

SGI® Altix® PA Expansion Module  
User's Guide

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## CONTRIBUTORS

Written by Mark Schwenden

Illustrated by Chrystie Danzer

Production by Karen Jacobson

Engineering contributions by Dick Brownell, Gary Hagensen, Mick Larson, Wendy Nunn, Derek Robb, and Paul Wiley

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# SGI® Altix® PA Expansion Module User's Guide

The PA expansion module (also known as a PA-brick) is a 2U-high NUMAlink connected PCI-X expansion subsystem that supports four PCI/PCI-X buses (with six PCI-X slots total). Note that the PA-brick is supported only in a NUMAlink-4 Altix configuration. The NUMAlink-4 connectors have a peak transfer rate of 3.2 GB per second in each direction.

Bus 0 and 2 support one slot each, bus 1 and 3 support two slots each. Each slot can run at speeds up to 133 MHz. PCI-X protocol enables I/O devices to operate at clock speeds of up to 133 MHz, or 1 Gigabyte per second. This protocol also enables I/O devices to operate more efficiently, thereby providing a higher sustained bandwidth at any clock frequency. Note that installing a slower card on a shared bus (PCI bus that serves two slots) will cause that bus to slow to the lowest speed card's operating bandwidth. All slots accept hot-plug PCI/PCI-X cards. Any bus serving two PCI/PCI-X cards is limited to a maximum transfer rate of 1064 MB per second.

The PA expansion module is AC-powered and offers one or (optionally) two hot-plug power supplies, and fixed (shelf) or optional telescoping (slide) rack mounting rails.

This document describes the function and physical components of the module, and provides basic guidelines for installing and configuring PCI cards. Specifically, it includes the following information:

- "Product Overview" on page 2
- "External Components" on page 4
- "Adding or Replacing a PCI or PCI-X Card" on page 7
- "Locating Online Documentation" on page 14
- "Manufacturer's Regulatory Declarations" on page 14
- "Product Support" on page 17

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

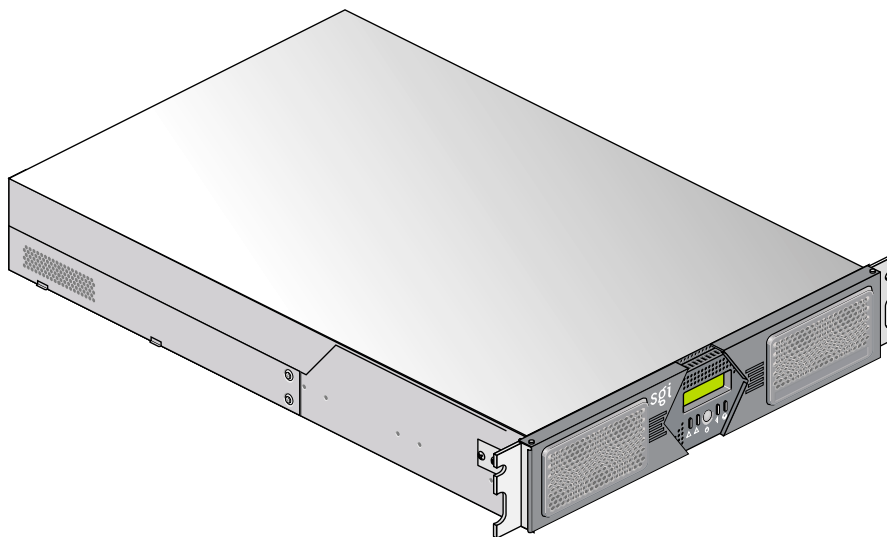
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## Product Overview

The 2U-high PA-brick shown in Figure 1 provides 6 card slots to support up to 6 PCI or PCI-X cards. The slots are physically configured as two sets of three vertically stacked PCI-X slots at the rear of the brick, see Figure 4. (Also see “Rear Panel Components” on page 5 for more information).

