Origin™ and Onyx2™ VME Option Installation Instructions

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FCC Warning

This equipment has been tested and found compliant 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.

Attention

This product requires the use of external shielded cables in order to maintain compliance pursuant to Part 15 of the FCC Rules.

Origin™ and Onyx2™ VME Option Installation Instructions
Document Number 108-0177-001

Silicon Graphics, Inc.
Mountain View, California

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Introduction

The *Origin and Onyx2 VME Option Installation Instructions* are intended for a Silicon Graphics trained or qualified installer. This document is not intended for untrained end users of Origin or Onyx2 VME options. End users should consult the *Origin and Onyx2 VME Option Owner's Guide* (007-3618-001) for information on the Origin VME options.

Previous experience with VME technology and installing XIO boards is helpful but not absolutely required for a successful installation. The manual content presumes a general familiarity with Origin2000 and Onyx2 hardware and XIO boards.

This manual is intended to provide a trained support engineer with complete cabling and installation information on all VME enclosures used with Origin2000 and Onyx2 products.

Note: Information and instructions for all field replaceable units (FRUs) is provided. For detailed installation information on the host systems, see the *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions*.

Structure of This Document

This installation guide contains the following chapters:

- Chapter 1, "VME Options Component Overview," illustrates and describes the Silicon Graphics optional VME enclosures and connecting hardware.
- Chapter 2, "Installing the VME Interface Board," describes how to install the 9U or 6U VME adapter board that goes in the ELMA chassis. These boards provide the interface between the VME data signals and the XIO board in the host system.
- Chapter 3, "VME XIO Board Installation in the Host System," provides the information necessary for installing the XIO board in an Origin2000 or Onyx2 host system.
- Chapter 4, "Configuration Guidelines," gives an overview of the rules to follow regarding location, numbers, operation, and mounting of the VME options.
- Chapter 5, "Diagnostic Tests," provides function verification diagnostic test information. Diagnosis is primarily concentrated on Silicon Graphics components, and will not verify customer or third party VME board functionality.

Typographical Conventions

These type conventions and symbols are used in this guide:

Helvetica Bold	Hardware labels
Italics	Executable names, filenames, IRIX commands, manual or book titles, new terms, program variables, tools, utilities, variable command-line arguments, variable coordinates, and variables to be supplied by the user in examples, code, and syntax statements
`Fixed-width type`	Error messages, prompts, and onscreen text
`Bold fixed-width type`	User input, including keyboard keys (printing and nonprinting); literals supplied by the user in examples, code, and syntax statements
“”	(Double quotation marks) on-screen menu items and references in text to document section titles
[]	(Brackets) surround optional syntax statement arguments

Chapter 1

VME Options Component Overview

The Silicon Graphics Origin2000 and Onyx2 optional VME assembly is made up of two major subassemblies: the XIO to VME adapter assembly, and the ELMA VME enclosure.

The XIO to VME adapter assembly consists of

- a crosstown XIO board for the host equipped with a ground lug
- a grounding cable used between the crosstown and VME interface boards
- a special 9-foot (2.74 m) crosstown cable
- a 6U or 9U interface board for the VME enclosure (also equipped with a ground lug)

The Origin2000 and Onyx2 VME enclosure options come in three variations:

- a 9U 5-slot rackmount enclosure, ELMA part 12V-0424-RHO5J12J3-P350-SGI-L2
- a 6U 5-slot rackmount enclosure, ELMA part 12V-0316-RHO5J12-P250-SGI-L2
- a 6U 21-slot rackmount enclosure, ELMA part 12V-0916-RV21J12-P750-SGI-L2

There is no requirement that the VME enclosures be mounted in a rack as long as all ventilation ports have adequate airflow clearance. Note that the 9U enclosure uses side-to-side ventilation, while the 6U enclosures use front-to-back ventilation. These enclosures are supplied by ELMA electronics and marketed to Silicon Graphics customers mainly through Bear Resources of Fremont, California. Silicon Graphics worldwide support does not stock spare components for these VME boxes. Repair or replacement of the ELMA enclosures must be arranged by the customer through Bear Resources or other ELMA representatives.

1.1 VME Enclosures

Each ELMA VME enclosure used with Origin2000 and Onyx2 systems has been modified to meet specific grounding requirements. These enclosures have a part number that includes the letters SGI. Any VME enclosure that does not have these Silicon Graphics specific part numbers has not been tested and is not approved for use with the Origin2000 and Onyx2. The enclosures are designed for mounting in generic 19-inch electronic equipment racks. They are not designed for (and should not be installed in) Origin2000 or Onyx2 racks. You should note that each enclosure actually provides one fewer slot than its labeled capacity. A five-slot enclosure really holds only four user VME boards, because one slot is always used by the Silicon Graphics VME interface board.

1.2 9U Five-Slot Enclosure

A front view of the 9U five-slot VME enclosure is shown in Figure 1-1. Figure 1-2 shows the rear view of the same enclosure. Note the difference between the interface board's ground lug and the enclosure ground. Always attach the ground cable to the interface board's I/O panel ground lug.

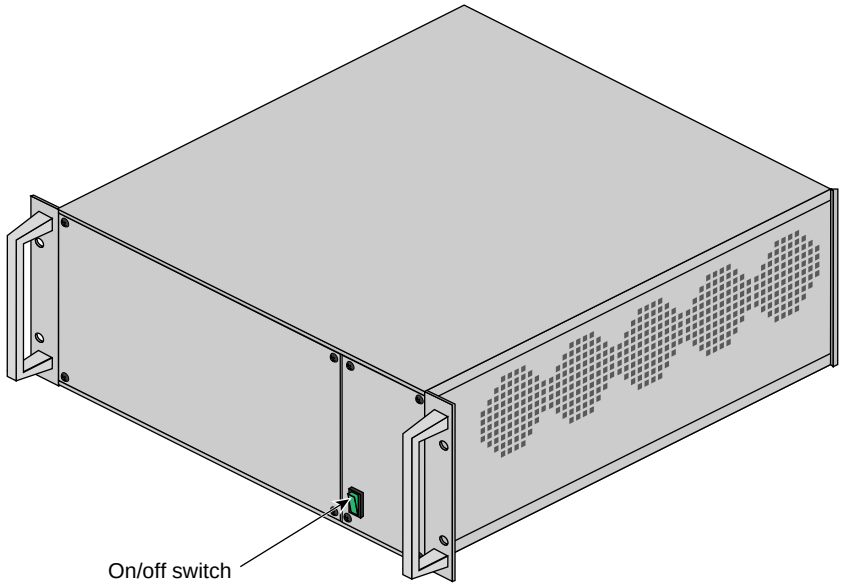

Figure 1-1 9U Five-Slot Enclosure (Front View)

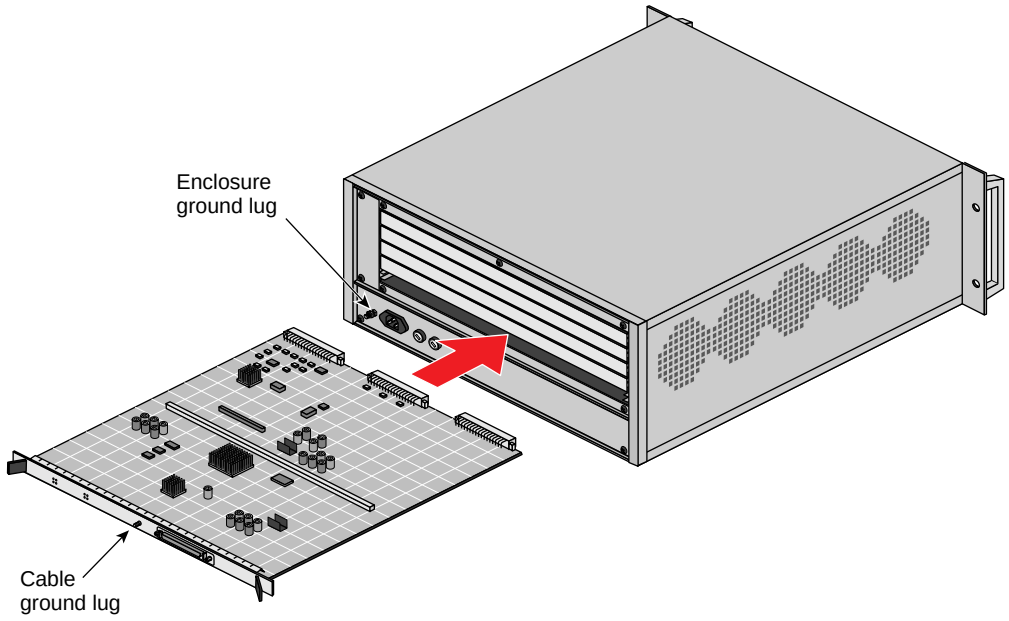

Figure 1-2 9U Five-Slot Enclosure (Rear View)

