commands to the specified L1 controller, except commands that are prefixed with CTRL T; the L2 controller interprets these commands.</p> <p>Console mode: L2 controller forwards all commands to the system console, except commands prefixed with CTRL T; the L2 controller interprets these commands.</p>

Table 3-2 (continued) L2 Controller Ports

Quantity	Port	Connector Label	Connects To	Purpose or Notes
1	L2 controller touch display	LCD display	L2 controller touch display	To display status and error messages generated by the L1 or L2 controller on the display panel located in the front door of your system.
1	Power	PWR	Power distribution unit	To provide a power source to the L2 controller.

The L2 controller connects to a modem through the modem connector on the back of the L2 controller. This connection provides a means of connecting remote support hardware to the system; however, the use of an Ethernet hub is the preferred method of connecting remote support hardware to the system.

The Ethernet hub provides eight Ethernet connectors and one cascade connector. Figure 3-7 shows sample connections between the Ethernet hub, L2 controllers, and an L3 controller.

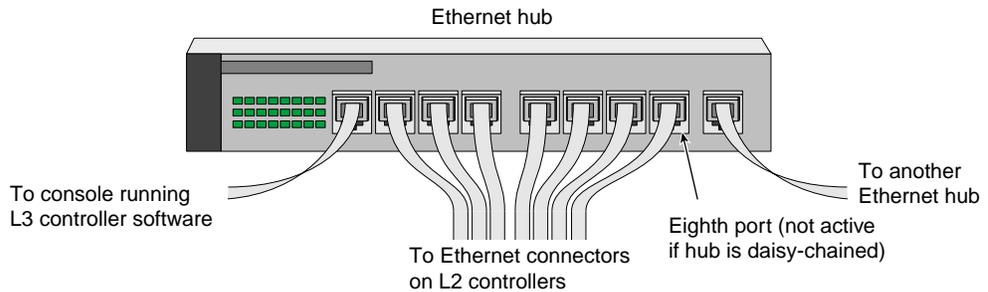


Figure 3-7 Ethernet Hub System Controller Connections (Example)

If a system has more than seven L2 controllers, the Ethernet hub can be daisy chained to another Ethernet hub through the cascade connector on the back of the Ethernet hub. (If you daisy-chain to a second Ethernet hub, the eighth port connector cannot be used.) The cascade connector provides Ethernet signals that can be cabled to one of the eight Ethernet ports on the second Ethernet hub. The remaining seven Ethernet ports of the second Ethernet hub can be cabled to seven L2 controllers. Large systems may require three Ethernet hubs in order to connect an L3 controller to all of the L2 controllers in the system.

L3 Controller

The L3 controller is a system-level controller residing on a system console that is running Linux operating system software. The L3 controller can reside on a Silicon Graphics 230 Visual Workstation serving as the system console. See your SGI sales representative for other devices that can run the L3 controller software.

The console running L3 controller software can be connected to the L2 controller's Ethernet port connector or to the C-brick's L1 Port (USB) connector. If you have multiple L2 controllers, the L2 controllers can connect to an Ethernet hub through their Ethernet ports, and the console with the L3 controller software can connect to one of the Ethernet hub ports.

The L2 controller, in turn, connects to the individual brick's L1 controller through its connection from one of its L1 ports to either the R-brick's L1 port connector or to the C-brick's L1 port connector if the system has no R-brick. The L1 controllers on the other bricks are connected to the L2 controller through their connections with the R-brick or the C-brick.

The D-brick, 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-brick.

Note: For instructions on how the G-brick connects and interacts with the L2 controller, see *SGI Onyx3000 Series Graphics System Hardware Owner's Guide*.

The L3 controller provides the following maintenance, control, and administrative functions:

- Console for the L1 and L2 controllers.
- Console for the system.
- Remote support.
- Adds the boundary scan diagnostic tool to your system console.

L3 Controller Hardware Requirements

The L3 controller software can run on a Silicon Graphics 230 Visual Workstation that is running Linux operating system software. See your SGI sales representative for other devices that can run the L3 controller software.

The console can connect to the L2 controller's console connector, or via a 10-Base-T Ethernet hub to which one or more L2 controllers can be connected. In an SGI Origin 3200 server system, without an L2 controller, the console can connect to an L1 controller via the L1 Port (USB) connector on the C-brick. The L3 controller is optional in all the SGI Origin 3000 server systems.

Figure 3-8 and Figure 3-9 show typical SGI Origin 3200 and SGI Origin 3400 server system control configurations, with the L3 controller software running on a Silicon Graphics 230 Visual Workstation running Linux operating system software.

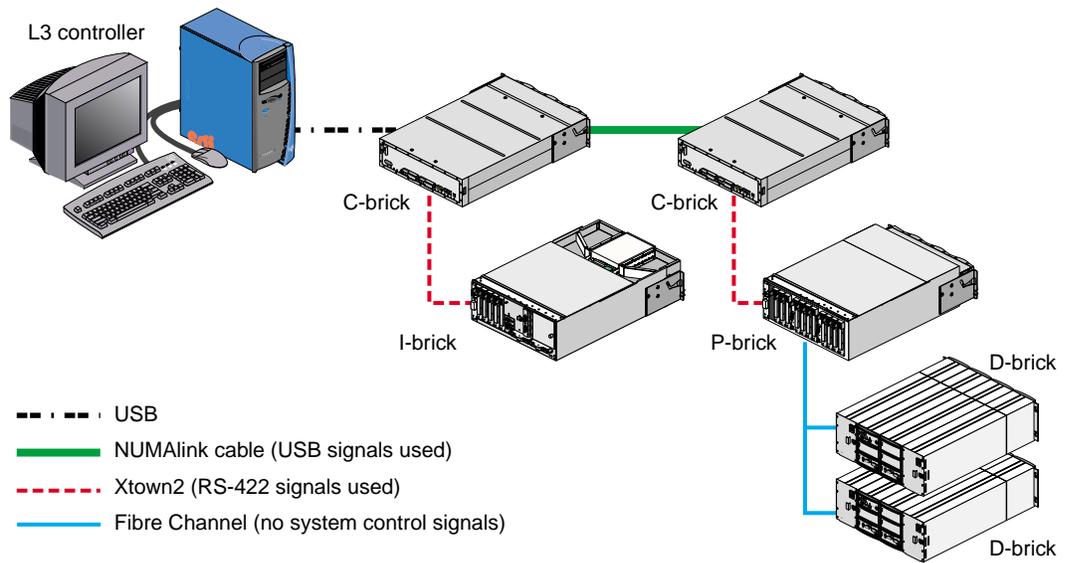


Figure 3-8 SGI Origin 3200 Server System Control Network (Example)

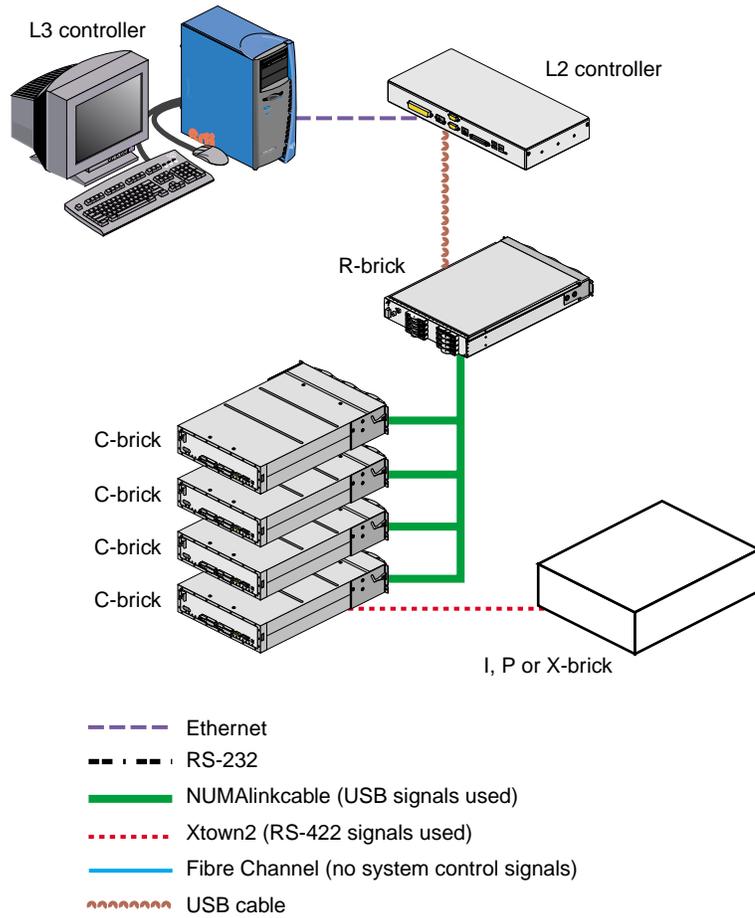


Figure 3-9 SGI Origin 3400 Server System Control Network (Example)

Using the L2 Controller Touch Display

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

- Power on and power off the system
- Reset the system
- Select command targets
- Review information, warning, and error logs

Figure 3-10 illustrates the L2 controller touch display.

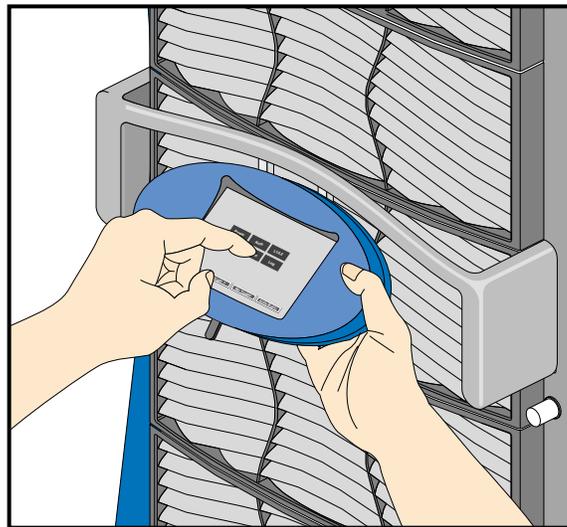


Figure 3-10 L2 Controller Touch Display Interface

Home Window

The Home Window of the L2 controller touch display, shown in Figure 3-11, includes a center matrix of six buttons:

Power	Power control
CPU	CPU control
Target	Target selection
Log	Log
Auth	Authority level (not yet functional)
L1/L2	L1/L2 log (not yet functional)

Four system status indicators are located at the bottom of the display. These indicate the following:

Power status	Power status of the bricks set in the target (see “Target Selection Window” on page 86 for more details). Values include Power On , Power Off , and Power? Power? , which indicates that one or more of the bricks in the target is off while the others are on, or vice versa.
Margin	Margin status of the brick set in the target. Values include Margin Norm , Margin Low , Margin High , and Margin? Margin? , which indicates that one or more bricks in the target do not match the others, or that the L2 cannot determine the margin state of the brick in the target.
Target	Set of bricks affected by commands initiated from the LCD.
Authority level	Authority level of the LCD (not yet implemented).

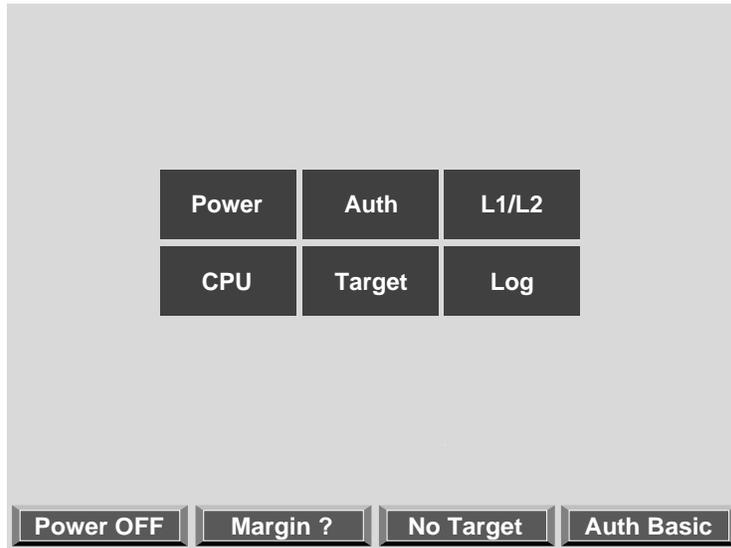


Figure 3-11 Home Window

Power Control Window

If you press the **Power** button in the home window, the power control window appears, as shown in Figure 3-12. The matrix of six buttons in the upper half of the LCD provide these power control commands:

- Pwr ON Power on the system
- Pwr OFF Power off the system
- Pwr CYCLE Power cycle the system
- Margin Hi Set power margin high
- Margin Norm Set power margin normal
- Margin Low Set power margin low

The power control command affects the list bricks set in the target. To set or change the target, press the **Set Tgt** button. To return to the home window, press the **Home** button. To return to the previous window, press the **Back** button.

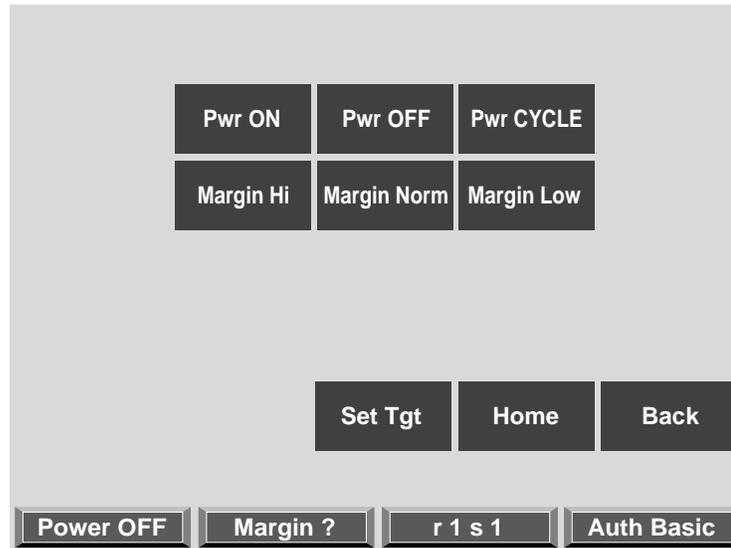


Figure 3-12 Power Control Window

CPU Control Window

If you press the CPU button in the home window, the CPU control window appears, as shown in Figure 3-13. The two buttons located in the upper half of the LCD provide these CPU control functions:

Reset	System reset
NMI	Non-maskable interrupt

The CPU control command affects the list bricks in the target. To set or change the target, press the **Set Tgt** button. To return to the home window, press the **Home** button. To return to the previous window, press the **Back** button.

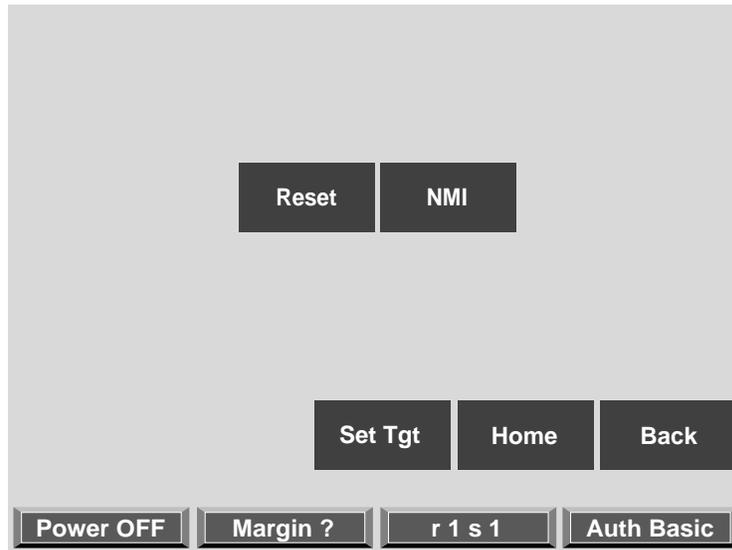


Figure 3-13 CPU Control Window

Command Confirmation Window

When you press any of the power control buttons, a command confirmation window, shown in Figure 3-14, appears and displays the target and command that will be initiated. To initiate the command, press the **Execute** button. To terminate the command, press the **Cancel** button. The confirmation window stays visible until the command successfully completes. An unsuccessful command results from an L1/L2 error in processing the command or a time-out in waiting for a response.

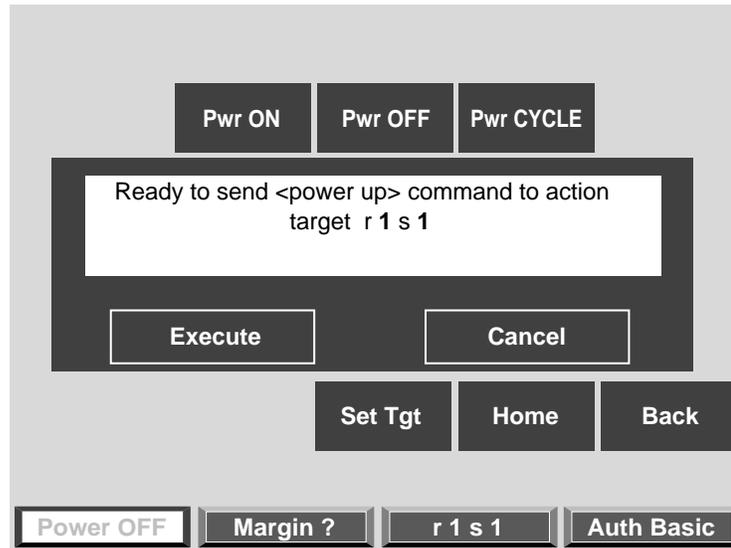


Figure 3-14 Command Confirmation Window

Command Error/Timeout Window

The command error/time-out window, shown in Figure 3-15, appears when an unsuccessful command results in an L1/L2 error in processing the command or a time-out occurs in waiting for a response. You can find detailed information about an error in the log window, accessible from the home window.

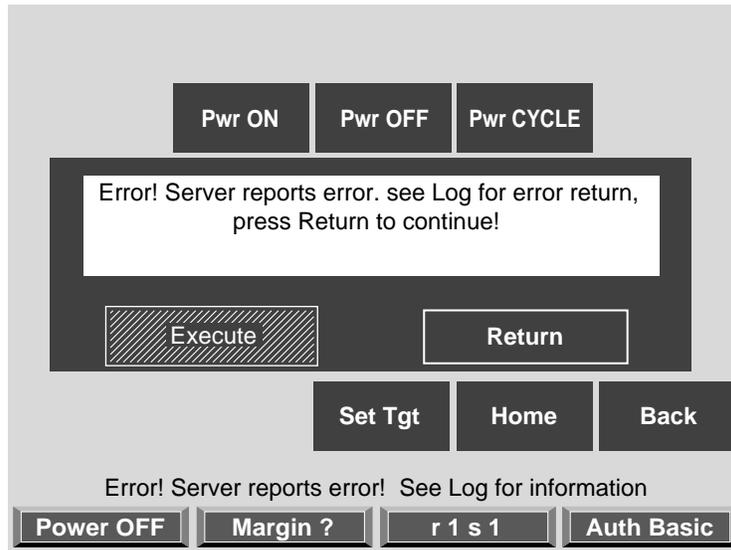


Figure 3-15 Command Error/Timeout Window

Target Selection Window

If you press the **Target** button in the home window or the **Set Tgt** buttons in any of the other windows, the Target Selection window appears, as shown in Figure 3-16. Use this window to select which bricks in the system will be affected by the command initiated from the LCD and to select which bricks are interrogated to update the status indicators across the bottom of the LCD.

A brick is referenced by its rack and slot/bay (unit position) number. To select all racks and all slots/bays, press the **All** button. To scroll the rack list and brick list (not shown in Figure 3-16), press the arrow buttons on the left edge of the LCD.

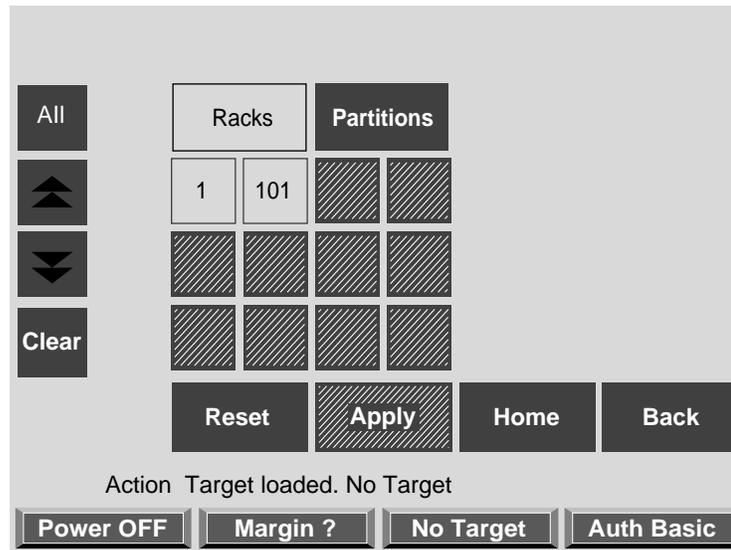


Figure 3-16 Target Selection Window - 1

Once you have selected the bricks, press the **Apply** button to set the target. This is reflected in the target indicator across the bottom of the LCD. Figure 3-17 shows no target selected and Figure 3-18 shows rack 1, slot 1 as the target.

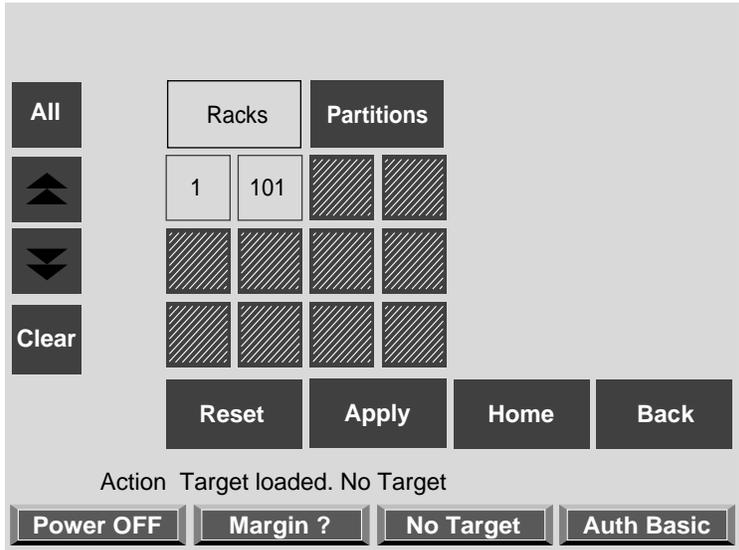


Figure 3-17 Target Selection Window - 2

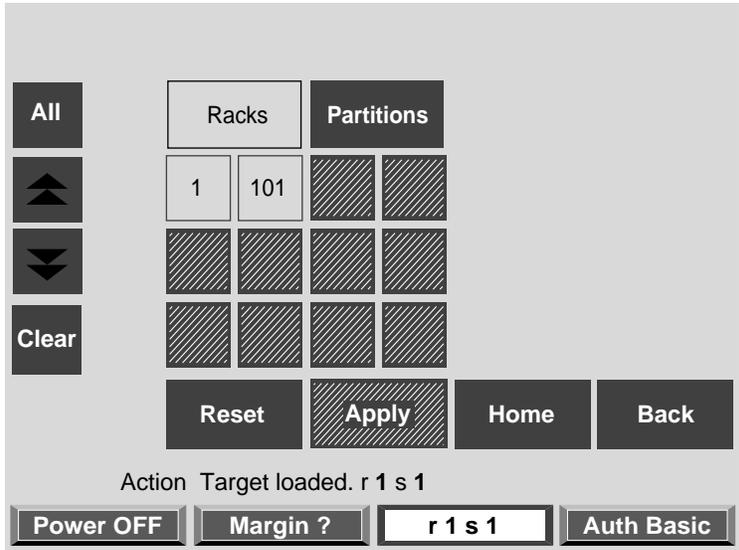


Figure 3-18 Target Selection Window - 3

If you select a single rack, you can select multiple bricks in that rack. Figure 3-19 shows the selection of bricks 17 and 28 from rack 1.

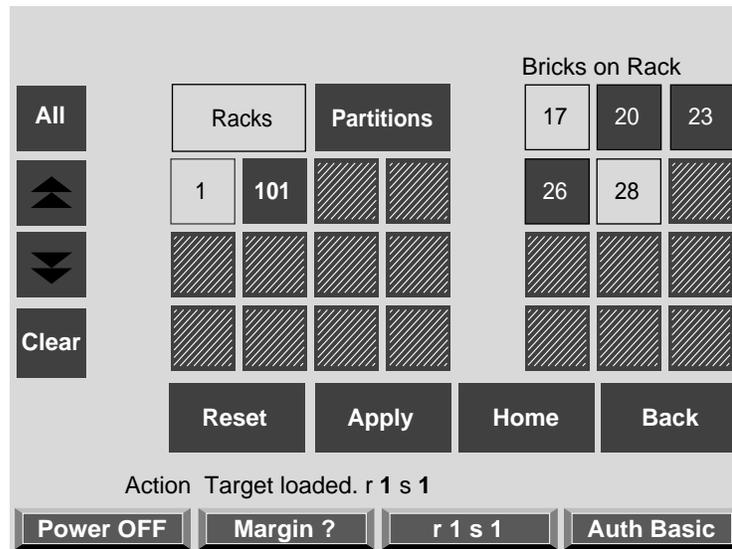


Figure 3-19 Target Selection Window - 4

Selecting **Apply**, sets the target as rack 1, slots 17 and 28 as shown in Figure 3-20.

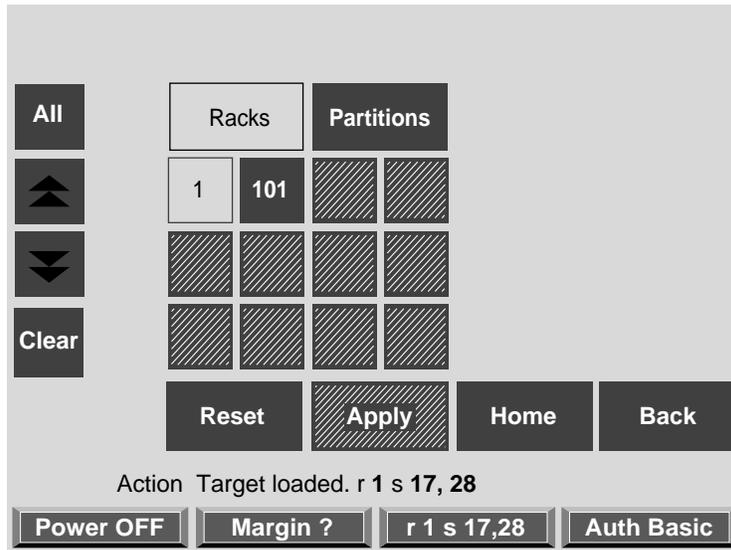


Figure 3-20 Target Selection Window - 5

Log Window

If you press the **Log** button in the home window, the log window appears, as shown in Figure 3-21 and Figure 3-22. The log window shows information, warnings, and errors about the commands initiated from the L3. You can scroll by pressing the arrow buttons along the left edge of the LCD. To activate the scrolling feature, press the **Stop** button.

Additional arrow buttons become active, allowing you to better control the scrolling of the log. To clear the log, press the * button, located in the bottom left corner of the LCD.

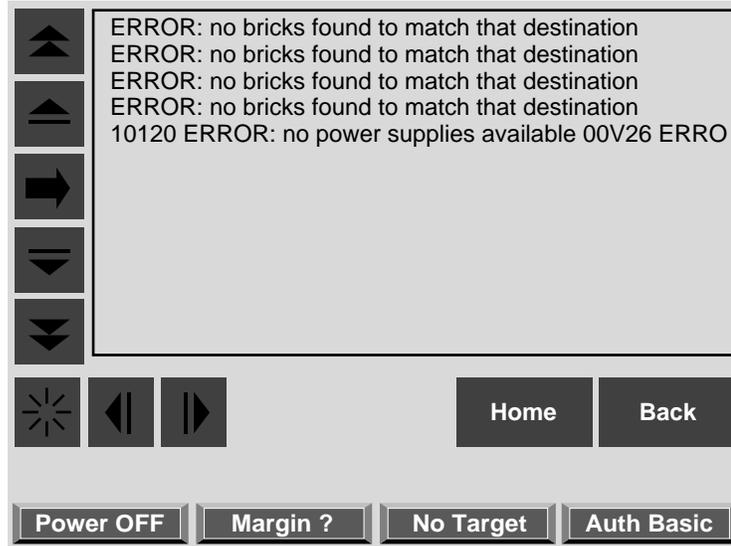


Figure 3-21 Log Window

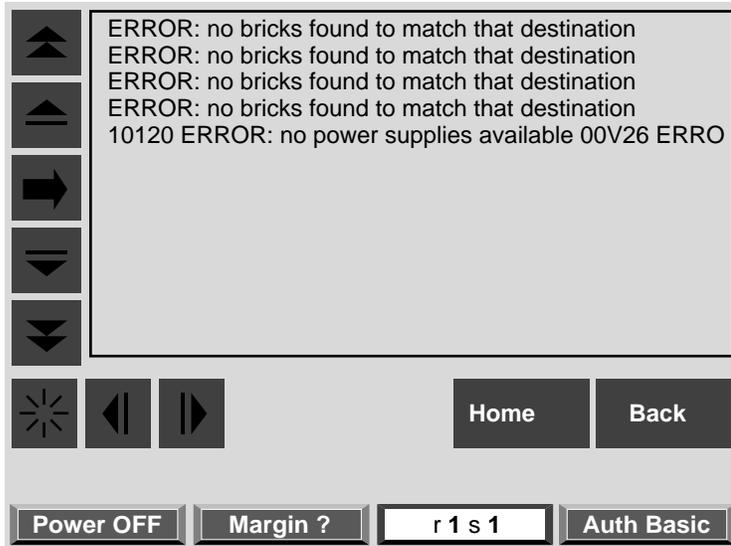


Figure 3-22 Log Window

About the L2 Software

The L2 software is the L3 application designed to be used in an Origin 3000 that does not include the L2 hardware. As the same application that executes on the L2 hardware, the L2 software provides the same functionality as the L2 hardware.

Only one Origin 3000 can be controlled with the L2 software. The USB ports on the L3 are connected to the C-bricks and R-bricks. USB hubs can provide additional USB ports. A total of 40 USB endpoints are supported by the USB driver on the L3.

You should install the L2 software executable in the `/stand/sysco/bin` directory on the L3. To start the L2 software, enter the following command at the L3 shell prompt:

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

The system should respond as follows:

```
SGI SN1 L2 Controller  
Software Revision: 0.3.5  
  
INFO: opened USB control /dev/sgil_cs  
INFO: opened USB /dev/sgil_0  
INFO: SMP listening on port: 8001  
L2>
```

Operating L2

The L2 software operates in one of three modes:

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

L2 Mode

After executing the L2 software as described in “About the L2 Software”, the following prompt indicates that the L2 is ready to accept commands:

```
L2>
```

Common operations are discussed in the following sections:

- “Viewing System Configuration”
- “Setting Command Targeting”
- “Viewing Information, Warnings, and Error Messages”
- “Powering On, Powering Off, and Resetting the System”

Viewing System Configuration

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

```
L2> config
127.0.0.1:
127.0.0.1:0:0 - 003c01
127.0.0.1:0:1 - 004c01
127.0.0.1:0:2 - 002c01
127.0.0.1:0:3 - 001x01
L2>
```

As shown above, `config` produces a list of bricks in the system and each brick’s system controller address. This is similar to the output from using the `config` command on the L1 with the addition of the L2 IP address 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. (In the example above, the IP address is 127.0.0.1.) |
| x | is the USB port number. (In the example above, the port number is zero.) |
| y | is the L1 index, specifically:
0 - local brick (the brick to which the USB cable is attached) |

- 1 - local brick's attached I/O brick
- 2 - local brick's attached C-brick
- 3 - local brick's attached C-brick's I/O brick

A brick is identified by its rack and slot. In the example shown above, 003c01 is a C-brick in rack 3 and unit position 1.

Setting Command Targeting

If a command is not understood by the L2 system controller, in general it is passed on to the L1 system controllers. The destination determines which L1s 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, sometimes referred to as a bay number, is the unit position of the bottom brick in the rack. The slot <slot list> is optional; if not given, then all slots in the specified rack(s) are implied. 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, should be avoided. Generally, a rack and slot together are used 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.

Default Destination

When the L2 starts, the default destination is set to all racks and all slots. You can determine the default destination by using the `destination` command.

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

The following command sets the destinations to rack 2 and 3, all slots:

```
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, the command would be sent to these bricks.

Note: In the current implementation, adding a brick to either rack 2 or 3 would not automatically include it in the default destination. You would need to reset the default destination.

```
L2> destination
002c01 (127.0.0.1:0:2)
003c01 (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 bricks and slots
L2>
```

Current Destination

The current designation is a range of racks and slots for a given 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.

Command Interpretation

Some L2 commands are the same as the L1 commands. In many cases, this is intentional because the L2 provides sequencing that is necessary for a command to function correctly. You can override this by using the 11 command (a current destination is required):

```
L2> r 2-4,7 11 <L1 command>
```

See the section “L2 Controller Command Set” in Appendix B for details on the L2 commands.

Viewing Information, Warnings, and Error Messages

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

```
002c01 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, such as the environmental monitor.

Each L1 has a log of local events. Use the L1 command `log` to view events on any of the L1s.

Powering On, Powering Off, and Resetting the System

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

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

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 in “Viewing Information, Warnings, and Error Messages.”

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

```
L2> 2 2 s 5 power up  
L2>
```

You can enter the `power down` and `reset` commands in a similar way. See Appendix B, “System Controller Commands” for details on the L2 commands.

Console Mode from L2

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

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

```
L2> Ctrl+D
entering console mode 002c01 console, <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 console mode 002c01 console, <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 can communicate with a brick set with the `select` command to be the system console or global master. This global master can be set and viewed with the `select` command.

The brick chosen as the default console depends on these factors:

- If the system has not powered on and an attempt to enter console mode is made, the C-brick with the lowest rack and slot number is selected.

- If the system has been powered on, then neither one of the bricks has a request to be a system console or the L2 has selected one based on the last brick sending output on the console subchannel—the former disables the latter.

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

```
L2> select
console input: 002c01 console
console output: not filtered
console detection: L2 detected
```

There are five common subchannels associated with console communications:

1. Subchannel 0 specifies CPU A.
2. Subchannel 1 specifies CPU B.
3. Subchannel 2 specifies CPU C.
4. Subchannel 3 specifies CPU D.
5. Subchannel 4 is the console subchannel.

The output `console input: 002c01 console` shows the L2 will send console input to brick 002c01 and the subchannel to be used is the console subchannel.

To change the brick that will be the system console, use the `select` command followed by the rack and slot numbers of the desired brick, as follows:

```
L2> select 3 1
console input: 003c01 console
console output: no filtered
console detection: L2 detected
```

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

```
L2> select 2
console input: 003c01 console CPU2
console output: no filtered
console detection: L2 detected
```

During the boot process on a multibrick system, there is a window in which the C-bricks are all producing output. This can result in a somewhat jumbled output at the L2. Console output can be filtered, though, which means that the L2 will show output only

from the brick chosen to receive console input. Filtering can be turned on and off with the `select filter` command.

Attempting to communicate with a brick that is not responding results in a time-out condition:

```
L2> Ctrl+D
entering console mode 003c01 CPU2, <CTRL-T> to escape to L2

no response from 003c01 bedrock CPU2 UART:UART_TIMEOUT
no response from 003c01 bedrock CPU2 UART:UART_TIMEOUT
```

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

L1 Mode from L2

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

To enter L1 mode, enter the `l1` command and specify a rack and a slot:

```
L2> r 2 s 1 l1
enterling L1 mode 002c01, <CTRL-T> to escape to L2

002c01-L1>
```

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

```
002c01-L1> Ctrl+T
escaping to L2 system controller, <CTRL-T> to send escape to L1
L2>
```

At this point, any L2 command can be entered. When the command completes execution, the L2 returns to L1 mode:

```
002c01-L1>
```

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

```
002c01-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>

Note: If you press Ctrl+D while in L1 mode, the L1 goes into console mode. Output from the system console will not be visible because the L2 never shows system console output unless the L2 is in console mode. To return to the L1 prompt at this point, press Ctrl+T twice, followed by the L1 command, to lock the L1 back into L1 mode:

```
003c01> Ctrl+D

entering console mode 002c01 console, <CTRL-T> to escape to L1
Ctrl+T
escaping to L2 system controller, <CTRL-T> to send escape to L1
L2> Ctrl+T
escaping to L1 system controller
003c01-L1> ll
L1 command processor engaged, <CTRL-T> to exit.
003c01-L1>
```

Operating L1

The L1 operates in one of two modes:

L1 Mode

The L1 prompt is visible and all input is directed to the L1 command processor.

