IRIS Crimson Graphics Upgrade Installation Instructions

Note to SSEs:
These installation instructions now contain information on RealityEngine and Extreme graphics for Crimson, as well as server, Entry, Elan, XS, XS24, and PowerVision (VGX) graphics.

Note for Document Number 108-7035-020

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Chapter 1

Introduction

This document explains how to install graphics upgrade kits in a Silicon Graphics® IRIS® Crimson™ system. This chapter contains the following sections:

- Overview of This Document
- Crimson Graphics Systems
- Crimson Graphics Upgrade Packages
- Conventions

Note: The IRIS Crimson system must run operating system Release IRIX™ 4D1-4.0.4 or later or, in the case of the Extreme option, 4D1-4.0.5H or later. If your customer does not have this release loaded, you must order the operating system software. Do not begin this upgrade until you have all of the required hardware and software.

Warning: **Installation of these upgrades requires specific training and technical knowledge. These instructions are provided for use by Silicon Graphics system support engineers or other Silicon Graphics trained personnel only. This equipment utilizes electrical power internally that is hazardous if the equipment is improperly disassembled.**

1.1 Overview of This Document

This guide consist of the following chapters:

Chapter 2 "Kit Contents" describes each upgrade kit in detail.

Chapter 3 "Installing the Upgrade" explains the installation procedure for each upgrade kit.

Chapter 4 "Testing the Boards" provides diagnostic and testing information to ensure proper operation of the newly installed graphics boards.

Chapter 5 "Packaging and Returning the Excess Hardware" explains the proper procedure for returning the replaced graphics boards to Silicon Graphics.

An index completes this guide.

1.2 Crimson Graphics Systems

The basic Crimson system is a single-tower deskside chassis that includes a 50MHz R4000 RISC processor, memory, a high performance I/O channel (POWER Channel™ IO3B), and version 4.0.4 or later (4D1-4.0.5F or later for the RealityEngine option; 4D1-4.0.5H or later for the Extreme option) of the IRIX operating system. The Crimson system is a low-cost, high performance workstation that provides a midpoint between the low end Indigo™ systems and the high end POWER Series™.

The Crimson system comes in the following graphics configurations:

- server (no graphics)
- Entry Graphics
- XS Graphics
- XS24 Graphics
- Elan Graphics
- Extreme Graphics
- PowerVision™ Graphics (VGX or VGXT)
- RealityEngine™

See the *IRIS Crimson Installation and Configuration Guide*, document number 108-7034-010, for a more detailed discussion of the features and components of the different graphics boards.

Note: The XS and XS24 graphics boards are not currently provided as upgrades. Installation for these graphics boards is the same as for the Elan board set.

1.2.1 Server

The Crimson server provides computing power to other remote workstations; it does not have any graphics boards. The server comes with an IP17 CPU board, the POWER Channel IO3B board, and various disk and tape configurations.

The IP17 CPU board contains the R4000-50 RISC CPU, the floating point unit (FPU), and from 16 to 64 MBytes of memory. The IO3B board has two SCSI channels, a VME adapter, and an Ethernet controller.

1.2.2 Entry Graphics

Entry graphics is a single-slot graphics subsystem that provides 1024 X 768 8-bit color graphics. It relies on the Crimson CPU to provide the graphics processing and uses system main memory as a virtual 32-bit z-buffer. It has two video connectors that can drive separate monitors.

The Entry graphics board is inserted in and supported by the MG1 board, which is in turn inserted in the GM slot of the Crimson card cage (slot 9). The MG1 board is an adapter board that connects the Entry graphics board to the Crimson backplane. The Entry graphics board uses the Graphics I/O (GIO) bus, while the Crimson system uses the MP bus. The MG1 matches the data rates of the MP and GIO buses and allows the GIO-based Entry board to accept inputs through the high-speed 3-way transfer of the Crimson bus. The Entry graphics/MG1 board assembly is shown in Figure 1-1.