The PA-bricks offer the following features:

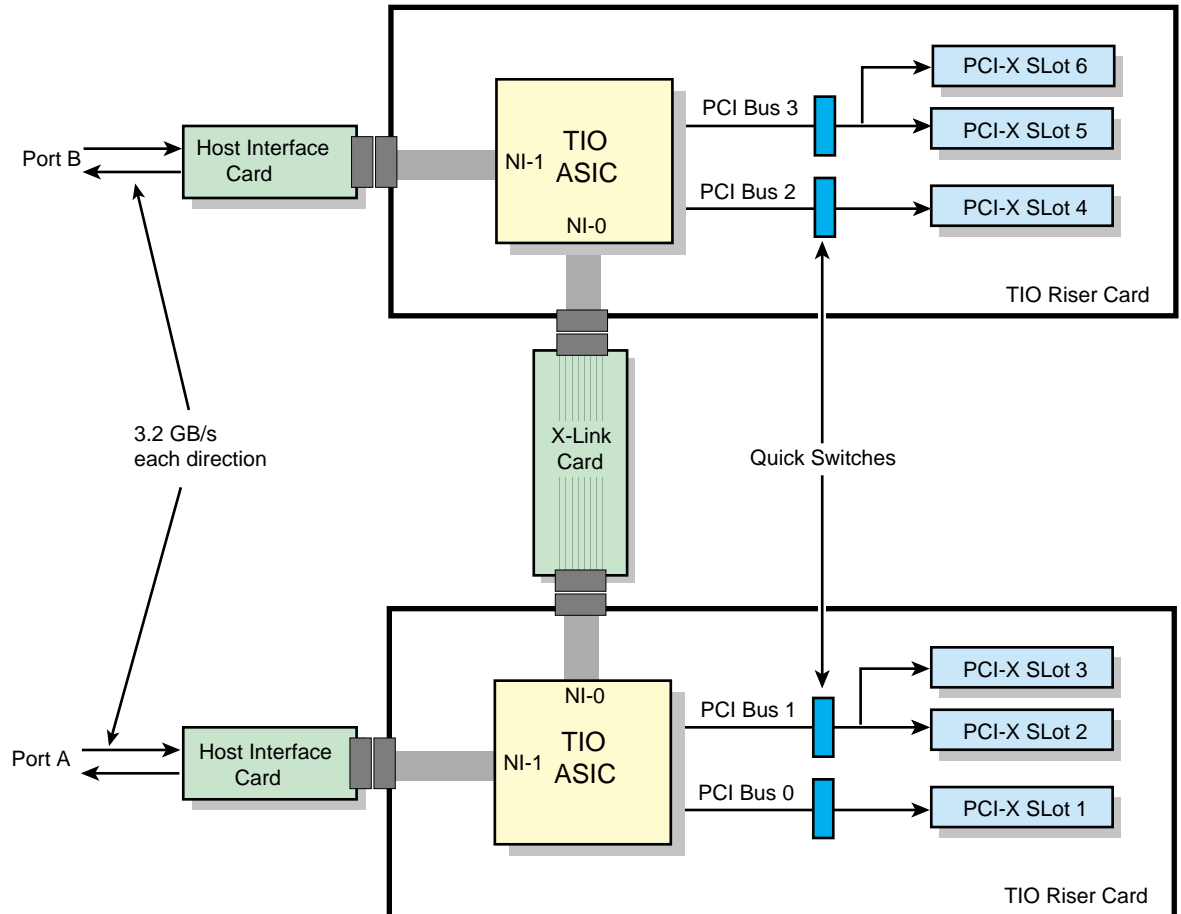
- The PA-brick supports both PCI cards and PCI-X cards.
- The PA-bricks can connect directly to an Altix CPU-brick via NUMALink-4 cabling.
- A USB L1 connection port is supported.



**Figure 1** Front and Side View of a PA-brick

Two TIO interface ASICs are key components of the PA architecture. The TIO ASICs support the following (see Figure 2):

- Two NUMalink-4 connectors to the TIO riser boards via individual circuit boards.
- Direct communication between the two TIO ASICs via an X-link card.
- Quick switches between the PCI bus lines support hot plugging of cards.
- Supports full L1 functionality under Linux.