1.3 6U Five-Slot Enclosure

Figure 1-3 shows a front view of the 6U five-slot VME enclosure. Figure 1-4 shows a rear view of the same enclosure.

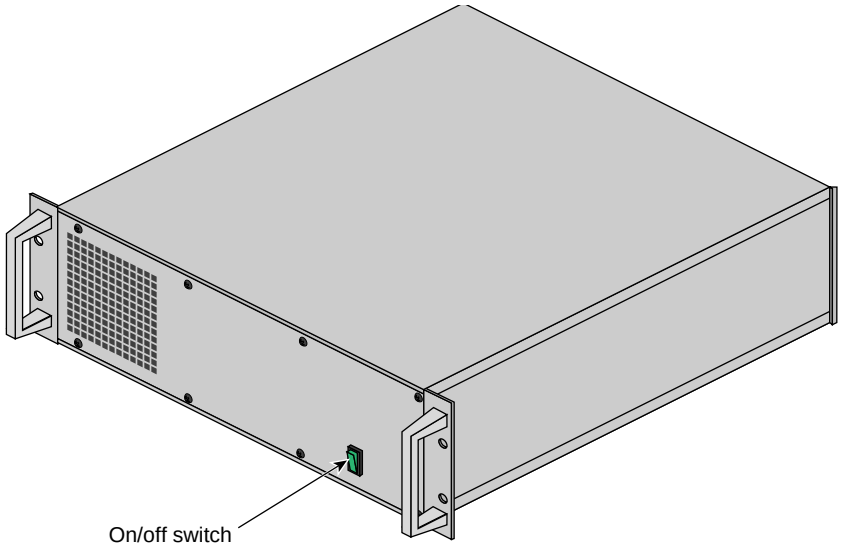

Figure 1-3 6U Five-Slot Enclosure (Front View)

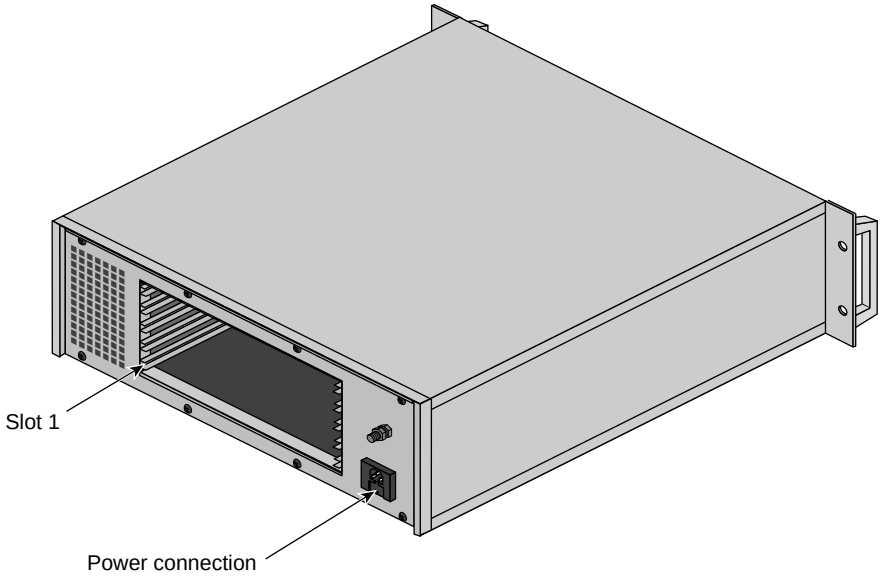

Figure 1-4 6U Five-Slot Enclosure (Rear View)

1.4 6U 21-Slot Enclosure

Figure 1-5 shows the front of the 6U 21-slot VME enclosure. Figure 1-6 shows the rear view of the same enclosure.

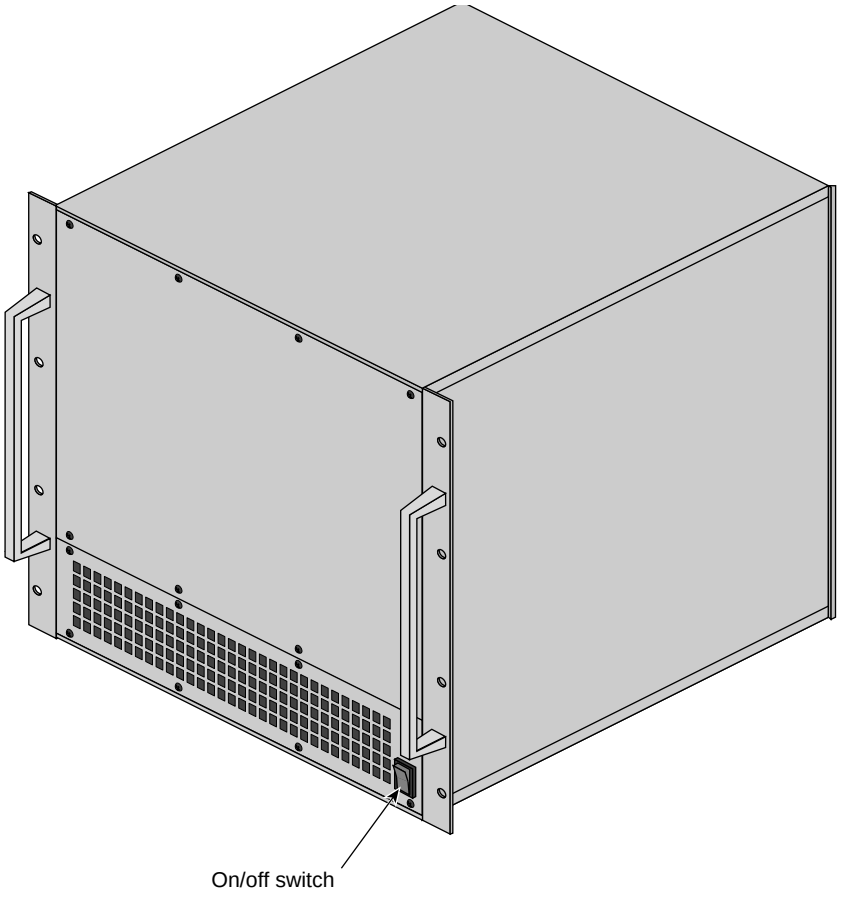

Figure 1-5 6U 21-Slot Enclosure (Front View)