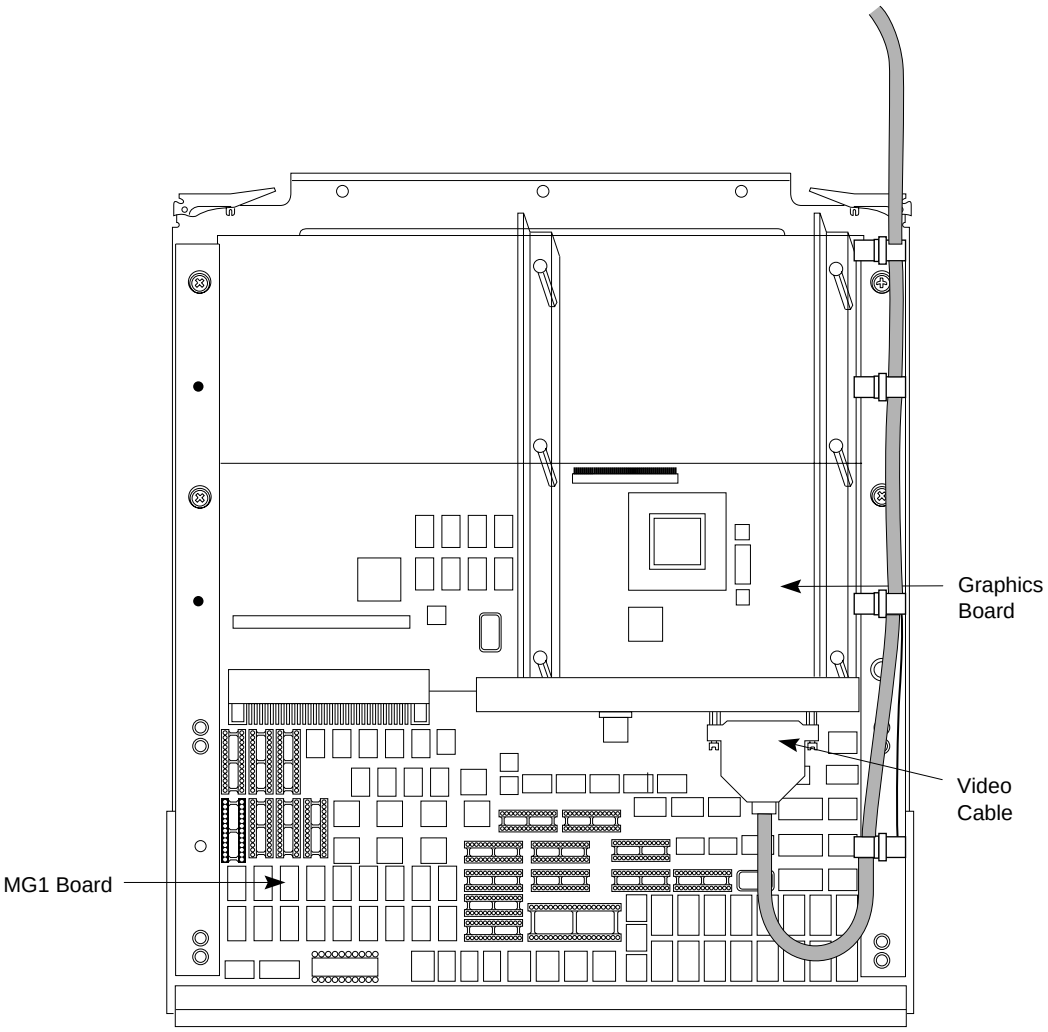


Figure 1-1 Entry Graphics Board Assembly

1.2.3 XS Graphics

XS graphics is a single-slot graphics subsystem that is installed in the GM slot of the Crimson card cage (slot 9). It uses the MG1 board to translate data between the GIO bus and the Crimson system's MP bus.

The XS graphics board includes all the features of Entry graphics, as well as greater screen resolution (1280 X 1024), a Geometry Engine® (GE7) ASIC for increased polygon performance, and an 8-bit Video Memory (VM2) bitplane. It has three connectors: video monitor, genlock, and stereoview. The XS graphics board can be upgraded with additional VM2 boards and a z-buffer daughter board as described later in this chapter. The XS graphics board assembly is shown in Figure 1-2.