**Figure 2** Functional Block Diagram of the PA-brick

## External Components

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

### Front Panel Components

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

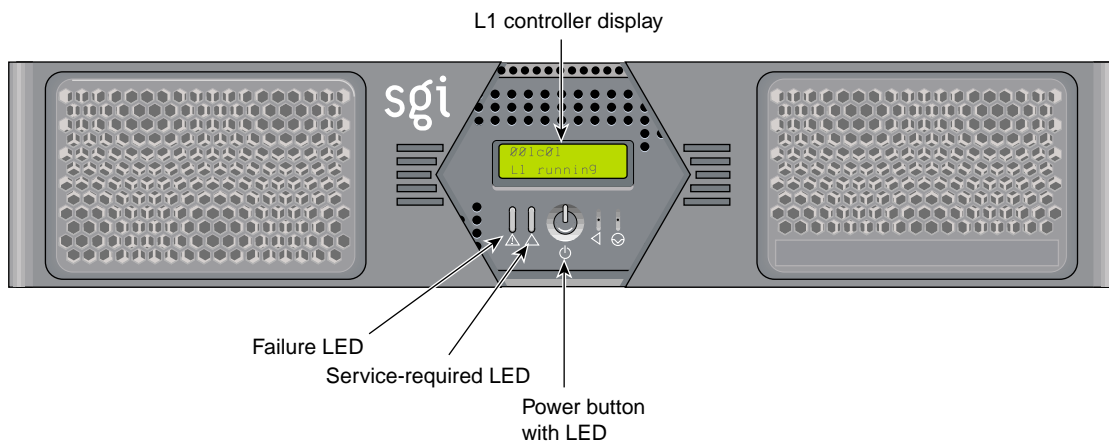
- **L1 controller and display.** The L1 controller generates PA-brick status and error messages that appear on the liquid crystal display (LCD).

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

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- **On/Off switch with LED.** Press this button to turn on the internal components of the PA-brick. Alternatively, you can turn on the internal components at an optional system console. When the internal components are on, the LED illuminates green.



**Figure 3** Front Panel of the PCI Module

- **LEDs:**
  - **On/Off switch LED.** This green LED illuminates when the internal components of the brick are on and turns off when they are off.



- **Service required LED.** This LED illuminates yellow to indicate that a component is broken or is not operating properly (for example, if a fan is off), but the PA-brick is still operating.
- **Failure LED.** This LED illuminates red to indicate that a system failure has occurred and the PA-brick is not operating.
- **Fans.** Three internal fans provide the required cooling for your PA-brick. These are **not** considered customer replaceable items.



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**Warning:** To prevent personal injury, or damage to the PCI module, the internal cooling fans can be installed/replaced only by a trained support provider.

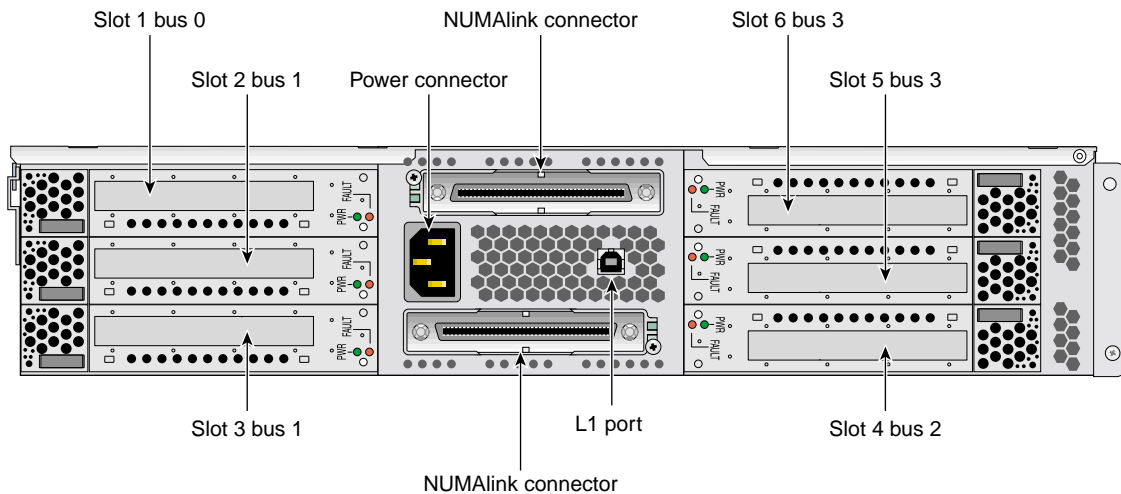
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## Rear Panel Components