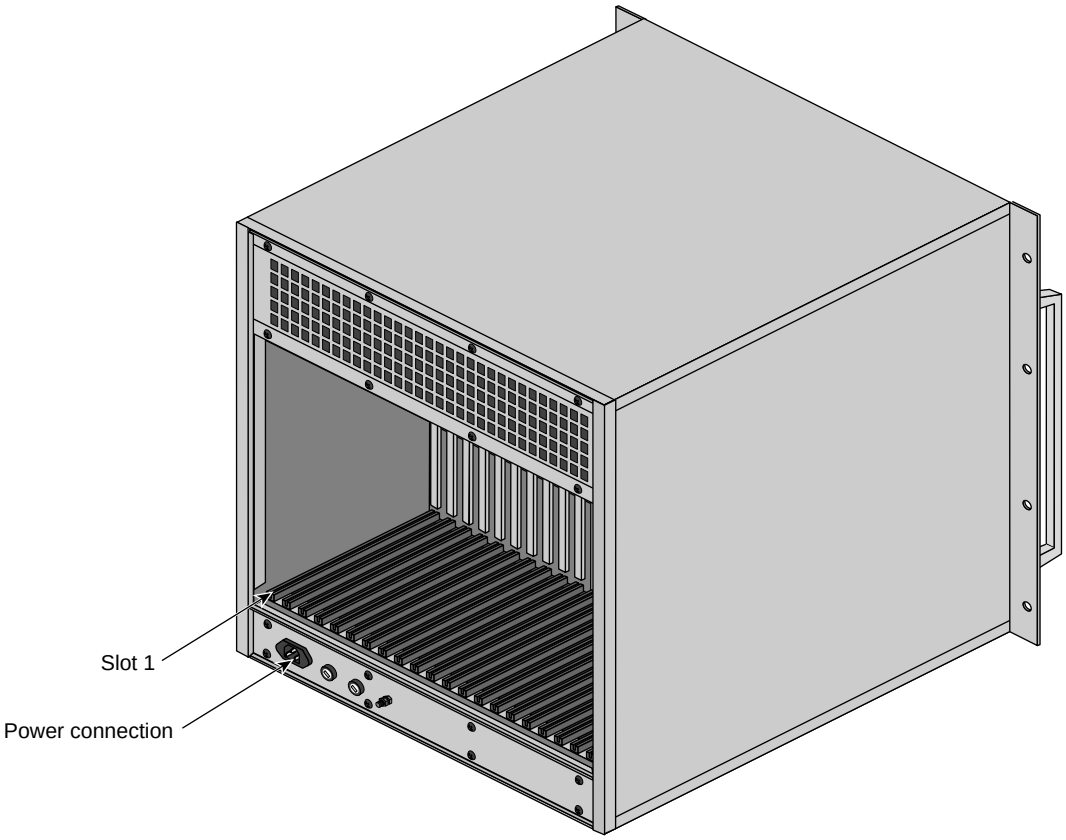

Figure 1-6 6U 21-Slot Enclosure (Rear View)

1.5 Mounting Hardware and Tools Needed

A #2 Phillips head screwdriver and a small adjustable wrench are the only tools required to complete the installation of all Silicon Graphics components. Use the #2 Phillips head screwdriver to loosen the lockbar that holds the blanking panel and baffle board in the XIO slot. The wrench is used to undo or tighten the ground lug on the VME XIO (crosstalk) and VME interface board's I/O panel.

If you are installing the ELMA VME chassis in a generic rack for the customer, you may need the #2 Phillips head screwdriver or other tools.

It may be helpful to tie-wrap the grounding cable to the crosstown cable during the installation. Having a half-dozen tiewraps on hand is recommended.

1.6 Field Replaceable Unit (FRU) List

The Silicon Graphics field-replaceable hardware components include the following:

- Origin2000 and Onyx2 VME XIO (crosstalk) board for the host (P / N 030-1280-001)
- A 9-foot (2.74 m) VME crosstown (Xtown) cable (P / N 013-2230-001)
- A grounding cable used between the XIO board and the VME interface board
- 6U interface board for the VME enclosure (P / N 030-1221-*xxx*)
- 9U interface board for the VME enclosure (P / N 030-1213-*xxx*)

The Origin VME kit contents are shown in Figure 1-7. Note that the kit comes with either a 9U VME interface board or a 6U interface board depending on the VME enclosure type ordered.

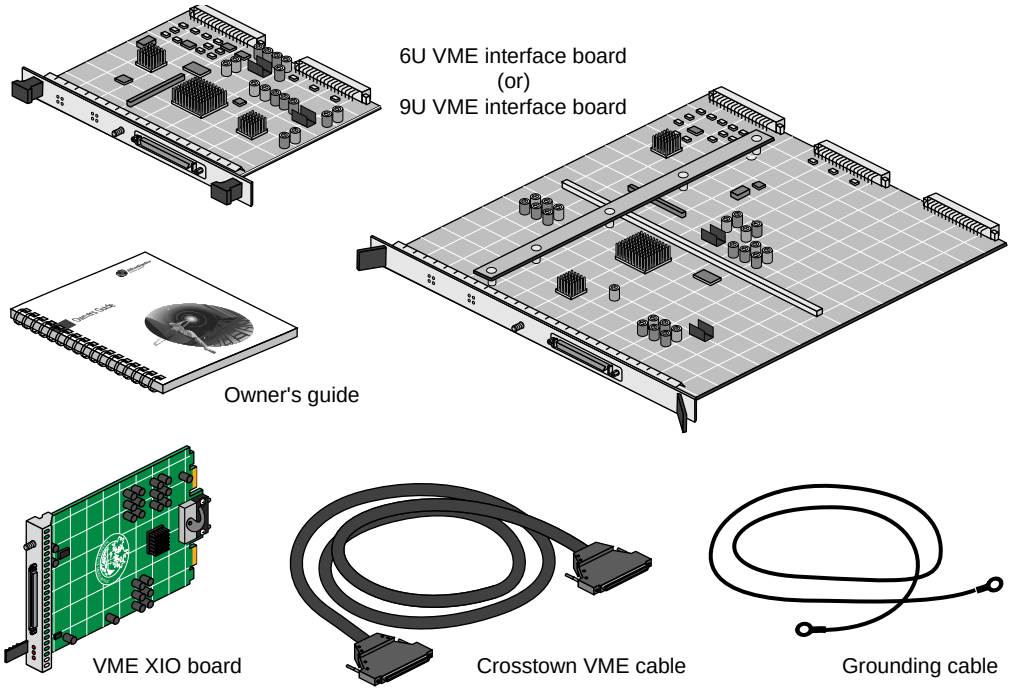

Figure 1-7 Silicon Graphics Origin VME Kit Contents

Chapter 2

Installing the VME Interface Board

This chapter provides information on properly installing the Silicon Graphics VME interface board in an ELMA enclosure.

As previously listed in this manual, there are two Silicon Graphics VME interface boards that install in an approved ELMA enclosure:

- a 6U interface board for the 6U VME enclosure
- a 9U interface board for the 9U VME enclosure

2.1 Installation Guidelines

Review the following guidelines prior to installing the VME interface board:

- The 6U interface board does not work in the 9U chassis.
- The 6U and 9U interface boards always install in slot 1 (the slot closest to the power connector).
- Never connect the VME interface boards to the XIO interface board with a cable other than the 9-foot (2.74 m) crosstown VME cable (P / N 013-2230-001) shipped with the kit.
- Leave the interface boards in their anti-static containers until you are ready for installation.
- Use a grounding strap, and follow all ESD precautions before installing a board.

2.2 Installing a Board

Use the following generic steps to install either the 6U or 9U VME interface board into an approved ELMA VME chassis:

1. After taking all standard ESD precautions, remove the 6U or 9U VME interface board from its anti-static container.
2. Align the board with the slide rails in slot 1 of the ELMA enclosure (the component side of the board should be toward the inside of the enclosure).

3. Slide the board gently into the enclosure until it mates with the VME connectors on the ELMA backplane. Note that the levers on either end of the board are for extraction only and are not used during the installation.
4. Press on the faceplate of the board until it is firmly seated on the connectors. Note that seating the board may take a moderate amount of force, and there may be no audible "click" when it is fully mated to the back plane connectors.
5. Install the ground wire cable to the lug on the back of the VME interface board's I/O panel (not the ground lug on the VME enclosure).
6. Install the 100-pin crosstown VME cable to the back of the interface board.