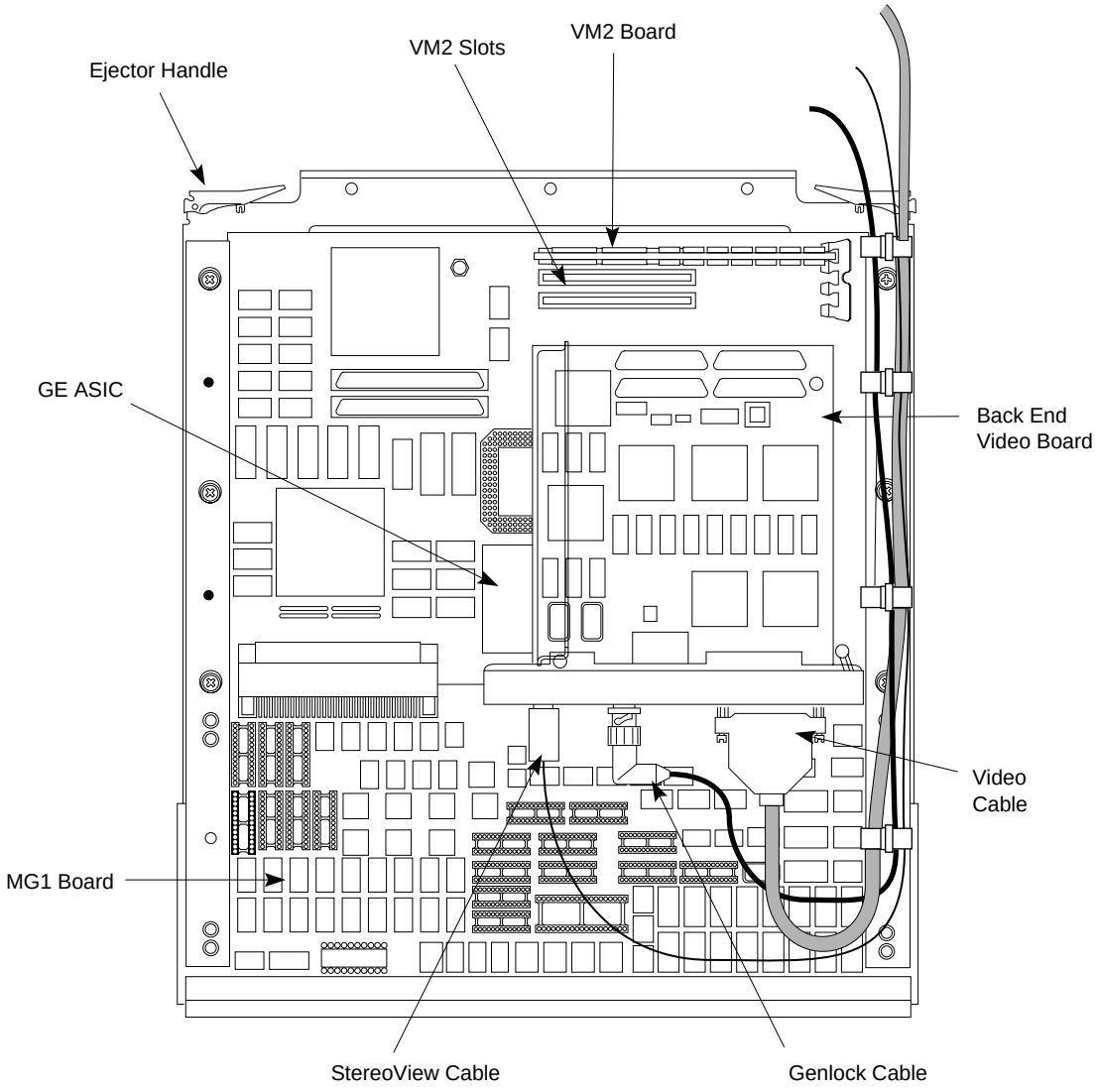


Figure 1-2 XS Graphics Board Assembly

1.2.4 XS24 Graphics

The XS24 graphics subsystem includes all of the features of XS graphics, as well as two additional 8-bit VM2 bitplanes. The three VM2 boards give the XS24 graphics subsystem 24-bit color capability. The XS24 can also be upgraded with a 24-bit z-buffer daughter board.

As with the Entry and XS graphics subsystems, the XS24 board mounts onto and is supported by the MG1 board, which translates data between the GIO bus used by the XS24 and the MP bus used by the Crimson system. The XS24 graphics board assembly is shown in Figure 1-3.

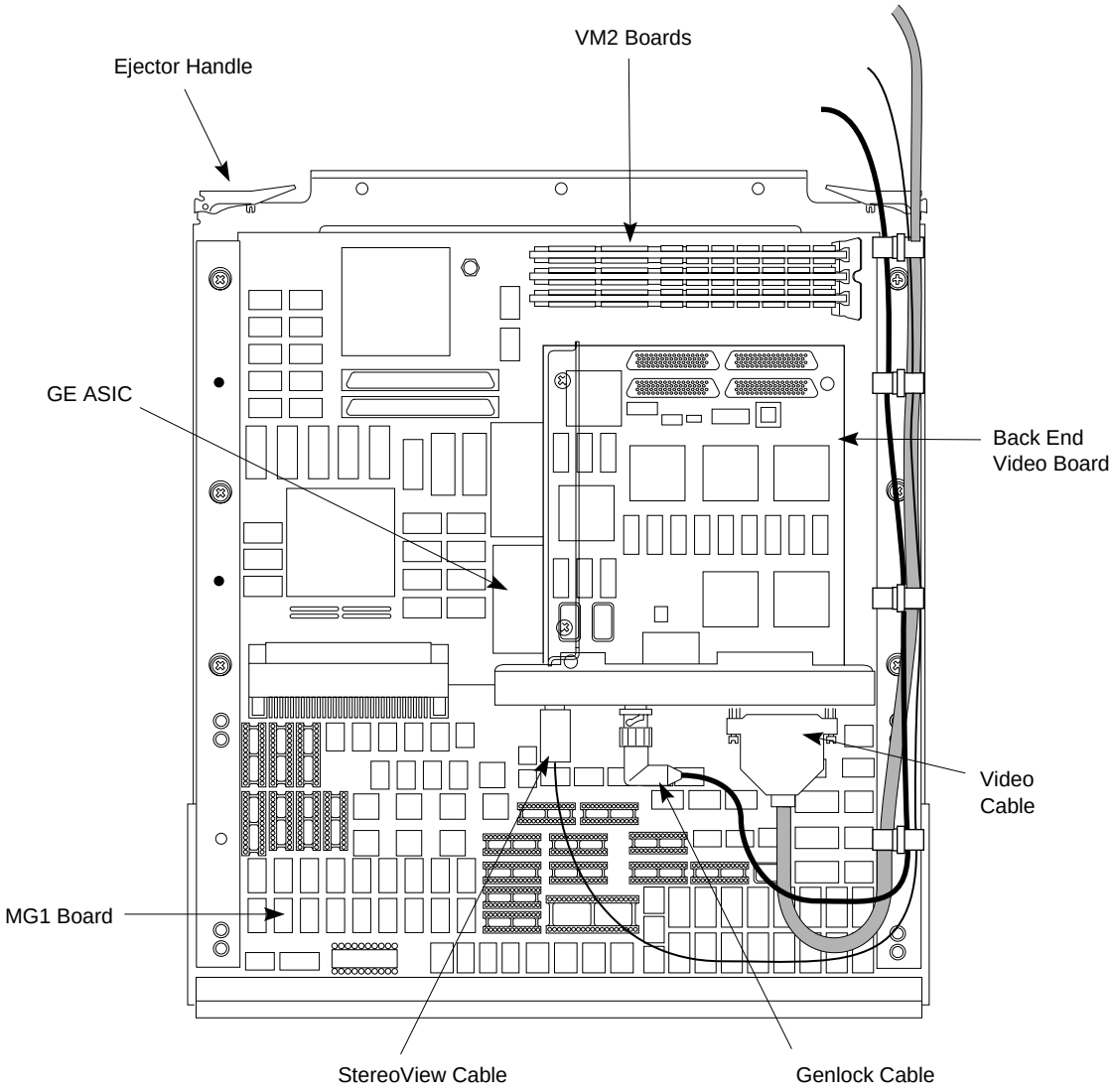


Figure 1-3 XS24 Graphics Board Assembly

1.2.5 Elan Graphics

Elan graphics has all the features of XS24 graphics as well as a 24-bit z-buffer daughter board and four GE7 ASICs.

The Elan graphics board set mounts onto the MG1 board, which translates between the GIO bus of the Elan graphics board and the Crimson system's MP bus. The Elan graphics board assembly is shown in Figure 1-4.