Console Mode from L1

Output from the system is visible and all input is directed to the system.

L1 Mode

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

```
001c19-L1>
```

Common operations include the following:

- Viewing System Configuration (from a Brick's Perspective)
- Command Targeting

- Viewing Information, Warnings, and Error Messages
- Powering On, Powering Off, and Resetting the Brick

Viewing System Configuration (from a Brick's Perspective)

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

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

```
003c01-L1> config
:0 - 003c01
:1 - 004i01
:2 - 002c01
:3 - 001x01
003c01-L1>
```

This example is a two-C-brick, two-I/O-brick system. The `:<number>` refers to the L1 connection relative to the local brick.

From a C-brick's perspective:

```
:0 is the local brick
:1 is the attached I/O brick
:2 is the attached C-brick
:3 is the attached C-brick's attached I/O brick.
```

From an I/O brick's perspective:

```
:0 is the local brick
:1 is the attached C-brick on port A
:2 is the attached C-brick on port B.
```

From an R-brick's perspective:

```
0: is the local brick
```

Command Targeting

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 (*).

```
003c01-L1> * version
003c01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
004i01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
002c01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
001x01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
003c01-L1>
```

You can also target commands to a single attached brick with either the `cti`, `ctc`, or `ctci` command:

```
003c01-L1> cti version
004i01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
002c01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
003c01-L1> cti version
001x01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
003c01-L1>
```

See the section “L1 Controller Command Set” in Appendix B for details on the L1 commands.

Viewing Information, Warnings, and Error Messages

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

```
002c01 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 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, such as the environmental monitor.

Each L1 has a log of local events. Use the L1 command `log` to view the event on any of the L1s.

Powering On, Powering Off, and Resetting the Brick

You can power on and power off the brick with the `power` command:

```
003c01-L1> power up
003c01-L1>
```

If an L2 is not present (hardware or software), the system needs to be powered on and powered off and reset from one of the C-bricks. This is accomplished by targeting all bricks:

```
003c01-L1> * power up
003c01-L1>
```

This command can require from several seconds to several minutes to complete.

You can enter the power off and reset commands in a similar fashion. See the “L1 Controller Command Set” in Appendix B for details on the L1 commands.

Console Mode from L1

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:

```
003c01-L1> Ctrl+D
entering console mode 003c01 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
003c01-L1>
```

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

```
re-entering console mode 003c01 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  
003c01-L1> l1  
L1 command processor engaged, <CTRL-D> for console mode.  
003c01-L1>
```

Console Selection

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

```
003c01-L1> select  
console input: 003c01 console  
console output: not filtered.
```

There are five common subchannels associated with console communications.

1. Subchannel 0 specifies CPU A.
2. Subchannel 1 specifies CPU B.
3. Subchannel 2 specifies CPU C.
4. Subchannel 3 specifies CPU D.
5. Subchannel 4 is the console subchannel.

The output `console input: 003c01 console` shows that the L1 will send console input to brick 003c01 and the subchannel to be used is the console subchannel.

To change system console status from one brick to the attached C-brick, use the **select** command followed by **ctc** or the rack and slot number of the attached C-brick:

```
003c01-L1> select ctc  
console input: 003c01 console  
console output: not filtered.  
003c01-L1> select 2 1  
console input: 002c01 console  
console output: not filtered.  
003c01-L1>
```

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

```
003c01-L1> select 2
console input: 002c01 CPU2
console output: not filtered.
003c01-L1>
```

During the boot process on a multi-rack system, there is a window where both C-bricks are all producing output. This output can produce a somewhat jumbled output at the L1. Console output can be filtered, though, meaning the L1 shows output only from the brick chosen to receive console input. Filtering can be turned on and off with the `select filter` command.

Attempting to communicate with a brick that is not responding results in a time-out condition:

```
003c01-L1>
```

```
entering console mode 002c01 console, <CTRL-T> to escape to L1
no response from 002c01 bedrock console UART:UART_TIMEOUT
```

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

Upgrading L1/L2 Firmware

The L1/L2 firmware is currently distributed as part of the Linux L3 controller software package. This collection of RPM packages contains L1/L2 firmware and the boundary scan application. Specifically, the L2 firmware is contained in the `sn1sc_firmware` package. The 0.4.0 version is the earliest version of `sn1sc_firmware` to include the L2 controller firmware. To determine which version of the package is installed on the L3, enter the following command:

```
$> rpm -q sn1sc_firmware
```

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

```
$> rpm -i sn1sc_firmware-0.4.2-1.i386.rpm
```

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's not instructed otherwise, it executes the newer of the two images. Since the L1 is running one of the two images, the image not in use is the image that will be overwritten when the firmware is upgraded. Any L1 update needs to be rebooted either by power cycling the brick or by using the L1 command `reboot_l1`. See the `flash` and `reboot_l1` commands in "L1 Controller Command Set" on page 215 in Appendix B for details.

Typically, you will upgrade the firmware through the network connection from the L3 to the L2.

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

This updates all the bricks in the system. Individual bricks can be updated by replacing *all* with a rack and slot number:

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

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

If a hardware L2 is not present, but an L3 is, then the L1 is updated through the L2 software running on the L3. In this case, the `--12<IP-address>` can be omitted.

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 L3 to the L2:

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

Once this command has completed execution, the L2 must be power cycled to run the new image. This can also be done with the L2 command, `reboot_l2`.

If the L2 update fails, there is no second image to fall back to as there is with the L1. The L2 will, however, not run the kernel image if it is not valid. The L2 is intelligent enough at this point to be upgraded through its console port.

```
$> /usr/cpu/firmware/sysco/bSEND /usr/cpu/firmware/sysco/l2.bin
```

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 takes several minutes. The L2 must be power cycled to run the new image. This can also be done with the L2 command, `reboot_l2`.

Identifying Bricks

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

To set the rack and slot from the L2 prompt, the brick is referenced by its USB port and L1 index:

```
L2> config
127.0.0.1:
127.0.0.1:0:0 - ---c--
127.0.0.1:0:0 - 004i01
127.0.0.1:0:0 - 002c01
127.0.0.1:0:0 - 001x01
L2> :0:0 brick rack 3
brick rack set to 003.
L2> :0:0 brick slot 1
brick slot set to 01.
L2> :0:0 reboot_l1
WARNING: can't read packet on L1 connection (/dev/sgill_0), status:
IRouter:read failed - read error
INFO: closed USB /dev/sgill_0
INFO: opened USB /dev/sgill_0
WARNING: last error on L1 connection (/dev/sgill_0) repeated 64 times
```

```
ERROR: no response from local
L2>
L2> config
127.0.0.1:
127.0.0.1:0:0 - 003c01
127.0.0.1:0:0 - 004i01
127.0.0.1:0:0 - 002c01
127.0.0.1:0:0 - 001x01
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, C-brick, or a C-brick's I/O brick), use the L1 targeting commands `cti`, `ctc`, or `ctci`.

```
003c01-L1> config
:0 - 003c01
:1 - ---i--
:2 - 002c01
:3 - 001x01
003c01-L1> cti brick rack 4
---i--:
brick rack set to 004.
003c01-l1> cti reboot_l1
003c01 ERROR: no response from ---i--
003c01-L1> config
:0 - 003c01
:1 - 004i01
:2 - 002c01
:3 - 001x01
003c01-L1>
```

C-brick

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

- “Functional Description” on page 109
- “Internal Components and Front Panel Items” on page 109
- “Switch, Connectors, and LEDs on C-brick Rear Panel” on page 116

Functional Description

The C-brick provides the computing functionality for the SGI Origin 3000 server series since it contains the processors and memory; this brick is also referred to as a compute node.

Internal Components and Front Panel Items

The following lists and describes the C-brick’s internal components and front panel items (Figure 4-1 shows the C-brick’s front panel items):

Internal components:

- **IP35 Motherboard.** Contains internal components such as the L1 controller logic, bedrock application-specific circuit (ASIC), the processor integrated memory modules (PIMMs), and the dual-inline memory modules (DIMMs).
- **PIMMs.** Location in which the CPUs (processors) are physically located. Each PIMM contains two processors; each C-brick can contain one or two PIMMs (two or four processors).
- **DIMMs.** Are the dual-inline memory modules for the server.

- **Bedrock ASIC.** Is a crossbar switch that allows communication between the processors, memory, network routers, and I/O devices.

Front panel items:

- **Fans.**
- **L1 controller display.** A liquid crystal display (LCD) for the L1 controller.
- **On/Off switch with LED.** Press this button to turn on the C-brick internal components. Alternatively, you can turn on the C-brick internal components at a system console.
- **L1 controller switches and LEDs:**
 - **On/Off switch LED.** Lights green when the C-brick internal components are on and turns off when they are off.
 - **Service required LED.** Lights orange to indicate that an item is broken or not operating properly (for example, a fan is off), but the C-brick is still operating.
 - **Failure LED.** Lights red to indicate that a system failure has occurred and the C-brick system is down.
 - **Reset switch.** Press this switch to reset the C-brick internal processors and ASICs. The reset will cause a memory loss. (See the non-maskable interrupt [NMI] to perform a reset without losing memory.)
 - **Non-maskable interrupt [NMI] switch.** Press this switch to reset the C-brick internal processors and ASICs without losing memory.

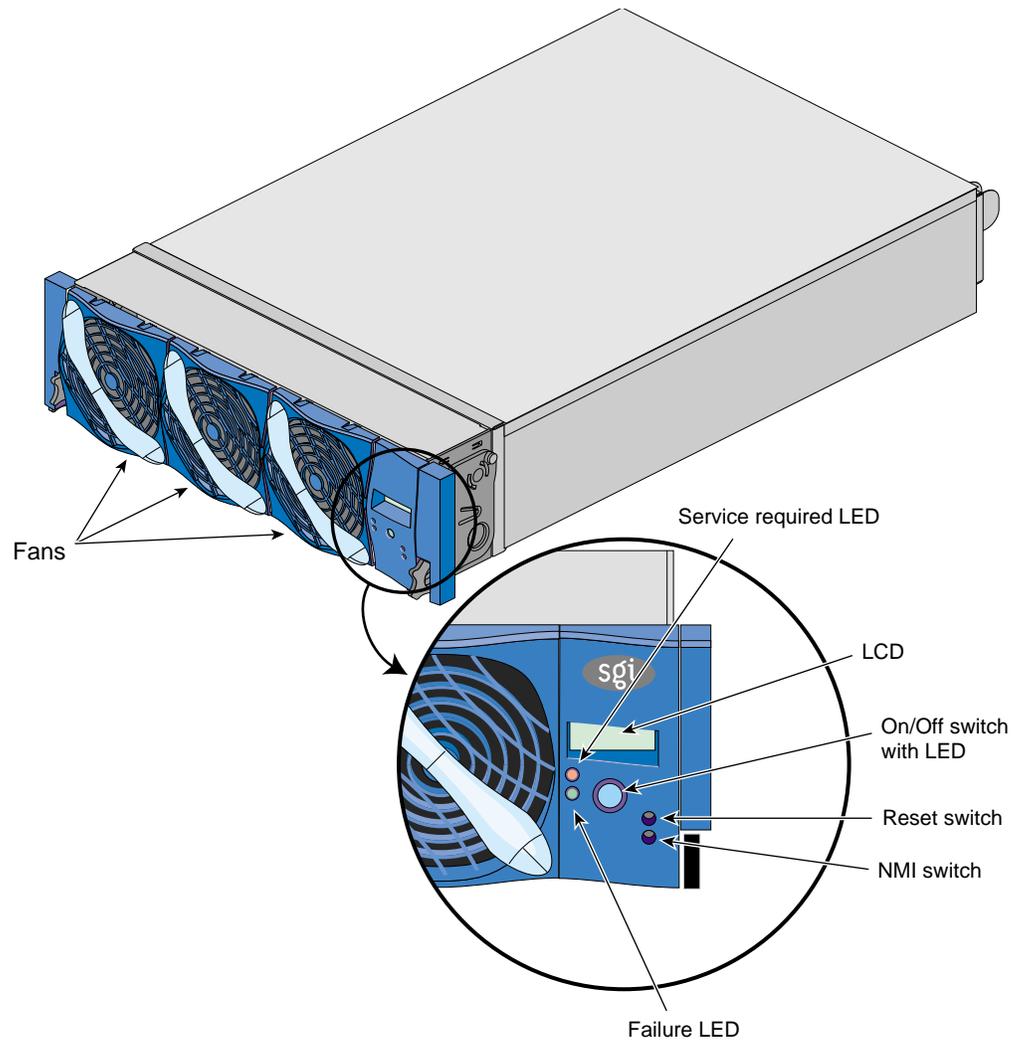


Figure 4-1 C-brick Front View

IP35 Motherboard

The half-panel IP35 motherboard houses these components:

- **L1 controller logic.**
- **One or two processor integrated memory modules (PIMMs)**, each with two processors (4- or 8-MB L2 cache per processor).
- **Eight dual-inline memory module (DIMM) slots** that are organized as one bank of memory per two DIMM slots (four banks total), configurable from 512 MB to 8 GB of main memory.
- **Bedrock memory controller.** The bedrock also controls all activity within the C-brick (for example, error correction and cache coherency).
- **Serial ID EEPROM** that contains component information.
- **Three 2.5 VDC, 30 A VRMs (VRMs 4, 3, and 8)** that convert the incoming 48 VDC to the voltage levels required by the components.
- **Four 240-pin PIMM connectors.**
- **Eight light-emitting diodes (LEDs)** on the C-brick rear panel.
 - Two NUMALink3 LEDs, controlled by the L1 controller
 - Two Crosstown2 LEDs, controlled by the L1 controller
 - Four heartbeat LEDs, controlled by the hub ASIC
- **Five connector ports** on the C-brick rear panel.

Note: Ports and LEDs on the C-brick rear panel are discussed in detail in “Switch, Connectors, and LEDs on C-brick Rear Panel” on page 116.

Processor Integrated Memory Modules (PIMMs)

The processors are physically located on processor integrated memory modules (PIMMs). Each C-brick can contain one or two PIMMs (two or four processors).

Each PIMM contains:

- Two processors.
- 8 MB of secondary cache per processor: synchronous static random access memory (SSRAM).

To reduce memory latency, a processor has access to two 32-KB primary caches (one for data and one for instructions) and an off-chip secondary cache. The primary caches are located within the processor for fast, low-latency access of instructions and data. The size of the secondary cache depends on the SGI Origin 3000 server.

Local Memory: Dual-Inline Memory Modules (DIMMs)

Each C-brick has from 512 MB to 8 GB of local memory, which includes *main memory* and *directory memory* for cache coherence.

Local memory can consist of 2 to 8 banks, which are referred to as banks 0 through 7. Each pair of banks consists of two dual-inline memory modules (DIMMs) that contain double data rate synchronous dynamic random access memory (DDR SDRAM chips). A pair of banks of memory is contained on two DIMMs (each DIMM has to half banks); memory is increased or decreased in two-DIMM increments only.

SGI Origin 3000 server series DIMMs are not compatible with the DIMMs used in Origin 200, Origin 2000, Onyx2, or Octane systems.

Two types of DIMMs that make up a bank set must be the same memory size; however, each pair of DIMMs in a C-brick can be a different memory size.

The SGI Origin 3000 servers support four types of memory kits:

- **512-MB kit with integrated directory memory.** Main memory for all server systems with less than 128 processors.
- **1-GB kit with integrated directory memory.** Main memory for all server systems with less than 128 processors.

- **1-GB kit with premium integrated directory memory.** Memory required for server systems over 128 processors; however, this memory can also be used in server systems with fewer than 128 processors. These DIMMs contain one additional memory chip to provide additional directory memory for building configurations with more than 128 processors.
- **2-GB kit with premium integrated directory memory.** Memory required for server systems with more than 128 processors, but can also be used for server systems with fewer than 128 processors.

Note: For cost reasons, if you plan to upgrade your site to more than 128 processors, use only DIMMs with premium integrated directory memory.

Table 4-1 outlines main memory sizes. This table does not cover systems that have multiple-size memory banks.

Table 4-1 Main Memory DIMM Sizes

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

L1 Controller

Every C-brick has an L1 system controller. The L1 controller monitors and controls the environment of the C-brick (for example, fan speed, operating temperature, voltage margins, and system LEDs). The L1 controller also reads component information from serial ID EEPROMs, provides a console connection, and interfaces with its own 2-line x 12-character liquid crystal display (LCD) at the front of the brick.

The L1 controller in the IP35 C-brick transfers status and control information to three types of external devices: console computer, L1 controller in another brick, and L2 or L3 controller.

The L1 controller consists of the display, logic components, and internal display cable. The logic components are located on the IP35 motherboard; the internal cable connects the display to the logic components.

For general information about the L1 controller, see Chapter 3, “System Control” of this guide.

Communication with a C-brick or an I/O-brick

The C-brick L1 controller communicates with the L1 controller in an I/O-brick (X-, I-, or P-brick) through the XIO (**II**) connector on the back of the C-brick (see Figure 4-2).

In the SGI Origin 3200, which has no R-brick, the L1 controller in a C-brick can communicate with the L1 controller in another C-brick through the link (**NI**) connector.

Communication with L2 and L3 Controllers

The C-brick can communicate with the L2 controller and a system console running L3 controller software through connectors located on its rear panel (see Figure 4-2).

In the SGI Origin 3200, the L1 controller in a C-brick can communicate with an L2 controller through the L1 port connector on the back of the C-brick. This connector provides universal serial bus (USB) protocol signals to communicate with the L2 controller.

In the SGI Origin 3400 and 3800, the L1 controller in a C-brick communicates with an L2 controller that is connected to an R-brick, to which the C-brick is connected. The C-brick's L1 communicates to the R-brick through the link (**NI**) connector on the back of the

C-brick. This connector, which provides USB protocol signals, connects to one of the R-brick’s connectors labeled R TO R or C TO R (2, 3, 4, and 5) to communicate with the USB hub residing inside the R-brick.

The L1 controller in a C-brick can communicate with system console running L3 controller software through the L1 port (USB) connector on the rear panel of the C-brick. This configuration is used for short rack systems that do not have an R-brick or an L2 controller. In these configurations, the L1 port connector provides USB protocol signals to communicate with the L3 controller.

In configurations of larger systems, the L1 controller in a C-brick does not communicate directly with an L3 controller. Instead, the L1 controller communicates with the USB hub in an R-brick. The USB hub in the R-brick communicates with an L2 controller. The L2 controller communicates with an L3 controller through an Ethernet hub.

Switch, Connectors, and LEDs on C-brick Rear Panel

Figure 4-2 shows the location of the power-on switch, connectors, and LEDs on the C-brick rear panel.

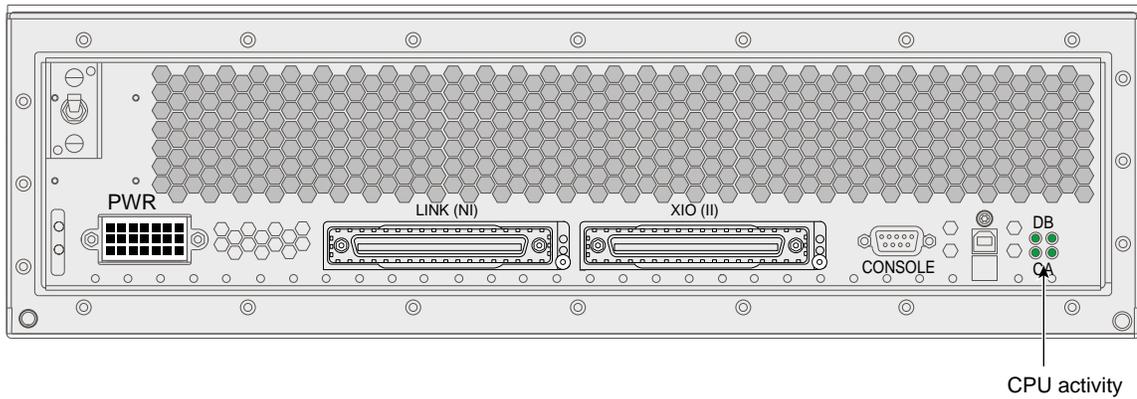


Figure 4-2 C-brick Rear View

The C-brick has the following items on the rear panel:

- **Power switch.** Move the power switch to the I position to power on the C-brick's L1 controller, and to the 0 position to power off the C-brick's L1 controller. Powering on the L1 controller lights the 12VDC LED green.
- **PWR (power) connector.** Connects the connector to the power bay, which gives power to the C-brick.
- **48 VDC and 12 VDC LEDs.** The power switch must be in the ON (I) position for these LEDs to be on. The 12 VDC lights green when the L1 controller is powered on and operating, and the 48 VDC lights green when the rest of the C-brick internal components are powered on and operating. The internal components are powered on by pressing the On/Off switch (brick reset button) located on the L1 controller panel.
- **LINK (NI - Network Interface) connector.** This Crosstown2 connector connects the C-brick to an R-brick or to another C-brick if the system does not have an R-brick, such as the SGI Origin 3200 server. This connection is made with a NUMALink™3 cable at 1.6 GB/sec in each direction.
- **XIO (II - I/O Interface) connector.** This Crosstown2 connector connects a C-brick to an I/O-brick (I-brick, P-brick, or X-brick); this connection occurs via a NUMALink™3 cable at 1.2 GB/sec in each direction.
- **Console connector.** This is a DB-9 RS-232 port (console and diagnostic port) connector that connects the C-brick's L1 controller to a system console. The C-brick L1 controller communicates with a system console through the console connector, which provides a serial bus that uses standard RS-232 protocol.
- **L1 port connector.** This universal serial bus (USB) connector connects the C-brick's L1 controller to a system console. The L1 port connector can also connect to the L2 controller on the rack enclosure for systems with no router.

Table 4-2 summarizes the function of the C-brick connectors.

Table 4-2 C-brick Port Connectors and LEDs

Label on Panel	Connector	Purpose	LED
PWR		Inputs power from the power bay.	
48 VDC 12 VDC	N/A	The 12 VDC LED lights green, indicating the L1 controller is on, when the power switch on the brick has been turned to the On (I) position. The 48 VDC LED lights green, indicating all other C-brick internals are on, after the switch has been turned on and the On/Off switch (brick reset button) on the L1 controller has been turned on. Alternatively, the L1 controller and the rest of the C-brick internals can be turned on and off from the system console.	2 (1 for 48 VDC and 1 for 12 VDC)
LINK (NI)	NUMAlink™	Connects the C-brick to an R-brick or to another C-brick (if the system does not have an R-brick); 1.6 GB/sec each direction.	2
XIO (II)	Crosstown2	Connects the C-brick to an I-brick, P-brick, or X-brick; 1.2 GB/sec each direction.	2
Console	DB-9	Connects the C-brick to the system console.	None
L1 Port	Series A universal serial bus (USB)	Connects the C-brick's L1 controller to a system console. Also, for systems with no router, this port connects directly to a USB connector on the L2 controller.	None
DB CA	N/A	Status of the processors in the C-brick. A C-brick can have up to four processors (two processors per PIMM).	4 (1 per processor [A, B, C, D])

The following LEDs are located on the C-brick rear panel:

- One 12 VDC LED and one 48 VDC LED.
- Two LINK (NI) Crosstown2 connector LEDs, controlled by the L1 controller.
- Two XIO (II) Crosstown2 connector LEDs, controlled by the L1 controller.
- Four heartbeat LEDs (one for each processor; two processors per PIMM) controlled by the hub ASIC.

Table 4-3 summarizes what the rear panel LEDs indicate.

Table 4-3 C-brick Rear Panel LEDs

Label on Panel	Quantity	Purpose
12 VDC	1	LED lights green when L1 controller is on. LED not lit indicates L1 controller is off. L1 controller is turned on by turning on the power switch.
48 VDC	1	LED lights green when all C-brick internal items besides L1 controller are on. LED not lit indicates C-brick internal items, besides L1 controller, are off. Internal devices are turned on by turning on the power switch and pressing the On/Off switch (brick reset button).
LINK (NI)	2	LEDs light yellow when connector is cabled securely to another device. LEDs light green when connection is negotiated with device with which connector is cabled.
XIO (II)	2	LEDs light yellow when connector is cabled securely to an I/O device. LEDs light green when connection is negotiated with device with which connector is cabled.
DB CA	4	Heartbeat LEDs for processors on PIMMs (one LED per processor [A, B, C, and D]; each PIMM has two processors).

I-brick

The following sections in this chapter describe the function and physical components of the I-brick, and explain how to add and replace PCI cards in the I-brick:

- “Functional Description” on page 121
- “Internal Components and Front Panel Items” on page 121
- “Switch, Connectors, Card Slots, and LEDs on I-brick Rear Panel” on page 125
- “PCI Card Installation” on page 129

Functional Description

The I-brick provides standard base I/O for all SGI Origin 3000 servers. This brick supports five hot-pluggable PCI cards configured on two PCI buses, two sled-mounted 3.5-in. fibre channel disk drives, and a DVD/CD-ROM. The I-brick also provides access to a network via a 10/100-Base-T Ethernet port, and access to peripherals via various other ports.

Internal Components and Front Panel Items

The following are descriptions of the I-brick’s front panel items and internal components (Figure 5-1 shows the I-brick’s front panel items):

- **DVD/CD-ROM.** Loads software onto your server system.
- **L1 controller and display.** L1 controller generates I-brick status and error messages that appear on the liquid crystal display (LCD).
- **On/Off switch with LED.** Press this switch to turn on the I-brick internal components. Alternatively, you can turn on the I-brick internal components at an L2 controller display or a system console.

L1 controller switches and LEDs:

- **On/Off switch LED.** Lights green when the I-brick internal components are on and turns off when they are off.
- **Service required LED.** Lights orange to indicate that an item is broken or not operating properly (for example, a fan is off), but the I-brick is still operating.
- **Failure LED.** Lights red to indicate that a system failure has occurred and the I-brick system is down.

Internal Components:

- **Fibre Channel Disk Drives.** This is where the server's IRIX operating system software resides.
- **I-brick Power Board.** The power board contains the logic components of the L1 controller, Dc to Dc convertors, and voltage regulator modules (VRMs).

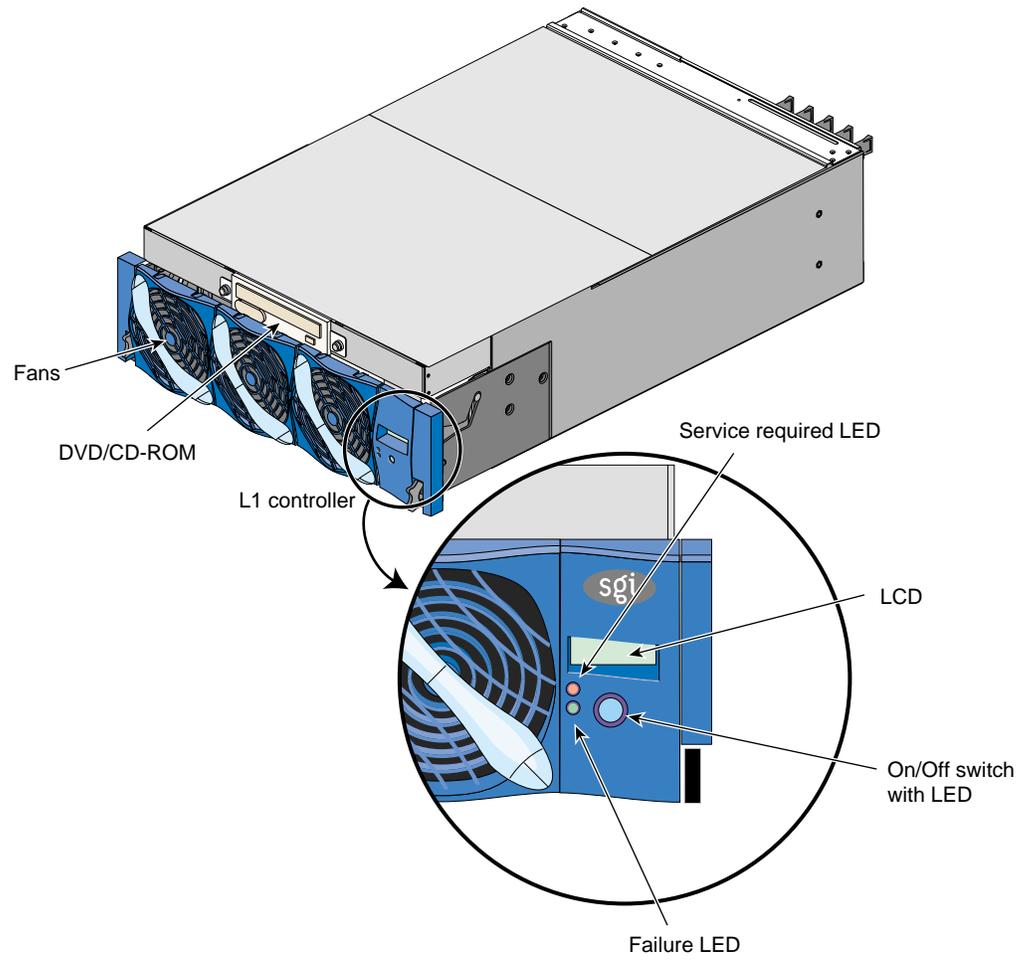


Figure 5-1 I-brick Front Panel

Fibre Channel Disk Drives

The I-brick contains one or two 3.5-in. fibre channel disk drives. One is standard; the second is optional. The disks connect to the fibre channel controller via the Input connector on the fibre channel bulkhead card.

The fibre channel disk drives are boot drives and are configured as separate drives or as mirrored images. The fibre channel disk drives is where your server's IRIX operating system resides.

Note: Only an SGI system support engineer (SSE) can add or replace a fibre channel disk drive module for you.

DVD/CD-ROM

The DVD/CD-ROM is a single removable media drive in the front of the brick (see Figure 5-1). It connects to the IEEE 1394 connector of the PCI motherboard.

IEEE 1394 is a high-performance serial bus protocol that provides a low-cost, high-bandwidth universal interconnect technology for digital media, storage, networking, and other applications.

I-brick Power Board

The power board contains the logic components of the L1 controller, Dc to Dc convertors, and voltage regulator modules (VRMs). The DC-to-DC converters and VRMs convert the 48 VDC coming from the power bay to voltage levels that the components required by the brick.

The power board supplies an average of 17.5 W (5.3 A, 3.3 V) of power to each PCI slot; however, a PCI card may consume up to 25 W of power. The L1 controller controls how the power board applies power to the PCI cards. The power board applies power to the PCI cards starting with the lowest numbered slot. It continues to apply power to the PCI slots until all of the power has been consumed.

The I-brick's L1 controller uses two presense pins in each PCI slot to total the power consumption of the PCI cards. The L1 controller prints a message to the console if there is not enough power for all of the PCI cards.

I-brick L1 Controller

The L1 controller monitors and controls the environment of the I-brick. It consists of a display, logic components, and an internal cable. The logic components are located on the I-brick power board. The cable connects the display to the logic components.

For general information about the L1 controller, see Chapter 3, "System Control."

Switch, Connectors, Card Slots, and LEDs on I-brick Rear Panel

Figure 5-2 shows the location of the power-on switch, PCI card slots, connectors, fibre channel disk drives, and LEDs on the I-brick rear panel.

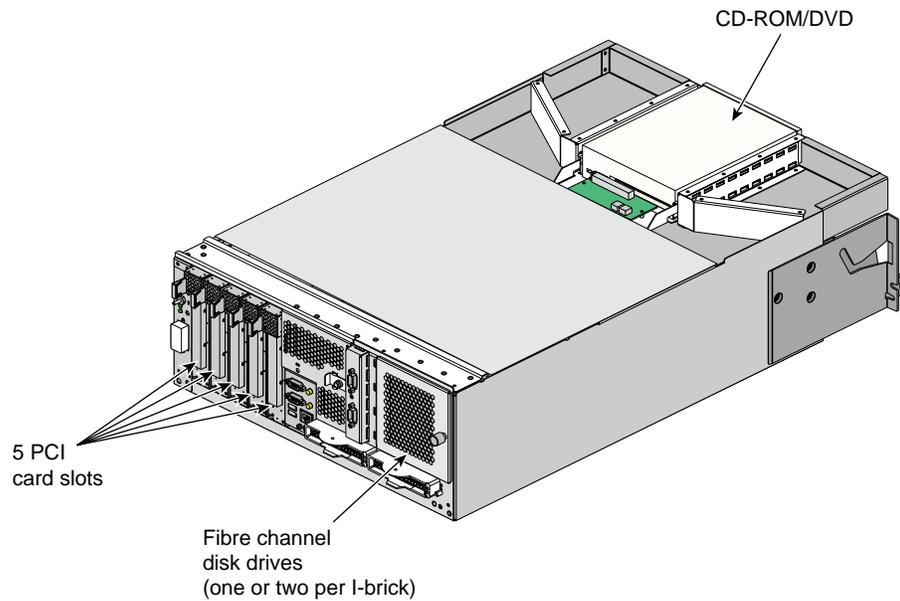


Figure 5-2 Rear View of I-brick

Figure 5-3 shows the I-brick rear panel in more detail.

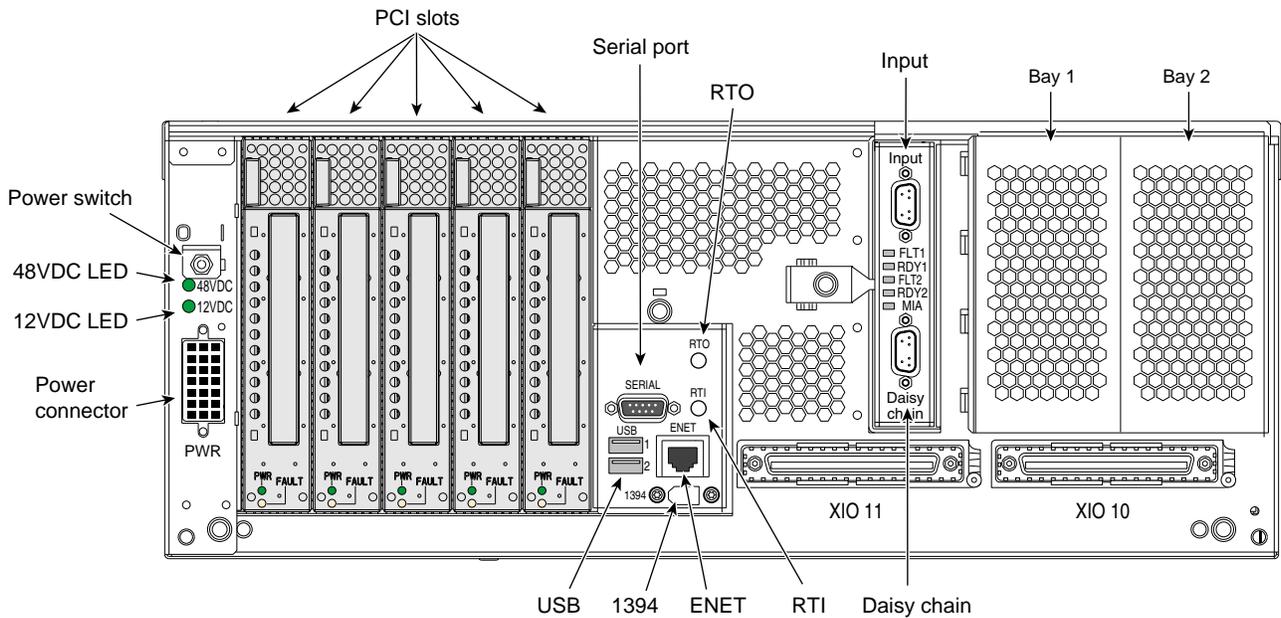


Figure 5-3 I-brick Rear Panel

The I-brick rear panel has the following items:

- **Power switch.** Moving the power switch to the 1 position powers on the I-brick’s L1 controller, and moving it to the 0 position powers off the I-brick’s L1 controller. Powering on the L1 controller lights the 12 VDC LED green.
- **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 lights green when the L1 controller is powered on and operating, and the 48 VDC lights green when the rest of the I-brick internal components are powered on and operating. The internal components are powered on by pressing the On/Off switch located on the L1 controller’s front panel.
- **PWR (power) connector.** Connects to the power bay to give power to the I-brick.
- **Five PCI slots.** Used to install and replace PCI cards onto your server system (normally, one of the five slots is reserved for a system PCI card to support the system disk drives). See “PCI Card Installation” on page 129:

- **Bus 1 slot (slots 1, 2, and 3).** To install 33-Mhz PCI cards.
- **Bus 2 Slot (slots 1 and 2).** To install 66-Mhz PCI cards.