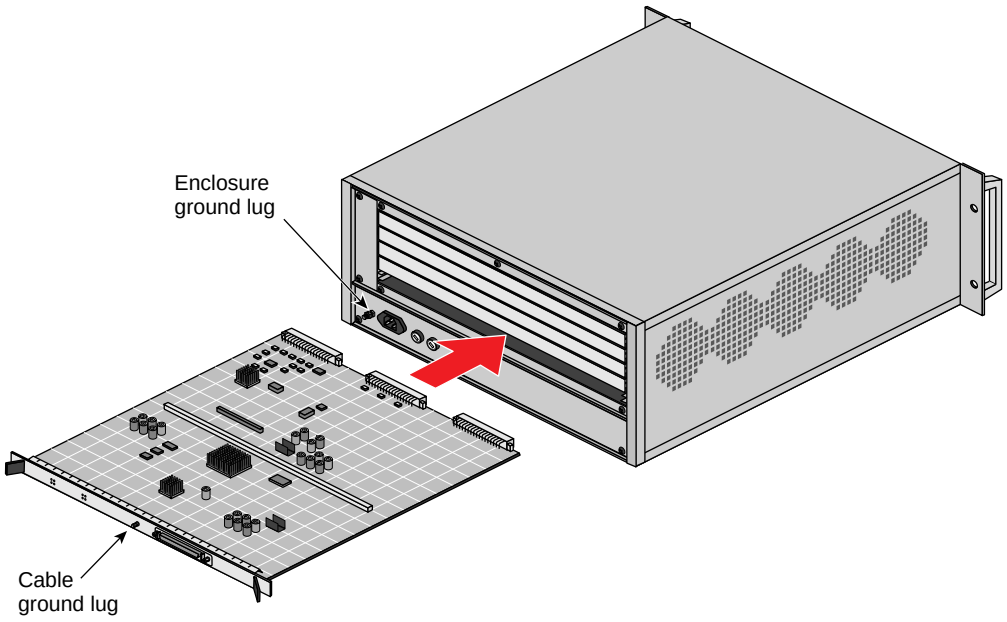

Figure 2-1 Installing the VME Interface Board

Caution: The Silicon Graphics VME interface board is designed in compliance with standard VME mechanical specifications as well as those specified by ELMA. This includes EMI shielding or (grounding fingers) that are connected to the side of the I/O panel (see Figure 2-2). Advise the customer that under certain circumstances, a VME board installed in slot 2 may contact these grounding fingers and cause a short in the slot-2 board.

One of the following methods should be used to avoid any risk of a mechanical short circuit while using the VME chassis:

- Leave VME slot 2 empty.
- With the system turned off, install a VME board in VME chassis slot 2 and visually inspect it to ensure that it is not contacting the VME interface board grounding fingers.
- Cover the grounding fingers with a non-conductive, protective tape.
- Remove the grounding fingers from the VME interface board.

Note: The Silicon Graphics VME interface board is designed in compliance with VME mechanical specifications and it is recommended that it should be used only with other VME compliant boards. If the end user installs VME boards that are not compliant with VME mechanical specifications, VME board problems can occur. The customer assumes full responsibility for problems related to installation of non-compliant VME boards in the ELMA system. Silicon Graphics is not liable for any system problems that occur as a result of using non-compliant VME boards.

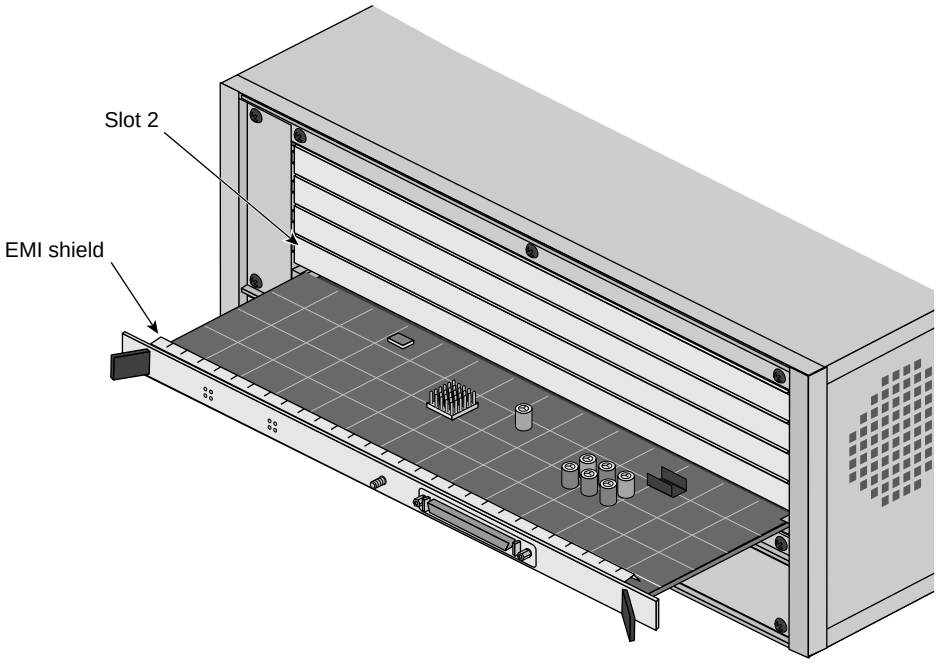

Figure 2-2 VME Interface Board Grounding Finger Location

2.3 VME Interface Board LEDs

Note that the VME interface boards have a total of eight function LEDs (located at the opposite side from the 100-pin connector). These LEDs provide a very basic functional status for each board. Note that LED0, LED1, LED2, and LED3 are not used and do not provide any useful field diagnostic information.

Figure 2-3 shows the location and identifies the LEDs. The LEDs provide the same information on both the 6U and 9U VME interface boards:

- The 3.3 volt level on the board is OK as long as this green LED is on; it goes dark if the voltage is off or out of its specified range.
- The link OK LED monitors the voltage link connection between the VME interface board and the XIO board in the host system. A green LED means the link is OK, while a flashing or dark LED means there is a linkage problem.

- The 1.7 volt level on the board is OK as long as the LED glows green; it goes dark if the voltage is off or out of its specified range.
- The 2.4 volt level on the board is OK as long as the LED glows green; it goes dark if the voltage is off or out of its specified range.

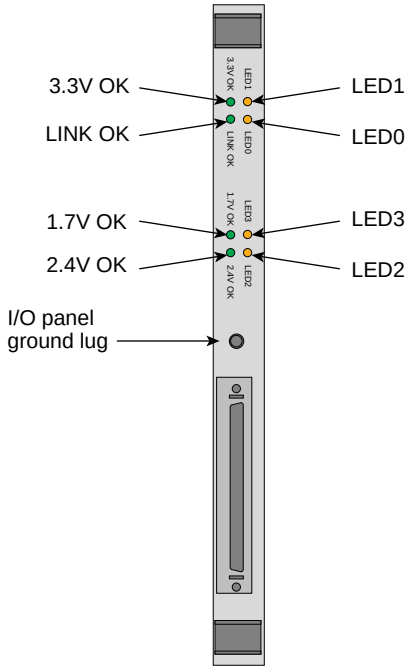

Figure 2-3 VME Interface Board Function LEDs

Chapter 3

VME XIO Board Installation in the Host System

Depending on the operating system the host is running, you may need to install a patch(es), diagnostic code, or even upgrade the operating system. You should always load needed software upgrades and diagnostic code before installing the new hardware. See the release notes for additional information on required software.

Installing or removing and replacing a new crosstown VME XIO board are procedures performed only by Silicon Graphics trained and qualified installers. A #2 Phillips-head and a medium or thin flat-blade screwdriver are required.