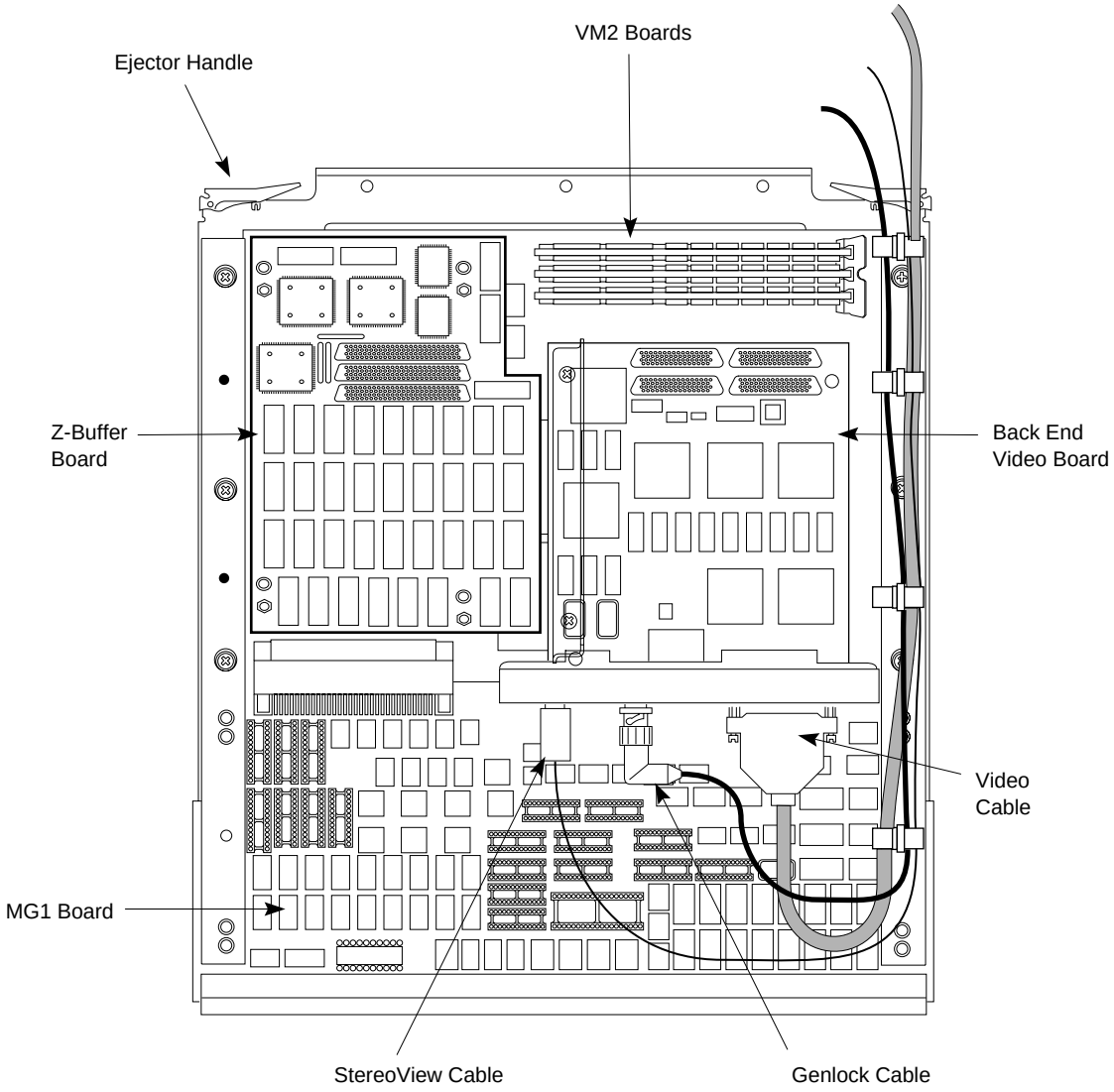


Figure 1-4 Elan Graphics Board Assembly

1.2.6 Extreme Graphics

Extreme graphics is the highest performing single-slot graphics subsystem available for the Crimson system. It has all the features of Elan graphics with eight GE7 ASICs.

The Extreme graphics board set mounts onto the MG1 board, which translates between the GIO bus of the Elan graphics board and the Crimson system's MP bus. The Extreme graphics board assembly is shown in Figure 1-5.