Note: A 66-Mhz card will operate at 33 Mhz if installed in one of the bus 1 slots, or if installed in a bus 2 slot that includes a 33-Mhz card installed in one of the other bus 2 slots.

- **PWR (power) and fault LEDs.** The power LED lights green when the PCI card is installed correctly and is getting power; the fault LED lights yellow when a fault occurs with the PCI card.
- **Serial connector.** Can be used as a COM port to connect modems or other serial devices.
- **Universal serial bus (USB) connectors (2).** Can be used to connect auxiliary equipment such as a printer, a scanner, a keyboard, or a mouse.
- **RT0 and RT1.** Real-time interrupts used by the graphics cards to keep the graphics synchronized and in time with each other.
- **Enet connector (Ethernet).** Connects the server system to an Ethernet network.
- **IEEE 1394 connector.** Provides a serial bus protocol connection for digital media, storage, networking, and other applications.
- **XIO 11 and XIO 10 connectors.** Each of these Crosstown2 connectors can connect the I-brick to a C-brick.
 - **XIO 11 and XIO 10 connector LEDs.** Light yellow when the connector is cabled securely to the C-brick device, and light green when the connection is negotiated with the C-brick device with which the connector is cabled.
- **Fibre channel bulkhead card.**
 - **Input connector.** Connects to the connector on a fibre channel card installed in one of the 33-Mhz PCI card slots available in the I-brick. This connection interconnects the fibre channel disk drive(s) (where the server system's operating system resides) in the I-brick with the PCI card slot bus. This connection enables powering on of the operating system by the C-brick via its connection to one of the I-brick's XIO connectors.
 - **Flt1 LED.** Lights yellow if the fibre channel disk drive in bay 1 discovers a fault. The disk drive goes off-line if it detects a fault.

- **RDY1 LED.** Lights red when the fibre channel disk drive in bay 1 is active and spun up.
- **FLT2 LED.** Lights yellow if the fibre channel disk drive in bay 2 discovers a fault. The disk drive goes off-line if it detects a fault.
- **RDY2 LED.** Lights red when the fibre channel disk drive in bay 2 is active and spun up.
- **MIA LED.** The media interface adapter (MIA) is a copper to optical converter that allows the fibre channel loop to be extended up to 2 km. The MIA LED lights if the MIA discovers a fault condition.
- **Daisy chain connector.** Used to add more fibre channel disks to the same fibre channel loop as the two internal disk drives connected to the fibre channel bulkhead card's input connector.

Table 5-1 summarizes the ports on the I-brick rear panel.

Table 5-1 I-brick Connector Ports

Quantity	Port	Connector Label	Purpose
1	Power connector	PWR	Connects to the power bay or some other power source to give power to the I-brick.
1	Serial: RS-232 or RS-422	Serial	Can be used as a COM port to connect modems or other serial devices.
1	Universal serial bus	USB	Can be used to connect auxiliary equipment such as a printer, a scanner, a keyboard, or a mouse.
1 each	RT0 and RT1	RT0 and RT1	Real-time interrupts used by the graphics cards to keep the graphics synchronized and in time with each other.

Table 5-1 (continued) I-brick Connector Ports

Quantity	Port	Connector Label	Purpose
1	10/100-Base-T Ethernet, RJ45	Enet	Autonegotiating Ethernet port enables the connection of the server to an Ethernet network.
1 each	IEEE 1394 internal and external	1394	Provides a serial bus protocol connection for digital media, storage, networking, and other applications.
2	Crosstown2	XIO 10 and XIO 11	Connects the I-brick to a C-brick. 1.2 GB/sec each direction. Crosstown2 ports support two speeds, 800 MB/sec and 1200 MB/sec, which can be selected with software.
2	Fibre Channel Bulkhead Card	Input and Daisy chain	Input connector connects to the connector on a fibre channel card installed in one of the 33-MHz PCI card slots available in the I-brick. This connection interconnects the fibre channel disk drive(s) (where the server system's operating system resides) in the I-brick with the PCI card slot bus. This connection enables the operating system to be powered on by the C-brick via its connection to one of the I-brick's XIO connectors. Daisy chain connector is used to add more fibre channel disks to the same fibre channel loop as the two internal disk drives connected to the system disk Input connector.

PCI Card Installation

The five hot-pluggable PCI slots support full-length 3.3-V PCI cards with 64-bit data and addressing. The five PCI slots are configured on two buses: bus 1 supports three PCI slots at 33 MHz and bus 2 supports two PCI slots at 66 MHz. Separate buses enable the system to run 66-MHz devices in the same brick as 33-MHz devices. If a PCI bus contains a 33-MHz card and a 66-MHz card, both slots of that bus run at 33 MHz. The PCI bus supports 32-bit and 64-bit PCI cards on the same bus.

You can use various types of PCI cards in the I-brick; for a list of SGI PCI cards, see Table 6-1 on page 137 in Chapter 6.

When the I-brick is shipped, any SGI PCI cards that were ordered are installed. The system fibre channel controller bulkhead card is standard. Unoccupied PCI slots are populated with empty PCI carriers; these must be present to maintain an even airflow through the PCI slots and to protect against electromagnetic interference (EMI).

Figure 5-4 shows PCI slot numbering in the I-brick.

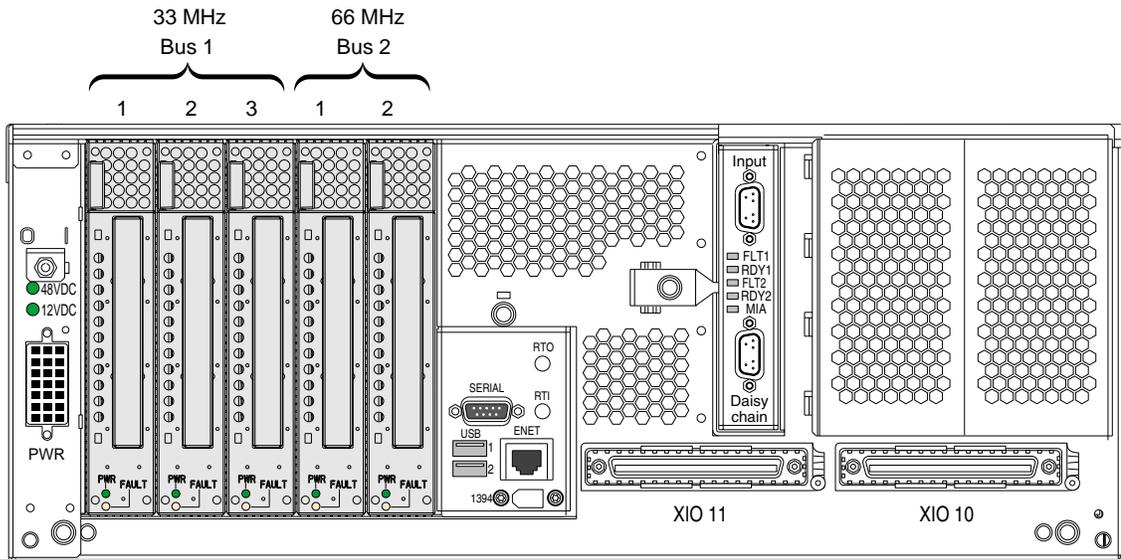


Figure 5-4 I-brick PCI Card Slot Numbering

PCI cards are hot-pluggable. This means that although you do not need to power off the I-brick to install the card, you must power off the slot in which you are to replace or add a PCI card. For installation instructions, see “PCI Card Description and Installation” on page 136 in Chapter 6. An SGI SSE can also replace these items for you.

P-brick

The following sections in this chapter describe the function and physical components of the P-brick, and explain how to add and replace PCI cards in the P-brick:

- “Functional Description” on page 131
- “Internal Components and Front Panel Items” on page 131
- “Switch, Connectors, Card Slots, and LEDs on Rear Panel” on page 134
- “PCI Card Description and Installation” on page 136

Functional Description

The P-brick is a 4U I/O expansion subsystem that supports a maximum of 12 3.3-volt or universal hot-pluggable PCI cards.

Internal Components and Front Panel Items

The following are the P-brick’s internal components and front panel items (Figure 6-1 shows the items located on the P-brick front panel):

Internal components:

- **Power board.** Provides the power to the P-brick.
- **PCI motherboard.** Houses the components and slots (and carriers) in which you can install PCI cards.

Front panel items:

- **L1 controller and display.** L1 controller generates P-brick status and error messages that appear on the liquid crystal display (LCD).

- **On/Off switch with LED.** Press this button to turn on the P-brick internal components. Alternatively, you can turn on the P-brick internal components at an L2 controller display or at a system console.
- **L1 controller switches and LEDs:**
 - **On/Off switch LED.** Lights green when the P-brick internal components are on and turns off when they are off.
 - **Service required LED.** Lights orange to indicate that an item is broken or not operating properly (for example, a fan is off), but the P-brick is still operating.
 - **Failure LED.** Lights red to indicate that a system failure has occurred and the P-brick system is down.
- **Fans.**

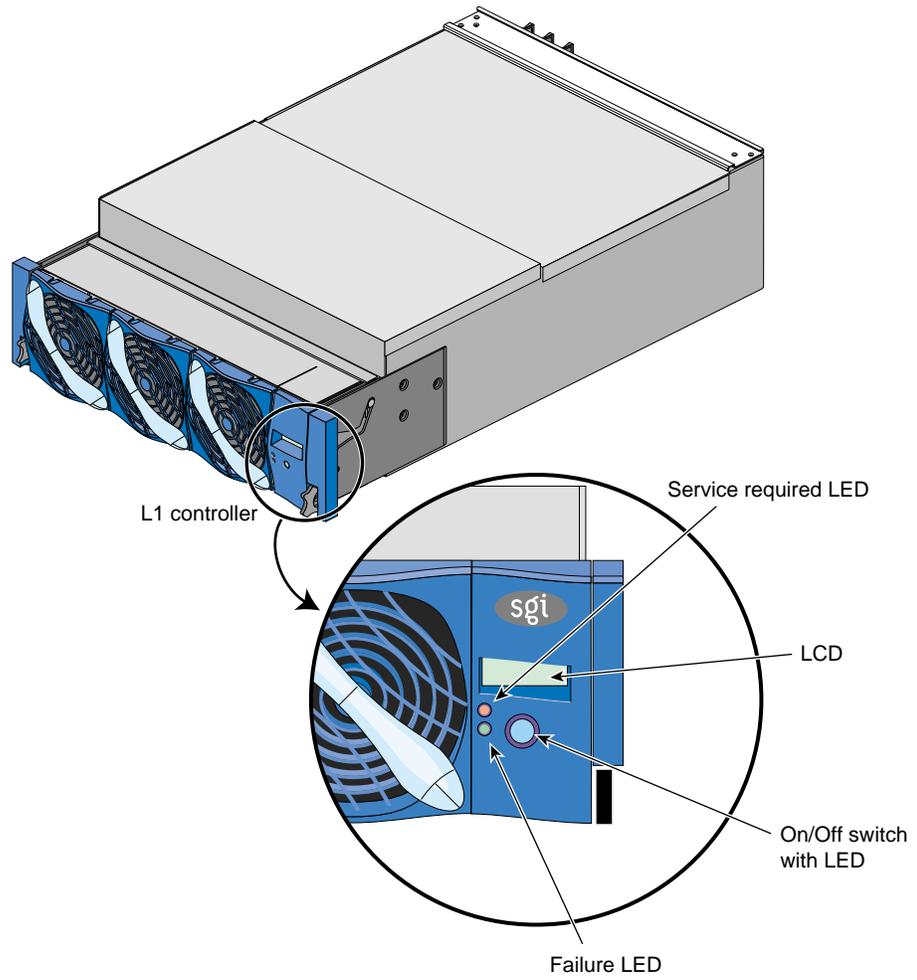


Figure 6-1 P-brick Front View

P-brick Power Board

The power board contains the logic components of the L1 controller, voltage regulator modules (VRMs), and a DC-to-DC converter. The VRMs and the DC-to-DC converter, convert the incoming 48 VDC to voltage levels required by the components within the brick. See Appendix A, “Technical Specifications” for more details.

PCI Motherboard

The P-brick’s 12 PCI slots are on the PCI motherboard. Three Xbridge ASICs interface between two Crosstown2 ports and the PCI cards. Each Crosstown2 port transmits 1.2 GB/sec each direction and can connect to a Crosstown2 port on a C-brick. The PCI motherboard also contains a serial ID EEPROM that contains component information.

P-brick L1 Controller

The L1 controller monitors and controls the environment of the P-brick. It consists of a display, logic components, and an internal cable. The display is located on the front of the P-brick. The P-brick’s L1 controller logic components are on the power board. The internal cable connects the display to the logic components.

For general information about the L1 controller, see Chapter 3, “System Control” of this guide.

Switch, Connectors, Card Slots, and LEDs on Rear Panel

Figure 6-2 shows the location of the power-on switch, PCI card slots, connectors, and LEDs on the P-brick rear panel.

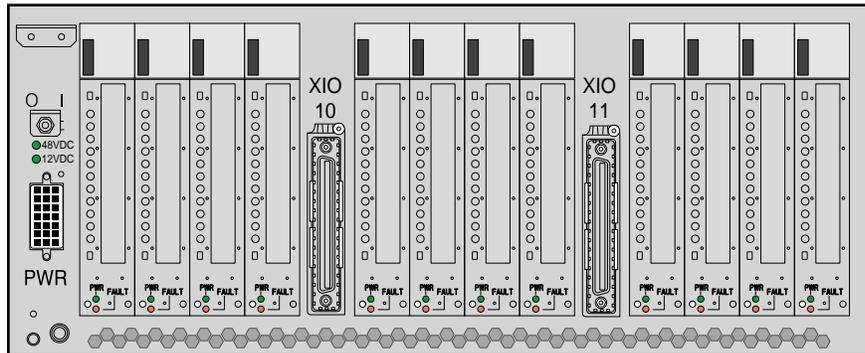


Figure 6-2 P-brick Rear Panel

The P-brick rear panel has the following items:

- **Power switch.** Moving the power switch to the I position powers on the P-brick's L1 controller, and moving it to the 0 position powers off the P-brick's L1 controller. Powering on the L1 controller lights the 12 VDC LED green.
- **48 VDC and 12 VDC LEDs.** The power switch must be in the ON (I) position for these LEDs to be on. The 12 VDC lights green when the L1 controller is powered on and operating, and the 48 VDC lights green when the rest of the I-brick internal components are powered on and operating. To power on the internal components, press the On/Off switch located on the L1 controller's front panel.
- **PWR (power) connector.** Connects to the power bay to give power to the P-brick.
- **PCI slots.** Use these slots to install and replace PCI cards onto your server system. See "PCI Card Description and Installation" on page 136. The PCI card slots are numbered bus 1 through bus 6. Each bus has two slots, labeled 1 and 2, as shown in Figure 6-3. All slots can accommodate 66 Mhz or 33 Mhz PCI cards. If a PCI bus contains both a 33-Mhz card and a 66-Mhz card, however, both slots of that bus run at 33 Mhz.
 - **PWR (power) LED.** Lights green when the PCI card carrier is installed securely and is getting power.
 - **Fault LED.** Lights orange when a fault occurs with the PCI card.
- **XIO 11 and XIO 10 connectors.** These Crosstown2 connectors connect the P-brick to a C-brick.

- **XIO 11 and XIO 10 connector LEDs.** Light yellow when the connector is cabled securely to the C-brick device. Light green when the connection is negotiated with the device with which the connector is cabled.

PCI Card Description and Installation

The PCI card slots on the motherboard are numbered bus 1 through bus 6. Each bus has two slots, labeled 1 and 2, as shown in Figure 6-3.

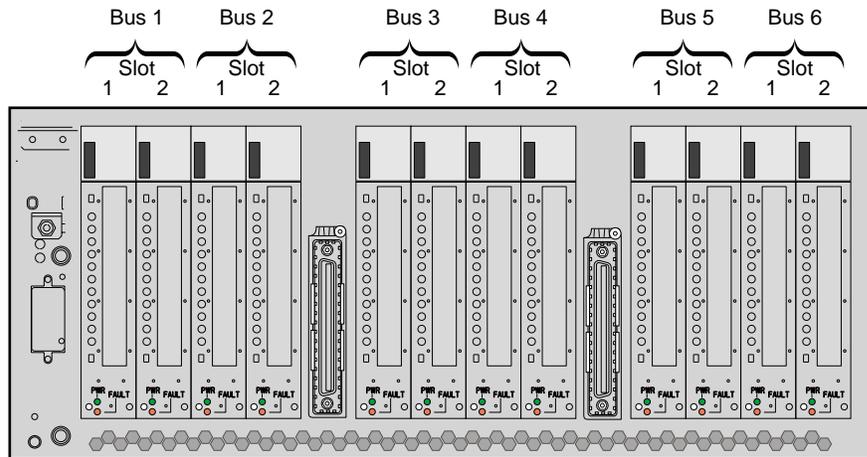


Figure 6-3 P-brick PCI Card Slot Numbering

Each bus has two slots that operate with 66-Mhz or 33-Mhz cards. If a PCI bus contains both a 33-Mhz card and a 66-Mhz card, both slots of that bus run at 33 Mhz. The PCI bus supports 32-bit and 64-bit PCI cards at the same time. Separate buses enable the P-brick to run 66-Mhz devices in the same brick as 33-Mhz devices.

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

Supported PCI Cards

The SGI Origin 3000 server systems support various PCI cards that can be purchased from SGI or from other manufacturer. Each PCI card is mounted in a carrier so that you can slide the PCI cards into and out of the brick. The PCI cards connect to the PCI motherboard when the PCI carrier is fully inserted into the brick.

Table 6-1 lists currently supported PCI cards from SGI.

Table 6-1 PCI Cards

Marketing Code	Description
PCI-SCSI-SE-2P	Ultra SCSI single-ended 2-port
PCI-SCSI-DF-2P	Ultra SCSI high-voltage differential 2-port
PCI-SCSI-LVD-2P	Ultra2 SCSI low-voltage differential 2-port (5 V)
PCI-FC-1POPT-A	Fibre channel with fiber optic cable, 66 MHz
PCI-FC-1PCOP-A	Fibre channel with copper cable, 66 MHz
PCI-ATMOC3-1P	ATM OC3
PCI-ATMOC12-1P	ATM OC12
PCI-GIGENET-C	Gigabit Ethernet (copper)
PCI-GIGENET-OR	Gigabit Ethernet (optical)
PCI-AUD-D1000	Digital audio

PCI Carrier

The PCI carrier is designed to support most PCI cards. If the carrier does not work with a specific card, the PCI card can be installed into the PCI slot without the carrier. Installing the PCI card without the carrier, however, removes the slot's hotplug capability.

When the P-brick is shipped, any SGI PCI cards that were ordered are installed with carriers, and any unoccupied PCI slots are populated with empty PCI carriers. PCI carriers must be present in nonpopulated PCI slots to maintain an even airflow through the PCI slots and to protect against electromagnetic interference (EMI).

You can use nonstandard PCI cards that do not fit in the carrier, but the cards cannot be hot-plugged.

PCI Card Installation

Although you need not power off the rack or the P-brick to add or replace a PCI card, you do need to power off the individual slot in which you will replace a PCI card.

Note: It is recommended that you use a grounding wrist strap while installing a PCI card.

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

1. Pull the handle on the empty PCI carrier straight out to extract it from a PCI slot, as shown in Figure 6-4.

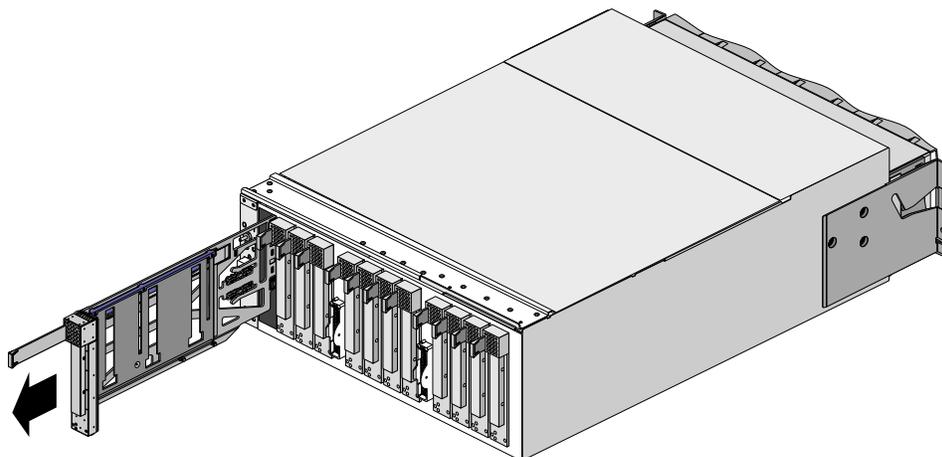


Figure 6-4 Removing a PCI Card Carrier

2. If you are replacing a card, gently pull the existing PCI card from the carrier. If adding a PCI card, extract the PCI carrier's metal filler, by pushing down on it as shown in Figure 6-5. This filler covers the area where your PCI card's connectors will protrude out to the rear panel of the P-brick.

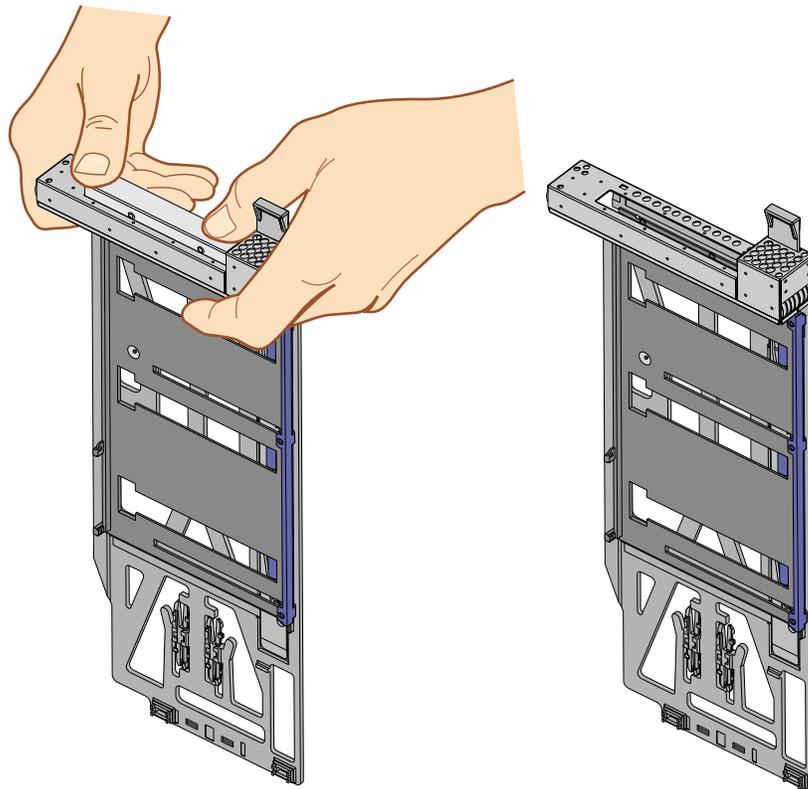


Figure 6-5 Extracting PCI Carrier's Metal Filler

3. Mount your new or replacement PCI card into the carrier using the guides, as shown in Figure 6-6.

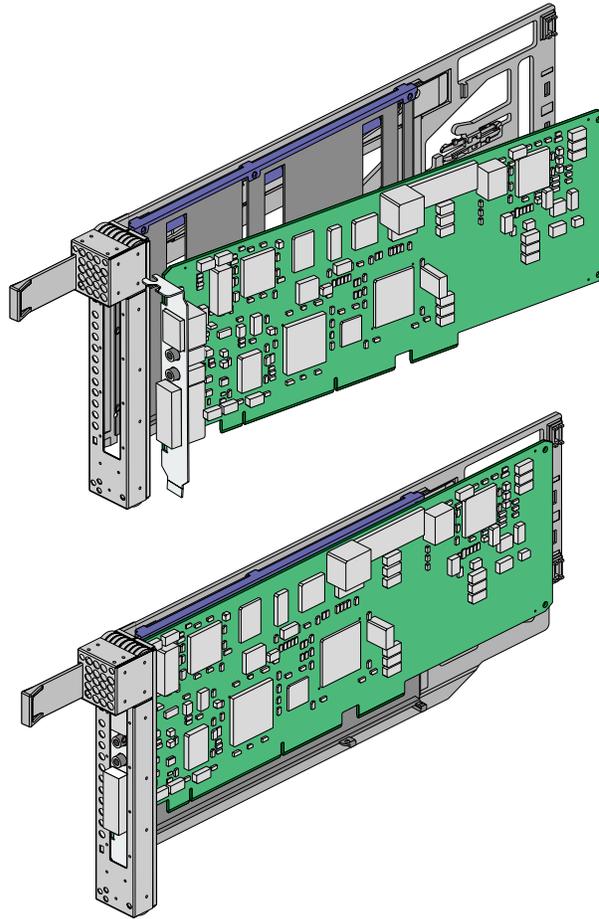


Figure 6-6 Mounting PCI Card Into Carrier

4. Insert the PCI carrier carrying the PCI card horizontally into the vacant slot, using the slot guides, as shown in Figure 6-7.

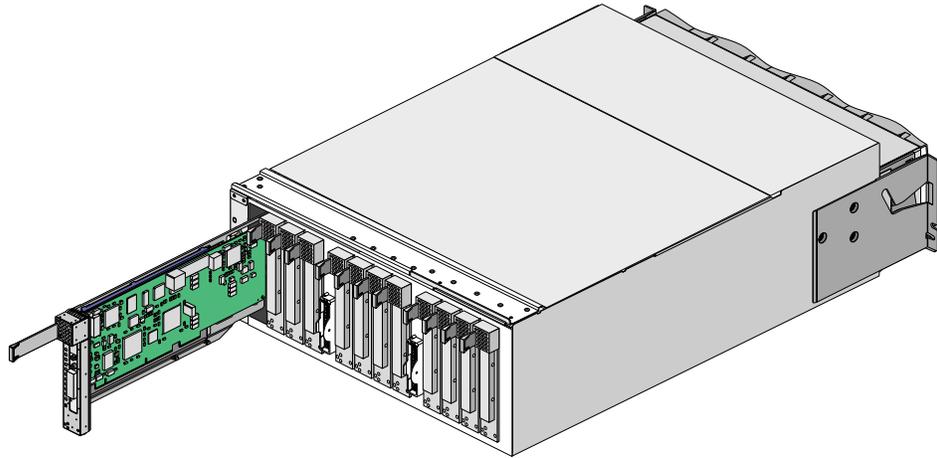


Figure 6-7 Installing a PCI Card in a PCI Slot

5. Pushing horizontally on the PCI carrier's seating bar, as shown in Figure 6-8, seats the PCI card securely in the slot. The PCI slot will need to be powered off after the card is installed.

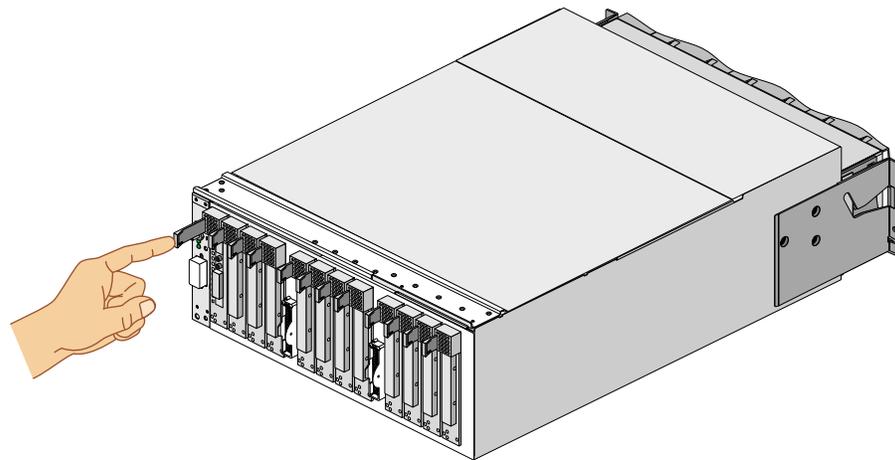


Figure 6-8 Seating the PCI Card in the Slot

X-brick

The following sections in this chapter describe the function and physical components of the X-brick:

- “Functional Description” on page 143
- “Internal Components and Front Panel Items” on page 143
- “Switch, Connectors, Card Slots, and LEDs on Rear Panel” on page 146
- “XIO Cards” on page 148

Functional Description

The X-brick is an I/O expansion brick that provides an XIO interface for the SGI Origin 3000 servers. Four XIO slots are available and will support a variety of XIO adapter cards. Please see Figure 7-1 on page 145 for a complete list of the XIO cards that are supported in the X-brick.

This XIO expansion is 4U high and can be installed in the I/O rack of the SGI Origin 3800 server, or combined within the first rack on the SGI Origin 3400 server if space is available.

Internal Components and Front Panel Items

The following are the X-brick’s internal components and front panel items (Figure 7-1 shows the items located on the X-brick front panel):

Internal components:

- **Power board.** Provides the power to the X-brick.
- **Midplane PCA.** The X-brick midplane contains an Xbridge ASIC that is the interface between the X-brick's two Crosstown2 ports and the XIO cards (see Figure 7-2). The midplane also has receptacles for the compression connectors of the XIO cards.

Front panel items:

- **L1 controller and display.** L1 controller generates X-brick status and error messages that appear on the liquid crystal display (LCD).
- **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.** Lights green when the X-brick internal components are on and turns off when they are off.
 - **Service required LED.** Lights orange to indicate that an item is broken or not operating properly (for example, a fan is off), but the X-brick is still operating.
 - **Failure LED.** Lights red to indicate that a system failure has occurred and the X-brick system is down.
- **Fans.**

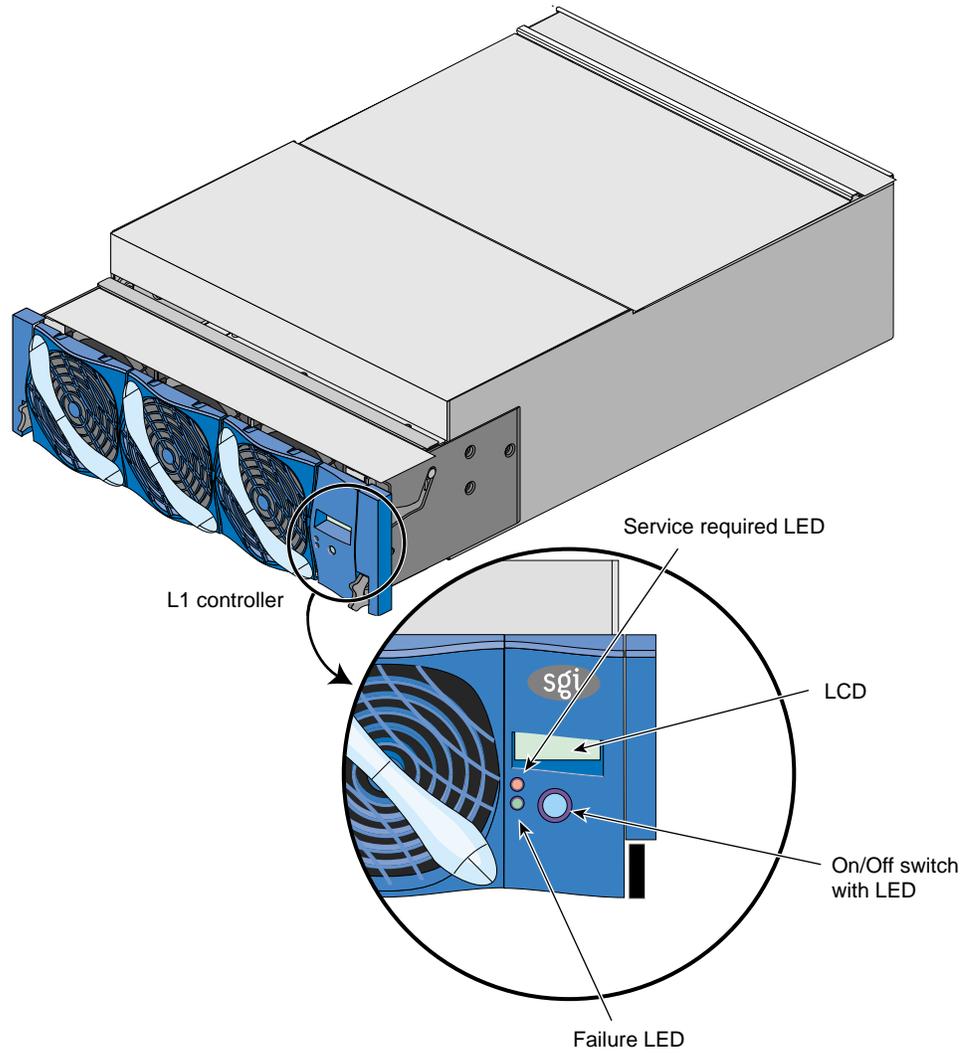


Figure 7-1 X-brick Front View

X-brick Midplane

The X-brick midplane contains an Xbridge ASIC that is the interface between the X-brick’s two Crosstown2 ports (XIO and the XIO cards), as shown in Figure 7-2. The midplane also has receptacles for the compression connectors of the XIO cards.

Figure 7-2 is a block diagram of the X-brick.

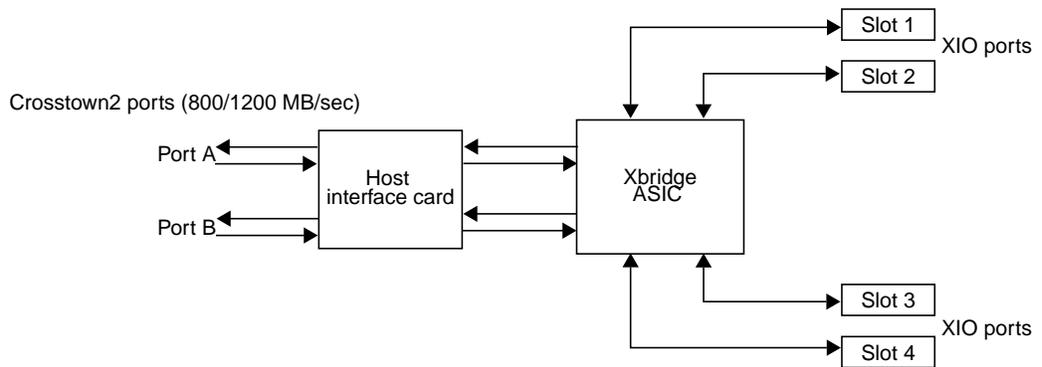


Figure 7-2 X-brick Block Diagram

X-brick L1 Controller

The L1 controller monitors and controls the environment of the X-brick. It consists of a display, logic components, and a cable. The display is located at the front of the brick. The logic components are located on the power board; an internal cable connects the display to the logic components.

For general information about the L1 controller, see Chapter 3, “System Control.”

Switch, Connectors, Card Slots, and LEDs on Rear Panel

Figure 7-3 shows the location of the power-on switch, XIO card slots, connectors, and LEDs on the X-brick rear panel.

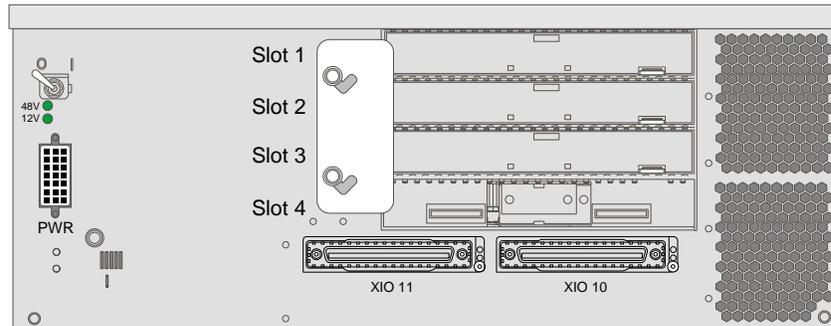


Figure 7-3 X-brick Rear Panel

The X-brick rear panel has the following items:

- **Power switch (O 1).** Moving the power switch to the 1 position powers on the X-brick's L1 controller, and moving it to the 0 position powers off the X-brick's L1 controller. Powering on the L1 controller lights the 12 VDC LED green.
- **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 lights green when the L1 controller is powered on and operating, and the 48 VDC lights green when the rest of the X-brick internal components are powered on and operating. The internal components are powered on by pressing the On/Off switch located on the L1 controller front panel.
- **PWR (power) connector.** Connects to the power bay to give power to the X-brick.
- **Slot 1, Slot 2, Slot 3, and Slot 4 XIO card slots.** Used to install and replace XIO cards onto your server system.