3.1 VME XIO Board Components

The VME XIO option boards are installed *only* in the XIO slots of Origin2000 and Onyx2 systems. Each active XIO slot provides up to 800 megabytes per second of bidirectional bandwidth (that is, 400 megabytes in each direction) through a nonblocking crossbar switch on the system's midplane. All XIO slots in a system can be active simultaneously. The main components of the XIO board are listed in Table 3-1.

Table 3-1 Main XIO to VME Board Components

Component	Explanation
100-pin port	The XIO to VME port is 100-pin female connector.
Grounding lug	The ground lug connects the host ground potential with that on the ELMA enclosure. Both ends of the grounding cable must be connected.
Compression connector	Provides communication between the XIO board and the system midplane.
Connector hooks	Hold compression connector securely to midplane or frontplane. There is one hook on each side of the compression connector. The hook actuator (next entry in this list) pushes or pulls the hooks into or out of the locked position.
Hook actuator	Device for moving hooks into and out of their locked position on the midplane or frontplane.
Thick side of board	The surface of the board that has the compression connector and the tallest components.
Thin side of board	The side of the board with low-profile components.

Caution: Do not wipe or touch the pads of the board's compression connector (see Figure 3-1). Take the board out of its antistatic bag and remove the compression connector cover only when you are ready to install it. When removing a board, immediately install the connector cover and place the board assembly in an antistatic container. Use all standard electrostatic discharge avoidance guidelines when handling the XIO board(s).

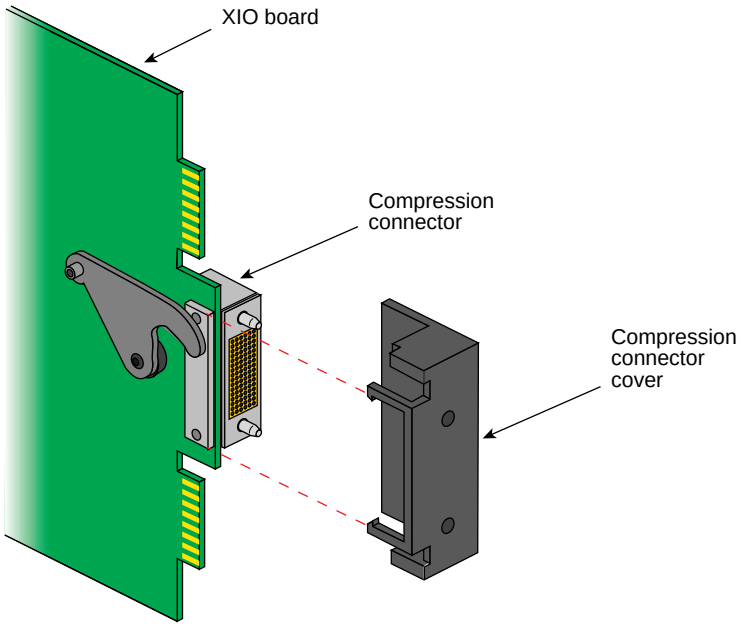

Figure 3-1 XIO Compression Connector and Cover

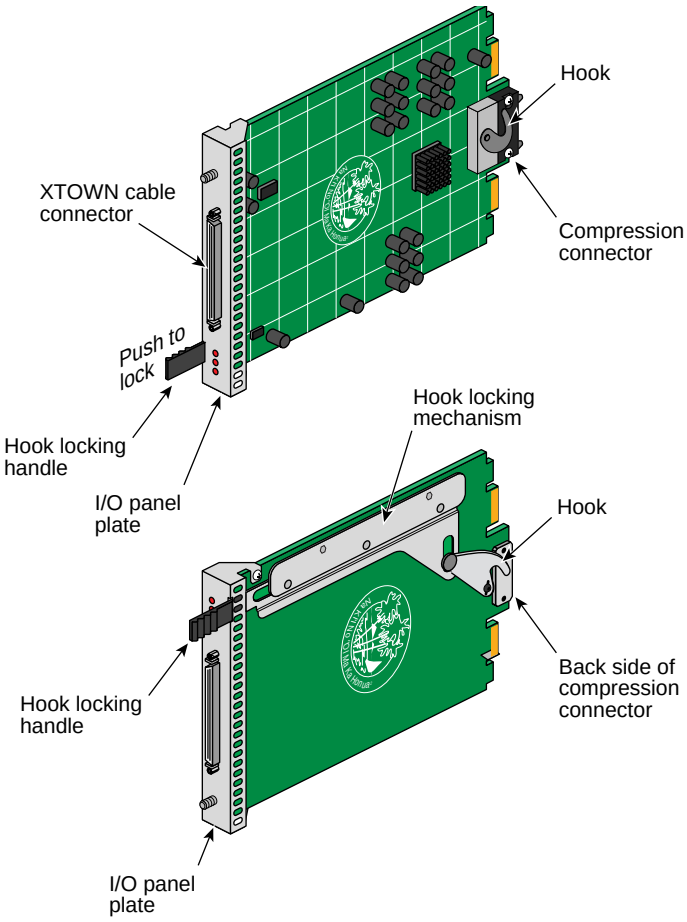

Figure 3-2 VME XIO Board

3.2 Host System Preparation

Follow the instructions in this section to shut down the host system before installing the XIO board. If you have already shut down the system, go to the next section and begin the board installation.

Use the following steps to prepare the host system for XIO installation:

1. Shut down the system:

```
% su
Password: the_password
# sync
# /etc/halt
```

2. When the message appears indicating that it is safe to power off the system, turn the key switch on the System Controller to the STANDBY position.

3. At the rear of the system, flip the power switch (circuit breaker) Off (down). Do not disconnect the power plug.
4. Wait 2 full minutes (after turning off the power) to allow the system's stored electrical charge to dissipate.

Warning: **Failure to properly shut down the host system before board installation may cause damage to equipment and expose the XIO board installer to risk of electric shock.**

3.3 Chassis Grounding Issues

Grounding issues are very important in Origin family and Onyx2 systems. Always connect the grounding cable lug on the XIO board to the VME interface board grounding lug using the special ground wire included with the kit.

In addition, each chassis should be well grounded through its power connector. All chassis connected together with XIO copper cables must share the same transformer, must be grounded through the same earthing rod, and must be on the same branch circuit.

If you have any doubts about the quality of the ground connection, it is important that you consult with a qualified electrician.

Caution: Any difference in ground potential greater than 500 millivolts (0.5 volts) between two chassis connected with copper XIO cables can cause severe equipment damage and can create hazardous conditions.

The branch circuit wiring should be provided with an insulated grounding conductor that is identical in size, insulation material, and thickness to the earthed and unearthed branch-circuit supply conductors.

The grounding conductor should be green, with or without one or more yellow stripes. This grounding or earthing conductor should be connected to earth at the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generator set.

The power receptacles in the vicinity of the systems should all be of an earthing type, and the grounding or earthing conductors serving these receptacles should be connected to earth at the service equipment.

3.4 Installing an XIO Board in the Host System

The XIO board installs in the Silicon Graphics host system in a manner similar to other XIO boards. The lever (handle) on the XIO board is pulled or pushed to work the compression connector's hook:

- Pushing the handle engages the hook and seats the compression connector to the midplane.
- Pulling the handle releases the hook in preparation for removing the board.

XIO boards are inserted at the rear of the chassis (module), on the right side. Where a slot is not populated, a baffle board is installed to ensure proper airflow. As a general rule, fill available odd-numbered XIO slots before filling even-numbered ones, and fill lower-numbered slots before higher-numbered ones.

To remove a blank panel and insert the new VME XIO board, follow these steps:

1. If you have not already done so, power off the system. At the back of the chassis, ground yourself and follow other ESD procedures (see the previous section).
2. Locate the panel plate containment bar, loosen each of the bar's screws and pull it towards you. You will need to slide the bar over some rivets. The bar snaps into a holding position so that it stays out of the way.
3. Remove the panel plate and XIO air baffle board from the selected slot and lay it aside.
4. Remove the new board from its packaging and lay it on an antistatic work surface.
5. Remove the protective cap from the new board's compression connector (if you have not already done so) as illustrated in Figure 3-1. Save this cap to cover the compression connector if you remove the board for any reason.