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

- **PWR (power) connector.** This connector connects to AC power and provides power to the PA-brick.
- **PCI/PCI-X slots.** These slots support PCI or PCI-X cards. The card slots are numbered 1 through 6 and are controlled by two TIO riser cards. Slots 1 through 3 are controlled by the first TIO ASIC riser card. Slots 4 through 6 are controlled by the second TIO ASIC riser card. Two slots that share a bus can each be configured with 133 MHz PCI-X cards, but the maximum transfer rate remains at 1064 MB/s.
- **PCI-X Slot LEDs.** Each slot has the following LEDs:
  - **PWR (power) LED.** This LED illuminates green when the PCI card carrier is installed securely and is getting power.
  - **Fault LED.** This LED illuminates yellow when a fault occurs with the PCI card.
- **NUMAlink connectors.** Each connector can connect the PA-brick to one compute brick. Both port A (top) and port B (bottom) are connected to a compute brick. In a ring-based topology the PA-brick may be connected with two separate compute bricks.
- **NUMAlink connector LEDs.** Each NUMA connector has two LEDs, as follows:
  - The yellow LED illuminates to indicate that both the PA-brick and the compute brick to which it is connected are powered on.
  - The green LED illuminates when a link has been established between the PA-brick and the brick to which it connects.

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



**Figure 4** Rear Panel of the Module

## Adding or Replacing a PCI or PCI-X Card



**Warning:** Before installing, operating, or servicing any part of this product, read the Safety Information section in your system user guide.

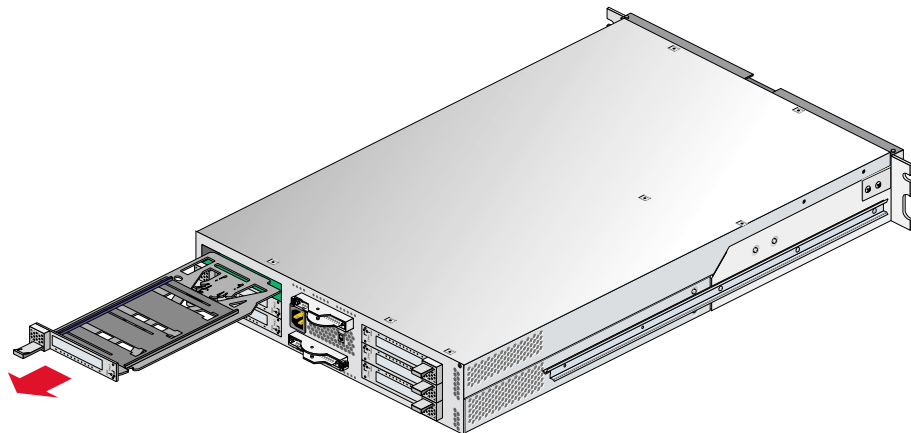
This section provides instructions for adding or replacing a PCI or PCI-X card in the PA-brick.



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

To add or replace a PCI card in the PA-brick, follow these steps:

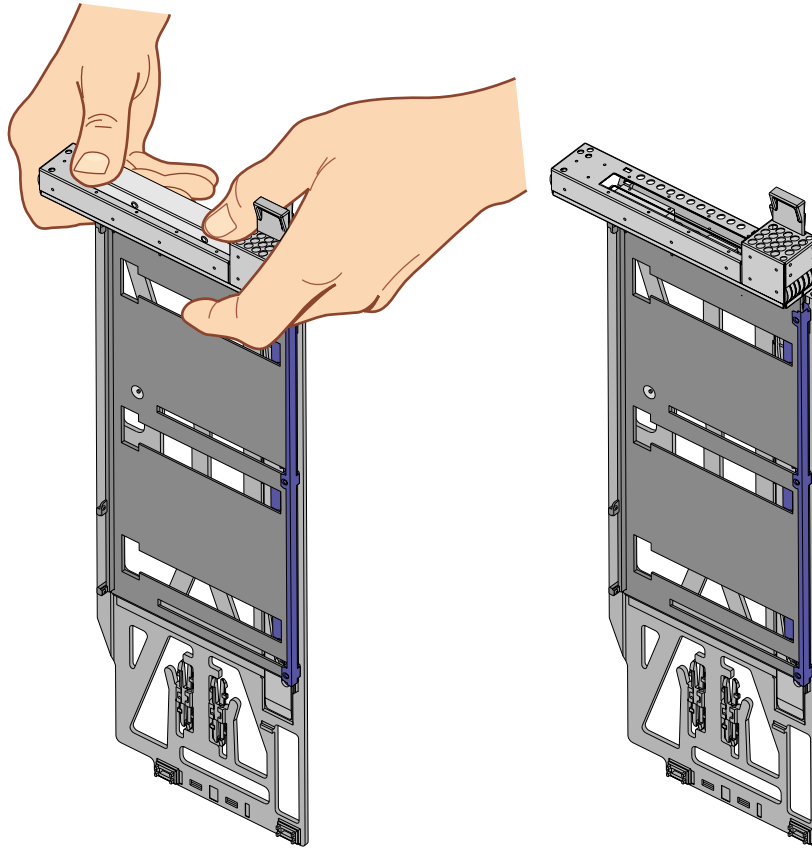
1. Shut down the operating system. (See your software guide if you need instructions to do this.)
2. Power off the I/O brick by following the power-off instructions in your system user's guide.
3. To extract the card carrier from a slot, pull the handle on the selected card carrier straight out, as shown in Figure 5.



**Figure 5** Removing a Card Carrier From the PA-brick

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

If you are adding a card, extract the carrier metal filler plate by pushing down on it, as shown in Figure 6. This filler plate covers the area where your card connectors will protrude out to the rear panel of the I/O brick.



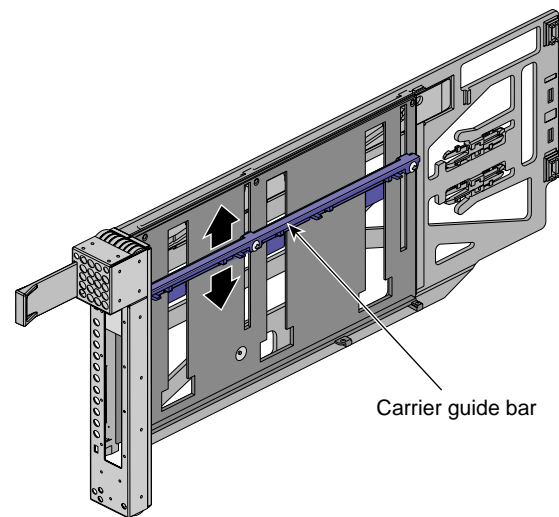
**Figure 6** Extracting the Carrier Metal Filler Plate