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

- **XIO 11 and XIO 10 connectors.** These Crosstown2 connectors connect the X-brick to a C-brick. Only one connector is required to connect to a single C-brick. As an option, the second Crosstown2 connector can be connected to another C-brick to create a dual-ported X-brick, which would provide greater bandwidth.
 - **XIO 11 and XIO 10 connector LEDs.** LEDs light yellow when the connector is cabled securely to the C-brick device, and light green when the connection is negotiated with the device with which the connector is cabled.

XIO Cards

The XIO cards insert horizontally into slots of the X-brick and connect to the X-brick's midplane. The XIO card slots are labeled Slots 1, 2, 3, and 4. Each slot can support a card with maximum power levels of 50 W.



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

Table 7-1 shows the SGI XIO cards supported in the X-brick. (Although other XIO cards are available from SGI and are supported in other systems, they are not supported in the X-brick.)

Table 7-1 XIO Cards

Marketing Code	Description
XT-HIPPI-800-SER	Single-port serial HIPPI
XT-FDDI-D	Dual-attach FDDI
XT-GSN-C-1XIO	Single-port GSN, copper interface
XT-GSN-C-2XIO	Dual-port GSN, copper interface
XT-DIVO	Digital video
XT-DIVO-DVC	Digital video with DVCPRO support
XT-HD	High-definition video
XT-VME-6U	Adapter for 6U VME card
XT-VME-9U	Adapter for 9U VME card

D-brick

The following sections in this chapter describe the function and physical components of the D-brick. These sections also explain how to operate, how to add and replace disk drive modules into, and how to troubleshoot the D-brick:

- “D-brick Functional Description” on page 149
- “Disk Drive Modules, and the Front Panel and Chassis” on page 150
- “Operating Panel, Modules, Connectors, and LEDs on D-brick Rear Panel” on page 154
- “Powering the D-brick On or Off” on page 163
- “D-brick Bay Numbering” on page 167
- “Adding and Replacing Disk Drive Modules” on page 168
- “Troubleshooting” on page 176

D-brick Functional Description

The D-brick is a module used to add JBOD (just a bunch of disks) storage to SGI Origin 3000 series of servers. It supports a maximum of 12 disk drives. (A minimum of 2 disk drives in specified slot locations described later in this chapter are required for D-brick management.) The D-brick provides the “hot-plugging” feature that enables you to add, replace, or take out disk drive modules from the D-brick without powering off the brick.

Note: The D-brick is added only as JBOD, but if you require RAID storage, ask your SGI sales representative about SGI’s RAID storage products, such as the TP 9100, to meet your needs.

Besides the disk drives, the D-brick includes the following modules and functionality:

- **Two power supply/cooling modules.** To provide power and cooling for the D-brick. Using a Y cable, these two power supplies bypass the power bay, which provides only 48 VDC, and connect directly to a single PDS outlet connector to get the 220 VAC it needs.
- **Enclosure system interface/operator panel (ESI/ops).** To operate, monitor, and troubleshoot the D-brick.
- **Two FC-AL loop resiliency circuit (LRC) I/O modules.** Each module provides input and output connectors to six disk drives. The modules provide connection to your server system's L2 or L3 controller, or to another D-brick to daisy chain two or more D-bricks together.

Disk Drive Modules, and the Front Panel and Chassis

Figure 8-1 shows a front view of the D-brick, with the full complement of 12 disk drive modules. You can have a minimum of 2 to a maximum of 12 disk drives. The left lowermost and right lowermost must have a disk drive module to enable management of the D-brick. See "Required Drives" on page 153 and "Operating Panel, Modules, Connectors, and LEDs on D-brick Rear Panel" on page 154 for detailed information about the required disk drive modules and their locations.

The D-brick uses disk technology that allows you to replace a disk while the system continues to run. This "hot-plugging" must be done under controlled circumstances; see "Adding and Replacing Disk Drive Modules" on page 168 for more information.

The disk drives are also dual-ported and can be configured on two separate loops to increase availability, in case one loop becomes disabled.

Disk-drive fillers are provided for all unused disk drive bays and are required to maintain a balanced airflow in the D-brick.

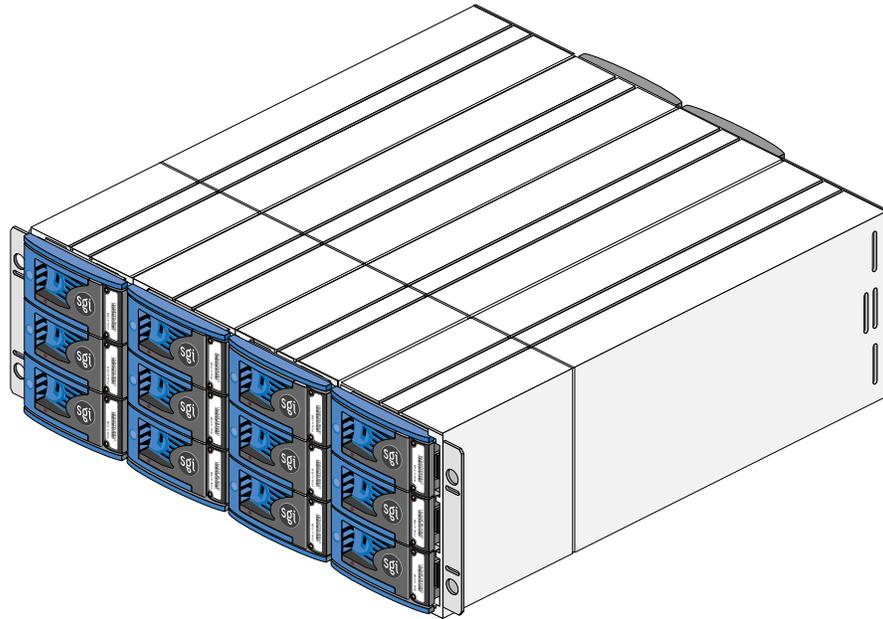


Figure 8-1 D-brick Front View

Figure 8-2 shows a close-up shot of the disk drive module, which consists of a hard disk mounted in an aluminum carrier. Each drive bay in the front of the D-brick houses a single 1.6-in. high (4.064 cm), 3.5-in. (8.89 cm) disk drive in its wrapper, or a 1-in. (2.54 cm) high drive, which has a foam filler.

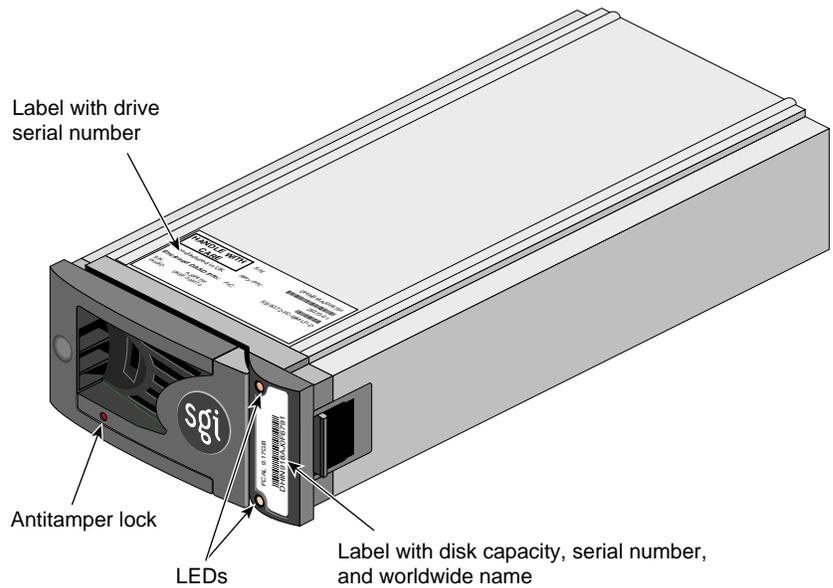


Figure 8-2 Disk Drive Module

The following items are found on the disk drive module:

- **Labels.** The label on the front of the drive has the drive capacity (for example, **FCAL 9.17GB**), the serial number, and worldwide name. The serial number of the drive is also on a label on the top of the carrier.
- **LEDs.** Each drive carrier has two LEDs, an upper (green) and lower (amber). In normal operation, the green LED is on and flickers as the drive operates. The amber LED illuminates when the drive is faulty.
- **Antitamper lock.** The drive carrier has an antitamper lock that disables the normal latch action of the handle for security purposes. A key to lock the disk drive is provided with each drive bay. A red indicator is visible in the center rectangular aperture in the handle if the antitamper lock is locked, and a black indicator is visible when the lock is unlocked.

Disk Drive Carrier

The extruded aluminum carrier (canister) provides thermal conduction, radio frequency and electromagnetic induction protection, and maximum physical protection of the drive.

The drive module cap has an ergonomic handle that provides the following functions:

- Camming of the carrier into and out of the drive bays
- Positive spring loading of the drive/backplane connector

Disk Drive Antitamper Lock

The drive carrier has an antitamper lock that disables the normal latch action of the handle; it is fitted in the drive carrier handle, as shown in Figure 8-2. The lock is set through the hole in the lower part of the handle trim. An indicator shows the setting:

- When the drive is locked, a red indicator is visible in the center rectangular aperture in the handle.
- When the drive is unlocked, a black indicator is visible.

The antitamper lock setting is changed with a key through the small round cutout in the lower part of the handle trim piece. (A key is included with each rack.) Changing the setting is explained in “Adding a Disk Drive Module” on page 168 and in “Replacing a Disk Drive Module” on page 175.

Required Drives

Figure 8-3 shows the location of the drives required by the ESI/ops panel, namely drive bays 1/3 and 4/3. “Operating Panel, Modules, Connectors, and LEDs on D-brick Rear Panel” on page 154 has full details about bay numbering.

Required			Required

Figure 8-3 Required Disk Drive Module Locations

Operating Panel, Modules, Connectors, and LEDs on D-brick Rear Panel

Figure 8-4 shows the location of the power-on switch, connectors, and LEDs on the D-brick rear panel.

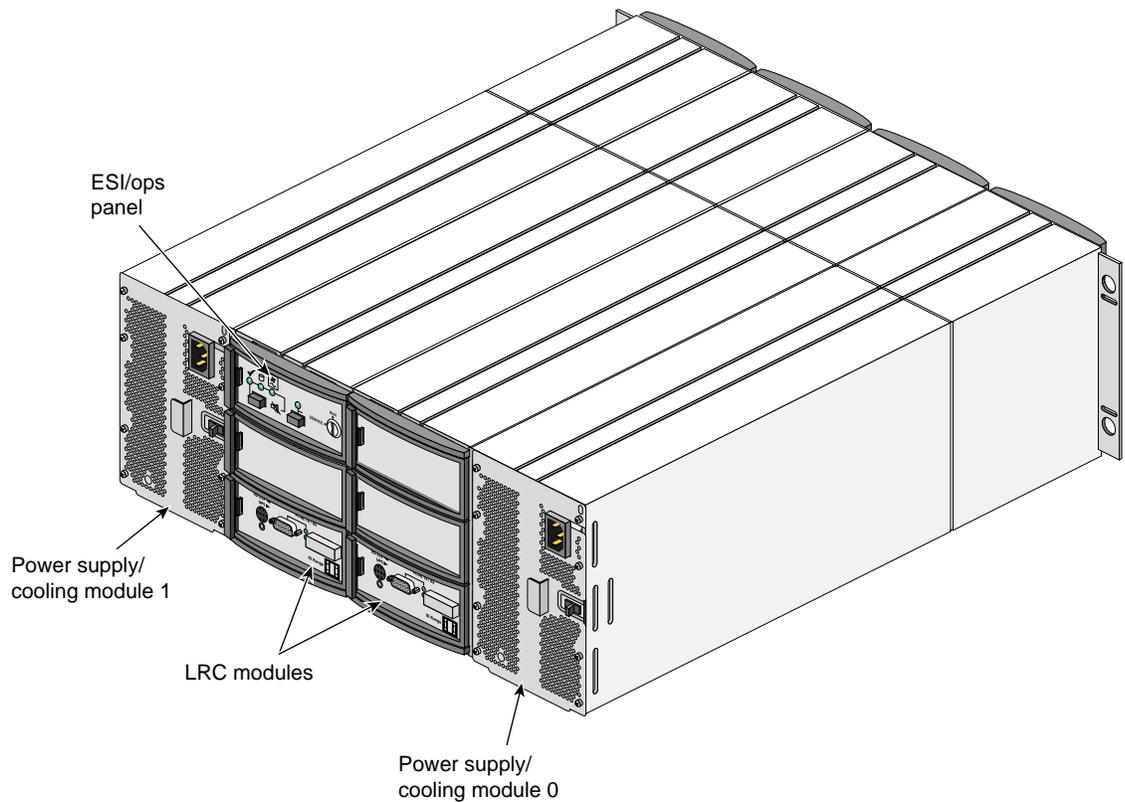


Figure 8-4 D-brick Rear View

The D-brick is shipped with the following component modules, shown in Figure 8-4, as standard equipment:

- Two power supply/cooling modules (modules 0 and 1)
- One enclosure system interface/operator panel (ESI/ops)
- Two loop resiliency circuit (LRC) I/O modules

These subsections provide details about the chassis and the component modules:

- “D-brick Chassis” on page 156
- “Power Supply/Cooling Module” on page 156

- “Enclosure System Interface/Operator (ESI/Ops) Panel Module” on page 157
- “FC-AL Loop Resiliency Circuit (LRC) I/O Modules” on page 161

D-brick Chassis

The D-brick chassis consists of two extended aluminum assemblies with a midplane PCB between them. Each chassis assembly contains 12 bays; a bay is defined as the space required to house a single 3.5-in. disk drive (1.6 in. high, or 1 in. high with a foam filler) in its carrier module. The two standard power supplies accommodate multiple bay spaces. The midplane PCB provides logic level signal and low-voltage power distribution paths.

Power Supply/Cooling Module

Two 550-W power supply/cooling modules are mounted in the rear of the D-brick. Figure 8-5 shows a module. The module contains two fans as well as the power supply and its associated electronics. The fans derive power from the chassis midplane, not from the power supply itself.

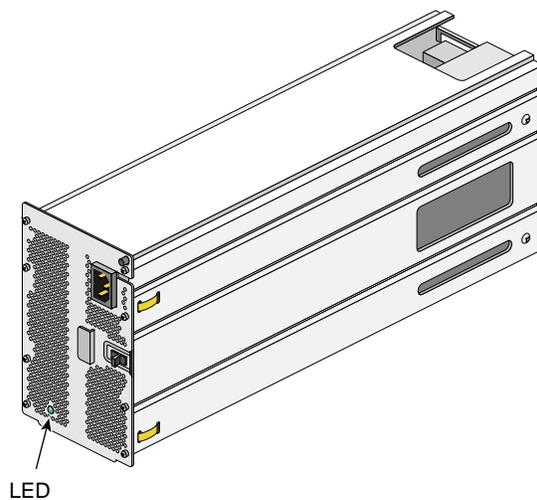


Figure 8-5 Power Supply/Cooling Module

Power supply voltage operating ranges are nominally 115 V or 230 V, selected automatically.

An LED on the front panel of the power supply/cooling module indicates the status of the power supply and the fan.

With a dual-headed hydra cable, the D-brick power supplies are connected directly to an output connector on the power distribution strip (PDS) to get the required 220 VAC.

Enclosure System Interface/Operator (ESI/Ops) Panel Module

The ESI/ops panel module provides the D-brick with a microcontroller for monitoring and controlling all elements of the D-brick. Each element (power, cooling, temperature, device status) is interfaced to the processor using an I²C (I square C) bus.

Figure 8-6 shows the location of the ESI/ops panel in the D-brick.

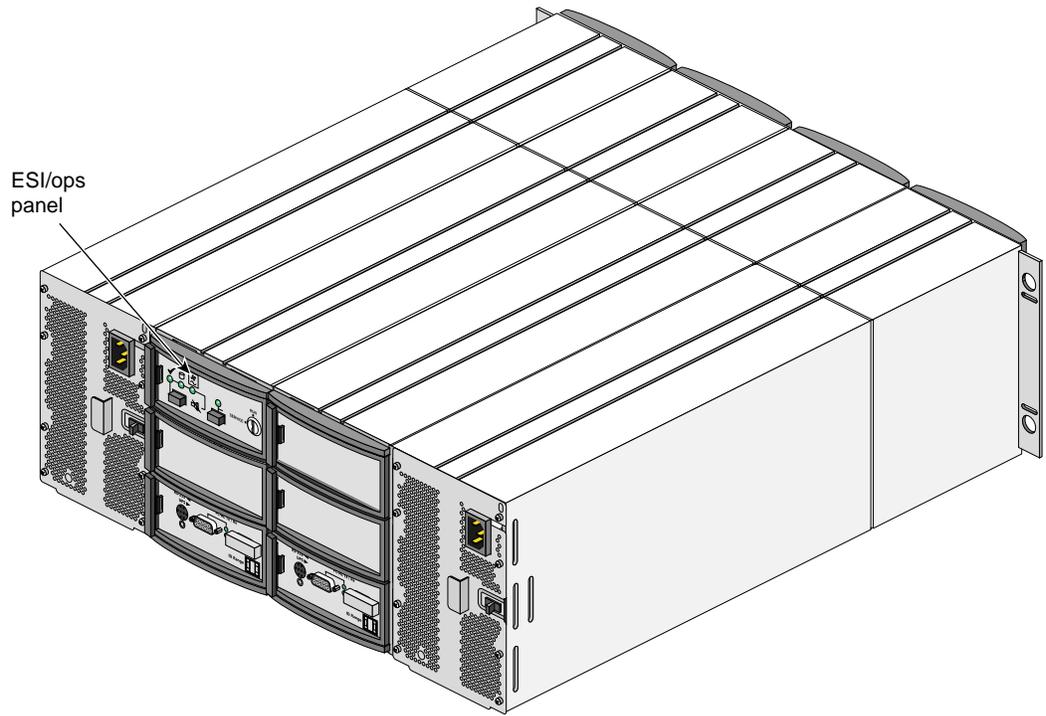


Figure 8-6 ESI/Ops Panel Module

Figure 8-7 shows details of the module's panel.

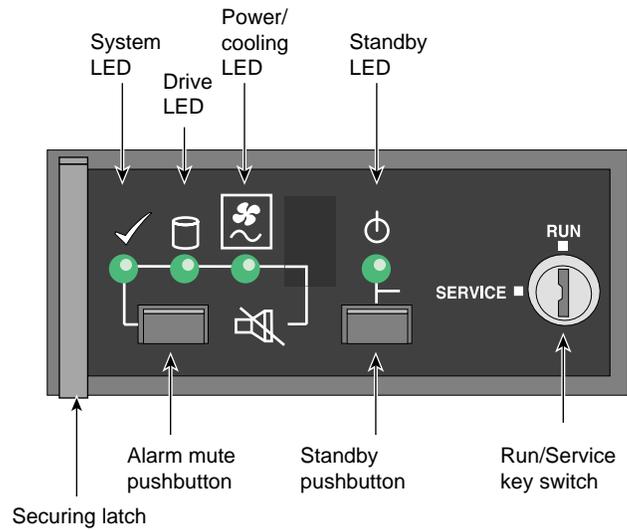


Figure 8-7 ESI/Ops Panel Indicators and Switches

The ESI/ops panel shows a consolidated status for all modules. Table 8-1 summarizes the functions of the LEDs on the ESI/ops panel, as well as those on other modules in the D-brick.

Table 8-1 D-brick LED Indicators

LED	Meaning
Green, steady	Positive condition
Green, flashing	Disk drives: data activity
Alternating green and amber, flashing	Noncritical condition
Amber, steady	Fault

In addition to the indicators on the ESI/ops panel, each module type has its own status LED(s). Using the LEDs for troubleshooting is explained in "Using D-brick LEDs for Troubleshooting" on page 177.

Other features of the ESI/ops panel are as follows:

- **Key switch.** Activates run or service mode, as explained in “Key Switch for Starting the D-brick.”
- **Standby button.** Activates standby mode when the key switch is in the Service position; see “Powering the D-brick On or Off” on page 163.
- **Alarm mute button.** Mutes the alarm; see “Audible Alarm” on page 160.

The ESI/ops panel module firmware includes SCSI enclosure services (SES), which monitor the modules in the D-brick and control the ESI/ops panel LEDs. The ESI/ops panel requires two disk drives in specific drive bays to serve as conduits for information from the D-brick to the ESI/ops panel module.

Key Switch for Starting the D-brick

For general use, the D-brick is started by turning the key switch on the far right (top) of the ESI/ops panel to the **RUN** position; the key is in this position when the D-brick is shipped. For specific instructions on starting and stopping the D-brick, see “Powering the D-brick On or Off” on page 163.

Audible Alarm

The audible alarm on the ESI/ops panel sounds when a fault state is present. Pressing the alarm mute button reduces the volume of the alarm, but beeps at approximately 10-second intervals to indicate that a fault state is still present. The mute button is beneath the indicators on the ESI/ops panel (see Figure 8-7).

“Using the Alarm for Troubleshooting” on page 182 explains alarm function.

FC-AL Loop Resiliency Circuit (LRC) I/O Modules

The D-brick is shipped with two FC-AL loop resiliency circuit (LRC) I/O modules, which make dual (redundant) data paths possible.

Figure 8-8 shows the location of the I/O modules.

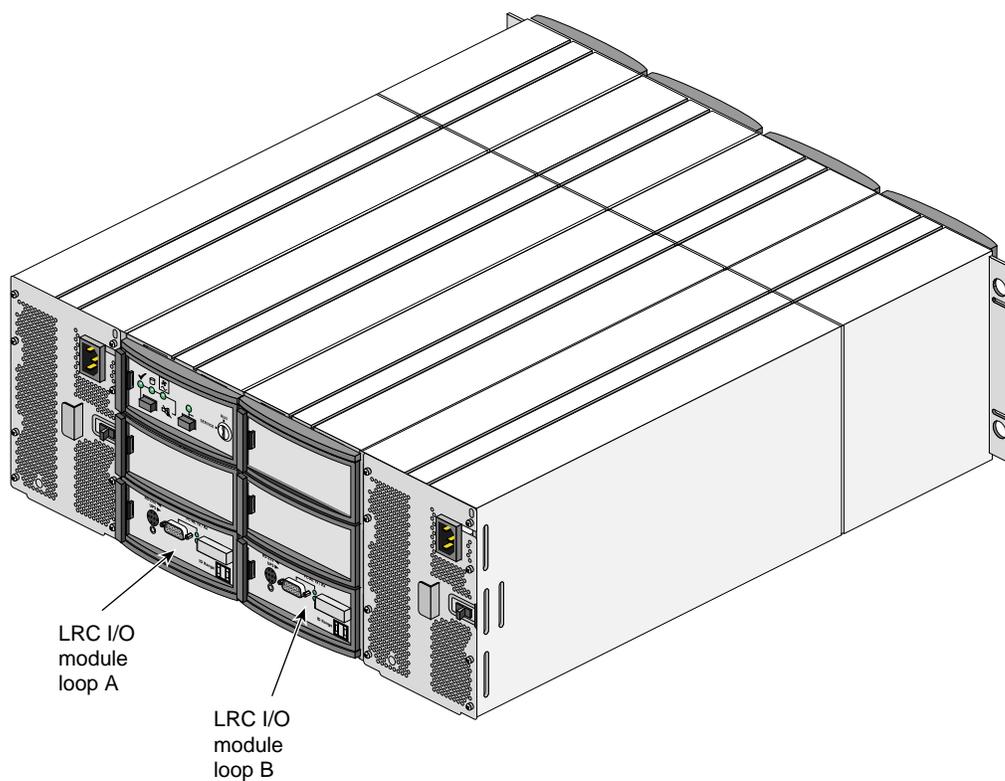


Figure 8-8 I/O Module Locations

Figure 8-9 shows features of the I/O module panel.

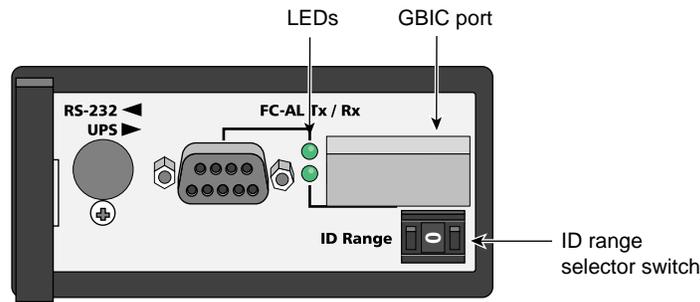


Figure 8-9 I/O Module Panel Features

Each I/O module has the following connectors and LEDs:

- **DB-9 connector.** This output connector can be cabled into a second D-brick's GBIC port connector to daisy-chain the two D-bricks.

The DB-9 port connector on the I/O module panel has an LED indicating its status. The LED lights green when the connection is negotiated with the device with which the connector is cabled and a good FC-AL signal is received on the cable attached to the adjacent connector. The LED lights amber when a problem with the connection is detected.

- **GBIC Port.** This Gigabit Interface Connector (GBIC) port is an input connector used to cable in an I/O brick on the server to the D-brick. This port connects to a host bus adapter (HBA) PCI card in an I-brick or P-brick on the server. You can also connect a cable coming from a second D-brick's DB-P connector into the GBIC port to daisy-chain the two D-bricks.

You insert an HSSDC GBIC module into the GBIC port to make the cabling connection.

The GBIC port connector has an LED indicating its status. The LED lights green when the connection is negotiated with the device with which the connector is cabled and a good FC-AL signal is received on the cable attached to the adjacent connector. The LED lights amber when a problem with the connection is detected.

- **ID range selector switch.** Each I/O module has an ID range selector switch for the system ID. Disk drive IDs are based on this ID. The legal address ID settings are 1 through 7.

At initial startup, each I/O module controls a separate loop of six drives

Powering the D-brick On or Off

1. Make sure that the ambient temperature is within the specified operating range of 10 °C to 40 °C (50 °F to 104 °F). If drives have been recently installed, make sure that they have had time to acclimatize before operating them.
2. Make sure that the D-brick's power supply/cooling modules' power connectors are cabled directly, with a Y cable, to an outlet connector of the power distribution strip (PDS).
3. For an unattended installation in which the D-brick is required to power on whenever AC power is present, the **RUN/SERVICE** key switch on each ESI/ops panel of each enclosure you are operating should be in the **RUN** position. The key switches are in this position when the D-bricks are shipped (see Figure 8-10).

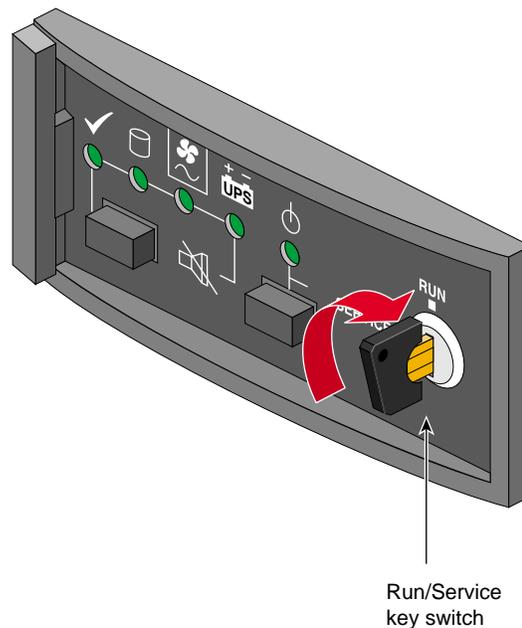


Figure 8-10 ESI/Ops Panel, Rackmount: Powering On

If the **RUN/SERVICE** key switch is in the **RUN** position, the enclosure powers on when power reaches the enclosure.

If the **RUN/SERVICE** key switch is in the **RUN** position and power is interrupted, the enclosure returns to the power-on condition when power is restored.

In run mode, the standby button is disabled.

Note: Setting the **RUN/SERVICE** key switch on the ESI/ops panel to the **SERVICE** position puts the D-brick in service mode; only SGI system support engineers (SSEs) use this mode. In service mode, if power is lost for any reason, the D-brick defaults to standby mode when power is restored. Press the standby button to power on the D-brick.

Checking AC Power and System Status

When you power on the system, the standby LED on each ESI/ops panel (see Figure 8-11) in each enclosure you are operating should turn green. If it does not, check that the power supply/cooling modules in the enclosure are correctly cabled to the rack PDUs.

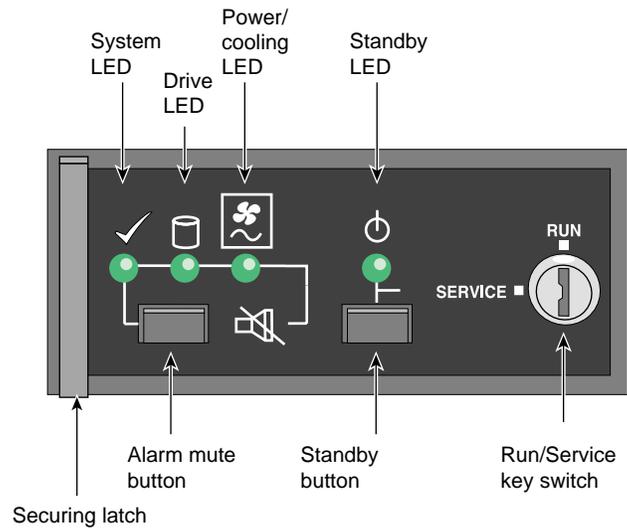


Figure 8-11 ESI/Ops Panel Indicators and Switches: Rackmount Enclosure

When you power on the system, check ESI/ops panel LEDs for system status. Under normal conditions, these LEDs should all be illuminated constant green. If a problem is detected, the ESI processor in the operator panel changes the relevant LED from green to amber. See “Solving Initial Startup Problems” on page 176 and “Solving Power Supply/Cooling Problems” on page 179.

Other modules in the D-brick also have LEDs, which are described in “Using D-brick LEDs for Troubleshooting” on page 177.

Powering Off the D-brick

The D-brick toggles between standby mode (all drives are powered off) and run (operation) mode whenever the standby button is pressed.

After making sure users are off the affected systems, power off the D-brick in one of two ways:

- Turn the key switch to the **SERVICE** position and then press the standby button for two seconds.

To power on the D-brick again from this setting, press the standby button for two seconds again.

- Remove power at the power source: unplug the D-brick from the PDS.

Note the following:

- If the key switch on the ESI/ops panel is in the **RUN** position when power is restored to the D-brick, the system powers on.

If the key switch is in the **SERVICE** position when power is restored to the D-brick, the system does not power on.

D-brick Bay Numbering

Figure 8-12 shows the correct positions of the disk drive modules and the enclosure bay numbering convention. A bay is defined as the space required to house a single 3.5-in. disk drive in its carrier module.

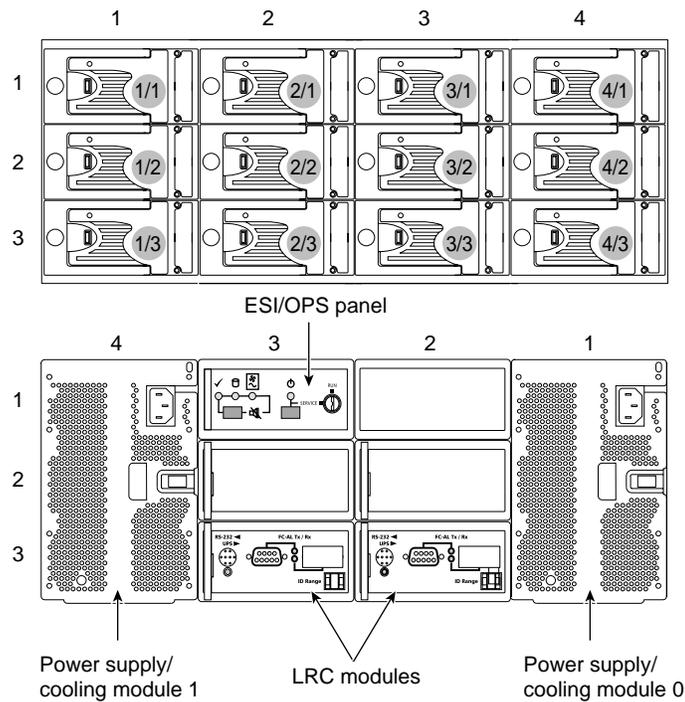


Figure 8-12 Module Locations and Bay Numbering

The D-brick is 4 bays wide by 3 bays high.

- The disk drive bays, located in front, are numbered 1 to 4 from left to right and 1 to 3 from top to bottom. Drives in bays 1/3 and 4/3 are required for D-brick management; these bays must always be occupied.
- The rear bays are numbered 1 to 4 from right to left and 1 to 3 from top to bottom.

Module locations are identified by combining the column and row numbers (top and side numbers in Figure 8-12). For example, the ESI/ops panel is in rear bay 3/1 (third column from right, top row).

Adding and Replacing Disk Drive Modules

This section explains how to replace a faulty disk drive module or install a new one, in the following sections:

- “Adding a Disk Drive Module” on page 168
- “Replacing a Disk Drive Module” on page 175

Adding a Disk Drive Module

Note the following:

- All disk drive bays must be filled with either a disk drive module or a drive filler; no bay should be left completely empty.
- The drives in bays 1/3 and 4/3 are required for enclosure management; these bays must always have a disk drive.
- Install drives in the order shown in Figure 8-13. Generally, after the two required bays are occupied, drive bays are filled starting at the bottom of the D-brick.

9	10	11	12
5	6	7	8
2 (required)	3	4	1 (required)

Figure 8-13 Drive Installation Order

Follow these steps to add a new disk drive module to the D-brick:

1. Make sure that enough disk drives and disk-drive fillers have been ordered to occupy all bays.
2. For each new drive, carefully open the bag containing the drive.



Warning: The disk drive handle might have come 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 disk drive modules on an antistatic work surface, and make sure that their antitamper locks are disengaged (unlocked). A disk drive module cannot be installed if its antitamper lock is activated outside the enclosure.

Drives are shipped with the locks set in the unlocked position. However, if a drive is locked, insert the key (included with the disk drive) into the socket in the lower part of the handle trim and turn it 90 degrees clockwise until the indicator visible in the center aperture of the handle shows black. See Figure 8-14.

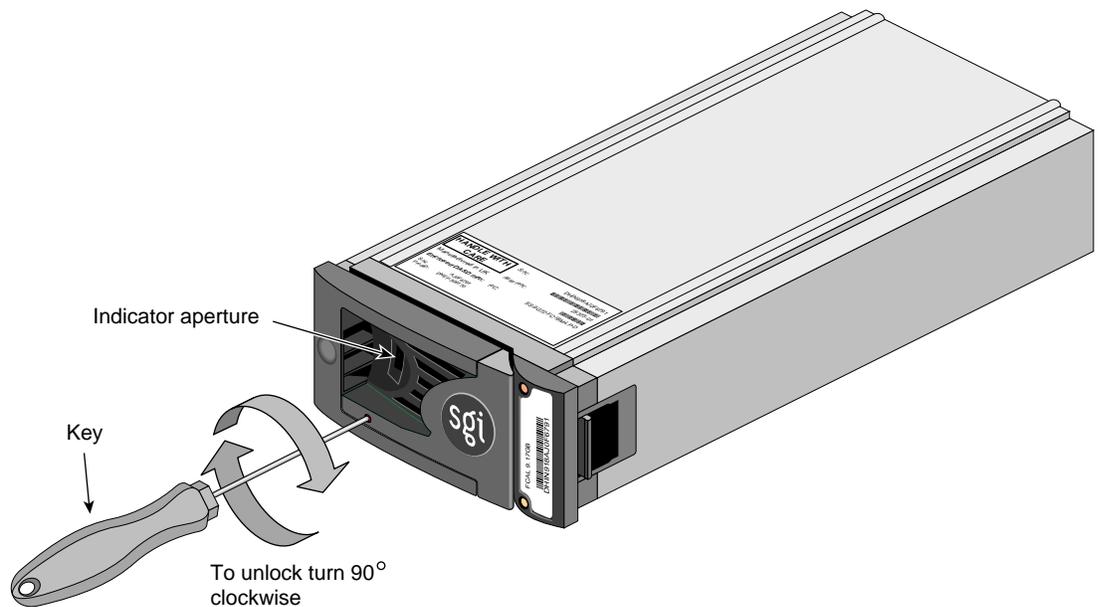


Figure 8-14 Unlocking the Disk Drive Module (Disengaging the Antitamper Lock)

4. Release the disk drive module handle by pressing on the small indentation on the left of the module front (see Figure 8-15).