   Caution: Failure to install the protective cap on the compression connector when the board is removed from the host system can result in irreparable damage to the connector's pads.
6. Orient the board depending on the slot it is to occupy, as diagrammed in Figure 3-3 and Figure 3-4, slide it into the chassis until it is snug against the midplane, and press evenly on the panel plate until the board comes to a stop. If the board's panel plate is not flush with the other panel plates, pull out and reinsert the locking handle.
7. Lock the board to the midplane by firmly pushing the handle of the engagement lever until it stops. Pushing in on this handle presses the compression connector's hook into its receiver on the midplane.
8. Slide the containment bar back into place so that it holds the panel plates. Tighten its screws.
9. Reverse the previous steps to remove an XIO board.

See Section 3.4.1, "VME Cabling to the XIO Board," for information on VME to XIO cabling installation. Do not power the system on until all the VME components are installed, checked, and powered on.

Note: IRIX release 6.4 supports a maximum of five XIO controller boards in a host system (not per module). Check the release notes for later OS versions to determine if this maximum number has changed.

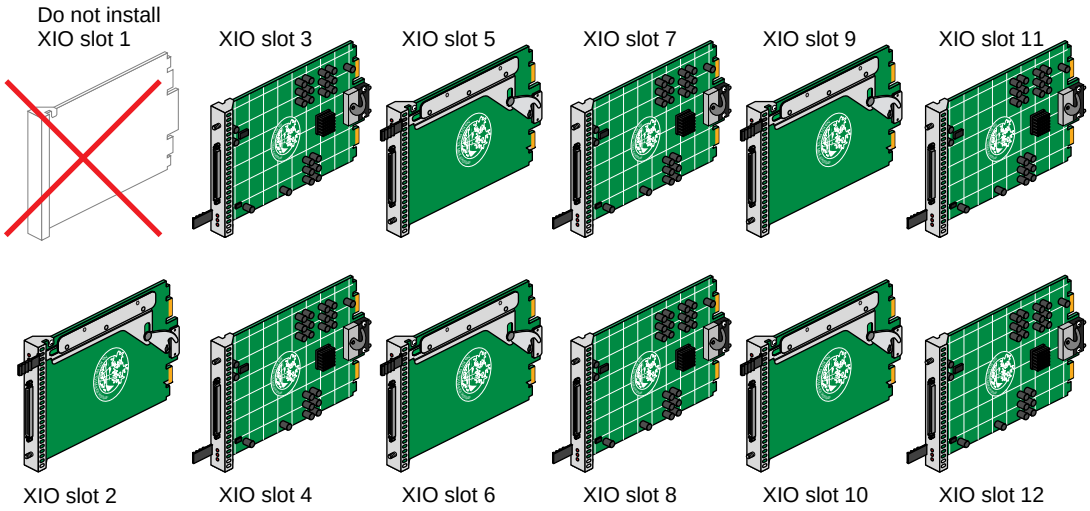

Figure 3-3 Board Orientation for Origin2000 Systems and Onyx2 Rackmount

The Onyx2 deskside system has a different board orientation scheme (see Figure 3-4).

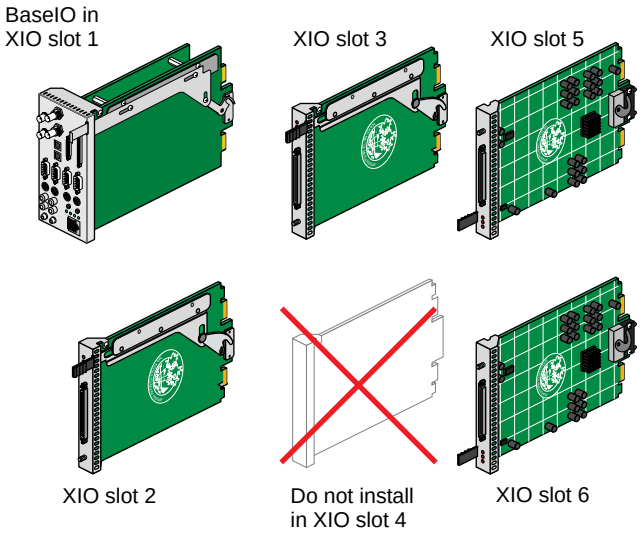

Figure 3-4 Board Orientation for Onyx2 Deskside

Note: In the Onyx2 deskside, slot 4 has no midplane connector.

3.4.1 VME Cabling to the XIO Board

This section describes the attachment of the XIO to VME board cable(s).

1. Locate the XIO to VME enclosure (crosstown) connection cable(s).
2. Attach labels on the panel plate and cable(s) if applicable.
3. Ensure the ground cable is securely attached to the ground lug on the I/O panel of each of the boards. Note that you may wish to tie-wrap the ground cable to the VME crosstown (Xtown) cable if they are not already bundled.
4. Attach the external cable(s) to the appropriate ports (see the example in Figure 3-5).
5. Power on the VME enclosure(s).