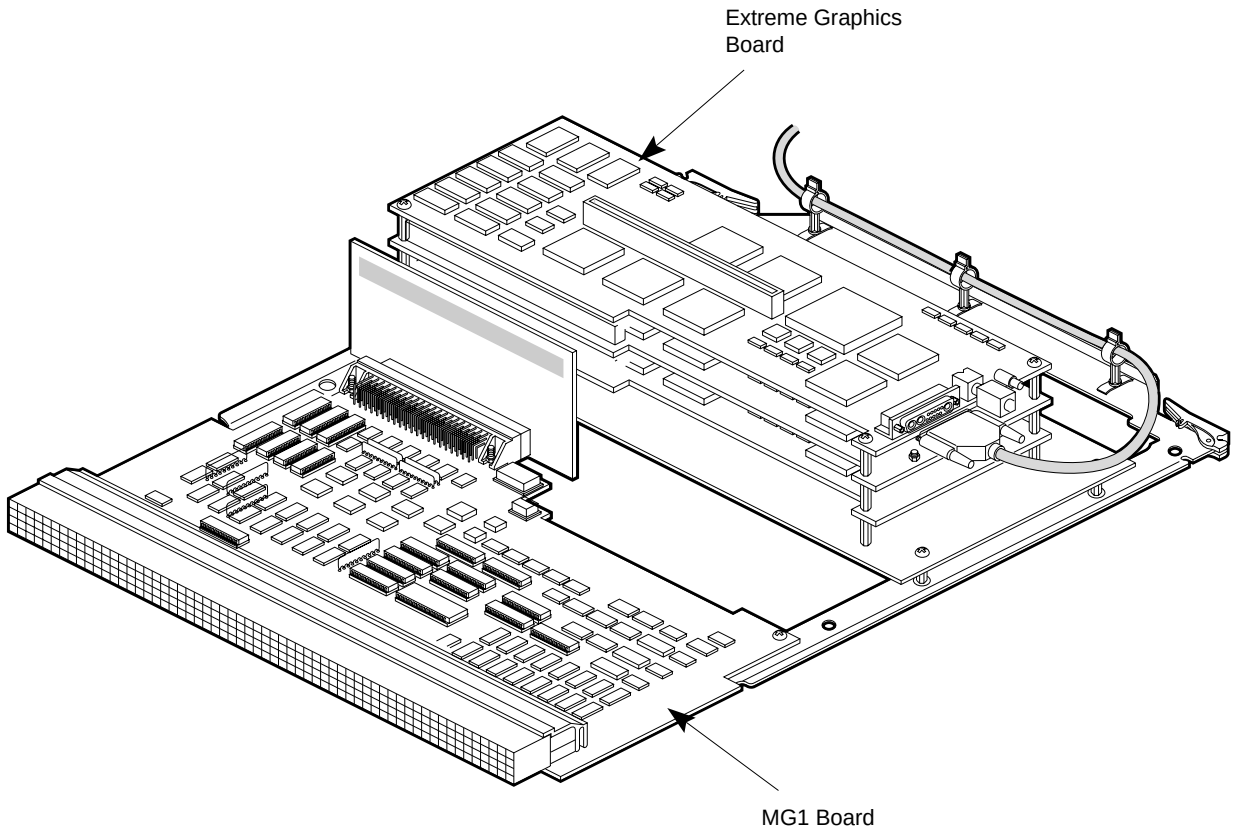


Figure 1-5 Extreme Graphics Board Assembly

1.2.7 PowerVision Graphics

The PowerVision graphics subsystem consists of VGX or VGXT graphics, which provides extremely fast polygon performance. The VGX board set consists of the following four boards:

- GM3 board
- GE6 board
- DG1 board
- RM2 board

PowerVision graphics are described in detail in the *PowerVision Upgrade Installation Instructions* (Part Number 007-5391-*xxx*). Additional information on VGXT graphics is provided in the *VGXT Installation Instructions* (Part Number 108-7013-*xxx*).

1.2.8 RealityEngine

The RealityEngine board set is an enhancement of the PowerVision graphics (VGX). RealityEngine features include greater texel storage capacity, greater texturing and antialiasing capability, more color, and greater depth and spatial resolution. The board set consists of:

- GE8 board
- DG2 board
- RM4T board
- RM4 board

For more information on RealityEngine, see the *RealityEngine Graphics Installation and Configuration Guide*.

1.3 Crimson Graphics Upgrade Packages

Nine Crimson graphics upgrade kits are available. Six of these graphics upgrades are complete graphics system upgrades. Two upgrades add features to the XS and XS24 graphics subsystems; these graphics boards are not currently provided as upgrades. Installation for these graphics boards is the same as for the Elan board set.

Table 1-1 lists each upgrade kit with its marketing code and description. The major components of each kit are summarized in the rest of this section.

Upgrade Kit	Marketing Code	Description
Entry Graphics	HU-4DSBLG	Upgrades a Crimson server to Entry graphics. Includes the MG1 Entry graphics board assembly, keyboard, mouse, and monitor.
XS24 Graphics[1]	HU-XSXS24	Upgrades an XS graphics system to an XS24 system. Consists of two additional VM2 boards to provide full 24-bit color.
Z-buffer upgrade[1]	HU-4DZBX	Upgrades XS and XS24 boards with a 24-bit z-buffer daughter board.
Elan Graphics	HU-4DELAN	Upgrades the system to complete Elan graphics, which includes 3 VM2 boards, and the 24-bit z-buffer daughter board.
Extreme Graphics	HU-4DEXTREM	Upgrades the system to complete Extreme graphics; includes MGI Extreme Graphics board assembly (the MGI board, AB1 board, and three EISA graphics boards), 4.0.5H software, top hat label., and cables (13W3 to I/O, StereoView, and genlock to I/O).
Professional Series [2]	HU-4SYSEG	Upgrades all Professional Series systems to a 16-MByte Crimson Elan graphics system. The existing keyboard, mouse, and monitor are used.
PowerVision (VGX) Graphics	HU-4DVGX	Upgrades the system to PowerVision VGX graphics. Consists of 4 to 5 full-size (9U) boards.
RealityEngine	HU-REALDH	Upgrades the system to RealityEngine graphics. Consists of 4 full-size boards.

1. These XS and XS24 boards are not provided as an upgrade. However, if you already have one of these boards, these upgrade kits allow you to increase the graphics capabilities of these boards.
2. Kit includes a Crimson server with IP17, IO3B board, and 16 MBytes of memory, as well as the Elan Graphics upgrade kit

Table 1-1 Crimson Graphics Upgrades

The rest of this section explains:

- Crimson graphics system upgrade kits
- Professional Series graphics system upgrades
- graphics board upgrades

1.3.1 Crimson Graphics System Upgrade Kits

The graphics system upgrade kits include all boards, cables, and associated hardware required to upgrade a Crimson system to Entry, Elan, Extreme, PowerVision (VGX), or RealityEngine graphics. The Crimson graphics system upgrades are shown in Figure 1-6.