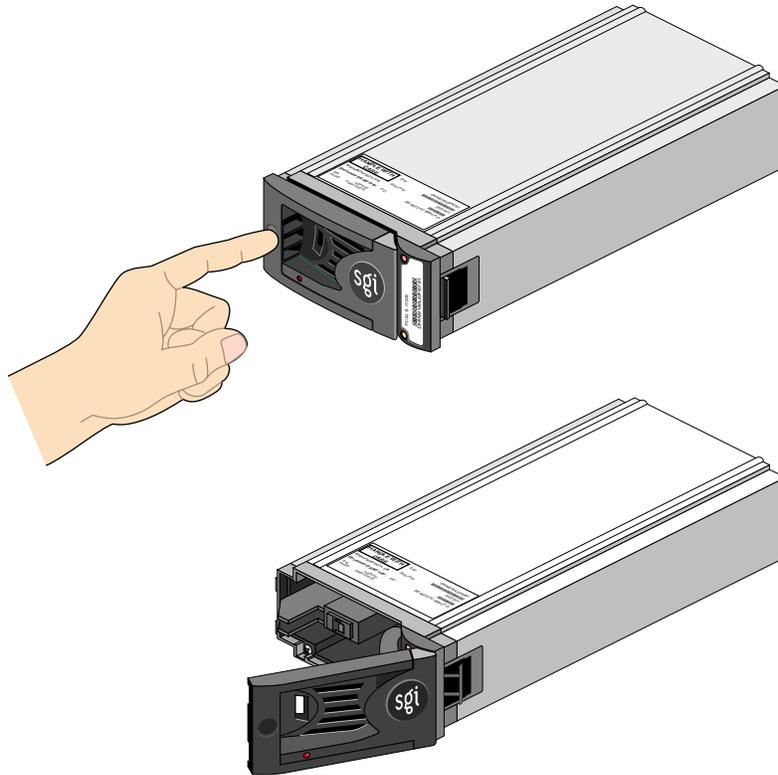


Figure 8-15 Releasing the Module Handle

5. Insert the disk drive module into the chassis, as shown in Figure 8-16.

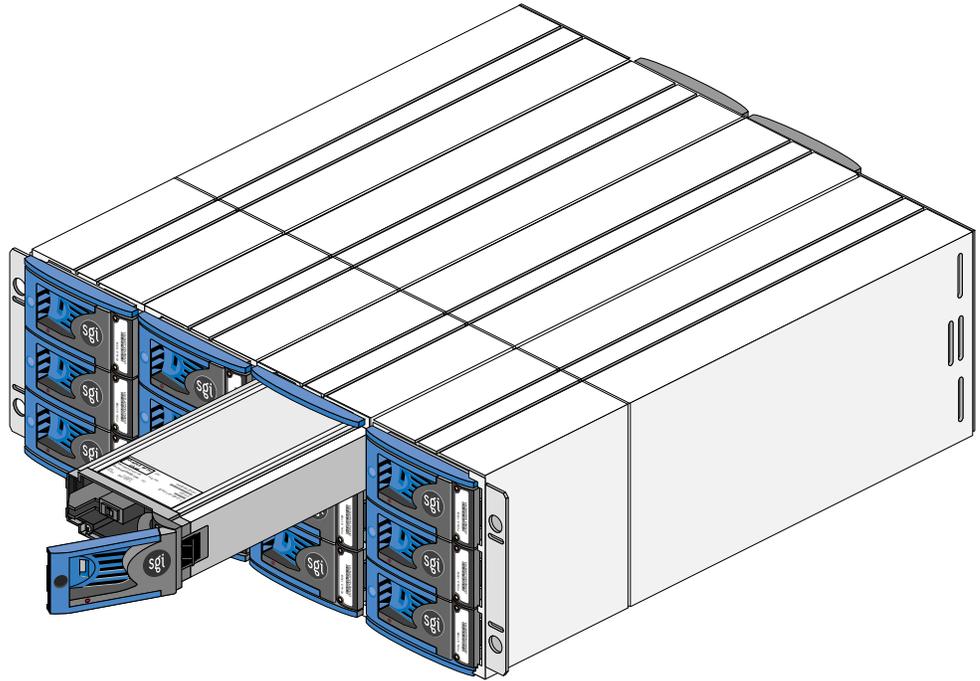


Figure 8-16 Inserting the Disk Drive Module

Note: The drive modules are not keyed. Make sure you are inserting the drive module in the correct orientation.

6. Push the disk drive module gently into the chassis until it is stopped by the camming lever on the right of the module, as shown in Figure 8-17.

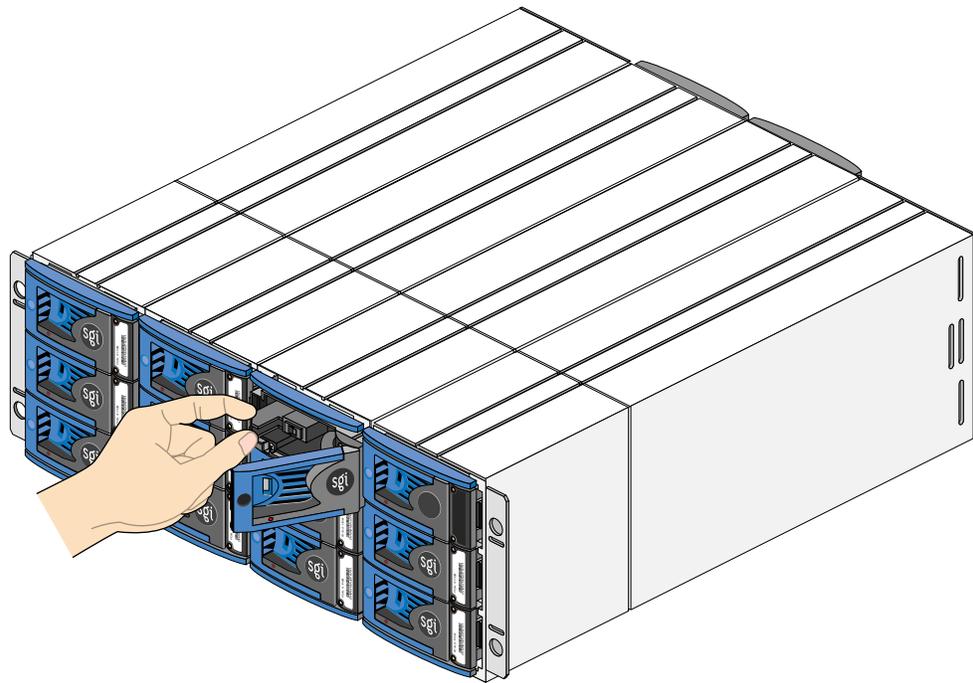


Figure 8-17 Drive Seated: Rackmount Enclosure

7. Press on the drive handle to seat the drive. The camming lever on the right of the module engages with a slot in the chassis, as shown in Figure 8-18.

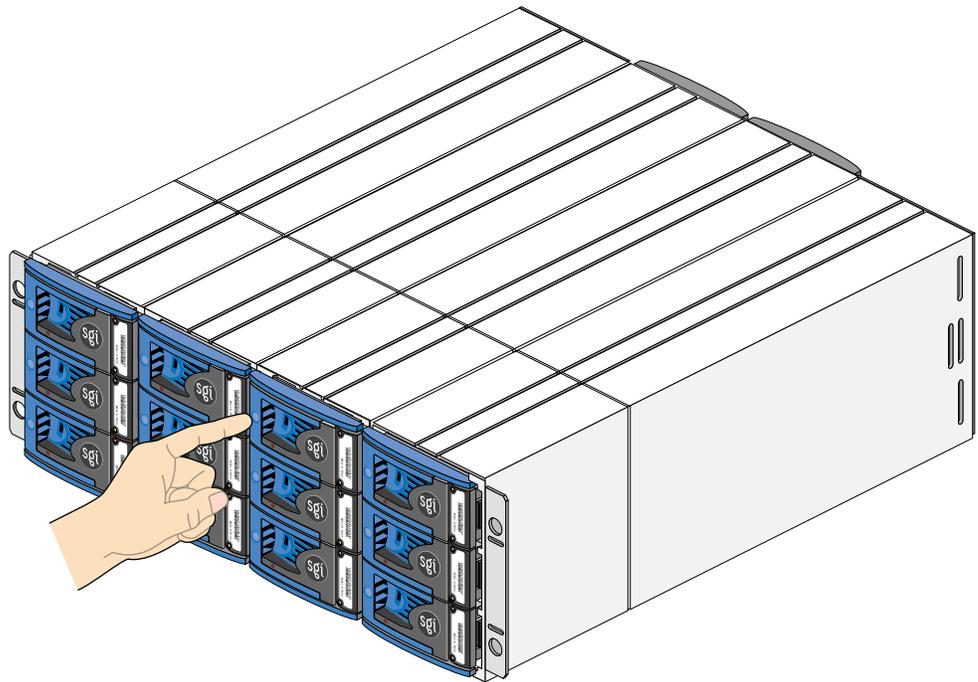


Figure 8-18 Engaging the Camming Lever: Rackmount Enclosure

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 have finished installing all drives, activate the drive antitamper lock on each one:
 - Carefully insert the lock key provided into the cutout in the handle trim. See Figure 8-19.

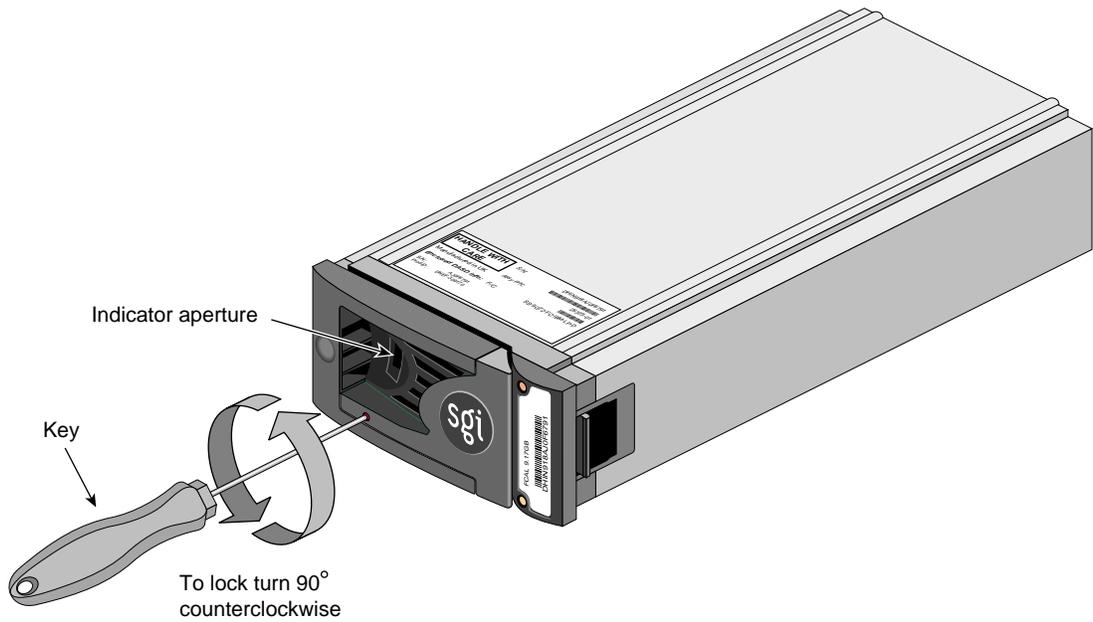


Figure 8-19 Locking the Disk Drive Module (Setting the Antitamper Lock)

- Rotate the key 90 degrees counterclockwise until the indicator in the handle shows red.
 - Remove the key and store it.
10. Fit all empty drive bays with disk-drive fillers. The drive handle and camming mechanism operate the same way as for disk drives.

Replacing a Disk Drive Module

If an LED indicates that a disk drive is defective, follow these steps to remove the faulty drive:

1. Make sure enough disk drives and disk-drive fillers are available to occupy all bays.
2. Make sure users are off the affected systems; back up data if necessary.

Note: Replace disk drive modules one at a time,

3. Using the key, turn the antitamper lock to the off position:
 - Carefully insert the lock key provided into the cutout in the handle trim, as shown in Figure 8-14.
 - Rotate the key 90 degrees clockwise until the indicator in the handle shows black.
 - Remove the key and store it.
4. Make sure the faulty drive has spun down.

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

5. Release the handle by pressing on the small indentation area on the left of the module front.
6. Gently withdraw the module approximately 25 mm (1 in.) and wait 30 seconds.
7. Withdraw the module from the drive bay. Replace the drive immediately; follow instructions in “Adding a Disk Drive Module” on page 168.
8. If you are replacing a module in a LUN that uses a hot spare, note the location of the replacement module; it is the new hot spare.

Troubleshooting

The D-brick includes a processor and associated monitoring and control logic that allow it to diagnose problems within the D-brick's power, cooling, and drive systems.

The SES (SCSI enclosure services) processor is housed in the ESI/ops panel module. The sensors for power, cooling, and thermal conditions are housed within the power supply/cooling modules. Each module in the D-brick is monitored independently.

This section consists of the following subsections:

- "Solving Initial Startup Problems" on page 176
- "Using D-brick LEDs for Troubleshooting" on page 177
- "Using the Alarm for Troubleshooting" on page 182
- "Solving Storage System Temperature Problems" on page 183
- "Using Test Mode" on page 185

Note: If a fault is indicated on the ESI/ops panel, see Table 8-2 in "Using D-brick LEDs for Troubleshooting" on page 177 and then see the section referenced within that table.

Solving Initial Startup Problems

If cords are missing or damaged, plugs are incorrect, or cables are too short, contact your supplier for replacements.

If the D-brick alarm sounds when you power on the SGI Origin 3000 server (or the D-brick, if it has been powered off separately), one of the following conditions exists:

- A fan is slowing down. See "Solving Power Supply/Cooling Problems" on page 179 for further checks to perform.
- There is an over temperature or thermal overrun condition. See "Solving Power Supply/Cooling Problems" on page 179.
- There is a D-brick fault. See "Solving Problems Indicated by ESI/Ops Panel LEDs" on page 177.

If an amber disk drive module LED drive fault is on, there is a drive fault. See Table 8-3 on page 181.

Using D-brick LEDs for Troubleshooting

This section summarizes LED functions and gives instructions for solving D-brick problems in these subsections:

- “Solving Problems Indicated by ESI/Ops Panel LEDs” on page 177
- “Solving Power Supply/Cooling Problems” on page 179
- “Solving Problems Indicated by FC LRC I/O Module LEDs” on page 180
- “Solving Disk Drive Problems” on page 181

Solving Problems Indicated by ESI/Ops Panel LEDs

Figure 8-20 shows details of the ESI/ops panel.

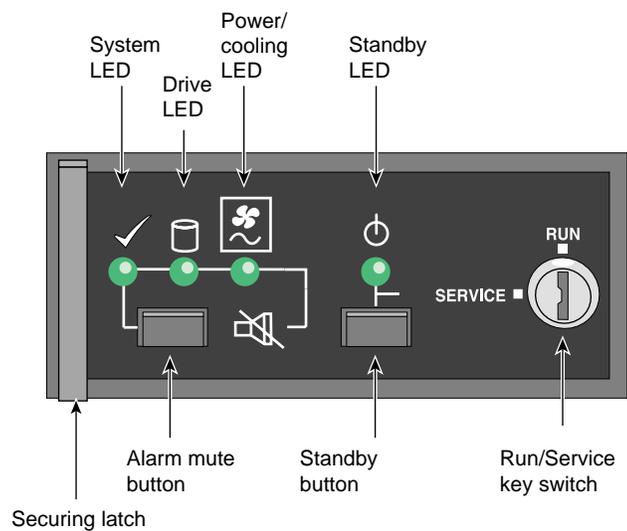


Figure 8-20 ESI/Ops Panel Indicators and Switches

Table 8-2 summarizes functions of the LEDs on the ESI/ops panel.

Table 8-2 ESI/Ops Panel LEDs and Troubleshooting

LED	Off	Green Steady	Green or Amber Flashing	Amber Steady	Remedy
 System status	Power is off, or standby mode is selected.	All ESI functions OK.	System configuration error.	ESI / PC function failure.	See "Solving Problems Indicated by ESI/Ops Panel LEDs" on page 177.
 Drive status	Power is off, or standby mode is selected.	All drives OK.	Drive fault (alternating green and amber). Note: ESI polling causes flash at regular interval.	N/A	Replace the drive as explained in "Adding and Replacing Disk Drive Modules" on page 168.
 Power/ Cooling	Power is off, or standby mode is selected.	All power and fans OK.	Not used.	Power supply/cooling module or fan fault.	See "Solving Power Supply/Cooling Problems" on page 179. Contact service provider for replacement.
 Standby	No AC power is supplied.	Power is good, or standby status is selected.	Not used.	Storage system is in standby mode due to ESI thermal shutdown.	See "Thermal Alarm" on page 183, "Thermal Shutdown" on page 184.

Note the following:

- If all LEDs on the ESI/ops panel flash simultaneously, see "Using Test Mode" on page 185.
- If test mode has been enabled (see "Using Test Mode" on page 185), the amber and green drive bay LEDs flash for any non-muted fault condition.
- The LED for the uninterruptible power supply (UPS) is covered with a sticker. This LED lights whether or not a UPS is present. Use of a UPS is not supported in this release. Leave the sticker in place.

If the system status LED on the ESI/ops panel is amber and the alarm is sounding, the ESI processor has detected an internal fault, such as failure of an internal communications path. Follow these steps:

1. Check if the LEDs on the power supply/cooling modules are amber. If a PSU error is present, there might be a communications problem with that power supply/cooling module. Contact your service representative for a replacement.
2. Check if the disk drive module LEDs are amber. If none are, there might be either an ESI processor problem or a chassis midplane problem. Contact your service provider.

See also “Thermal Shutdown” on page 184.

Solving Power Supply/Cooling Problems

If the alarm is sounding, the power supply/cooling LED on the ESI/ops panel is amber, and the LED on one or both power supply/cooling modules is amber, the cause is one of the following:

- Power fault
- Fan failure
- Thermal condition that is causing the power supply/cooling module to overheat.

To troubleshoot the problem, follow these steps:

1. Check the power connection to the power supply/cooling module.
2. If possible, reduce the ambient temperature. If the problem persists, contact your service provider.

If one of the power supply/cooling modules is missing or defective, all of the following occur:

- Alarm sounds.
- System LED on the ESI/ops panel flashes.
- Power supply/cooling module LED remains illuminated.

If these warnings occur, check the LED on the power supply/cooling module. If it is amber, contact your service representative.

Figure 8-21 shows the location of the LED on the power supply/cooling module.

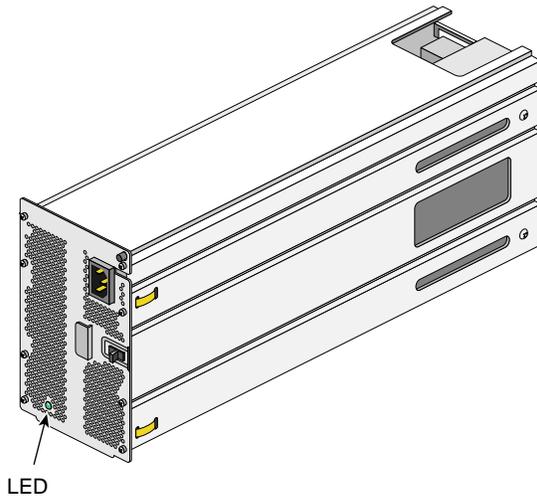


Figure 8-21 Power Supply/Cooling Module LED

If this LED is amber, or if the power/cooling LED on the ESI/ops panel is amber and the alarm is sounding, contact your service provider.

Solving Problems Indicated by FC LRC I/O Module LEDs

Two LEDs between the DB-9 connectors on the I/O panel light steady green to indicate a good FC-AL signal on the cables attached to the adjacent connectors. Figure 8-22 shows the LEDs on the I/O module panel.

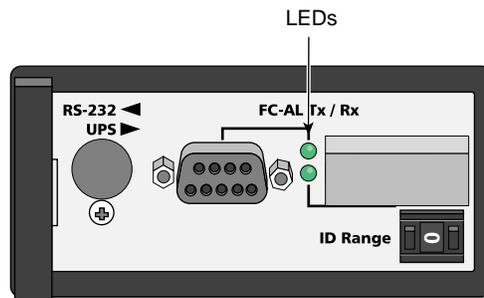


Figure 8-22 FC LRC I/O Module LEDs

If the LED for a connector is amber, check the connection. If the problem persists, contact your service provider for a replacement.

Solving Disk Drive Problems

Each disk drive module has two LEDs, an upper (green) and a lower (amber), as shown in Figure 8-23.

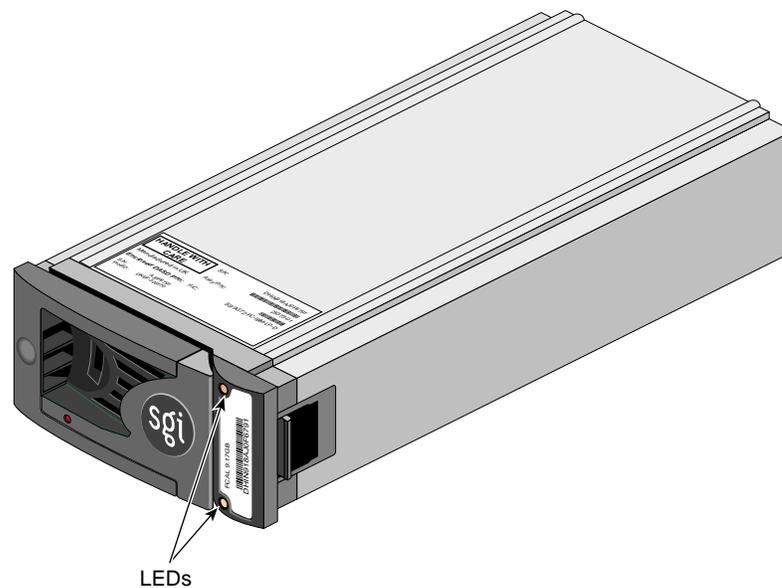


Figure 8-23 Disk Drive Module LEDs

The LEDs on the disk drive modules provide the information summarized in Table 8-3.

Table 8-3 Disk Drive LED Function

Green LED	Amber LED	State	Solution
Off	Off	No disk drive fitted; that is, the drive is not fully seated.	Check that the drive is fully seated.
On	Off	Disk drive power is on, but the drive is not active.	N/A

Table 8-3 (continued) Disk Drive LED Function

Green LED	Amber LED	State	Solution
Blinking	Off	Disk drive is active (LED might be off during power-on).	N/A
Flashing at 2-second intervals	On	Disk drive fault (SES function).	Contact your service provider for a replacement drive and follow instructions in "Adding and Replacing Disk Drive Modules" on page 168.
N/A	Flashing at half-second intervals	Disk drive identify (SES function).	N/A

In addition, the amber drive LED on the ESI/ops panel alternates between on and off every 10 seconds when a drive fault is present.

Using the Alarm for Troubleshooting

The ESI/ops panel includes an audible alarm that indicates when a fault state is present. The following conditions activate the audible alarm:

- Drive fault
- Fan slows down
- Voltage out of range
- Over temperature
- Thermal overrun
- Storage system fault

You can mute the audible alarm by pressing the alarm mute button for about a second, until you hear a double beep. The mute button is beneath the indicators on the ESI/ops panel (see Figure 8-20).

When the alarm is muted, it continues to sound with short intermittent beeps to indicate that a problem still exists. It is silenced when all problems are cleared.

Note: If a new fault condition is detected, the alarm mute is disabled.

Solving Storage System Temperature Problems

This section explains D-brick temperature conditions and problems in these subsections:

- “Thermal Control” on page 183
- “Thermal Alarm” on page 183
- “Thermal Shutdown” on page 184

Thermal Control

The D-brick uses extensive thermal monitoring and ensures that component temperatures are kept low and acoustic noise is minimized. Airflow is from front to rear of the D-brick.

If the ambient air is cool (below 25 °C or 77 °F) and you can hear that the fans have sped up by their noise level and tone, then some restriction on airflow might be raising the D-brick’s internal temperature. The first stage in the thermal control process is for the fans to automatically increase in speed when a thermal threshold is reached. This might be a normal reaction to higher ambient temperatures in the local environment. The thermal threshold changes according to the number of drives and power supplies fitted.

If fans are speeding up, follow these steps:

1. Check that there is clear, uninterrupted airflow at the front and rear of the D-brick.
2. Check for restrictions due to dust buildup; clean as appropriate.
3. Check for excessive recirculation of heated air from the rear of the D-brick to the front.
4. Check that all blank plates and disk-drive fillers are in place.
5. Reduce the ambient temperature.

Thermal Alarm

The thermal alarm is a combination of all these:

- Alarm sounds.
- Power supply/cooling LED on the ESI/ops panel is amber.
- LED on one or both power supply/cooling modules is amber.

- Air temperature of the air exiting the PSU is above 55 °C (131 °F).

This alarm sounds when the internal temperature (measured in the airflow through the D-brick) exceeds a threshold. Follow these steps:

1. Check that local ambient environment temperature is below the upper temperature specification of 40 °C (104 °F).
2. Check that there is clear, uninterrupted airflow at the front and rear of the D-brick.
3. Check for restrictions due to dust buildup; clean as appropriate.
4. Check for excessive recirculation of heated air from the rear to the front.

Thermal Shutdown

The D-brick automatically shuts down to protect itself and the disk drives from damage. Thermal shutdown occurs under these conditions:

- After the thermal alarm condition is present. Shutdown occurs at a higher threshold than the thermal alarm.
- When all fans fail.
- When only one fan is operating and the D-brick internal temperature reaches 40 °C (104 °F).

The D-brick shuts down ten seconds after any of these conditions is present.

When a thermal shutdown is imminent, all amber LEDs on the ESI/ops panel and on all disk drives flash and the alarm sounds continuously and cannot be muted.

When thermal shutdown conditions are present, follow these steps (if possible):

1. Check for airflow restrictions.
2. Check for power supply/cooling module faults as detailed in “Solving Power Supply/Cooling Problems” on page 179.
3. Check for excessive ambient temperatures (over 40 °C [104 °F])

If the overheating problem is not solved, thermal shutdown occurs. The standby LED on the ESI/ops panel and the power supply status LED are amber and the D-brick powers itself off.

Follow these steps:

1. Correct the source of the overheating.
2. Allow the D-brick to cool down.
3. Unplug the power cord from the D-brick and leave it unplugged for at least 30 seconds to reset the shutdown condition.
4. Reconnect the power cord and restart the D-brick, following the normal procedure (see “Powering the D-brick On or Off” on page 163).
5. Check for cooling faults that persist, particularly fan failure. If a fan has failed, contact your service provider for a replacement.

Using Test Mode

When no faults are present in the D-brick, you can run test mode to check the LEDs and the audible alarm on the ESI/ops panel. In this mode, the amber and green LEDs on each of the drive carrier modules and the ESI/ops panel flash on and off in sequence; the alarm beeps twice when test mode is entered and exited.

To activate test mode, press the alarm mute button until you hear a double beep. The LEDs then flash until the D-brick is reset, either when you press the alarm mute button again or if an actual fault occurs.

R-brick

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

- “Functional Description” on page 187
- “Internal Components and Front Panel Items” on page 188
- “Switch, Connectors, and LEDs on R-brick Rear Panel” on page 190

Functional Description

The R-brick (router brick) includes one SGI router ASIC, which is an 8-port router in the SGI Origin 3000 series. The R-brick acts as a centralized hub for the NUMALink interconnect fabric, where all C-bricks in the system are connected to the R-brick with NUMALink cables.

R-bricks are included in all standard configurations of the SGI Origin 3400 server and the SGI Origin 3800 server. The SGI Origin 3200 server does not support an R-brick since the maximum 8-processor configuration can be achieved by connecting the two C-bricks directly with a NUMALink cable.

Because each R-brick has four port connectors to connect to C-bricks, the ratio of C-bricks to R-bricks in a fully-populated configuration is 4 to 1.

Note: Each R-brick, which comes bundled with the SGI Origin 3400 and 3800 servers, requires 2U of rack space.

The following three types of routers are available as R-bricks in the SGI Origin 3000 servers:

- The 6-port router comes only on the SGI Origin 3400 server and supports up to a maximum of 8 C-bricks.

- The 8-port router comes standard on the SGI Origin 3800 server and supports up to 32 C-bricks.
- The metarouter is used in the SGI Origin 3800 sever only to expand beyond 128 and up to 512 processors. This router connects only to other 8-port routers; it does not connect to C-bricks.

This chapter discusses the R-brick as a router used in the NUMA3 interconnect fabric.

Internal Components and Front Panel Items

The following are the R-brick's internal components and front panel items (Figure 9-1 shows the R-brick's front panel items):

Internal components:

- **Router printed circuit board (PCB) with port connectors.**
- **Power board.**

Front panel items:

- **L1 controller and display.** L1 controller generates R-brick status and error messages that appear on the liquid crystal display (LCD).
- **On/Off switch with LED.** Turns on the R-brick internal components.
- **L1 controller LEDs and switches:**
 - **On/Off switch LED.** Lights green when the R-brick internal components are on and turns off when they are off.
 - **Service required LED.** Lights 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.** Lights red to indicate that a system failure has occurred and the R-brick system is down.
- **Fans.**

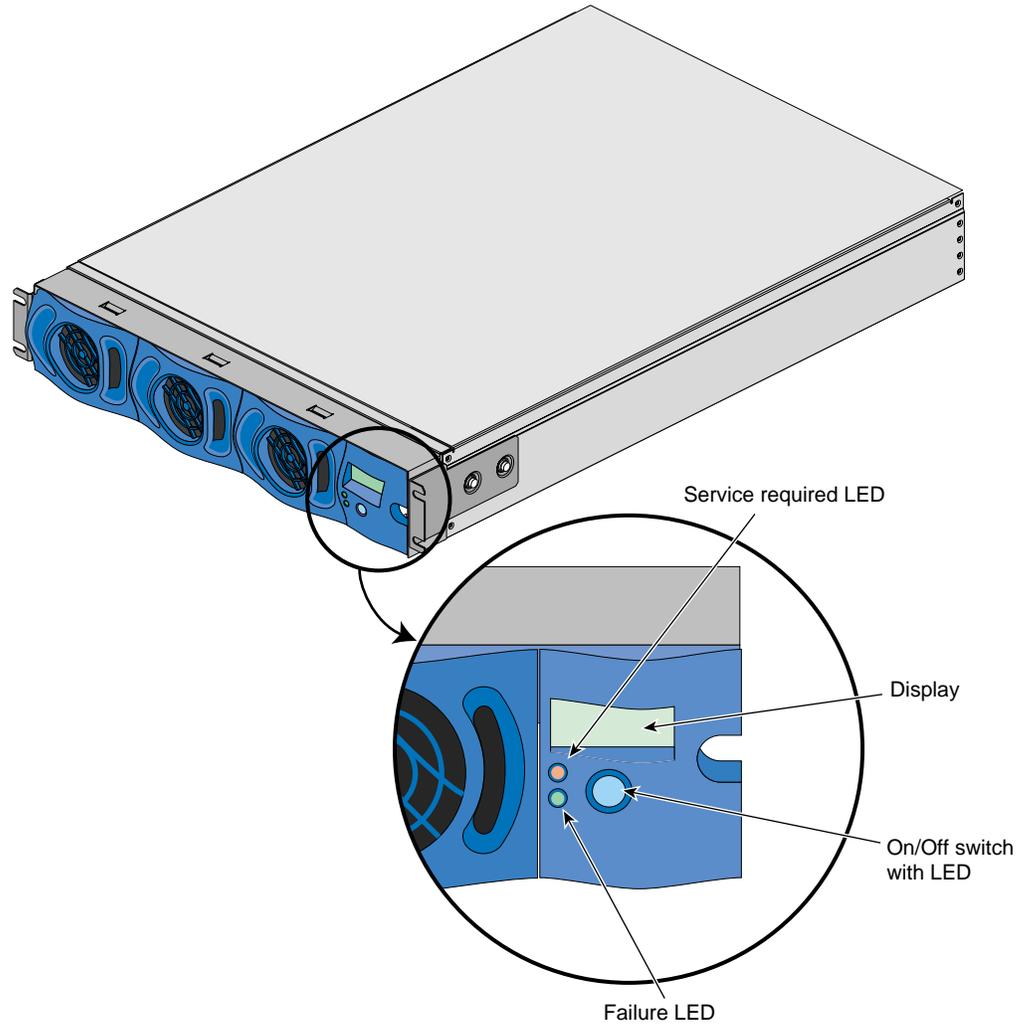


Figure 9-1 R-brick Front View

L1 Controller

The L1 controller monitors and controls the environment of the R-brick, specifically, its operating temperature, voltage margins, and system LEDs. The L1 controller also reads component information from serial ID EEPROMs, and interfaces with its own 2-line x 12-character liquid crystal display (LCD).

The R-brick's L1 controller also connects to the L2 controller. For general information about the L1 controller, see Chapter 3, "System Control."

Fans

The front of the R-brick houses two cooling fans. However, only the middle and rightmost fans cool components. The leftmost component serves as a spare in case one of the other fans needs to be replaced by your SGI system support engineer (SSE).

The R-brick fans are smaller than other brick fans and run at a single speed.

Warning: To avoid personal injury and to avoid damage to your system, these R-brick fans, which are N+1 redundant, can be hot-swapped only by your SGI system support engineer (SSE).

Switch, Connectors, and LEDs on R-brick Rear Panel

Figure 9-2 shows the location of the power-on switch, connectors, and LEDs on the R-brick rear panel.

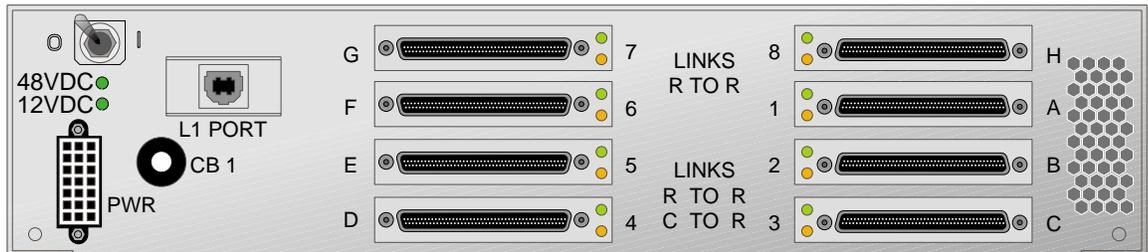


Figure 9-2 R-brick Rear Panel.

The R-brick has the following rear panel items:

- **PWR (power) connector.** Connects to the power bay to provide power to the R-brick.
- **Power switch.** Moving the power switch to the 1 position powers on the R-brick, and moving it to the 0 position powers off the R-brick. Moving the power switch to the 1 position turns on the L1 controller. Pressing the On/Off switch (brick reset button) turns on the rest of the R-brick internal components.
- **48 VDC and 12 VDC LEDs.** The power switch must be in the ON (I) position for these LEDs to be on. The 12 VDC lights when the L1 controller is operating, and the 48 VDC lights when the rest of the C-brick internal components are on.
- **CB1 circuit breaker (PUSH, 2.5, RE-CIRK-IT).** Pressing this button resets your system.
- **L1 port connector.** This universal serial bus (USB) connector connects the R-brick's L1 controller to a system console. The L1 port connector can also connect to the L2 controller on the rack enclosure. Therefore, it is not necessary for an R-brick to distribute USB signals to other R-bricks. R-brick-to-R-brick network connections are normally made through the four port connectors that do not carry USB signals; however, they are not restricted to these four ports.

The USB hub receives the USB signals from the L2 controller via the USB port, labeled **L1 Port** on the R-brick panel, and distributes these USB signals to the L1 controllers of the attached C-bricks.

- **Links R TO R (1, 6, 7, and 8 or A, F, G, and H).** These link connectors connect the R-brick to other R-bricks in the server system.

- **Link connector LEDs.** All the link connectors (1 through 8) have two LEDs (one that lights green and another that lights yellow):
 - The green LED (the hardware LED) lights to indicate that a cable is connected properly between the R-brick and another brick.
 - The yellow LED (the software LED) lights to indicate that packets are being transferred successfully across the link.
- **Links R TO R and C TO R** (2, 3, 4, and 5 or B, C, D, and E). These link connectors connect the R-brick to C-bricks.