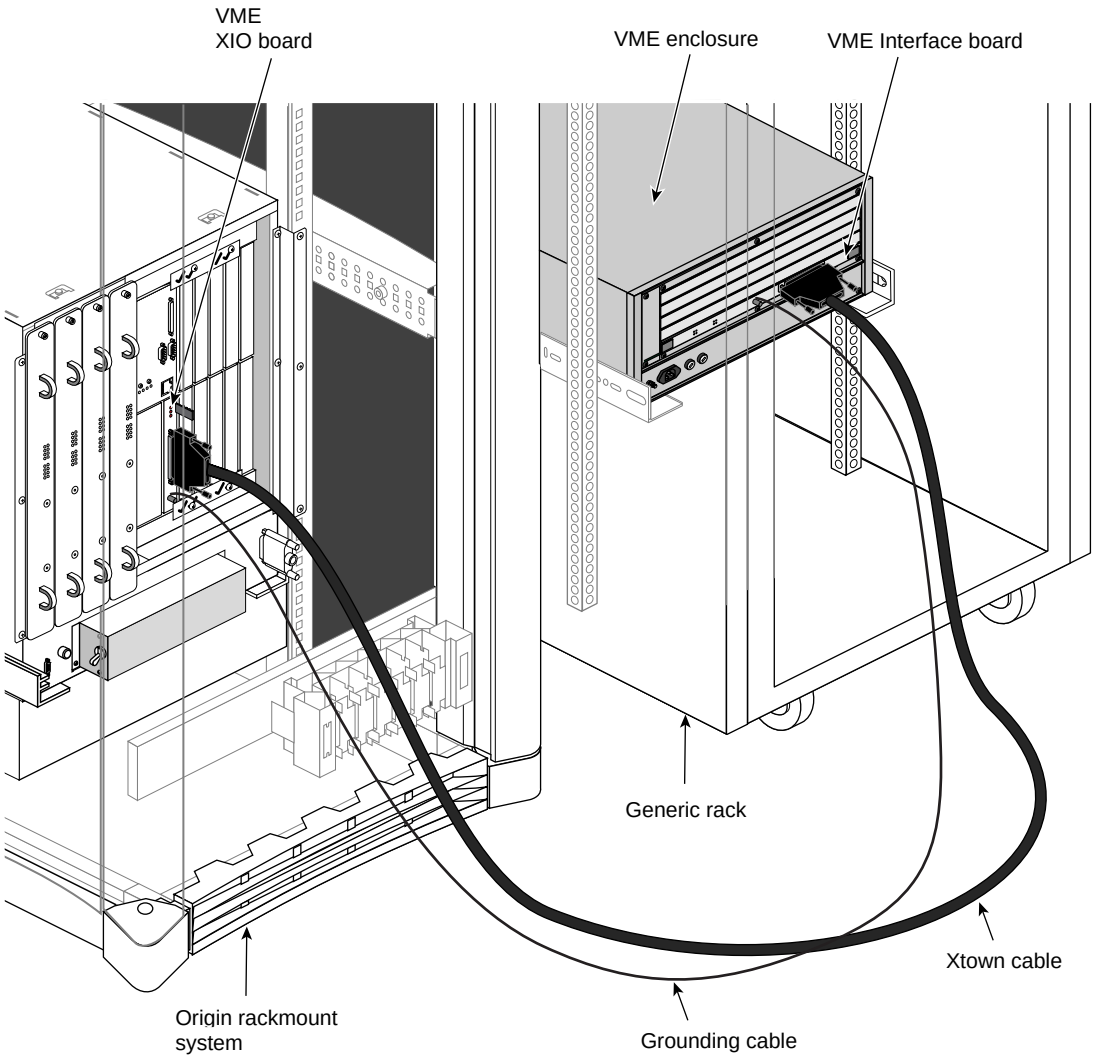

Figure 3-5 VME to XIO Board Cabling Example

3.5 Restarting the Host System

Restart the host only after the VME enclosure(s) is installed, configured, and properly connected. When the board is installed and connected, restart the host system:

1. Confirm that the VME enclosure is properly powered on. The fans should be running and some of the LEDs on the VME interface board will light.
2. Set the Origin or Onyx2 system circuit breaker power switch to the On position.
3. Restart the system by turning the key in the module's System Controller to On.
4. Log on after the system boots. Depending on the IRIX release on the host system, you should have already installed a patch(s), diagnostic code, or even possibly upgraded the operating system as indicated at the beginning of this chapter.
5. If you have not installed and configured the software, do so now by following the instructions in the release notes. The new XIO to VME interface does not function until the software has been properly configured.

   Note: If you waited until after the new hardware was installed to load the needed software upgrades, reboot the system (or run the *autoconfig* command) to build a new operating system (kernel) that includes the new drivers. Reboot the host again to start the new operating system.

3.6 Checking the New Installation

Verify that the NIC on the VME interface board is recognized by the operating system during the bootup. Use the *hinv* command which provides a listing similar to that shown below. This may change with future operating system releases.

```
# hinv
FPU: MIPS R10010 Floating Point Chip Revision: 0.0
CPU: MIPS R10000 Processor Chip Revision: 2.6
1 195 MHZ IP27 Processor
Main memory size: 128 Mbytes
Instruction cache size: 32 Kbytes
Data cache size: 32 Kbytes
Secondary unified instruction/data cache size: 4 Mbytes
Integral SCSI controller 0: Version QL1040B
  Disk drive: unit 1 on SCSI controller 0
Integral SCSI controller 1: Version QL1040B
IOC3 serial port: tty1
IOC3 serial port: tty2
Integral Fast Ethernet: ef0, version 1
VME bus: adapter 2
VME bus: adapter 4
VME bus: adapter 1
VME bus: adapter 3
IOC3 external interrupts: 1
```

Every system is slightly different; the point of the previous *hinv* example is to provide general information on what to look for after the installation and successful bring-up of the VME enclosure(s) and the host.

To confirm or identify the host XIO slot the XIO to VME interface board is installed in, enter the following and you will receive information similar to:

```
# find /hw -name vme -print
/hw/module/1/slot/io4/vme_xtown/pci/7/vme
/hw/module/1/slot/io2/vme_xtown/pci/7/vme
/hw/module/1/slot/io5/vme_xtown/pci/7/vme
/hw/module/1/slot/io3/vme_xtown/pci/7/vme
/hw/vme
```

This should correctly identify the chassis and XIO slot into which you installed the board(s). Once you have this information you can use list the contents of the */hw/vme* directory for more detail about the option; for example:

```
# ls /hw/vme
1 2 3 4
```

If you cd to 1 and list the contents, you should see something like:

```
# ls
controller  direct      dma_engine  usrvme
```

For diagnostic test information, see Chapter 5, “Diagnostic Tests.”

For more general information on the Origin2000 or Onyx2 host systems, see the *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions*.

Chapter 4

Configuration Guidelines

This chapter discusses configuration limits and allowances for the VME options. You should read this information carefully if you have never before installed the VME option for an Origin or Onyx2 system. This chapter may also be of interest to an installer who is expanding an existing host system with additional ELMA VME options.

The ELMA VME chassis options must be *only* those approved and tested to work with Silicon Graphics systems. Each approved ELMA chassis has a grounding lug on the back of the enclosure and a part number that includes the letters “SGI.” The chassis should always be properly grounded when installed in an equipment rack (see Figure 4-1).

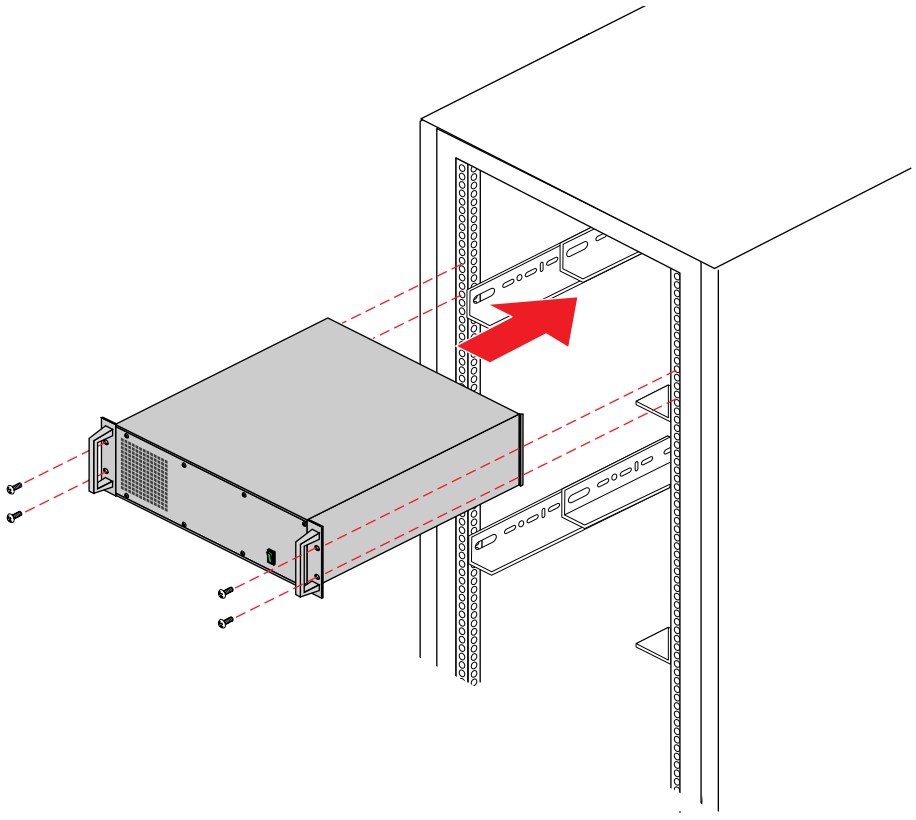

Figure 4-1 VME Chassis Mounted in a 19-Inch Equipment Rack

Note: Each ELMA VME enclosure has been certified and licensed by international safety agencies for use as either a stand-alone unit, or for installation in a 19-inch equipment rack. Regardless of whether the VME enclosure is set up and installed by the customer or a Silicon Graphics authorized service person, installation in a rack may require submittal to an approved safety agency for their evaluation and certification or licensing of the new rack-system combination.