Note: When upgrading a server, you must first upgrade to either the Entry graphics subsystem or the PowerVision subsystem in order to have a monitor, mouse, and keyboard. You cannot upgrade directly from a server to an Elan or Extreme graphics system.

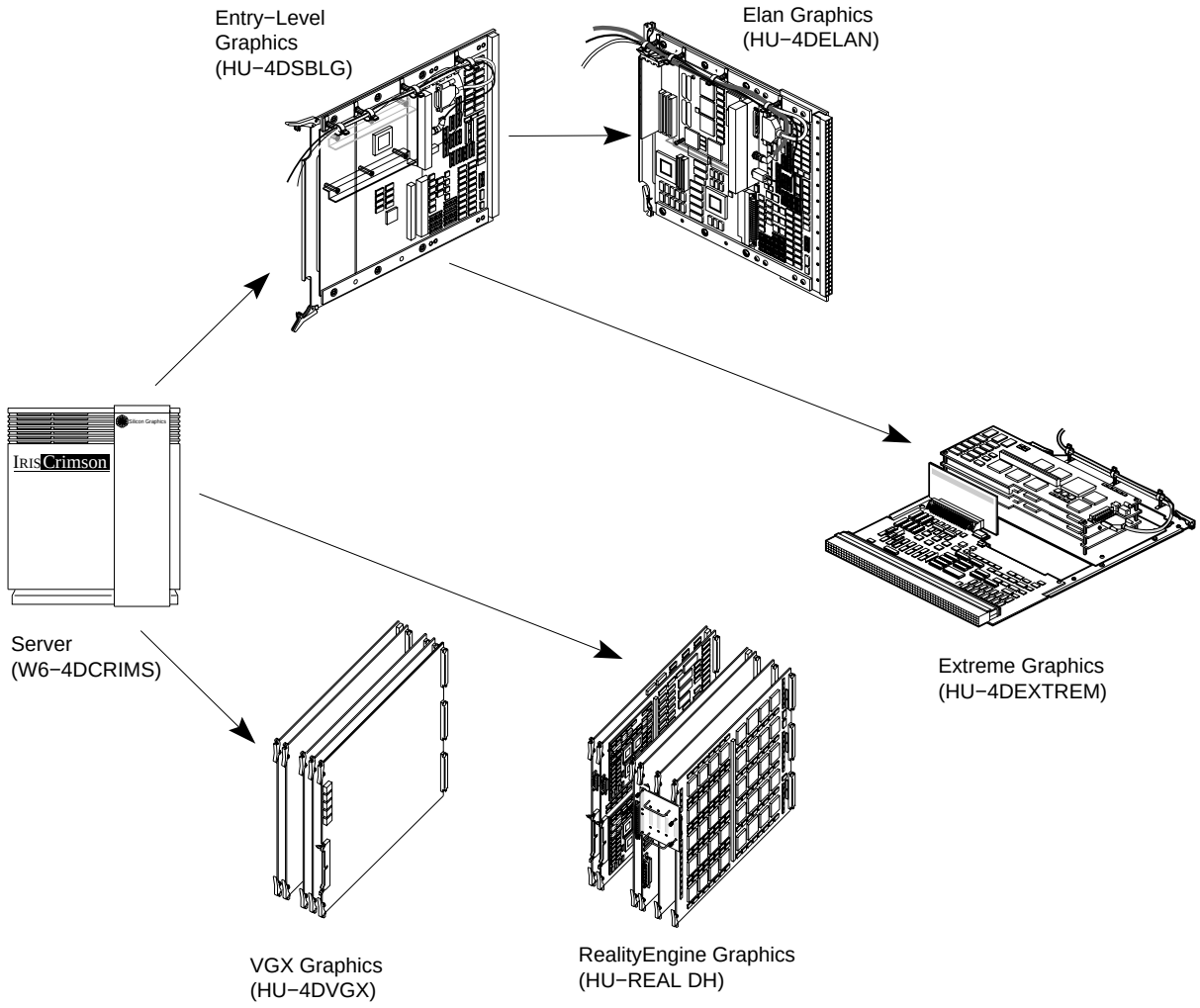
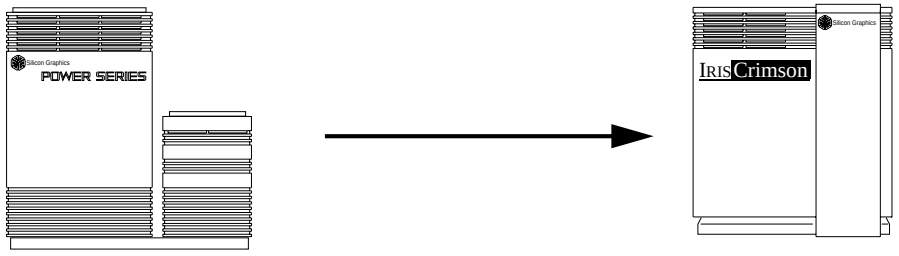


Figure 1-6 Crimson Graphics System Upgrades

1.3.2 Professional Series Graphics System Upgrades

The Professional Series graphics system upgrade kit is a complete chassis upgrade. This upgrade kit includes a Crimson single-tower chassis, IP17, IO3B, and Elan graphics boards, cables, and associated hardware required to upgrade older twin-tower Professional Series systems to a Crimson Elan graphics system.

This upgrade is essentially a chassis swap. The older system is returned, and a new Crimson chassis with Elan graphics is installed (see Figure 1-7). The older system's monitor, keyboard, and mouse are retained.