Note: Links 2, 3, 4, and 5 are also used in the metarouter to connect other routers in server configurations greater than 128 processors.

Besides link signals, links 2, 3, 4, and 5 carry system controller USB signals, which are distributed over the network cables. Since the C-bricks require USB signals, the C-bricks are cabled only to ports 2, 3, 4, and 5.

If the SGI Origin 3400 server system has more than four C-bricks, C-bricks are cabled to a second R-brick as shown in Figure 9-3. These C-bricks communicate with the first four C-bricks through a connection between the R-bricks. R-brick to R-brick links use ports 1, 6, 7, and 8 located on the top half of the R-brick panel and labeled LINKS R TO R.

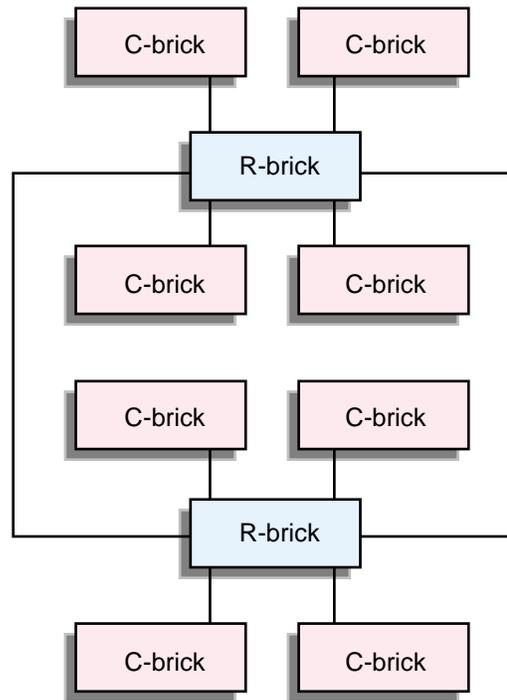


Figure 9-3 R-brick Connections

In the case of a server configuration greater than 128 processors, the metarouters would use links 1, 6, 7, and 8 in addition to Links 2, 3, 4, and 5, which are normally used to connect directly to C-bricks.

The following are the LEDs on the L1 controller of the R-brick front panel:

- **On/Off switch LED.** Lights green when the internal components are turned on, and turns off when they are off.
- **Service required LED.** Lights 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.** Lights red to indicate that a system failure has occurred and the R-brick system is down.

The following are the LEDs on the R-brick rear panel:

- **48 VDC and 12 VDC LEDs.** The power switch must be in the ON (I) position for these LEDs to be on. The 12 VDC lights when the L1 controller is operating, and the 48 VDC lights when the rest of the C-brick internal components are on.
- **Link connector LEDs.** All the link connectors (1 through 8) have two LEDs (one that lights green and another that lights yellow):
 - The green LED (the hardware LED) lights to indicate that a cable is connected properly between the R-brick and another brick.
 - The yellow LED (the software LED) lights to indicate that packets are being transferred successfully across the link.

System Power

The following sections in this chapter describe the function and physical components that make up the power system for the SGI Origin 3000 series of server products:

- “Overview of the Power System” on page 195
- “Power Bay Front Panel, Internal Components, and Functional Description” on page 199
- “Power Bay Rear Panel Connectors and Fault Reset Switch” on page 203
- “Power Distribution Units (PDUs)” on page 204
- “Cabling” on page 205

Overview of the Power System

This section describes the power devices on a tall rack and a short rack for an SGI Origin 3000 server series.

Tall Rack Power Devices

The power devices on a tall rack for the SGI Origin 3000 server series shown in Figure 10-1 illustrate the following items:

- **Power bay(s).** Each power bay can contain up to six 950 W hot-swappable power supplies that are inserted into and interconnected with the power bay through an internal power management card. The power bay has the following connectors on its rear panel:
 - Six input power connectors (one per power supply) that connect each power supply that corresponds to the individual power connector to a power receptacle through the power distribution units (PDUs).

- Eight output connectors to connect to an individual brick's PWR (power) connector and provide power to the brick. These output connectors also connect to the L2 controller's power connector to provide power to the L2 controller.
- Fault Reset Switch that is used to reset the power bay.

Note: The D-brick has two power supplies of its own. Because these power supplies require 220 VAC, they bypass the power bays, which only provide 48 VDC, and connect directly to a 220 VAC power receptacle through a PDS.



Warning: To avoid personal injury and damage to the server system, only a qualified SGI system support engineer (SSE) can add, remove, replace, or service the power bays and power supplies. Contact your service provider for assistance.

- **One PDU per power bay** in the rack to a maximum of two PDUs. If you have two PDUs, they are located one above the other. The PDUs are located on the left side of the rack as you face the rear of the rack. The PDUs connect directly to a wall power source. The PDUs in turn have connectors that connect to the power bay's six input power connectors.
- **Cabling** to interconnect the PDUs to the input power connectors on the power bay, and cabling to connect the individual bricks to the output connectors on the power bay.

Short Rack Power Devices

The power devices on a short rack for the SGI Origin 3000 server series has the following items:

- **Power bay(s).** Each power bay can contain up to six 950 W hot-swappable power supplies that are inserted into and interconnected with the power bay through an internal power management card. The power bay has the following connectors on its rear panel:
 - Six input power connectors (one per power supply) that connect each power supply that corresponds to the individual power connector to a wall power source through the power distribution strips (PDSs).

- Eight output connectors to connect to an individual brick's PWR (power) connector and provide power to the brick. These output connectors also connect to the L2 controller's power connector to provide power to the L2 controller. The L2 controller is optional on a short rack.
- Fault Reset Switch that is used to reset the power bay.



Warning: To avoid personal injury and damage to the server system, only a qualified SGI system support engineer (SSE) can add, remove, replace, or service the power bays and power supplies. Contact your service provider for assistance.

- **One power distribution strip (PDS).** The top six outlet connectors connect to the power bay's six input power connectors. The PDS's bottom-most connector connects to the wall power source.
- **Cabling** to interconnect the PDS to the input power connectors on the power bay, and cabling to connect the individual bricks to the output connectors on the power bay.

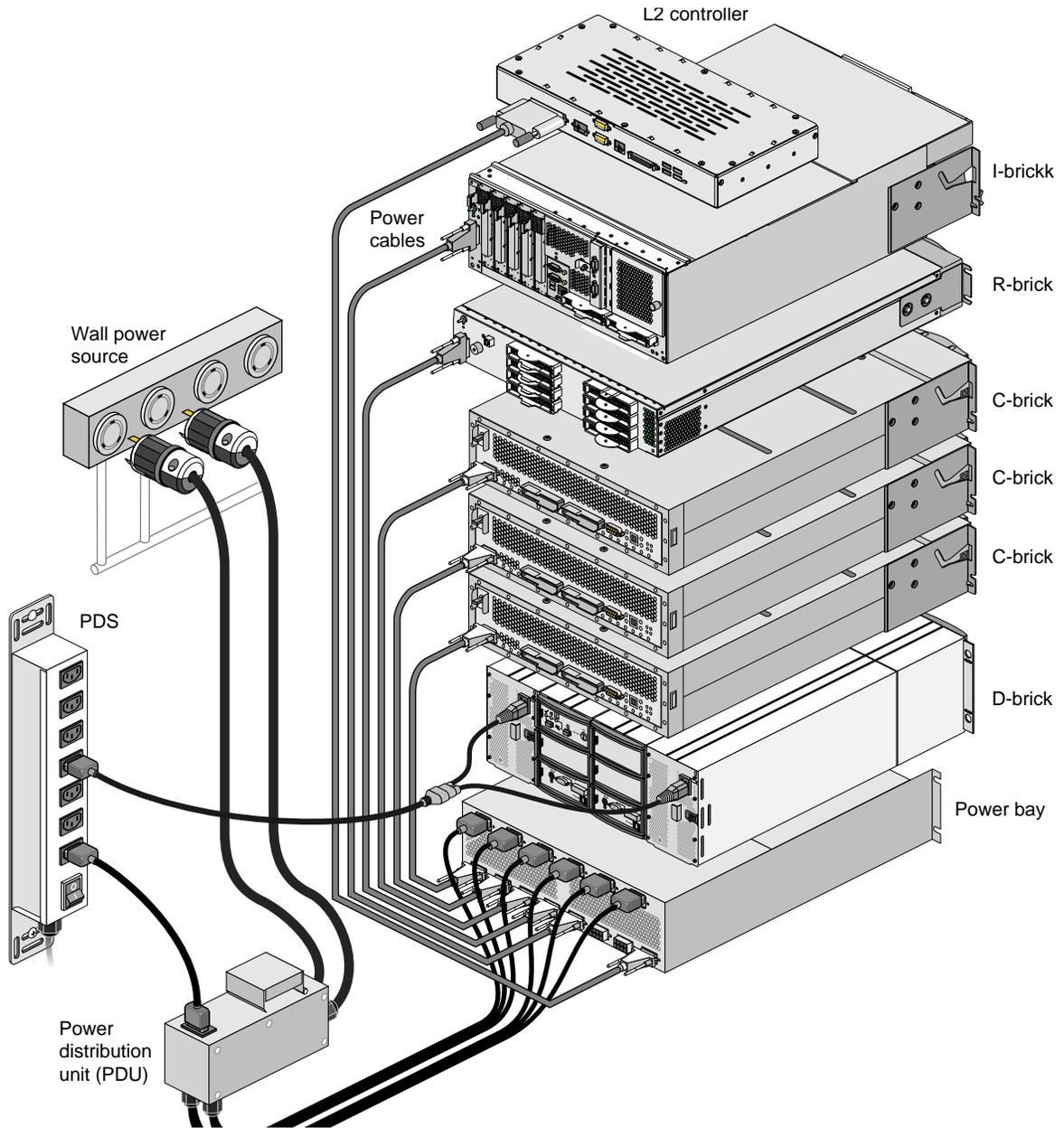


Figure 10-1 SGI Origin 3000 Series Power System

Power Bay Front Panel, Internal Components, and Functional Description

The short rack is shipped with one power bay; the tall rack is shipped with either one or two power bays, depending on the configuration.

Each power bay monitors, controls, and supplies AC power to as many as six hot-swappable power supplies that can be inserted into the power bays. When inserted into the power bay, these power supplies make up the power bay's front panel. Figure 10-2 shows six power supplies installed in the power bay and their numbering.

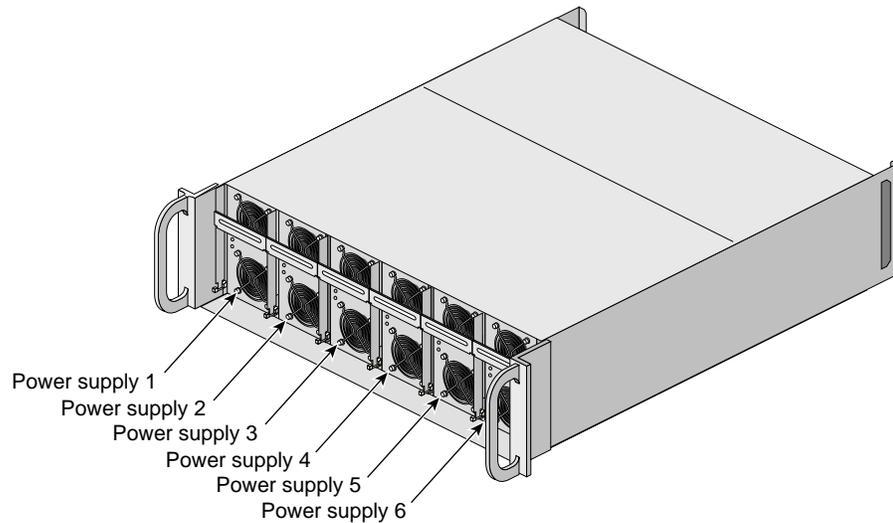


Figure 10-2 Power Bay Front Panel

Figure 10-3 shows front and rear views of one of the power supplies that are installed in the power bay:

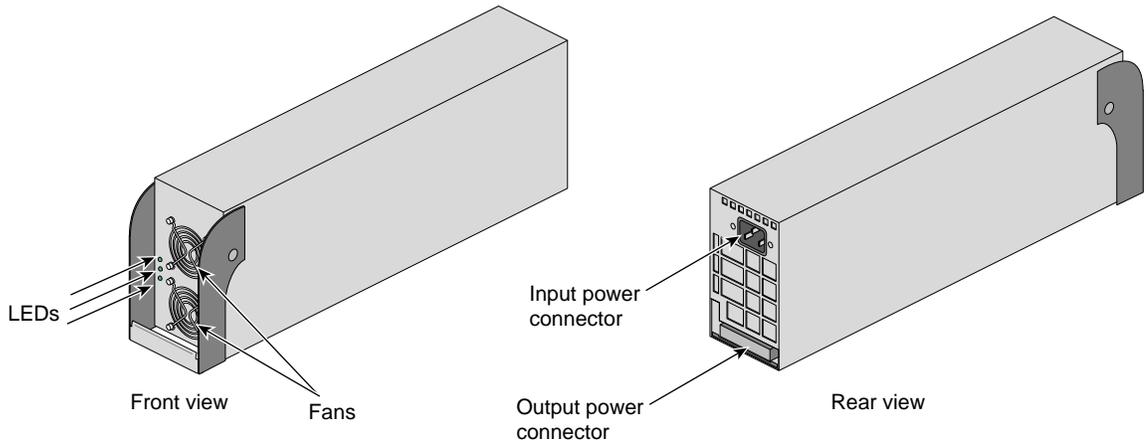


Figure 10-3 Front and Rear Views of Power Supply

The input and output power connectors shown in the rear view of the power supply interconnect with the power bay through a power management board located inside the power bay.

The LEDs and fans shown on the front view of the power supply become the LEDs and fans of the power bay's front panel.

Power Management Card

The power bay's power management card connects the power supplies to the connectors at the rear of the power bay enclosure. The power management card also contains a serial ID EEPROM that indicates the model and serial number of the unit and other information about the unit's capabilities and configuration. The L1 controller of a connecting brick reads this information via a serial bus (RS-422), which is part of the DC power cable.

Power Supply LEDs

Each power supply has three LEDs:

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

Table 10-1 lists conditions of the power supplies and the corresponding states of the LEDs.

Table 10-1 Power Supply LED States

Condition	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

Power Supply Fans and Airflow

Each power supply has two fans that move air from the front of the rack to the rear of the rack (see Figure 10-3). Blanking panels cover unoccupied spaces in the bay and must be present for correct airflow.

Power Supply Configuration

Each power bay contains between two and six distributed power supplies. The power bay supplies AC voltage to these power supplies and also monitors and controls the power supplies.

Each distributed power supply inputs the single-phase AC power and outputs 950 W at 48 VDC. The outputs are bussed together to provide a maximum of 4,750 W of available power in an N+1 redundant configuration, which means you have one additional 950 W power supply for reserve. This additional 950 W reserve power supply means that if you lose any one power supply, you still have enough power to power your system.

The number of power supplies in a power bay depends on the electrical requirements of the bricks in the rack. A minimum of two power supplies must be present per system at all times to provide standby 48 V power. A minimum of two supplies must be present to provide the N+1 redundant configuration. For example, a system with four C-bricks (which require a total of approximately 1828 W) and one R-brick (which requires approximately 50 W) would require four power supplies (three power supplies plus one redundant power supply, which together produce 3800 W).

VRM and DC-to-DC Converter Interactions with Power Bay

The voltage regulator modules (VRMs) and DC-to-DC converters in each brick receive 48 VDC from the power bay and convert it to the voltage levels required by the brick components.

When the power bay receives power from the PDU or PDS and the 12 V enable for the brick is on, the power bay powers on the L1 controller by supplying a 12 V standby voltage to the brick. The L1 controller signals the power bay to supply the 48 VDC to its brick if the brick is enabled.

You can enable a brick by pressing the On/Off switch (brick reset button), located below the L1 display, or by entering a console command. The power bay does not supply the 48 VDC to the brick until the L1 controller signals it to do so.

When the brick receives the 48 VDC, the L1 controller controls the application of the 48 VDC to the VRMs and DC-to-DC converters within the brick. The VRMs and DC-to-DC converters convert the 48 VDC to the voltage levels required by the brick components.

Power Bay Rear Panel Connectors and Fault Reset Switch

Besides the power supplies and the power management card, the power bay contains the following input and output connectors as shown in Figure 10-4:

- **Six input power connectors.** These six input power connectors (one per corresponding power supply) connect the individual power supply to a power receptacle through the power distribution units (PDUs) or power distribution strips (PDSs). (Each power supply in the power bay gives power to each of the power bay's eight output connectors.)
- **Eight output connectors.** A power cord connects an output connector to a brick. This connection provides 48 VDC and 12 V standby voltage and monitoring signals to the brick. These output connectors also connect to the L2 controller. (If you have two power bays in your rack, the L2 controller connector connects to a connector on the power bay located lowermost on your rack.)
- **Fault Reset Switch.** Use this switch to reset the power bay.

Note: The D-brick has two power supplies of its own. Because these power supplies need 220 VAC, they bypass the power bay, which provides 48 VDC, and connect directly to a PDS outlet connector.

Note: The L1 controller of a connecting brick can monitor the status of the power bay; however, it cannot control the power bay.

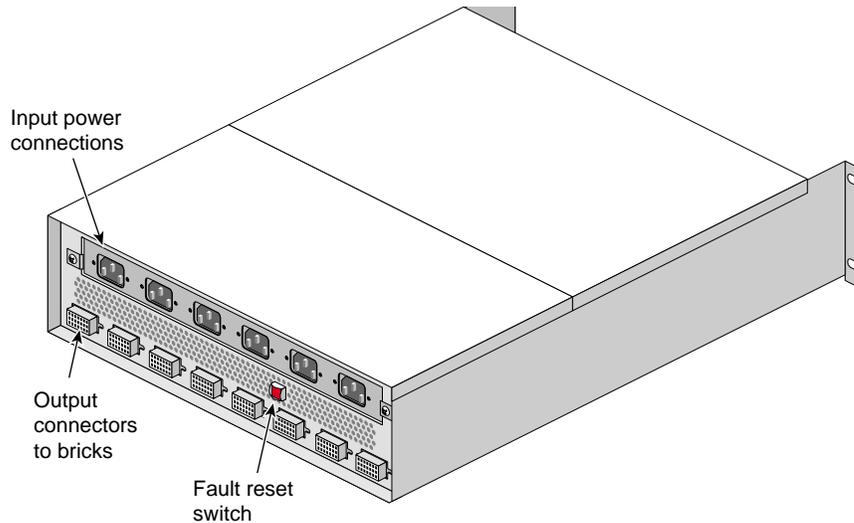


Figure 10-4 Rear View of Power Bay

Power Distribution Units (PDUs)

Each tall rack enclosure is shipped with one PDU for each power bay in the rack to a maximum of two PDUs per rack. Table 10-2 describes these PDUs.

Table 10-2 Power Distribution Units

Phase Type	Voltage	Country Standard	Number of Wall Outlet Connectors	Number of Connectors to Bricks
Single-phase	200-240 VAC	U.S./Canada	2 per PDU	2 connectors: each can have a 3-headed hydra cable.
Three-phase	200-240 VAC	U.S./Canada	1 per PDU	2 connectors: each can have a 6-headed hydra cable.

Table 10-2 (continued) Power Distribution Units

Phase Type	Voltage	Country Standard	Number of Wall Outlet Connectors	Number of Connectors to Bricks
Single-phase	200-240 VAC	International	2 per PDU	2 connectors: each can have a 3-headed hydra cable.
Three-phase	400 VAC	International	1 per PDU	2 connectors: each can have a 6-headed hydra cable.

Power Distribution Strips (PDSs)

Each short rack enclosure is shipped with a single PDS. Table 10-3 describes these PDSs.:

Table 10-3 Power Distribution Strips

Voltage	Country Standard	Number of Wall Outlet Connectors	Number of Connectors to Bricks
200-240 VAC	U.S./Canada/International	1 per PDS	6 connectors

Cabling

You need the following cables to enable the SGI Origin 3000 servers' power system:



Warning: To avoid personal injury or damage to your system, all cabling is done by an SGI system support engineer (SSE).

- Cables that connect the PDU to the input connectors on the power bay. One cable is needed for each of the six input connectors that has a power supply inserted in the location that corresponds to the position of the connector.
- Cables to connect the eight output connectors on the power bay to the PWR (power) connectors on the individual bricks.
- A cable to connect the L2 controller power connector to one of the eight output connectors on the power bay.

- A Y cable to connect the two power bays that reside in the D-brick to a PDS outlet connector (220 VAC).

Note: If you have two power bays, the L2 controller should be connected to an output connector in the power bay located in the lower position on the rack enclosure.

Maintenance and Troubleshooting

This chapter contains hardware-specific information that helps you maintain and troubleshoot your SGI Origin 3000 server.

This chapter consists of these sections:

- “Performing Maintenance” on page 207
- “Adding or Replacing Disk Drive Modules” on page 208
- “Adding or Replacing a PCI Card” on page 208

Performing Maintenance

Although you can perform the following maintenance activities, a qualified SGI system support engineer (SSE) can also perform the following maintenance tasks on an SGI Origin 3000 server for you:

- Adding, replacing, or removing PCI cards into or out of the I-brick and P-brick.
- Adding, replacing, or removing disk drives into or out of the D-brick.

The PCI cards and disk drives are hot-pluggable, meaning that although you do not have to power down the individual brick involved, you do have to power down the slot where you are to add, replace, or remove the PCI card or disk drive.



Warning: To avoid personal injury or damage to your system, only an SGI system support engineer (SSE) can add or replace a fibre channel disk drive, fans, and a DVD/CD-ROM in the I-brick. Also, only an SGI SSE can add or replace an XIO board in the X-brick and a power supply in the power bay.

A trained SGI SSE must power down individual bricks for most maintenance activities; however, the server can remain powered on. The following are some examples of the maintenance an SSE can perform without powering down the server:

- The IRIX operating system allows an SSE to remove (partition) a C-brick from the system, power it off, perform the maintenance activity, power it on, and configure it back into the system. All of these activities can occur while the operating system is running.
- An SGI SSE can replace a power supply in the power bay without powering down the system.

The following are some examples where the maintenance can be performed without powering down the individual brick involved:

- An SGI SSE can replace fans and the DVD/CD-ROM on the I-brick without powering down the I-brick.
- An SGI SSE can add, replace, or remove an XIO card in the X-brick without powering down the X-brick.
- You or an SGI SSE can add, replace, or remove a PCI card without powering down the I-brick or P-brick (the individual slot will have to be powered down, however).
- You or an SGI SSE can add, replace, or remove a disk drive module without powering down the D-brick (the individual slot will have to be powered down, however).

Adding or Replacing Disk Drive Modules

See “Adding and Replacing Disk Drive Modules” on page 168 for instructions on adding, replacing, or removing disk drive modules in the D-brick.

See the troubleshooting section in Chapter 8, “D-brick” for instructions on troubleshooting the D-brick

Adding or Replacing a PCI Card

See “PCI Card Description and Installation” on page 136 for instructions on adding, replacing, or removing a PCI card.

Technical Specifications

This appendix lists technical specifications of the SGI Origin 3000 server in these sections:

- “System-Level Specifications” on page 209
- “Brick-Level Specifications” on page 211
- “Power Specifications” on page 211

System-Level Specifications

Table A-1 summarizes system configuration ranges.

Table A-1 System Configuration Ranges

Category	Minimum	Maximum
Processors	2	512
Peak performance	~1600 Mflops (one 2P node brick)	~410 Gflops (128 4P node bricks)
C-brick memory capacity	512 MB	8 GB
System main memory capacity	512 MB (one node brick)	1 Tbyte (128 node bricks)
I/O channels	1	128
Aggregated peak I/O bandwidth	0.768 GB/sec (one I-brick)	~ 152 GB/sec (one I-brick and 63 P-bricks)

Table A-2 gives physical specifications for the short rack.

Table A-2 Short Rack Physical Specifications

Characteristic	Specification
Height	36 in. (914.40 mm)
Width	26 in. (609.60 mm)
Depth	41 in. (914.40 mm)
Weight (maximum)	600 lbs (225.00 kg)
Shipping weight (maximum)	675 lbs (270.00 kg)

Table A-3 lists the physical specifications of the tall rack.

Table A-3 Tall Rack Physical Specifications

Characteristic	Specification
Height	74.25 in. (1,880 mm)
Width	32.00 in. (813 mm)
Depth	50.00 in. (1,168 mm)
Weight (maximum)	1,600 lbs (726 kg)
Shipping weight (maximum)	1,800 lbs (816 kg)

Brick-Level Specifications

Table A-4 gives physical specifications for all bricks.

Table A-4 Brick Physical Specifications

Brick or Bay	Height	Height	Maximum Weight
C-brick	3U	5.25 in. (133.35 mm)	65.0 lb (20.25 kg)
I-brick	4U	6.64 7.0 in. (177.80 mm)	69 lb 70 lb (31.50 kg)
P-brick	4U	6.64 7.0 in. (177.80 mm)	70 lb (31.50 kg)
X-brick	4U	7.0 in. (177.80 mm)	60 lb (27.00 kg)
D-brick	4U	171 mm (6.95 in.)	94.3 lb (43 kg)
R-brick	2U	3.35 3.3 in. (83.82 mm)	18 lb 20 lb (9 kg)
L2 controller	1U		
Power bay	3U	Height 5.1 in. (129.54 mm) Bay: 5.01 H ¥ 17.5 W ¥ 24.5 D	32.40 kg (72 lb) fully loaded with 6 power supplies
Power supply	3U	Height 5 in. (127.00 mm)	7.5 lb (3.38 kg)

Power Specifications

Table A-5 shows the power requirements of individual bricks.

Table A-5 Brick Power Consumption

Brick	Power Consumption	Input Power
C-brick with 2 processors		
C-brick with 4 processors	467 W	+48 VDC
I-brick	414 W	+48 VDC (~375 W with 3.3 VDC PCI cards)
P-brick	518 W	+48 VDC (~568 W with 3.3 VDC PC cards)

Table A-5 (continued) Brick Power Consumption

Brick	Power Consumption	Input Power
X-brick	356 W	
D-brick		
R-brick	80 W	+48 VDC
L2 controller	12 W	48 VDC
Power supply ^a	950 W	

a. Power supply efficiency needs to be taken into consideration if calculating total AC power input.

The following sections provide more details about the I-brick, P-brick, R-brick, and X-brick.

I-brick:

- Supports a DVD/CD-ROM
- Supports five 3.3/Universal VDC PCI cards (3 PCI cards @ 33 MHz and 2 PCI cards @ 66 MHz)
- Supports two 3.5-in. sled-mounted fibre channel disk drives
- FC disk controller uses one of the PCI slots
- One 12 VDC, 10 A voltage regulator module (VRM1)
- One 5 VDC, 25 A voltage regulator module (VRM2)
- Two 3.3 VDC, 30 A voltage regulator module (VRM3 and VRM4)
- One 2.5 V, 30 A voltage regulator module (VRM7)
- One 12.0 VDC, 4.17 A DC-to-DC converter
- One 3.3 VDC voltage regulator
- Two 5 VDC voltage regulators

P-brick:

- Supports twelve 3.3/Universal volt PCI cards
- One 12 VDC, 10 A voltage regulator module (VRM1)

- One 5 VDC, 25 A voltage regulator module (VRM2)
- Four 3.3 VDC, 30 A voltage regulator module (VRM3 through VRM6)
- One 2.5 VDC, 30 A voltage regulator module (VRM7)
- One 12 VDC, 4.17 A DC-to-DC converter

The P-brick power board supplies an average of 17.5 W (5.3 A, 3.3 V) of power to each PCI slot; however, a PCI card may consume up to 25 W of power. The L1 controller controls how the power board applies power to the PCI cards. The power board applies power to the PCI cards starting with the lowest numbered slot. It continues to apply power to the PCI slots until all of the power has been consumed. The L1 controller uses two presense pins in each PCI slot to total the power consumption of the PCI cards. The L1 controller prints a message to the console if there is not enough power for all of the PCI cards.

X-brick:

The power board contains the logic components of the X-brick's L1 controller, five VRMs, one DC-to-DC converter, and three voltage regulators. The VRMs, DC-to-DC converter, and voltage regulators convert the incoming 48 VDC to voltage levels required by the components in the brick.

- One 12 VDC, 10 A voltage regulator module (VRM1)
- One 5 VDC, 25 A voltage regulator module (VRM2)
- Two 3.3 VDC, 30 A voltage regulator module (VRM3 and VRM4)
- One 2.5 V, 30 A voltage regulator module (VRM7)
- One 12.0 VDC, 4.17 A DC-to-DC converter
- One 3.3 VDC voltage regulator
- Two 5 VDC voltage regulators

R-brick:

- One USB port (connects to L2 controller)
- Eight NUMAlink I/O connectors (located in rear)
- Input power is +48 VDC (~70 W)

Table A-6 shows power supply electrical data

Table A-6 Power Bay, Power Supply Specifications

Feature	Value
Power bay supplies	4.4 kW continuous power (if all 6 supplies are being used)
Maximum output rating per power supply	950 W
Output connection	Eight 48 VDC
Cable	AC input (200-230 VAC 1P 20 A each cord)

System Controller Commands

This appendix lists L1 and L2 commands for the SGI Origin 3000 servers in these sections:

- “L1 Controller Command Set” on page 215
- “L2 Controller Command Set” on page 256

A stand-alone PC or a laptop computer may connect to the system controller network. If you use one of these computers, you may issue L1 and L2 system controller commands that read status from the controllers or set variables that the controllers use.

L1 Controller Command Set

The following subsections describe the L1 controller command set. The commands are listed alphabetically and include examples of output where applicable.

*

Use the asterisk character (*) to broadcast a command. A command that is broadcast is sent to all of the bricks that are attached to the C-brick that issued the command. The broadcast option is valid only for the C-brick. Example B-1 shows sample output from the * version command.

Example B-1 * version Command Output

```
001c07-L1>* version
001c07:
L1 0.7.27 (Image A), Built 04/28/2000 13:06:43 [P1 support]
001i21:
L1 0.8.xx (Image B), Built 06/13/2000 09:54:32 [P1 support]
```

bedrock

The bedrock set of commands either provide the status of the L1 controller-to-hub-ASIC protocol setting or set the L1 controller-to-hub-ASIC protocol setting. There are three commands in the bedrock command set:

- bedrock
- bedrock raw
- bedrock ppp

In the bedrock command set, the mnemonic `bdrck` may be used instead of the word `bedrock`. The bedrock command set is valid only for the C-brick.

Use the `bedrock` command to determine the current settings for the L1-controller-to-hub-ASIC protocol. Example B-2 shows sample output from the `bedrock` command and Table B-1 lists the valid protocols. (Use the `l1dbg` set of commands to turn debugging on or off.)

Example B-2 bedrock Command Output

```
001c003-L1>bedrock
bedrock protocol is PPP
```

Table B-1 Valid Protocols

Name	Description
RAW	Raw protocol
PPP	Point-to-point protocol

Use the `bedrock raw` command to set the L1-controller-to-hub protocol to RAW. Use the `bedrock ppp` command to set the L1-controller-to-hub protocol to PPP. Example B-3 shows sample output from the `bedrock ppp` command.

Example B-3 bedrock ppp Command Output

```
001c003-L1>bedrock ppp
bedrock protocol is PPP
```

brick

The brick set of commands provides the status of the brick location and type or sets the brick location and type. There are seven commands in the brick command set:

- brick
- brick type <bricktype>
- brick ptype <brickptype>
- brick rack <racknumber>
- brick slot <slotnumber>
- brick partition none
- brick partition <partition>

In the brick command set, the mnemonics `upos` and `part` may be used instead of the words `slot` and `partition`.

Use the `brick` command to determine the brick location and type. Example B-4 shows sample output from the `brick` command and Table B-2 lists the valid brick types.

Example B-4 brick Command Output

```
001c07-L1>brick
rack: 001 slot: 07 partition:0type: C source: EEPROM
```

Table B-2 Valid Brick Types

Type	Description
C	C-brick
I	I-brick
P	P-brick
R	R-brick
X	X-brick
?	Unknown brick type

Use the `brick type <bricktype>` command to set the brick type. In this command, the variable `<bricktype>` is the name of a valid brick type. Example B-5 shows sample output from the `brick type X` command.

Example B-5 `brick type X` Command Output

```
001c07-L1>brick type x
brick type changed (eeprom), reset the L1.
```

Use the `brick ptype <brickptype>` command to set the brick pseudo type. In this command, the variable `<brickptype>` is the name of a valid brick type (`b`, `c`, `i`, `p`, `r`, or `x`). Example B-6 shows sample output from the `brick ptype x` command. The `brick ptype <brickptype>` command is valid only for the L1 test boards.

Example B-6 `brick ptype x` Command Output

```
001c07-L1>brick ptype X
brick pseudo type changed (eeprom), reset the L1.
```

Use the `brick rack <racknumber>` command to set the brick rack number. In this command, the variable `<racknumber>` is the number of a valid rack. Example B-7 shows sample output from the `brick rack 01` command. This command is valid only for the L1 controller test boards.

Example B-7 `brick rack <racknumber>` Command Output

```
001c07-L1>brick rack 1
brick rack set to 001.
```

Use the `brick slot <slotnumber>` command to set the brick unit position (slot number) in the rack. In this command, the variable `<slotnumber>` is a unit number from 01 to 39. Example B-8 shows sample output from the `brick slot 03` command. For the `brick slot <slotnumber>` command, the mnemonic `upos` may replace the word `slot`.

Example B-8 `brick slot 7` Command Output

```
001c07-L1>brick slot 07
brick slot set to 07.
```

Use the `brick partition none` command to clear the brick partition number. Example B-9 shows sample output from the `brick partition none` command.

Example B-9 brick partition none Command Output

```
001c07-L1>brick partition none  
brick partition cleared.
```

Use the brick partition <partition> command to set the brick partition number. Example B-10 shows sample output from the brick partition <partition> command.

Example B-10 brick partition <partition> Command Output

```
001c07-L1>brick partition 255  
brick partition set to 255.
```

ctc <cmd>

Use the ctc <cmd> command to send a command to an attached C-brick. This command is valid only for a C-brick. Example B-11 shows sample output from the ctc version command.

Example B-11 ctc version Command Output

```
003c01-L1>ctc version  
002c01:  
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
```

ctci <cmd>

Use the ctci <cmd> command to send a command to an I/O brick (X-brick, P-brick, or I-brick) that connects to an attached C-brick. This command is valid only for a C-brick. Example B-12 shows sample output from the ctci version command.

Example B-12 ctci version Command Output

```
003c01-L1>ctci version  
001x01:  
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
```

cti <cmd>

Use the `cti <cmd>` command to send a command to an attached I/O brick. This command is only valid for the C-brick. Example B-13 shows sample output from the `cti version` command.

Example B-13 `cti version` Command Output

```
003c01-L1>cti version
004i01:
L1 0.7.37 (Image A), Built 05/24/2000 14:59:42 [P1 support]
```

config

Use the `config` command to view the L1 controller configuration information. Example B-14 shows sample output from the `config` command.

Example B-14 `config` Command Output

```
003c01-L1>config
:0 - 003c01
:1 - 004i01
:2 - 002c01
:3 - 001x01
003c01-L1>
```

In the output, the first number after the colon is the L1 index number. Table B-3 lists the values of the L1 index for a C-brick and an R-brick. Only L1 index number 0 is valid for an R-brick.

Table B-3 L1 Index Values for a C-brick and an R-brick

L1 Index	Name	Description
0	Local brick	The local brick is the C-brick or R-brick that contains the L1 issuing the command.
1	Attached I/O brick	The attached I/O brick is an I/O brick that connects to the local brick.

Table B-3 (continued) L1 Index Values for a C-brick and an R-brick

L1 Index	Name	Description
2	Attached C-brick	The attached I/O brick is a C-brick that connects to the local brick.
3	I/O brick attached to the attached C-brick	The I/O brick attached to the attached C-brick is an I/O brick that connects to a C-brick that connects to the local brick.

Table B-4 lists the values of the L1 index for an I/O brick.

Table B-4 L1 Index Values for an I/O brick

L1 Index	Name	Description
0	Local brick	The local brick is the I/O brick that contains the L1 issuing the command.
1	Attached C-brick on port A	The attached C-brick on port A is a C-brick that connects to the local brick through port A.
2	Attached C-brick on port B	The attached C-brick on port B is a C-brick that connects to the local brick through port B.