4.1 Cabling and Grounding

The following list provides cabling and grounding rules for the ELMA VME options used with Origin2000 and Onyx2 systems:

- Each ELMA VME option must use the 9-foot (2.74 m) crosstown interface cable. (P / N 013-2230-001).
- A grounding cable with a ring-type lug connector on each end is always used in conjunction with the VME crosstown cable.
- Always order and use the crosstown XIO VME adapter board (P / N 030-1280-001) for first installation and spares. This XIO board has the ground lug connection on its I / O panel.
- Never use the graphics interface version of the XIO board (P / N 030-0846-001).

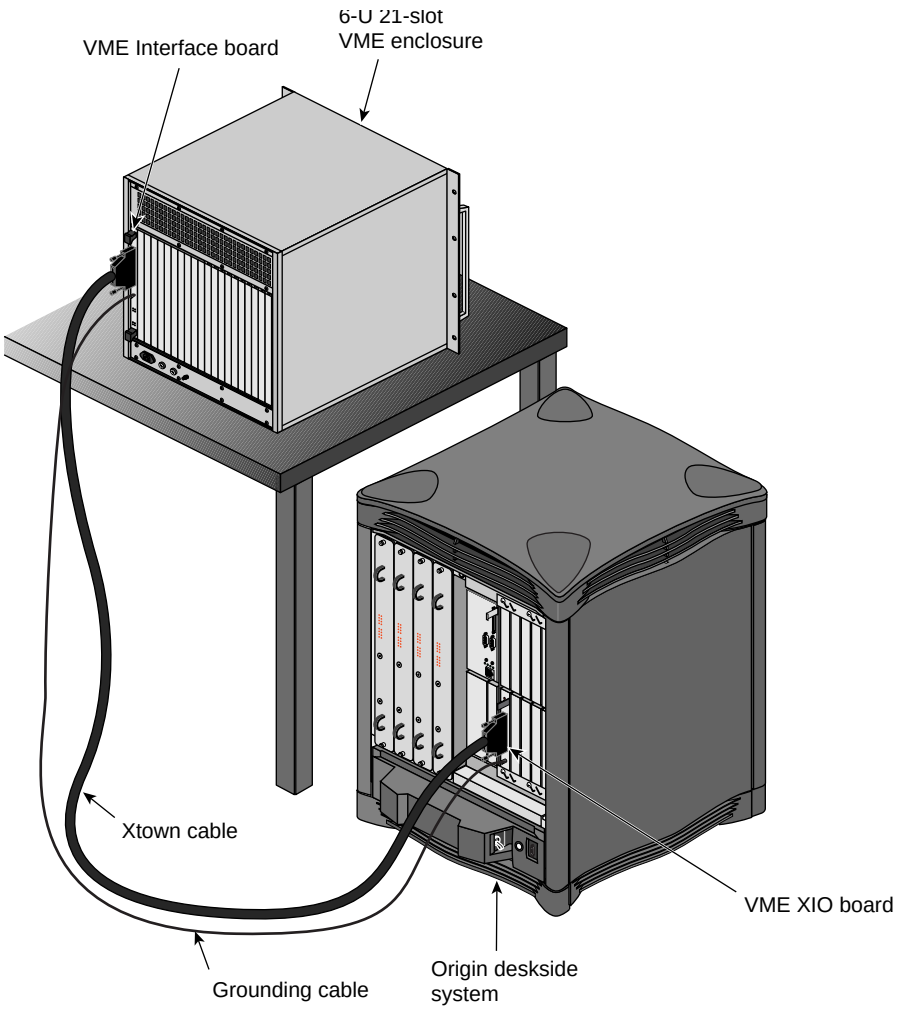

Figure 4-2 VME Interface Cabling Example

4.2 Maximum Number of VME Connections Per Host

The maximum supported number of XIO VME options per host system is five. This number is the maximum no matter how many modules the Origin2000 or Onyx2 systems include.

Note that the maximum number of available XIO slots in the Onyx2 deskside system is four (reference Figure 3-4 and “Installing an XIO Board in the Host System” in Chapter 3).

Chapter 5

Diagnostic Tests

This chapter provides basic diagnostic testing information that may be used after completion of the installation.

There are a number of diagnostic tests available for the Origin2000 and Onyx2 XIO to VME interface boards. Most of these tests are oriented toward fault isolation and diagnosis in the factory and some require special hardware. Two function tests that are useful in the field are documented in this chapter.

Diagnostic test code is available for downloading from a designated Silicon Graphics Web site or on a CD.

5.1 bridge Diagnostic Command

The *bridge* diagnostic command is used after the VME option is installed and the host and VME enclosure are powered on.

The *bridge* adapter test commands probe two aspects of the adapter ASIC on the Silicon Graphics VME interface board:

- *bridge_ram* tests all the host system's bridge adapter's internal (and external, when present) mapping ram.
- *bridge_rev* checks all the host system's bridge adapter's revision levels. This allows scripts to easily determine bridge ASIC revision levels when that information is important.

Unless there is only a single bridge adapter board used in the host system module, you must specify a hardware graph (*hwgraph*) path argument to the *bridge* diagnostic command. This argument, (known as the port-specifier flag) is a *-g* argument to the *bridge* command, and is followed by the hardware path. Suppose you issued this diagnostic command:

bridge_ram -g /hw/module/1/slot/io3/vme_xtown_6u/pci/controller

The *bridge* diagnostic would examine the amount of bridge RAM present on the XIO to VME board located in module 1, XIO slot 3 on the host system.

The *-e* argument to the *bridge* command tells the diagnostic to read the bridge adapter hwgraph from the environment variable file *DIAG_PCI_DEVICE* rather than from the

command line. The *-e* argument is used primarily with scripts and repetitive test situations and may not be practical in the field.

The *-r* argument to *bridge* sets the lowest allowed revision number for the bridge ASIC. If the bridge adapter fails to meet the minimum revision level you set, the test fails and returns a value of 1.

The *bridge_rev* command checks only the selected bridge adapter's revision level. You would still need to use the *-r* argument to *bridge_rev* to determine if the revision is below acceptable limits.

Note: The bridge tests return a 0 when all tests show OK, and a 1 when an error condition is detected.

The verbosity of the bridge test results can be increased or decreased using the *D_REPORTLEVEL* file. The maximum verbosity level is 5 and the default level is 2.

See the bridge(1) reference (man) page for additional information on these commands.

5.2 universe_pio Adapter Tests

The *universe_pio* test command and its optional arguments check PCI configuration, memory space access, and addressing correctness on the Universe ASIC. The Universe ASIC is located on the Silicon Graphics VME adapter board that plugs into the VME chassis.

Using the Universe adapter's PCI software interrupt loopback mode, *universe_pio* tests eight PCI interrupt levels.

You must use command line options identifying a particular board with the *universe_pio* diagnostic test. If no board is specified, *universe_pio* looks in the *DIAG_PCI_DEVICE* environment file. It automatically uses the information in *DIAG_PCI_DEVICE* if it is properly defined. If neither option specifies a board location path, *universe_pio* prints a usage message and exits.

The primary command line option of interest to the field installer is *-g*.

The *-g* option is the hardware graph string location of the VME XIO board. This is the most straightforward method to obtain the information.

If you have some need to specify the test of a particular functional aspect of the VME configuration, use one of the following arguments:
-m -i -n -p and *-h*

The *-m* (module name) argument identifies the module the XIO board is located in. The *-i* is followed by the XIO slot number. The *-n* is the generic board name incorporated in the NIC (vme_xtown_9u). The *-p* represents the PCI slot of the board (the bridge ASIC always sees the universe ASIC as a PCI device in slot 7). The *-h* argument identifies the hub number the DMA test runs on.

To get a list of all USRPCI accessible devices on the host, use the find command:

```
% find /hw -name usrpci -print
```

Use the universe_pio command with the -g argument and the vme_xtown_9u information to construct a diagnostic command inquiry, such as this:

```
% universe_pio -g /hw/module/1/slot/io3/vme_xtown_9u/pci/7
```

See the universe_pio(1) reference (man) page for additional details.