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

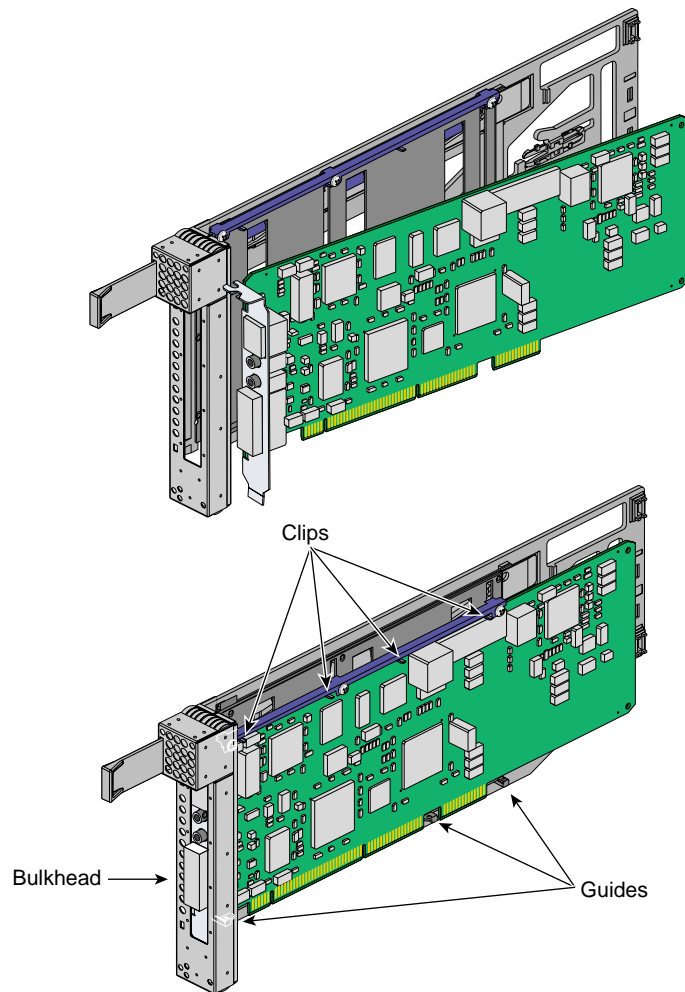
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5. If the full-height card that you want to install does not fit in the carrier, follow these steps:
  - a. Loosen the three screws on the guide bar with a Phillips screwdriver (if your carrier uses T8 Torx screws, you will need a Torx screw driver).
  - b. Adjust the carrier guide bar (also known as the alignment rail) up or down as necessary (see Figure 7).



**Figure 7** Adjusting the Carrier Guide Bar

- c. Mount the card in the carrier, (see Figure 8) and ensure the following occurs:
  - The card connectors protrude through the bulkhead where the metal filler plate was located.
  - The edge connectors fit between the bottom guides of the carrier.
  - The top of the card fits under the clips on the guide bar.
- d. Tighten the three screws on the guide bar. Skip step 6 and proceed to step 7.



**Figure 8** Mounting Card in Carrier

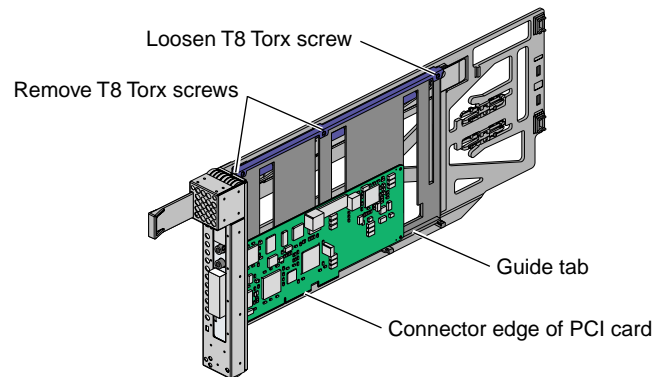
6. To install a half-height PCI card in a carrier, follow these steps:
  - a. Remove the two screws from the carrier guide bar, as shown in Figure 9.

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

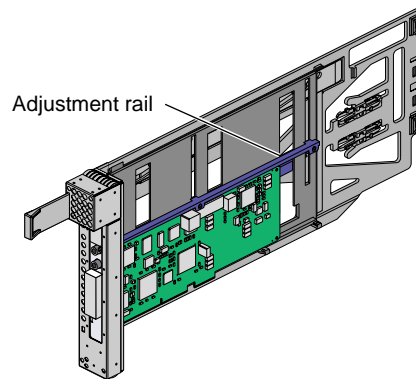
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- b. Loosen the third screw of the carrier guide bar.
  - c. Place the half-height PCI card in the carrier so that the connector edge of the card rests against the lower guide tab of the carrier (see Figure 9).