The number that follows the L1 index, after the dash, is the brick identification (for example, 003c01). The first three digits of the brick identification indicate the rack that the brick resides in. The fourth digit of the brick identification indicates the type of brick (refer to Table B-5). The last two digits of the brick identification indicate the slot position that the brick resides in.

Table B-5 Valid Brick Types

Type	Description
c	C-brick
i	I-brick
p	P-brick
r	R-brick

Table B-5 (continued) Valid Brick Types

Type	Description
x	X-brick
?	Unknown brick type

date

Use the date set of commands to view or set the current date and time used by the L1 controller. There are three commands in the date command set:

- date
- date set <value>
- date set tz <value>

Use the date command to view the current date and time value used by the L1 controller. Example B-15 shows sample output from the date command.

Example B-15 date Command Output

```
001r19-L1>date
09/14/4655 22:47:07
```

Use the date set <value> command to set the date and time value used by the L1 controller. In this command, the variable <value> is a time value in the form *yyyymmddHHMMSS* (where *yyyy* is the four-digit year, *mm* is a two-digit month, *dd* is a two-digit day, *HH* is a two-digit hour, *MM* is a two-digit minute, and *SS* is a two-digit second).

Use the date set tz <value> to set the time zone offset used by the L1 controller. In this command, the variable <value> is a maximum of +12 (for 12 hours ahead of GMT) and a minimum of -12 (for 12 hours behind GMT).

debug

The debug set of commands provides the status of the virtual debug switches or sets the virtual debug switches. There are two commands in the debug command set:

- debug
- debug <switches>

The debug command set is valid only for C-bricks.

Use the debug command to determine the current settings for the virtual debug switches. Example B-16 shows sample output from the debug command.

Example B-16 debug Command Output

```
001c07-L1>debug
debug switches set to 0x0000.
```

Use the debug <switches> command to set the virtual debug switches. In this command, the variable <switches> is a hexadecimal value for the switches. Example B-17 shows sample output from the debug <switches> command.

Example B-17 debug <switches> Command Output

```
001c07-L1>debug 0x0001
debug switches set to 0x0001
```

display

The display set of commands display text on the front panel display and control the LEDs on the front panel display. There are five commands in the display command set:

- display
- display <line> <text>
- display power <on|off>
- display attention <on|off>
- and display failure <on|off>

Use the display command to view the font-panel display status. Example B-18 shows sample output from the display command.

Example B-18 display Command Output

```
001c07-L1>display  
line 2: C
```

Use the `display <line> <text>` command to display text on a line of the L1 controller display. The length of the variable `<text>` must be 12 characters or less. Example B-19 and Figure B-1 show sample output from the `display 1 Football` command.

Note: For these commands, the mnemonic `dsp` may replace the word `display`.

Example B-19 display 1 Football Command Output

```
001c07-L1>display 1 Football
```



Figure B-1 display 1 <text> Front-panel Display Output

Use the `display power <on|off>` command to turn the power LED on or off. Use the `display attention <on|off>` command to turn the attention LED on or off. Use the `display failure <on|off>` command to turn the failure LED on or off.

EEPROM

Use the `EEPROM` command to view the EEPROM data for a brick. Example B-20 shows sample output from the `EEPROM` command.

Example B-20 eeprom Command Output

```
001c07-L1>eeprom
PWR/LOG (UNKNOWN)
43 20 01 06 00 00 00 d9 00 02 17 c2 4e 41 c2 4e
41 c1 00 00 00 00 00 84 ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
00 09 00 3a 52 21 c9 43 45 4c 45 53 54 49 43 41
c4 49 50 33 35 c6 4b 48 4b 35 36 35 cc 30 33 30
5f 31 36 30 34 5f 30 30 31 00 c2 5f 46 01 02 c2
30 30 04 ff ff ff ff 04 ff ff ff ff 04 ff ff ff
ff c1 00 00 00 00 25 ff ff ff ff ff ff ff ff
PIMM 0 - no hardware detected
PIMM 1 - no hardware detected
DIMM 0 (SPD)
80 08 07 0c 0a 02 48 00 04 a0 80 02 80 08 08 01
0e 04 04 01 02 26 00 00 00 00 00 50 3c 50 30 40
b0 b0 60 60 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 51
ce 00 00 00 00 00 00 00 01 4b 4d 4d 33 20 34 36
4c 33 33 31 33 42 20 54 2d 47 30 20 42 05 00 14
16 02 09 ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff 64 ff
DIMM 2 - no hardware detected
DIMM 4 - no hardware detected
DIMM 6 - no hardware detected
DIMM 1 (SPD)
80 08 07 0c 0a 02 48 00 04 a0 80 02 80 08 08 01
0e 04 04 01 02 26 00 00 00 00 00 50 3c 50 30 40
b0 b0 60 60 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 51
ce 00 00 00 00 00 00 00 01 4b 4d 4d 33 20 34 36
4c 33 33 31 33 42 20 54 2d 47 30 20 42 05 00 14
19 02 09 ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff 64 ff
DIMM 3 - no hardware detected
DIMM 5 - no hardware detected
DIMM 7 - no hardware detected
```

env

The env set of commands provides the status of environmental conditions in a brick or turn environmental monitoring on and off. There are five commands in the env command set:

- env
- env auto <on|off>
- env temp <on|off>
- env altitude <high|low>
- env reset

Use the env command to view the status of the voltage, fan speed, and internal temperature of a brick. The output of the env command is divided into four areas: the environmental monitoring and auto start status, the voltage status, the fan status, and the temperature status (see Example B-21).

Example B-21 env Command Output

001c07-L1>env

Environmental monitoring is disabled. Auto start at L1 boot is disabled.

Description	State	Warning Limits	Fault Limits	Current
DIMM	Enabled	10% 2.250/ 2.750	20% 2.000/ 3.000	2.509
2.5V	Enabled	10% 2.250/ 2.750	20% 2.000/ 3.000	2.522
1.5V	Enabled	10% 1.350/ 1.650	20% 1.200/ 1.800	1.509
3.3V aux	Enabled	10% 2.970/ 3.630	20% 2.640/ 3.960	3.337
3.3V L1	Enabled	10% 2.970/ 3.630	20% 2.640/ 3.960	3.302
5V aux	Enabled	10% 4.500/ 5.500	20% 4.000/ 6.000	4.992
12V bias	Enabled	10% 10.800/ 13.200	20% 9.600/ 14.400	12.188
PIMMO SRAM	Enabled	10% 2.970/ 3.630	20% 2.640/ 3.960	3.276
PIMMO CPU	Enabled	10% 1.710/ 2.090	20% 1.520/ 2.280	1.875
PIMMO 1.5V	Enabled	10% 1.350/ 1.650	20% 1.200/ 1.800	1.495
PIMMO 3.3V aux	Enabled	10% 2.970/ 3.630	20% 2.640/ 3.960	3.320
PIMMO 5V aux	Enabled	10% 4.500/ 5.500	20% 4.000/ 6.000	4.914
PIMMO 12V bias	Enabled	10% 10.800/ 13.200	20% 9.600/ 14.400	12.125
PIMM1 SRAM	Disabled	10% 2.970/ 3.630	20% 2.640/ 3.960	12.125
PIMM1 CPU	Disabled	10% 1.710/ 2.090	20% 1.520/ 2.280	12.125
PIMM1 1.5V	Disabled	10% 1.350/ 1.650	20% 1.200/ 1.800	12.125
PIMM1 3.3V aux	Disabled	10% 2.970/ 3.630	20% 2.640/ 3.960	12.125

PIMM1 5V aux	Disabled	10%	4.500/	5.500	20%	4.000/	6.000	12.125
PIMM1 12V bias	Disabled	10%	10.800/	13.200	20%	9.600/	14.400	12.125

Description	State	Warning RPM	Current RPM
FAN 0	Enabled	2160	2421
FAN 1	Enabled	2160	2421
FAN 2	Enabled	2160	2404

Description	State	Advisory Temp	Critical Temp	Fault Temp	Current Temp
TEMP 3	Enabled	30C/ 86F	35C/ 95F	40C/104F	26c/ 78F
TEMP 5	Disabled	30C/ 86F	35C/ 95F	40C/104F	0c/ 32F

The environmental monitoring and auto start status area has two statements. The first statement describes the current state of environmental monitoring. The environmental monitoring state is “disabled - initialization error.”, “disabled - configuration error.”, “disabled - start error.”, “disabled.”, “disabled - unknown error (0x00).”, or “running.” The second statement describes the current state of the auto start. The auto start state is “enabled” or “disabled.”

The voltage status contains five columns. The Description column provides the name of the supply voltage (2.5 V, 3.3 V, 5 V, etc.). The State column provides the current state of the supply voltage (Enabled, Fault, Warning, Waiting, or Disabled). The Warning Limits column provides the range of voltages that, when exceeded, causes a supply voltage to be in a Warning state. The Fault Limits column provides the range of voltages that, when exceeded, causes a supply voltage to be in a Fault state. The Current column provides the current value of the supply voltage.

The fan status contains four columns. The Description column provides the name of each fan. The State column provides the current state of the fan (Warning, Enabled, Waiting, or Disabled). The Warning RPM column provides the lowest revolutions-per-minute allowed before a fan enters a Warning state. The Current RPM column provides the current value of the revolutions-per-minute for the fan.

The temperature status contains six columns. The Description column provides the name of a temperature sensor. The State column provides the current state of the temperature sensor (Fault, Warning, Enabled, or Disabled). The Advisory Temp column provides the temperature that, when exceeded, causes a temperature advisory state. The Critical Temp column provides the temperature that, when exceeded, causes a critical temperature state. The Fault Temp column provides the temperature that, when

exceeded, causes the temperature sensor to be in a Fault state. The Current Temp column provides the current temperature reading from the temperature sensor.

Use the `env auto <on|off>` command to automatically enable or automatically disable environmental monitoring when the L1 controller boots. In this command, the variable `<on|off>` is on or off. The L1 controller stores the value of the automatic environmental monitoring variable in non-volatile random access memory (NVRAM). Example B-22 shows sample output from the `env auto on` command.

Example B-22 `env auto on` Command Output

```
001c07-L1>env auto on
001c07-L1>
```

Use the `env temp <on|off>` command to enable or disable temperature monitoring. In this command, the variable `<on|off>` is on or off. Example B-23 shows sample output from the `env temp on` command.

Example B-23 `env temp on` Command Output

```
001c07-L1>env temp on
001c07-L1>
```

Use the `env altitude <high|low>` command to enable high- or low-altitude setting for the environmental monitoring. In this command, the variable `<high|low>` is high or low. Example B-24 shows sample output from the `env altitude high` command.

Example B-24 `env altitude high` Command Output

```
001c07-L1>env altitude high
001c07-L1>
```

Use the `env reset` command to reset all current warnings and faults that are set. Example B-25 shows sample output from the `env reset` command.

Note: For this command, the mnemonic `rst` may replace the word `reset`.

Example B-25 `env reset` Command Output

```
001c07-L1>env reset
001c07-L1>
```

fan

The fan set of commands provides the status of the fan speed for a brick or sets the fan speed for a brick. There are five commands in the fan command set:

- fan
- fan <on|off>
- fan speed
- fan speed <level>
- fan speed <low|med|high>

Use the fan command to determine whether the fans are on or off and to read the fan speeds. In the fan command output, the number in parentheses is the counter reading for the fan. The counter reading is a value provided by the fan tachometer. The system controller converts the counter reading into a revolutions-per-minute value.

Example B-26 shows sample output from the fan command.

Example B-26 fan Command Output

```
001c07-L1>fan
fan(s) are on.
fan 0 rpm 2465 (339)
fan 1 rpm 2423 (352)
fan 2 rpm 2430 (349)
```

When the temperature of the brick is below 30 °C, the fans run at 2400 rpm. If a fan fails and the speed of the fan drops below 2100 rpm, the system controller increases the fan speed for the fans to 4400 rpm. If any two fans drop below 2100 rpm, the system controller shuts down the brick.

When the temperature of the brick is between 30 °C and 40 °C, the fans run at 3400 rpm. If a fan fails and the speed of the fan drops below 3100 rpm, the system controller shuts down the brick.

Use the fan <on|off> command to turn the fans on or off. In this command, the variable <on|off> is on or off. Example B-27 shows sample output from the fan on command.

Example B-27 fan on Command Output

```
001c07-L1>fan on
001c07-L1>
```

Use the fan speed command to determine the value of the speed setting for the fans. Example B-28 shows sample output from the fan speed command.

Example B-28 fan speed Command Output

```
001c07-L1>fan speed
fan(s) speed: 8.
```

Use the fan speed <level> command to set the speed value for the fans. In this command, the variable <level> is a number from 0 (off) to 31 (highest speed). Example B-29 shows sample output from the fan speed 5 command.

Example B-29 fan speed 5 Command Output

```
001c07-L1>fan speed 5
001c07-L1>
```

Use the fan speed <low | med | high> command to set the relative speed for the fans. In this command, the variable <low | med | high> is low, med (for medium), or high. Example B-30 shows sample output from the fan speed high command.

Example B-30 fan speed high Command Output

```
001c07-L1>fan speed high
001c07-L1>
```

flash

The flash set of commands provide status on the firmware images stored in flash memory and update the firmware images stored in flash memory. There are 12 commands in the flash command set:

- flash status
- flash default <a|b>
- flash default reset
- flash remove <a|b>
- flash serial <a|b>

- flash serial boot
- flash util erase all
- flash util erase <offset> <length>
- flash util program <offset> <stringdata>
- flash util test
- flash util test <passes>
- flash <ctc|cti|ctci|all|*>
- flash <ctc|cti|ctci|all|*> <a|b>

Use the `flash status` command to view the status of the two firmware images stored in flash memory. Example B-31 shows sample output from the `flash status` command. Each image has a checksum value that indicates whether an image is valid.

Example B-31 flash status Command Output

```
001c07-L1>flash status
Flash image A currently booted
```

Image	Status	Revision	Built
A	default	0.7.27	04/28/2000 13:06:43
B	valid	0.8.0	05/24/2000 10:50:23

Use the `flash default <a|b>` command to set firmware image a or firmware image b as the default image that the system controller uses when booting. In this command, the variable <a|b> is a or b. Use the `flash default reset` command to set the firmware image with the latest timestamp as the default image that the system controller uses when booting. If the selected firmware image is not valid, the flash default commands will return “cannot set default--image A (or B) is invalid!”

Use the `flash remove <a|b>` command to remove firmware image a or firmware image b from flash memory. In this command, the variable <a|b> is a or b. Example B-32 shows sample output from the `flash remove b` command.

Example B-32 flash remove b Command Output

```
001c003-L1>flash remove b
Do you really want to remove (invalidate) flash image b? [y/n]
```

Use the `flash serial <a|b>` command to load new code into firmware image a. In this command, the variable `<a|b>` is a or b. Use the `flash serial boot` command to load new code into the bootstrap image. Example B-33 shows sample output from the `flash serial boot` command.

Example B-33 `flash serial boot` Command Output

```
001c003-L1>flash serial boot
***** WARNING *****
This command updates the boot section of the Flash image.
If this update fails, the system controller WILL NOT BOOT
without reprogramming the flash via an in-circuit emulator
or debugger.

Do you really want to update the boot image? [y/n]
```

Use the `flash util erase all` command to erase contents of flash memory. Use the `flash util erase <offset> <length>` command to erase a specified amount of flash memory. In these commands, the variable `<offset>` is a location in flash memory and the variable `<length>` is the number of lines in flash memory.

Use the `flash util program <offset> <stringdata>` to program a line of flash memory. In these commands, the variable `<offset>` is a location in flash memory and the variable `<stringdata>` is program data.

Use the `flash util test` command to test the flash erase or flash program. Use the `flash util test <passes>` command to test the flash erase or flash program multiple times. In these commands, the variable `<passes>` is the number of times to run the test. Example B-34 shows sample output from the `flash util test` command.

Example B-34 `flash util test` Command Output

```
001c003-L1>flash util test
flash test passed.
```

Use the `flash <ctc|cti|ctci|all|*>` command to update the flash images in the attached bricks with the default local image. In this command, the variable `<ctc|cti|ctci|all|*>` is `ctc` (attached C brick), `cti` (attached I/O brick), `ctci` (attached C and I/O bricks), `all` (all attached bricks), or `*` (all attached bricks).

Use the `flash <ctc | cti | ctci | all | *> <a | b>` command to update the flash images in the attached bricks with firmware image a or firmware image b. In this command, the variable `<ctc | cti | ctci | all | *>` is `ctc` (attached C-brick), `cti` (attached I/O brick), `ctci` (attached C-brick and I/O brick), `all` (all attached bricks), or `*` (all attached bricks). In this command, the variable `<a | b>` is a or b.

help

The help set of commands provides helpful information on the system controller commands. There are two commands in the help command set:

- `help`
- `help <command>`

Use the `help` command to generate a list of all of the system controller commands. Use the `help <command>` command to display more information on a single command. In this command, the variable `<command>` is the name of a command.

history

Use the `history` command to create a list of commands that have been issued. In the `history` command output, the first number in the History length is the number of commands stored in the history array. The second number in the History length is the maximum number of commands that can be stored in the history array. Example B-35 shows sample output from the `history` command.

Example B-35 history Command Output

```
001c07-L1>history
History length: 3/20
2: fan speed 4
1: fan
0: env
```

l1

Use the `l1` command to engage the L1 controller command processor. Press Ctrl-D to disengage the command processor. Example B-36 shows sample output from the `l1` command.

Example B-36 L1 Command Output

```
001c003-L1>l1
L1 command processor engaged, <CTRL-D> to exit.
```

l1dbg

The l1dbg set of commands displays the state of communication debugging features or sets the state of communication debugging features. There are eight commands in the l1dbg command set:

- l1dbg
- l1dbg bedrock <on|off>
- l1dbg irtr <on|off>
- l1dbg env <on|off> l1dbg port <on|off>
- l1dbg i2c <on|off>
- l1dbg uart <on|off>
- l1margin <on|off>

Use the l1dbg command to display the state of the communication debugging features. Example B-37 shows sample output from the l1dbg command.

Example B-37 l1dbg Command Output

```
001c07-L1>l1dbg
L1 irouter debugging is off
L1 bedrock communication debugging is off
L1 environmental debugging is off
L1 port interrupt debugging is off
L1 i2c interrupt debugging is off
L1 voltage margin debugging is off
```

Use the l1dbg bedrock <on|off> command to turn on communication debugging for the L1 controller-to-bedrock-ASIC communication. In this command, the variable <on|off> is on or off. Example B-38 shows sample output from the l1dbg bedrock on command.

Example B-38 `l1dbg bedrock on` Command Output

```
001c07-L1>l1dbg bedrock on
L1 irouter debugging is off
L1 bedrock communication debugging is on
L1 environmental debugging is off
L1 port interrupt debugging is off
L1 i2c interrupt debugging is off
L1 voltage margin debugging is off
```

The remaining `l1dbg` commands function in the same manner as the `l1dbg bedrock <on|off>` command. Table B-6 lists the `l1dbg` commands and describes the debugging features each command controls.

Table B-6 `l1dbg` Commands

Command	Description
<code>l1dbg bedrock <on off></code>	Controls bedrock ASIC debugging
<code>l1dbg irtr <on off></code>	Controls irouter debugging
<code>l1dbg env <on off></code>	Controls environmental debugging
<code>l1dbg port <on off></code>	Controls l1 port interrupt debugging
<code>l1dgb i2c <on off></code>	Controls I ² C interrupt debugging
<code>l1dbg uart <on off></code>	Controls bedrock UART debugging
<code>l1dbg margin <on off></code>	Controls voltage margin debugging

log

The log set of commands displays the contents of the log, resets the log, and writes an entry into the log. There are three commands in the log command set:

- `log`
- `log reset`
- `log <entry>`

Use the `log` command to view the contents of the log. Example B-39 shows sample output from the `log` command. If the log is empty, the output from the `log` command is "log is empty."

Example B-39 `log` Command Output

```
001c07-L1>log
USB: registered as remote
USB-R: USB:device was reset
USB: unregistered
USB-R: IRouter:read failed - read error
USB: registered as remote
USB-R: USB:device was reset
USB: unregistered
USB-R: IRouter:read failed - read error
USB: registered as remote
SMP-R: UART:UART_NO_CONNECTION
L1 booting...
[L1-0] ALERT: eeprom.c line 367 ; eeprom 0 checksum error.
USB: registered as remote
L1 booting...
[L1-0] ALERT: eeprom.c line 367 ; eeprom 0 checksum error.
USB: registered as remote
CTI-R: UART:UART_BREAK_RECEIVED
CTI-R: IRouter:read failed - read error
USB-R: USB:device was reset
```

Use the `log reset` command to empty the log. Example B-40 shows sample output from the `log reset` command.

Example B-40 `log reset` Command Output

```
001c003-L1>log reset
log reset.
```

Use the `log <entry>` command to write a line in the log. In this command, the variable `<entry>` is text to enter into the log. Example B-41 shows sample output from the `log Start the Test` command.

Example B-41 `log Start the Test` Command Output

```
001c003-L1>log Start the Test
log entry made.
```

ioport

The `ioport` set of commands either displays or sets the speeds and clock source of the I/O ports. In the `ioport` command set, the mnemonic `ioprt` may replace the word `ioport`. The `ioport` commands are valid only for C-, I-, P-, and X-bricks. There are three commands in the `ioport` command set:

- `ioport`
- `ioport <speed>`
- `ioport clksrc <a|b>`

Use the `ioport` command to view the speed of the I/O ports in the C-, I-, P-, or X-brick and the clock source for the universal system time (UST). The I/O port speed is 400 MHz or 600 MHz. In the command output, the word `Bedrock` refers to the hub ASIC in the C-brick. The word `XBridge` refers to the crosstown ASIC in the I-, P-, or X-brick. Example B-42 and Example B-43 show sample output from the `ioport` command. This command is valid only for the C-, I-, P-, and X-bricks.

Example B-42 `ioport` Command Output for a C-Brick

```
001c07-L1>ioport
Bedrock I/O port speed: 600 MHz - current, attached I/O is detected
                        400 MHz - default, when no attached I/O
detected
```

Example B-43 `ioport` Command Output for an X-Brick

```
001i21-L1>ioport
XBridge port A speed: 400 MHz - current, no attached C detected
XBridge port B speed: 600 MHz - current, from attached C
                        400 MHz - default, when no attached C detected
XBridge UST clock source: port A
```

Use the `ioport <speed>` command to set the speed of all of the I/O ports in the C-, I-, P-, or X-brick. In this command, the variable `<speed>` is 400 or 600 (400 MHz or 600 MHz). Example B-44 shows sample output from the `ioport 600` command.

Example B-44 `ioport 600` Command Output

```
001x004-L1>ioport 600
nvram parameter changed, reset required to affect change.
```

Use the `ioport clksrc <a|b>` command to set the universal system time clock source in the I-, P-, or X-brick to port a or port b. In this command, the variable <a|b> is a or b. Example B-45 shows sample output from the `ioport clksrc a` command. These `ioport` commands are valid only for the I-, P-, and X-bricks.

Example B-45 `ioport clksrc a` Command Output

```
001x004-L1>ioport clksrc a
nvram parameter changed, reset required to affect change.
```

istat

Use the `istat` set of command to view the status of memory, the queues, tasks, and memory allocation. There are four commands in the `istat` command set:

- `istat memory`
- `istat queues`
- `istat tasks`
- `istat pmalloc`.

Use the `istat memory` command to view the status of memory. Example B-46 shows sample output from the `istat memory` command.

Example B-46 `istat memory` Command Output

```
001c07-L1>istat memory
SYSMEM [0x30005cf8] Size: 41656 Avail: 26792
SMLPOOL [0x30005cbc] Size: 8704/ 272 Avail: 28
BIGPOOL [0x30005c80] Size: 16640/1040 Avail: 15
```

Use the `istat queues` command to view the status of the queues. Example B-47 shows sample output from the `istat queues` command.

Example B-47 `istat queues` Command Output

```
001c07-L1>istat queues
CMD_REQQ [0x30008a54] Size: 10 Avail: 10 Msgs: 0
CMD_RSPQ [0x30008a9c] Size: 10 Avail: 10 Msgs: 0
SMP_RQUE [0x3000c8a0] Size: 10 Avail: 10 Msgs: 0
SMP_WQUE [0x3000c8e8] Size: 10 Avail: 10 Msgs: 0
SMP_IQUE [0x3000c930] Size: 10 Avail: 10 Msgs: 0
CTI_WQUE [0x3000f38c] Size: 10 Avail: 10 Msgs: 0
```

```

USB_WQUE [0x3000ee7c]    Size: 10    Avail: 10    Msgs:  0
SCAN_QUE [0x30002440]   Size: 20    Avail: 20    Msgs:  0
FLASH_Q  [0x30009c64]   Size:  5    Avail:  5    Msgs:  0
BDR_WQUE [0x3000a0c8]   Size: 10    Avail: 10    Msgs:  0

```

Use the `istat tasks` command to view the status of the tasks. Example B-48 shows sample output from the `istat tasks` command.

Example B-48 `istat tasks` Command Output

```

001c07-L1>istat tasks
MAIN_TSK [0x300019f8] (SLEEP      ) STACK: 2048 @ 0x300011f8 ( 904 used, 1144 free)
USB_CNTL [0x30007f38] (DRV_SUSP   ) STACK: 1536 @ 0x30007fe0 ( 288 used, 1248 free)
CMD_ITSK [0x300096e4] (READY      ) STACK: 3072 @ 0x30008ae4 (1936 used, 1136 free)
SMP_RTSK [0x3000e1c8] (EVT_SUSP   ) STACK: 2048 @ 0x3000c9c8 ( 800 used, 1248 free)
SMP_ITSK [0x3000e318] (QUEUE_SUSP) STACK: 2048 @ 0x3000d9c8 ( 768 used, 1280 free)
SMP_WTSK [0x3000e270] (QUEUE_SUSP) STACK: 2048 @ 0x3000d1c8 ( 416 used, 1632 free)
ENV_PITK [0x3000a9ec] (SEM_SUSP   ) STACK: 1024 @ 0x3000addc ( 276 used,  748 free)
ENV_FITK [0x3000aa94] (SEM_SUSP   ) STACK: 1024 @ 0x3000b1dc ( 260 used,  764 free)
ENV_TITK [0x3000ab3c] (SEM_SUSP   ) STACK: 1024 @ 0x3000b5dc ( 264 used,  760 free)
ENV_PMTK [0x3000abe4] (SEM_SUSP   ) STACK: 1024 @ 0x3000b9dc ( 260 used,  764 free)
ENV_FMTK [0x3000ac8c] (SEM_SUSP   ) STACK: 1024 @ 0x3000bddc ( 268 used,  756 free)
ENV_TMTK [0x3000ad34] (SEM_SUSP   ) STACK: 1024 @ 0x3000c1dc ( 324 used,  700 free)
BDR_RTSK [0x30009f30] (DRV_SUSP   ) STACK: 2048 @ 0x30016524 (1204 used,  844 free)
BDR_WTSK [0x3000a020] (QUEUE_SUSP) STACK: 1024 @ 0x30016d34 ( 532 used,  492 free)
CTI_RTSK [0x3000f23c] (DRV_SUSP   ) STACK: 2048 @ 0x3001717c ( 892 used, 1156 free)
CTI_WTSK [0x3000f2e4] (QUEUE_SUSP) STACK: 2048 @ 0x3001798c ( 572 used, 1476 free)
USB_RTSK [0x3000edd4] (READY      ) STACK: 1800 @ 0x300181d4 ( 732 used, 1068 free)
USB_WTSK [0x3000eeec] (QUEUE_SUSP) STACK: 1500 @ 0x300188ec ( 480 used, 1020 free)
SCAN_TSK [0x30002398] (QUEUE_SUSP) STACK: 2048 @ 0x30001b98 ( 600 used, 1448 free)
I2C_HIGH [0x30007154] (SEM_SUSP   ) STACK: 1500 @ 0x300071fc ( 248 used, 1252 free)
I2C_LOW  [0x30006a2c] (SEM_SUSP   ) STACK: 1500 @ 0x30006ad4 ( 396 used, 1104 free)
FLASH_T  [0x30009bbc] (QUEUE_SUSP) STACK: 1024 @ 0x300097bc ( 316 used,  708 free)

```

Use the `istat pmalloc` command to view the status of the memory allocation. Example B-49 shows sample output from the `istat pmalloc` command.

Example B-49 `istat pmalloc` Command Output

```

001c07-L1>istat pmalloc

small pool size:    272
small pool avail:   28
small pool used:    3
small pool max:     25

```

```
big pool size:    1040
big pool avail:   15
big pool used:    0
big pool max:     3

pmalloc calls:   0
prealloc calls:  3

history:
```

leds

Use the `leds` command to read the value of the group 0 and group 1 status LEDs in the C-brick. These LEDs connect to I/O expanders that monitor Group 0 Status LEDs 0 through 15 and Group 1 Status LEDs 0 through 15. In the output of the `leds` command, CPU A corresponds to I/O expander A_0100001x - Group 0 Status LEDs 0 through 7, CPU B corresponds to I/O expander A_0100010x - Group 0 Status LEDs 8 through 15, CPU C corresponds to I/O expander A_0100011x - Group 1 Status LEDs 0 through 7, and CPU D corresponds to I/O expander A_0100100x - Group 1 Status LEDs 8 through 15. The number next to the CPU letter is a hexadecimal value that represents the value of the status LEDs that connect to the I/O expander (a bit set to 1 indicates the LED is on, a bit set to 0 indicates the LED is off). Example B-50 shows sample output from the `leds` command. The `leds` command is valid only for the C-brick.

Example B-50 `leds` Command Output

```
001c07-L1>leds
CPU A: 0x02
CPU B: 0x02
CPU C: 0x0f
CPU D: 0x0f
```

margin

The `margin` set of commands displays the state of the supply margins or sets the state of the supply margins. There are six commands in the `margin` command set:

- `margin`
- `margin default`
- `margin <low|norm|high>`

- `margin <voltage> default`
- `margin <voltage> <low|norm|high>`
- `margin <voltage> <level>`

For the margin command set, the mnemonic `mgn` may replace the word `margin`.

Use the `margin` command to view the current state of the margin values for the supplies in a brick. Example B-51 shows sample output from the `margin` command.

Example B-51 `margin` Command Output

```
001c07-L1>margin
Supply          State Voltage   Margin  Value
-----
          DIMM      on    2.509V  default  132
          2.5V      on    2.522V  default  120
          1.5V      on    1.509V  default  110
    PIMM0 SRAM      on    3.276V  default  125
      PIMM0 CPU      on    1.875V  default  142
    PIMM0 1.5V      NC    1.495V  default   3
    PIMM1 SRAM      <not present>
      PIMM1 CPU      <not present>
    PIMM1 1.5V      <not present>
```

Use the `margin default` command to set the margin values for the supplies to their default values. Use the `margin <low|norm|high>` command to set the margin values for the supplies to the low-margin, normal-margin, or high-margin values. In this command, the variable `<low|norm|high>` is low (low-margin), norm (normal margin), or high (high margin). Example B-52 shows sample output from the `margin default` command.

Example B-52 `margin default` Command Output

```
001c07-L1>margin default
```

Use the `margin <voltage> default` command to set the margin value for a specific supply to its default value. Use the `margin <voltage> <low|norm|high>` command to set the margin value for a specific supply to its low-margin, normal-margin, or high-margin value. In this command, the variable `<low|norm|high>` is low

(low-margin), norm (normal margin), or high (high margin). Table B-7 lists the valid values for the <voltage> variable in these commands.

Table B-7 Valid Values for <voltage>

<voltage>	Description
2.5	2.5-V supply in all bricks
3.3	3.3-V supply in all bricks
5	5-V supply in all bricks
dimm	DIMM supply in C brick only
1.5	1.5-V supply in C brick only
1.5p0	1.5-V processor 0 supply in C brick only
1.5p1	1.5-V processor 1 supply in C brick only
p0sram	SRAM supply in C brick with O200 DIMM only
p1sram	SRAM supply in C brick with O200 DIMM only
p0cpu	SRAM supply in C brick only
p1cpu	SRAM supply in C brick only

Use the margin <voltage> <level> command to set the margin for a specific supply to a specified level. Table B-7 lists the valid values for the <voltage> variable in these commands. In this command, the variable <level> is a number from 0 to 255.

network

The network set of commands displays the mode of the network communication interface or sets the mode for the network communication interface. There are three commands in the network command set:

- network
- network usb
- network 422

The network command set is valid only for C-bricks.

Use the `network` command to view the current mode of the network communication interface. Example B-53 shows sample output from the `network` command.

Example B-53 `network` Command Output

```
001c07-L1>network
network interface communication is USB
```

Use the `network usb` command to set the network communication interface mode to universal serial bus (USB). Use the `network 422` command to set the network communication interface mode to RS-422 protocol. Example B-54 shows sample output from the `network usb` command.

Example B-54 `network usb` Command Output

```
001c003-L1>network usb
nvram parameter changed, reset required to affect change.
```

nmi

Use the `nmi` command to issue a non-maskable interrupt in a C-brick. After the system controller receives an `nmi` command, it displays “NMI...” on the front-panel display and asserts the NMI signal in I/O Expander B_0100001x. If no errors occur while the system controller issues the NMI, it displays “NMI done” on the front-panel display (refer to Example B-55 and Figure B-2). If an error occurs, the system controller displays “NMI Fail” on the front-panel display. The `nmi` command is valid only for the C-brick.

Example B-55 `nmi` Command Output

```
001c07-L1>nmi
001c07-L1>
```



Figure B-2 Example nmi Front-panel Display Output

pci

The pci set of commands either displays the status of the pci cards in an I/O brick or powers up, powers down, or resets a pci card. There are ten commands in the pci command set:

- pci,pci <u|d>
- pci reset
- pci <bus> <u|d>
- pci <bus> reset
- pci <bus> <slot> <u|d>
- pci <bus> <slot> reset

The pci set of commands are valid only for I and P bricks. In the pci command set, the mnemonic `rst` may replace the word `reset`

Use the pci command to view the value of the status register for each PCI card in an I or P brick. The output of the pci command contains eight columns. The Bus column lists the number of the bus for each PCI card. The Slot column lists the slot value for each PCI card. The Stat column lists the hexadecimal value of the status register for each PCI card. The Card Type column lists the card type (7.5 W, 15 W, 25 W, or none) for each slot. The Power column lists the value (error & off, error & on, okay & off, or okay & on) of the Power OK and Power On bits. The Attn LED column lists the value (off or on) of the Attention LED for the PCI card. The Enable column lists the value (off or on) of the Bus

Enable bit for the PCI card. The Reset column lists the value (off or on) of the Reset bit for the PCI card. Example B-56 shows sample output from the `pci` command. This command is valid only for I and P bricks.

Example B-56 `pci` Command Output

```
001i21-L1>pci
Bus Slot Stat Card Type Power          Attn LED Enable Reset
-----
 1    1 0x91      15W okay & on      off    on   off
 1    2 0x57      none okay & off    off    off  on
 1    3 0x91      15W okay & on      off    on   off
 1    4 0xff  on board  N/A & N/A      N/A    N/A  off
 2    1 0x57      none okay & off    off    off  on
 2    2 0x57      none okay & off    off    off  on
```

Use the `pci <u|d>` command to power up or power down all of the PCI cards in an I or P brick. In this command, the variable `<u|d>` is u (power up) or d (power down). Example B-57 shows sample output from the `pci d` command.

Example B-57 `pci d` Command Output

```
001i21-L1>pci d
001i21-L1>
```

Use the `pci reset` command to reset all of the PCI cards in an I or P brick. Example B-58 shows sample output from the `pci reset` command.

Example B-58 `pci reset` Command Output

```
001i21-L1>pci reset
001i21-L1>
```

Use the `pci <bus> <u|d>` command to power up or power down all of the PCI cards on a bus in an I or P brick. In this command, the variable `<u|d>` is u (power up) or d (power down). The variable `<bus>` is the bus number. Example B-59 shows sample output from the `pci 1 u` command.

Example B-59 `pci 1 u` Command Output

```
001i21-L1>pci 1 u
001i21-L1>
```

Use the `pci <bus> reset` command to reset all of the PCI cards on a bus in an I- or P-brick. In this command, the variable `<bus>` is the bus number. Example B-60 shows

sample output from the `pci 1 reset` command. This command is valid only for I- and P-bricks.

Example B-60 `pci 1 reset` Command Output

```
001i21-L1>pci 1 reset
001i21-L1>
```

Use the `pci <bus> <slot> <u|d>` command to power up or power down an individual PCI card in an I- or P-brick. In this command, the variable `<u|d>` is `u` (power up) or `d` (power down). The variable `<bus>` is the bus number and the variable `<slot>` is the slot number. Example B-61 shows sample output from the `pci 1 2 u` command.