This chassis is discarded and replaced with Crimson chassis. Crimson Elan Graphics System

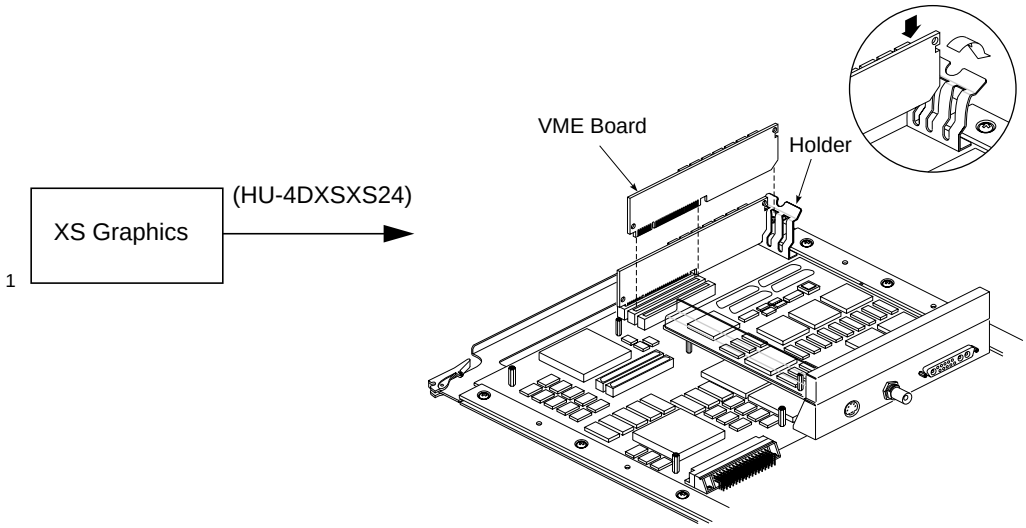
Figure 1-7 Professional Series Chassis Upgrade

1.3.3 Graphics Board Upgrades

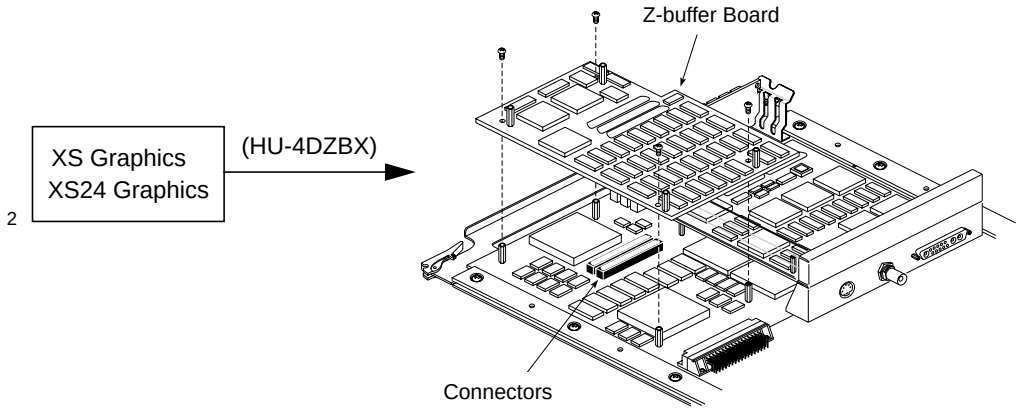
The XS and XS24 graphics boards are not provided as upgrades. However, these boards can be upgraded in the field. Since the XS and XS24 boards are simplified versions of the Elan graphics board, daughter boards can be installed to increase their performance.

- The XS graphics board can be upgraded from 8-bit to 24-bit color. This in effect changes it into an XS24 graphics board.
- Both the XS and XS24 graphics boards can accept a 24-bit z-buffer daughter board upgrade for improved depth rendering.

Figure 1-8 shows how the VM2 and z-buffer boards are installed.



1 Requires installing two VM2 8-bit bitplanes to the XS Graphics board.



2 Requires installing a z-buffer daughter board to the XS or XS24 Graphics board

Figure 1-8 Graphics Board Upgrades

1.4 Conventions

In command syntax descriptions and examples, square brackets ([ ]) surrounding an argument indicate an optional argument. Variable parameters are in italics. Replace these variables with the appropriate string or value.

In text descriptions, IRIX™ file names are in italics. The names of IRIS keyboard keys are printed in boldface typewriter font and enclosed in angle brackets, such as **<Enter>** or **<Esc>**.

Messages and prompts that appear on-screen are shown in typewriter font. Entries that are to be typed exactly as shown are in boldface typewriter font.

Chapter 2

Kit Contents

This chapter describes the contents of the graphics upgrade kits for the Crimson system. Refer to Table 1-1, “Crimson Graphics Upgrades,” for a list of the graphics upgrade kits. The contents of each of these kits are described in this chapter:

- Entry Graphics Upgrade Kit
- XS to XS24 Graphics Upgrade Kit
- z-buffer upgrade kit
- Elan graphics upgrade kit
- Extreme graphics upgrade kit
- Professional Series upgrade kit
- PowerVision Graphics (VGX or VGXT) upgrade kit
- RealityEngine upgrade kit

2.1 Entry Graphics Upgrade Kit

The Entry Graphics Upgrade Kit, Product Code HU-4DSBLG, upgrades a Crimson server to Entry graphics. The customer uses this product code to order the upgrade, which contains the items listed in Table 2-1.