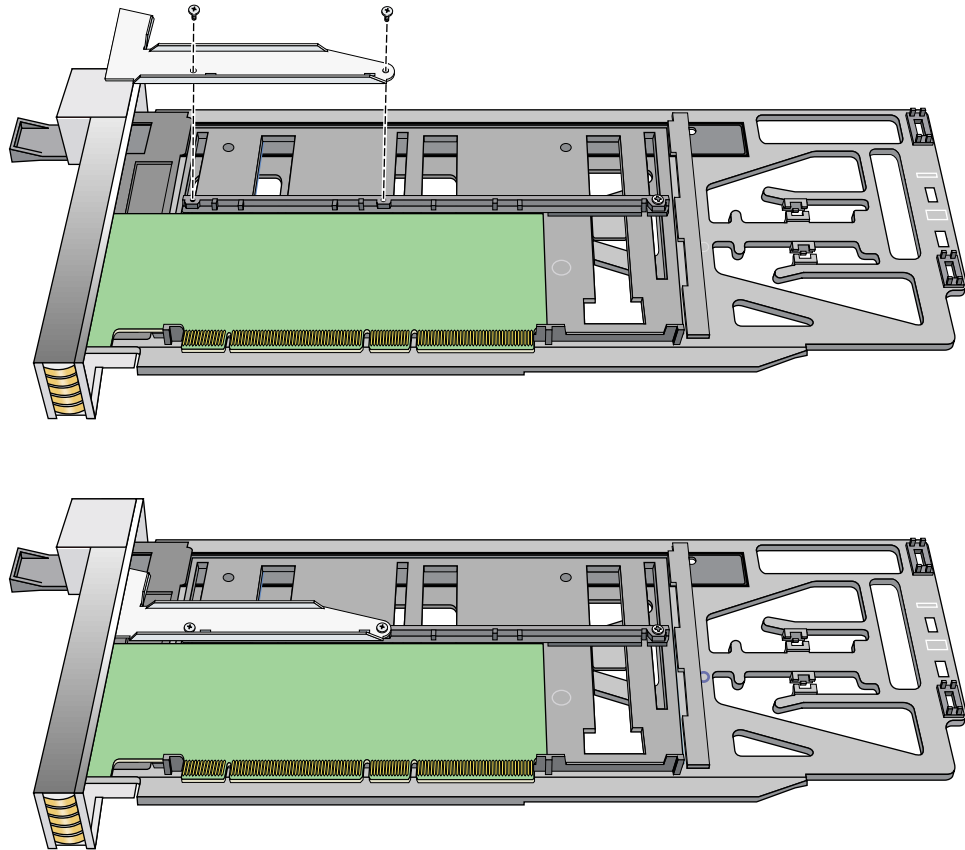
**Figure 9** Mounting Half-height PCI Card into Carrier

- d. Move the carrier guide bar (adjustment rail) so that it holds the card firmly in place (see Figure 10).



**Figure 10** Moving Carrier Guide Bar to Secure Half-height PCI Card

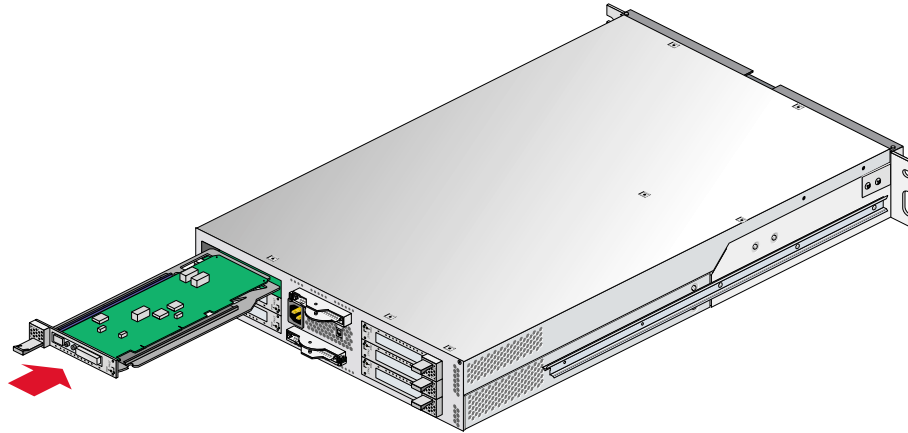
- e. Place the PCI card bracket so that the screw holes of the bracket align with the empty screw holes of the carrier guide bar, as shown in Figure 11.
- f. Secure the bracket to the carrier guide bar with two T8 Torx screws.
- g. Tighten the screw that you loosened in step 6b.