Example B-61 `pci 1 2 u` Command Output

```
001i21-L1>pci 1 2 u
001i21-L1>
```

Use the `pci <bus> <slot> reset` command to reset an individual PCI card in an I- or P-brick. In this command, the variable `<bus>` is the bus number and the variable `<slot>` is the slot number. Example B-62 shows sample output from the `pci 1 2 reset` command.

Example B-62 `pci 1 2 reset` Command Output

```
001i21-L1>pci 1 2 reset
001i21-L1>
```

pimm

The `pimm` set of commands displays the state of the processor inline memory module (PIMM) clock source and clock mode or sets the PIMM clock source and clock mode. There are three commands in the `pimm` command set:

- `pimm`
- `pimm clksrc <external|internal>`
- `pimm clkmode <async|sync>`

In the `pimm` command set, the mnemonics `int` and `ext` may be used instead of the words `internal` and `external`. The `pimm` command set is valid only for C-bricks.

Use the `pimm` command to determine the PIMM clock source (internal or external) and the clock mode (synchronous or asynchronous). Example B-63 shows sample output from the `pimm` command.

Example B-63 `pimm` Command Output

```
001c07-L1>pimm
PIMM clock source is external
PIMM mode is asynchronous
```

Use the `pimm clksrc <external|internal>` command to set the PIMM clock source to external or internal. In this command, the variable `<external|internal>` is external or internal. Example B-64 shows sample output from the `pimm clksrc internal` command.

Example B-64 `pimm clksrc internal` Command Output

```
001c07-L1>pimm clksrc internal
nvram parameter changed, reset required to affect change.
```

Use the `pimm clkmode <async|sync>` command to set the PIMM clock mode to asynchronous or synchronous. In this command, the variable `<async|sync>` is `async` (for asynchronous) or `sync` (for synchronous). Example B-65 shows sample output from the `pimm clkmode sync` command.

Example B-65 `pimm clkmode sync` Command Output

```
001c07-L1>pimm clkmode sync
nvram parameter changed, reset required to affect change.
```

port

Use the `port` command to view the value of the status register for each port in the brick. The output of the `port` command contains six columns. The Port column lists the name of each port. The Stat column lists the hexadecimal value of the status register for each port. The Remote Pwr column lists the value, "okay" or "none", of the Remote Power OK bit (bit 0) for each port. The Local Pwr column lists the value, "okay" or "none", of the Local Power OK bit (bit 1) for each port. The Link LED column lists the value, "on" or "off", of the Link LED bit (bit 2) for each port. The SW LED column lists the value, "on" or "off", of the Software LED bit (bit 3) for each port (refer to Example B-66 and Example B-67). For this command, the mnemonic `prt` may replace the word `port`.

Example B-66 port Command Output for an R-brick

```
001r19-L1>port
Port Stat Remote Pwr Local Pwr Link LED SW LED
-----
A 0x02 none okay off off
B 0x0f okay okay on on
C 0x0f okay okay on on
D 0x02 none okay off off
E 0x02 none okay off off
F 0x0b okay okay off on
G 0x0b okay okay off on
H 0x02 none okay off off
```

Example B-67 port Command Output for a C-brick

```
001c07-L1>port
Port Stat Remote Pwr Local Pwr Link LED SW LED
-----
A 0x0f okay okay on on
B 0x0f okay okay on on
```

power

The power set of commands displays the status of the supplies or powers up and powers down the supplies. There are four commands in the power command set:

- power
- power check
- power <up|down>
- power up hold.

For the power command set, the mnemonics `pwr`, `u`, and `d` may replace the words `power`, `up`, and `down`.

Use the `power` command to view the detailed current state of the power and margin values for the supplies in a brick. Example B-68 shows sample output from the `power` command.

Example B-68 power Command Output

```
001c07-L1>power
Supply          State Voltage   Margin  Value
-----
          48V      on      N/A      N/A
          DIMM     on      2.509V  default  132
          2.5V     on      2.522V  default  120
          1.5V     on      1.509V  default  110
          3.3V aux  NC      3.337V  N/A
          3.3V L1  NC      3.302V  N/A
          5V aux   NC      4.992V  N/A
          12V bias NC      12.188V N/A
          PIMM0 SRAM on      3.276V  default  125
          PIMM0 CPU on      1.875V  default  142
          PIMM0 1.5V NC      1.495V  default   3
PIMM0 3.3V aux  NC      3.320V  N/A
          PIMM0 5V aux  NC      4.914V  N/A
PIMM0 12V bias  NC      12.125V  N/A
          PIMM1 SRAM <not present>
          PIMM1 CPU <not present>
          PIMM1 1.5V <not present>
PIMM1 3.3V aux  <not present>
          PIMM1 5V aux <not present>
PIMM1 12V bias <not present>
```

Use the `power check` command to view the summary of the current state of the power and margin values for the supplies in a brick. Example B-69 shows sample output from the `power check` command.

Example B-69 power check Command Output

```
001c07-L1>power check
power appears on
```

Use the `power <up | down>` command to power up or power down all of the supplies in a brick. In this command, the variable `<up | down>` is up or down. Example B-70 shows sample output from the `power up` command.

Example B-70 power up Command Output

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

Use the `power up hold` command to power up and hold the reset for a brick. Example B-71 shows sample output from the `power up hold` command.

Example B-71 `power up hold` Command Output

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

reboot_l1

The `reboot_l1` command set reboots the L1 controller. There are two commands in the `reboot_l1` command set:

- `reboot_l1`
- `reboot_l1 <a|b>`

Use the `reboot_l1` command to reboot the L1 controller using the newest firmware image (firmware image a or firmware image b). Use the `reboot_l1 <a|b>` command to reboot the L1 controller using the specified firmware image. In this command, the variable `<a|b>` is a (firmware image a) or b (firmware image b).

reset

Use the `reset` command to perform a reset of the brick. After the system controller receives a `reset` command, it sets various control and status signals back to their default values. Example B-72 shows sample output from the `reset` command.

Example B-72 `reset` Command Output

```
001c07-L1>reset
001c07-L1>
```

router

Use the `router set of` command to view the router type or set the router type. There are two commands in the `router` command set:

- `router`
- `router <type>`

The router command set is valid only for R-bricks.

Use the `router` command to view the current router type. Example B-73 shows sample output from the `router` command.

Example B-73 `router` Command Output

```
001r19-L1>router
router type is ordinary
```

Use the `router <type>` command to set the current router type. In this command, the variable `<type>` is `meta` (for a meta-router), `repeater` (for a repeater router), or `ordinary` (for a regular router). In this command, the mnemonics `rep` and `ord` may replace the words `repeater` and `ordinary`.

scan

The scan set of commands interface with the boundary scan components of the L1 controller. More information on the scan commands will be provided in a future revision of this document.

select

The select set of commands either displays or sets the mode of console I/O. There are five commands in the select command set:

- `select`
- `select <rack> <slot>`
- `select local`
- `select ctc`
- `select console`
- `select <a|b|c|d>`
- `select <subchannel>`
- `select filter <on|off>`

The select command set is valid only for C-bricks.

Use the `select` command to view the current mode of console I/O. Example B-74 shows sample output from the `select` command.

Example B-74 `select` Command Output

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

Use the `select <rack> <slot>` command to set the rack and slot for console I/O. Use the `select ctc` command to set the attached C-brick for console I/O. Use the `select console` command to set the mode of console I/O to console. Use the `select <a|b|c|d>` command to set the mode of console I/O to a CPU name. In this command, the variable `<a|b|c|d>` is the name of a CPU (a, b, c or d). Use the `select <subchannel>` command to set the mode of console I/O to a specified subchannel (0, 1, 2, 3, or 4).

Use the `select filter <on|off>` command to enable or disable the console output filter. In this command, the variable `<on|off>` is on (enabled) or off (disabled).

serial

Use the serial set of commands to view or set the system serial number that is stored in each brick. There are two commands in the serial command set:

- `serial`
- `serial <key> <key> <key> <key>`

Use the `serial` command to view the brick serial number (BSN) and the system serial number (SSN) settings stored in the NVRAM. Use the `serial <key> <key> <key> <key>` command to reassign the system serial number for a brick. In this command, the variable `<key> <key> <key> <key>` is the value of a security key that is provided only to SGI employees.

softreset

Use the `softreset` command to issue a software reset in a C-brick. After receiving a `softreset` command, the system controller displays “Sft rst...” on the front-panel display and asserts the Soft Reset signal in I/O Expander B_0100001x. If no errors occur while the system controller issues the Soft Reset, it displays “Sft rst done” on the front

panel display (refer to Example B-75 and Figure B-3). If an error occurs while the system controller issues the Soft Reset, it displays “Sft rst fail” on the front-panel display. The `softreset` command is valid only for the C-brick.

Note: In this command, the mnemonic `softrst` may be used instead of the word `softreset`.

Example B-75 `softreset` Command Output

```
001c07-L1>softreset
001c07-L1>
```



```
Sft rst. . . .
```



```
Sft rst done
```

Figure B-3 Example `softreset` Command Output

test

Use the test set of commands to test various components in the L1 controller. There are seven commands in the test command set:

- `test i2c <passes>`
- `test ioexp set <index> <value>`
- `test ioexp get <index>`
- `test ioexp get all`
- `test intr`
- `test display`

- `test exception <value>`

In this command, the mnemonic `tst` and `exc` may replace the words `test` and `exception`.

Use the `test i2c <passes>` command to test the I²C bus. In this command, the variable `<passes>` is optional and is the number of times to run the test. Use the `test ioexp set <index> <value>` command to set a value for an I/O expander. In this command, the variable `<index>` is an I²C bus address and the variable `<value>` is the value for the I/O expander.

Use the `test ioexp get <index>` command to read a value from an I/O expander. In this command, the variable `<index>` is an I²C bus address. Use the `test ioexp get all` command to read the values from all of the I/O expanders.

Use the `test intr` command to view the I²C bus interrupt counts. Example B-76 shows sample output from the `test intr` command.

Example B-76 `test intr` Command Output

```
001r19-L1>test intr
I2C interrupts, High: 25 Low: 406
DS1780 0, 1: 0 (0x00) 2: 0 (0x00)
IOExp 0: 197
IOExp 1: 0
IOExp 2: 0
IOExp 3: 0
IOExp 4: 137
IOExp 5: 0
IOExp 6: 11
IOExp 7: 0
```

Use the `test exception <value>` to test the memory fault handling, stack corruption error handling, software watchdog reset, and `fatal_error()` call. In this command, the variable `<value>` is `mem` (for memory fault handling), `stack` (for stack corruption error handling), `wdog` (for software watchdog reset), and `fatal` (for `fatal_error()` call).

trace

The trace set of commands interface with the trace buffers in the L1 controller. More information on the trace commands will be provided in a future revision of this document.

verbose

The verbose set of commands provides the status of the verbose mode for the console or sets the verbose mode for the console. Verbose mode enables the command prompt and character echo for the console. There are two commands in the verbose command set:

- `verbose`
- `verbose <on|off>`

Use the `verbose` command to determine the verbose mode setting (on or off) for the console. Example B-77 shows sample output from the `get verbose` command.

Example B-77 `get verbose` Command Output

```
001c07-L1>verbose
SMP verbose mode is off
```

Use the `verbose <on|off>` command to set the verbose mode on or off for the console. In this command, the variable `<on|off>` is on or off. Example B-78 shows sample output from the `verbose on` command.

Example B-78 `verbose on` Command Output

```
001c07-L1>verbose on
SMP verbose mode is on
```

version

Use the `version` command to view the version of the firmware that is running in the system controller. Example B-79 shows sample output from the `version` command.

Example B-79 `version` Command Output

```
001r19-L1>version
L1 0.7.27 (Image A), Built 04/28/2000 13:06:43 [P1 support]
```

L2 Controller Command Set

The following subsections describe the L2 controller command set. The commands are listed alphabetically and include examples of output where applicable.

config

The config set of commands displays the L2 controller configuration information. There are five commands in the config command set:

- config
- config devices
- config rescan
- config auto
- config manual

Note: For these commands, the mnemonic `cfg` may replace the word `config`.

Use the `config` command to view the L2 controller configuration information (refer to Example B-80). In the `config` command output, the first number is the IP address of the L2 controller (127.0.0.1 in the output below). The number that follows the IP address, after the first colon, is the USB port number (1 in the output below).

Example B-80 config Command output

```
L2> config
127.0.0.1:
127.0.0.1:0:0 - 001r19
127.0.0.1:1:0 - 001c07
127.0.0.1:1:1 - 001i21
127.0.0.1:2:0 - 001c10
```

The number that follows the USB port number, after the second colon, is the L1 index. Table B-8 lists the values of the L1 index.

Table B-8 L1 Index Values

L1 Index	Name	Description
0	Local brick	The local brick is the C-brick that connects to the L2 through the USB cable.
1	Attached I/O brick	The attached I/O brick is an I/O brick that connects to the local brick.
2	Attached C-brick	The attached I/O brick is a C-brick that connects to the local brick.
3	I/O brick attached to the attached C-brick	The I/O brick attached to the attached C- brick is an I/O brick that connects to a C- brick that connects to the local brick.

The number that follows the L1 index, after the dash, is the brick identification number (for example, 001c07). The first three digits of the brick identification indicate the rack that the brick resides in. The fourth digit of the brick identification indicates the type of brick (refer to Table B-9). The last two digits of the brick identification indicate the slot position in which the brick resides.

Table B-9 Valid Brick Types

Type	Description
c	C-brick
i	I-brick
p	P-brick
r	R-brick
x	X-brick
?	Unknown brick type

Use the `config devices` command to show configuration information with devices. Example B-81 shows sample output from the `config devices` command.

Example B-81 config devices Command Output

```
L2> config devices
127.0.0.1:
127.0.0.1:0:0 - 001r19 (/dev/sgill_0)
127.0.0.1:1:0 - 001c07 (/dev/sgill_1)
127.0.0.1:1:1 - 001i21 (/dev/sgill_1)
127.0.0.1:2:0 - 001c10 (/dev/sgill_2)
```

Use the `config rescan` command to force an L1 controller configuration update. Use the `config auto` command to enable automatic configuration updates for the L1 controller. Use the `config manual` command to disable automatic configuration updates for the L1 controller.

Note: For these commands, the mnemonics `re` and `man` may replace the words `rescan` and `manual`.

destination

The destination set of commands displays the brick identification numbers of bricks that are the destination of L2 commands, or sets the bricks that are the destination for L2 commands. There are four commands in the destination command set:

- `destination`
- `r <racks> destination`
- `r <rack> s <slots> destination`
- `destination reset`

Note: For these commands, the mnemonic `dest` may replace the word `destination`. Also, the words `rack` and `slot` may replace the mnemonics `r` and `s`.

Use the `destination` command to view the brick identification numbers of the bricks that are the destination of L2 commands. Example B-82 shows sample output from the `destination` command.

Example B-82 destination Command Output

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

Use the `r <racks> destination` command to set the racks that are the destination for L2 commands (this command selects all of the bricks in a rack as the destination bricks). In this command, the variable `<racks>` is a rack number, a comma separated list of rack numbers, or a range of rack numbers indicated by a dash character. Example B-83 shows sample output from the `r <racks> destination` command.

Example B-83 r <racks> destination Command Output

```
L2> r 1 destination
4 default destination(s) set
L2> destination
001i21 (127.0.0.1:1:1)
001r19 (127.0.0.1:0:0)
001c07 (127.0.0.1:1:0)
001c10 (127.0.0.1:2:0)
```

Use the `r <rack> s <slots> destination` command to set individual bricks that are the destination for L2 commands. In this command, the variable `<rack>` is a rack number. The variable `<slots>` is a slot number, a comma separated list of slot numbers, or a range of slot numbers indicated by a dash character. Example B-84 shows sample output from the `r <rack> s <slots> destination` command.

Example B-84 r <rack> s <slots> destination Command Output

```
L2> r 1 s 7 destination
1 default destination(s) set
L2> destination
001c07 (127.0.0.1:1:0)
```

Use the `destination reset` command to reset the destination bricks to all racks and all slots. Example B-85 shows sample output from the `destination reset` command.

Note: For this commands, the mnemonic `rst` may replace the word `reset`.

Example B-85 destination reset Command Output

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

help

The help set of commands provides helpful information on the system controller commands. There are two commands in the help command set:

- help
- help <command>

Use the help command to generate a list of all of the system controller commands. Use the help <command> command to display more information on a single command. In this command, the variable <command> is the name of a command.

l1

The l1 set of commands enter L1 mode or send an L1 controller command to a specified L1 controller. There are three commands in the l1 command set:

- r <rack> s <slot> l1
- r <rack> s <slot> l1 <cmd>
- :<port>:<l1> l1 <cmd>

Note: For these commands, the words rack and slot may replace the mnemonics r and s.

Use the r <rack> s <slot> l1 command to engage the L1 command processor for the specified rack and slot. In this command, the variable <rack> is a rack number and the variable <slot> is a slot number. Example B-86 shows sample output from the r <rack> s <slot> l1 command.

Example B-86 r <rack> s <slot> l1 Command Output

```
L2> r 1 s 19 l1
entering L1 mode 001r19, <CTRL-T> to escape to L2

001r19-L1>
```

Use the r <rack> s <slot> l1 <cmd> command to send a command to a destination brick without changing the default destination value. In this command, the variable

<rack> is a rack number, the variable <slot> is a slot number, and the variable <cmd> is an L1 controller command. Example B-87 shows sample output from the `r <rack> s <slot> l1 config` command.

Example B-87 `r <rack> s <slot> l1 config` Command Output

```
L2> r 1 s 7 l1 config
:0 - 001c07
:1 - 001i21
L2>
```

Use the `:<port>: l1 <cmd>` command to send a command to a destination brick that does not have a brick identification number assigned to it yet. In this command, the variable <port> is the port number and the variable <cmd> is an L1 controller command.

l2

Use the `l2` command to engage and lock the L2 command processor. Example B-88 shows sample output from the `l2` command.

Example B-88 `l2` Command Output

```
L2> l2
L2 command processor engaged, <CTRL-D> for console mode.
```

loopback

Use the `r <rack> s <slot> loopback <bytes> <count>` command to test the L2-to-L1 connection. In this command, the variable <rack> is a rack number, the variable <slot> is a slot number, the variable <bytes> is the number of bytes to send, and the variable <count> is the number of times to run the test.

Note: For these commands, the words `rack` and `slot` may replace the mnemonics `r` and `s`.

power

The power set of commands displays the status of the supplies or powers up and powers down the supplies. There are five commands in the power command set:

- power
- power up
- power down
- r <rack> s <slot> power
- r <rack> s <slot> power up
- r <rack> s <slot> power down
- power delay
- power delay <value>

For the power command set, the mnemonics `pw`, `u`, and `d` may replace the words `power`, `up`, and `down`.

Use the `power` command to view the power status of each brick identified by the destination set of commands. Use the `power up` and `power down` commands to power up or power down each brick identified by the destination set of commands. Example B-89 shows sample output from the `power` command.

Example B-89 power Command Output

```
L2> power
001i21:
power appears on
001r19:
power appears on
001c07:
power appears on
001c10:
power appears on
```

Use the `r <rack> s <slot> power` command to view the power status of a specified brick. Use the `r <rack> s <slot> power up` and `r <rack> s <slot> power down` command to power up or power down specified bricks. In these commands, the variable `<rack>` is a rack number and the variable `<slot>` is a slot number. Example B-90 shows sample output from the `r <rack> s <slot> power` command.

Example B-90 r <rack> s <slot> power Command Output

```
L2> r 1 s 19 power
power appears on
```

Use the `power delay` command to view the current power-command delay value. The power-command delay value is the amount of time between L1 power commands that are issued by the L2 during a power up or power down sequence. Use the `power delay <value>` command to set the delay value. In this command, the variable <value> is the delay value. Example B-91 shows sample output from the `power delay` command.

Example B-91 power delay Command Output

```
L2> power delay
delay is set to 500 milliseconds
```

quit

Use the `quit` command to exit the L2 command processor.

select

The `select` set of commands display the brick id number and subchannel that receives console input or set the brick id number and subchannel that will receive console input. There are five commands in the `select` command set:

- `select`
- `select <rack> <slot>`
- `select <subchannel>`
- `select filter` and `select syscon <value>`

In this command set, the mnemonic `sel` may replace the word `select`.

Use the `select` command to view the brick id number and subchannel that receives console input. Example B-92 shows sample output from the `select` command. In this example, the brick id is a C-brick in rack 2, slot 1 (002c01) and the subchannel is the console channel.

Example B-92 select Command Output

```
L2> select
console input: 002c01 console
console output: not filtered
console detection: L2 detected
```

Use the `select <rack> <slot>` command to set the brick id number that receives console input. Example B-93 shows sample output from the `select <rack> <slot>` command. In this command, the variable `<rack>` is a rack number and the variable `<slot>` is a slot number. In the example, the brick id is a C-brick in rack 3, slot 1 (003c01).

Example B-93 select <rack> <slot> Command Output

```
L2> select 3 1
console input: 003c01 console
console output: not filtered
console detection: L2 detected
```

Use the `select <subchannel>` command to set the subchannel for the brick that receives console input. Example B-94 shows sample output from the `select <subchannel>` command. In this command, the variable `<subchannel>` is the subchannel number (a, b, c, d or console).

Example B-94 select <subchannel> Command Output

```
L2> select c
console input: 003c01 CPUc
console output: not filtered
console detection: L2 detected
```

Use the `select filter <value>` command to turn the console output filter on or off. Example B-95 shows sample output from the `select filter on` command. In this command, the variable `<value>` is on or off.

Example B-95 select filter Command Output

```
L2> select filter on
console input: 003c01 console
console output: filtered
console detection: L2 detected
```

Use the `select syscon <value>` command to set which device detects the system console. In this command, the variable `<value>` is l2 (indicates that the L2 to detects the system console) or prom (indicates that the PROM request system console).

serial

Use the serial set of commands to view the system serial number and to set the system serial number. There are two commands in the serial command set:

- serial
- serial <snum>

Use the serial command to view the system serial number. Example B-96 shows sample output from the serial command.

Example B-96 serial Command Output

```
L2> serial
system serial number: not set.
```

Use the serial <snum> command to set the system serial number. In this command, the variable <snum> is the system serial number. Example B-97 shows sample output from the serial <snum> command.

Example B-97 serial <snum> Command Output

```
L2> serial L0000010
system serial number set to L0000010.
L2> serial
system serial number: L0000010.
```

shell

Use the shell command to escape to the L2 operating system. In this command, the character ! may be used instead of the word shell. Example B-98 shows sample output from the shell command.

Example B-98 shell Command Output

```
L2> shell
bash$ rm core
bash$ exit
exit
L2>
```

smp

The smp set of commands show the status of the system maintenance port (SMP) network connection and reset the SMP network connection. There are two commands in the smp command set:

- smp
- smp reset

Use the smp command to view the status of the SMP network connection. Use the smp reset command to reset the SMP network connection. Example B-99 shows sample output from the smp reset command.

Example B-99 smp reset Command Output

```
L2> smp reset
INFO: SMP listening on port: 8001
SMP network connection reset.
```

sync

The sync command is used by the L2 controller, but it does not produce human-readable results.

tty

The tty command displays the terminal configuration. Example B-100 shows sample output from the tty command.

Example B-100 tty Command Output

```
L2> tty
---
iflag: 0x0020
oflag: 0x0005
cflag: 0x00bd
lflag: 0x8a31
ispeed:      0
ospeed:      0
cc_c[INTR   ]: 0x0000
cc_c[QUIT   ]: 0x001c
```

```
cc_c[ERASE ]: 0x007f
cc_c[KILL ]: 0x0015
cc_c[EOF ]: 0x0004
cc_c[EOL ]: 0x0000
cc_c[EOL2 ]: 0x0001
cc_c[MIN ]: 0x0000
cc_c[TIME ]: 0x0011
cc_c[SWTCH ]: 0x0013
cc_c[START ]: 0x0000
cc_c[STOP ]: 0x0000
cc_c[SUSP ]: 0x0012
cc_c[REPRINT ]: 0x000f
cc_c[DISCARD ]: 0x0017
cc_c[WERASE ]: 0x0016
cc_c[LNEXT ]: 0x0000
cc_c[RPRNT ]: 0x0000
cc_c[FLUSHO ]: 0x0000
cc_c[0x13 ]: 0x0000
cc_c[0x14 ]: 0x0000
cc_c[0x15 ]: 0x0000
cc_c[0x16 ]: 0x0000
cc_c[0x17 ]: 0x0000
cc_c[0x18 ]: 0x0000
cc_c[0x19 ]: 0x0000
cc_c[0x1a ]: 0x0000
cc_c[0x1b ]: 0x0000
cc_c[0x1c ]: 0x0000
cc_c[0x1d ]: 0x0000
cc_c[0x1e ]: 0x0000
cc_c[0x1f ]: 0x0000
```

version

Use the `version` command to view the version of the firmware running in the system controller. In this command, the mnemonic `ver` may replace the word `version`. Example B-101 shows sample output from the `version` command.

Example B-101 version Command Output

```
L2> version
L2 version 0.4.0
```


Controller Status and Error Messages

This appendix lists and describes the status and error messages generated by the L1 and L2 controllers. It also explains how to resolve the errors, if action is necessary.

L1 Controller Messages

The L1 controller front panel display shown in Figure C-1 consists of a 2-line, 12-character liquid crystal display (LCD) that provides the following:

- Brick identification
- System status
- Warning of required service or failure
- Identification of failed components

Note: Besides the L1 control display, if you have an L2 controller, you can see the L1 controller messages on the L2 controller touch display located on the front door of the rack where the L2 controller resides. If you have a system console, you can also see the L1 controller messages on your system console.

Besides the display, the L1 controller front panel also includes the following items:

- **On/Off switch with LED** (brick reset button with LED). Pressing this button turns on the brick's internal components. The LED on the button lights green when the brick's internal components are on and turns off when the internal components are off.
- **Service required LED.** Lights orange to indicate that some item is broken or not operating properly (for example, a fan is off), but the brick is still operating.
- **Failure LED.** Lights red to indicate that a system failure has occurred and the brick system is down.

The following items are available on the C-brick only:

- **Reset switch.** Use this switch to reset the C-brick internal processors and ASICs. The reset will cause a memory loss. (See the non-maskable interrupt information that follows to perform a reset without losing memory.)
- **Non-maskable interrupt (NMI) switch.** Use this switch to reset the C-brick internal processors and ASICs without losing memory.

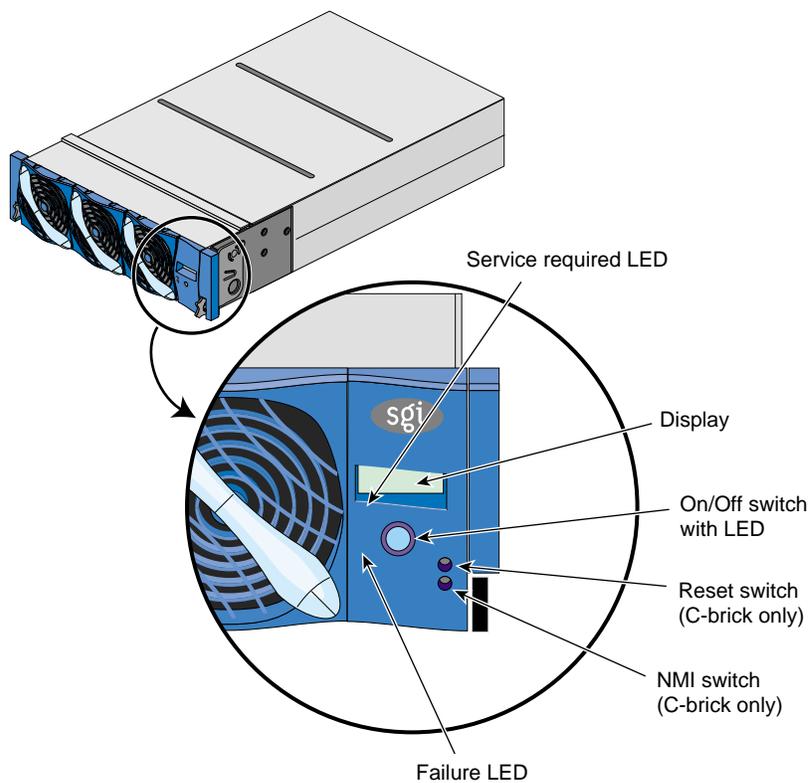


Figure C-1 L1 Controller

Table C-1 lists the L1 controller messages.

Note: Note that in Table C-1, 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 by 20 percent.

Table C-1 L1 Controller Messages

L1 System Controller Message	Message Meaning and Action Needed
Internal voltage messages:	
ATTN: x.xV high fault limit reached @ x.xxV	30-second power off sequence for the brick (or system, if no backup is available).
ATTN: x.xV low fault limit reached @ x.xxV	30-second power off sequence for the brick (or system, if no backup is available).
ATTN: x.xV high warning limit reached @ x.xxV	A higher than nominal voltage condition is detected.
ATTN: x.xV low warning limit reached @ x.xxV	A lower than nominal voltage condition is detected.
ATTN: x.xV level stabilized @ x.xV	A monitored voltage level has returned to within acceptable limits.
Fan messages:	
ATTN: FAN # x fault limit reached @ xx RPM	A fan has reached its maximum RPM level. The ambient temperature may be too high. Check to see if a fan has failed.
ATTN: FAN # x warning limit reached @ xx RPM	A fan has increased its RPM level. Check the ambient temperature. Check to see if the fan stabilizes.
ATTN: FAN # x stabilized @ xx RPM	An increased fan RPM level has returned to normal.
Temperature messages: low alt.	
ATTN: TEMP # advisory temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded 30 degrees centigrade.

Table C-1 (continued) L1 Controller Messages

L1 System Controller Message	Message Meaning and Action Needed
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded 35 degrees centigrade.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded 40 degrees centigrade.
Temperature messages: high alt.	
ATTN: TEMP # advisory temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded 27 degrees centigrade.
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded 31 degrees centigrade.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the brick's air inlet has exceeded 35 degrees centigrade.
Temperature stable message:	
ATTN: TEMP # 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 5 seconds until shutdown.
Brick appears to have been powered down	The L1 controller has registered a fault and has shut down.

L2 Controller Messages

The L2 controller monitors and generates status and error messages related to the rack chassis items, such as the power bay and other rack items. The L2 controller also displays status and error messages generated by each individual brick's L1 controller. This section lists only those messages generated by the L2 controller. (See "L1 Controller Messages" on page 269 for L1 controller message descriptions.)

The L2 controller information is displayed on the L2 controller touch display located in the front door of your server system, as shown in Figure C-2. (The actual L2 controller is located on the top of your rack enclosure.)

Note: Besides on the L2 controller touch display, if you have a system console, you can see the L2 controller messages on the system console. You can also have a system console with L3 controller software, which adds the boundary scan diagnostic tool to your console.

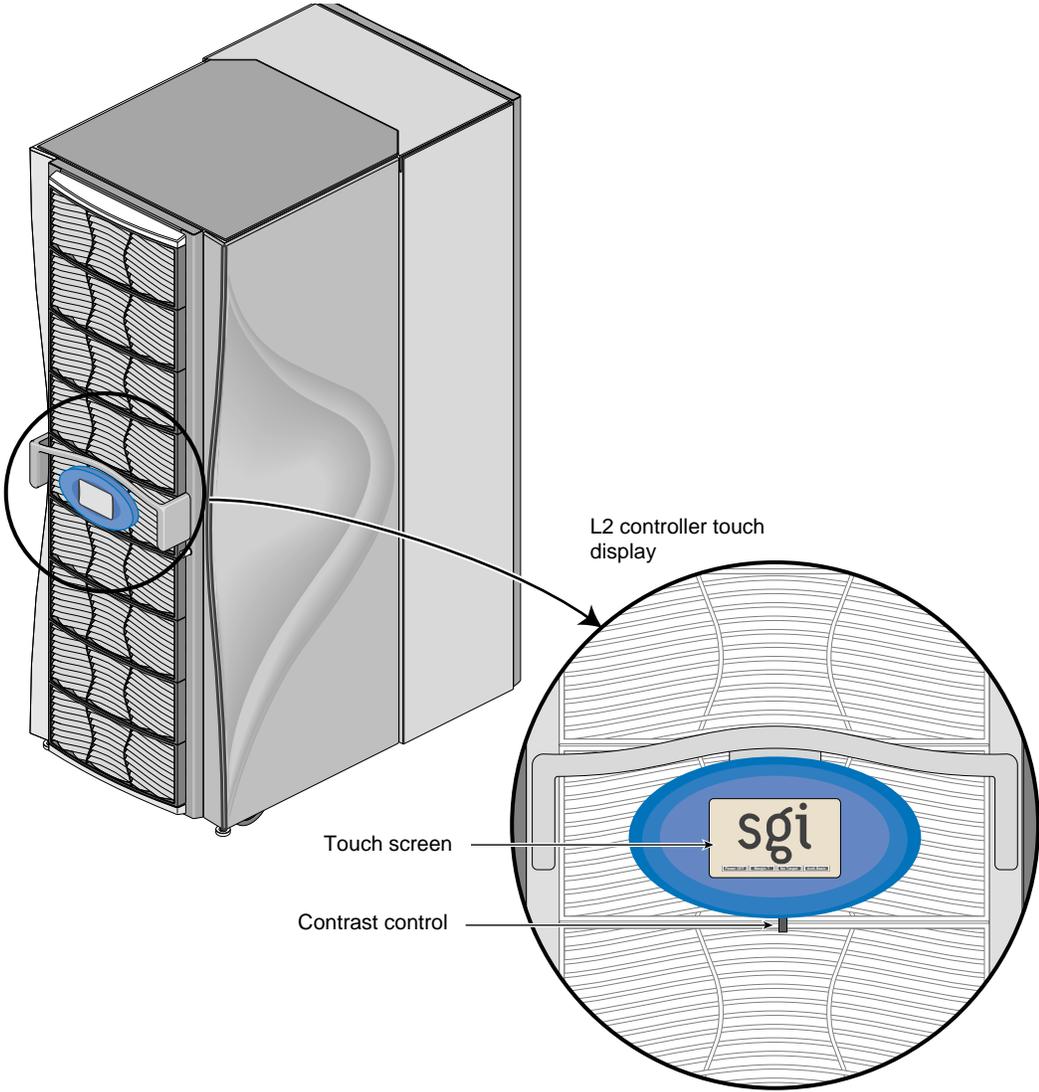


Figure C-2 L2 Controller Display

Regulatory Specifications

The following sections and illustrations present information that may be important to the operation of your SGI Origin 3000 series server.

Manufacturer's Regulatory Declarations

The SGI 3000 series of server products conform to several national and international specifications and European Directives listed on the "Manufacturer's Declaration of Conformity." The CE insignia displayed on each device is an indication of conformity to the European requirements.

Caution: Each SGI server system has several governmental and third-party approvals, licenses, and permits. Do not modify this product in any way that is not expressly approved by SGI. If you do, you may lose these approvals and your governmental agency authority to operate this device.

Server Model Number

The CMN (model) number for each server is shown on the system label on the unit.

CE Notice and Manufacturer's Declaration of Conformity

Marking by the "CE" symbol indicates compliance of the device to directives of the European Community. A "Declaration of Conformity" in accordance with the standards has been made and is available from SGI upon request.

Electromagnetic Emissions

FCC Notice (USA Only)

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) 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 the user will be required to correct the interference at his 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, the user is 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 into 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: Users should note that changes or modifications to the equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Industry Canada Notice (Canada Only)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique n'émet pas de perturbations radioélectriques dépassant les normes applicables aux appareils numériques de Classe A prescrites dans le Règlement sur les interférences radioélectriques établi par le Ministère des Communications du Canada.

VCCI Notice (Japan Only)

この装置は、情報処理装置等電波障害自主規制協議会 (VCCI) の基準に基づくクラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Chinese Class A Regulatory Notice

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Korean Class A Regulatory Notice

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며 만약 잘못 판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Shielded Cables

The SGI Origin 3000 series of server products 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 server system use additional filtering molded into the cable jacket to reduce radio frequency interference.

Always use the cable supplied with your system. If your monitor cable becomes damaged, obtain a replacement cable from SGI.

Electrostatic Discharge

SGI designs and tests its products to be immune to the effects of electrostatic discharge (ESD). ESD is a source of electromagnetic interference and can cause problems ranging from data errors and lockups to permanent component damage.

It is important that you keep all the covers and doors, including the plastics, in place while you are operating the server system. The shielded cables that 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 when installing these upgrades to prevent the flow of static electricity, and it should protect your system from ESD damage.

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