**Figure 11** Installing the Bracket to Secure a Half-height PCI Card

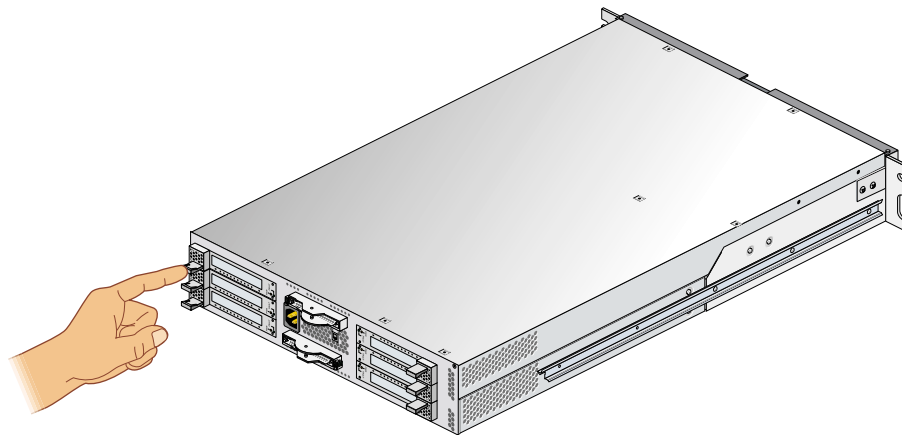


7. Insert the carrier-mounted PCI card into the vacant slot, using the slot guide, as shown in Figure 12.



**Figure 12** Installing a Card in a Slot

8. Push in horizontally on the carrier seating bar, as shown in Figure 13, to seat the card securely in the slot.



**Figure 13** Seating the Card in the Slot

9. Power on the I/O brick by following the power-on steps and instructions in your system user's guide. In most cases you will power on the PA prior to system boot.

10. Boot your operating system software. (See your software start here or operation guide if you need instructions to boot your operating system.)
11. Run the `lspci` inventory command to verify the installation. This command lists PCI hardware that the operating system discovered during the boot operation.

## Locating Online Documentation

For additional information on the system you are connecting the expansion module(s) with, see your SGI system user guide. If your hardcopy document is not readily available, you can read (or download) a copy via the SGI Technical Publications Library online, see <http://docs.sgi.com>.

## Manufacturer's Regulatory Declarations

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**Caution:** This device has several governmental and third-party approvals, licenses, and permits. Do not modify this product in any way that is not expressly approved by Silicon Graphics. If you do, you may lose these approvals and your governmental agency authority to operate this device.

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The device conforms 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.

## CMN Number

The module's model number, or CMN number, is on the back of the unit.

To obtain the Manufacturer's Declaration of Conformity from SGI, you must either provide the CMN number to your local SGI sales representative, or, contact the Technical Assistance Center at 1 800 800 4SGI.

## Class A Compliance

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.

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**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.

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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 one or more of the following measures:

- 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.

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**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.

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## Electromagnetic Emissions

This device complies with the Class A limits of Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.

- This device must accept any interference received, including interference that may cause undesired operation.

Also, this device complies with Class A electromagnetic emissions limits of C.I.S.P.R. Publication 22, Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.

## 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。

## 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.

## Shielded Cables

The device is FCC-compliant under test conditions that include the use of shielded cables between this PCI module and its peripherals. Your system and any peripherals you purchase from Silicon Graphics 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 Silicon Graphics, be sure they are shielded. Telephone cables do not need to be shielded.

## Electrostatic Discharge

Silicon Graphics 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.

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**Note:** While operating your system, keep all covers and doors, including the plastics, in place. The shielded cables included with the system and its peripherals should be installed correctly, with all thumbscrews fastened securely.

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An ESD wrist strap is included with some products, such as memory and graphics 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.

## Product Support

Silicon Graphics provides a comprehensive range of product support for its products. If you are in North America and would like support for your Silicon Graphics-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 Silicon Graphics subsidiary or authorized distributor in your country.