Quantity	Part Number	Description
1	026–0763–xxx	Entry graphics board kit
1	9330814	16-inch 1024 x 768, 60Hz noninterlaced multiscan RGB monitor (D-M16A)
1	013-0453-xxx	Keyboard and mouse

Table 2-1 HU-4DSBLG Kit Contents

The Entry Graphics Board Kit (PN 026-0763-001) includes the items listed in Table 2-2.

Quantity	Part Number	Description
1	013-0493-001	Entry graphics board assembly, including MG1 board
1	018-0285-001	15-foot cable assembly, 13W3 to 13W3
1	024-0559-040	Crimson top hat label
1	024-0577-001	Crimson daughter label
1	026-0736-002	I/O panel screw kit
1	7570012	Transparent static shield bag, 18 x 20
1	090-0089-001	Shipping box

Table 2-2 Entry Graphics Board Kit

2.2 XS to XS24 Graphics Upgrade Kit

The XS24 Graphics upgrade kit (product code HU-4DXSXS24) upgrades an XS graphics board to an XS24 board. The kit contains the items listed in Table 2-3.

Quantity	Part Numbers	Description.
2	030-8059-002	VM2 8-bit color bitplane boards
2	090–0088–001	Shipping box
2	7570801	Transparent static shield bag, 10 x 12

Table 2-3 HU-4DXSXS24 Upgrade Kit Contents

2.3 Z-buffer Upgrade Kit

The z-buffer upgrade kit (product code HU-4DZBX) upgrades either an XS or XS24 graphics board with a 24-bit z-buffer daughter board. The upgrade kit contains the items listed in Table 2-4.

Quantity	Part Number	Description.
1	030–8060–001	Z-buffer daughter board
4	7270805	6-32 x 1/4 screws
1	090–0088–001	Shipping box

Table 2-4 HU-4DZBX Upgrade Kit Contents

2.4 Elan Graphics Upgrade Kit

The Elan Graphics upgrade kit (product code HU-4DELAN) upgrades Crimson Entry, XS, or XS24 graphic systems to an Elan graphics subsystem. The upgrade kit contains the items listed in Table 2-5.

Quantity	Part Number	Description
1	026–0765–002	Elan graphics board kit

Table 2-5 HU-4DELAN Upgrade Kit Contents

The Elan Graphics Board Kit (PN 026-0765-002) includes the items listed in Table 2-6.

Quantity	Part Number	Description
1	013-0494-002	Elan graphics board assembly, including MG1 board
1	018-0285-001	15-foot cable assembly, 13W3 to RGB
1	024-0559-043	Crimson top hat label
1	024-0577-001	Crimson daughter label
1	026-0736-002	I/O panel screw kit
1	7570012	Transparent static shield bag, 18 x 20
1	090-0089-001	Shipping box

Table 2-6 Elan Graphics Upgrade Kit Contents

2.5 Extreme Graphics Upgrade Kit

The Extreme Graphics upgrade kit (product code HU-4DEXTREM) upgrades Crimson Entry, XS, or XS24 graphic systems to an Extreme graphics subsystem. The upgrade kit contains the items listed in Table 2-7.

Quantity	Part Number	Description
1	026–0803–001	Extreme graphics board kit

Table 2-7 HU-4DEXTREM Upgrade Kit Contents

The Extreme Graphics Board Kit (PN 026-0803-001) includes the items listed in Table 2-8.

Quantity	Part Number	Description
1	013-0675-001	Extreme graphics board assembly, including MG1 board, AB1 board, 3 EISA graphics boards, and cables
1	018-0286-001	15-foot cable assembly, 13W3 to RGB
1	024-0646-001	Crimson top hat label
1	024-0577-001	Crimson daughter label
1	026-0736-002	I/O panel screw kit
1		Transparent static shield bag, 18 x 20
1	090-0089-002	Shipping box

Table 2-8 Extreme Graphics Upgrade Kit Contents

2.6 Professional Series Upgrade Kit

The Professional Series upgrade kit (product code HU-4DSYSEG) upgrades older twin-tower systems with a Crimson Elan graphics system. The upgrade kit contains the items listed in Table 2-9.

Quantity	Part Number	Description
1	W6-4DCRIMS	Crimson single-tower server chassis with power cables, IP17 R4000-50 CPU board, 16MBytes of memory, and IO3B I/O Power Channel
1	026–0765–002	Elan graphics upgrade kit
1	090-0006-003	Shipping pallet and ramp
2	HU-MODFLR	Modular to front loading drive upgrade kit (brackets)

Table 2-9 HU-4DSYSEG Upgrade Kit Contents

2.7 PowerVision Graphics Upgrade Kit

The PowerVision Graphics (VGX) upgrade kit (product code HU–SVGX4D) upgrades the Crimson server to VGX graphics. The upgrade kit contains the items listed in Table 2-10.

Quantity	Part Number	Description
1	026–0767–001	PowerVision graphics board kit
1	9330812	19-inch 1280 x 1024, 60Hz noninterlaced color autoscan RGB monitor (D-M19A)
1	013-0453-002	Keyboard and optical mouse
1	024-0517-001	Daughter label set, 4D
1	026-0745-001	Upgrade label kit
1	9350033	Power cord, 125V, 10A
1	090-0013-001	Shipping container, GT upgrade
1	090-0009-001	Shipping container, VME PCB

Table 2-10 HU–SVGX4D Kit Contents

The PowerVision Graphics Board Kit (PN 026-0767-001) includes the items listed in Table 2-11.

Quantity	Part Number	Description
1	018-0189-002	RV1.5 to alpha / PP2 coaxial cable assembly
1	030-0153-004	GE6 board
1	030-0155-001	GI3 board
1	030-0156-004 030-0220-001	RM2 board (VGX) RM3 board (VGXT)
1	030-0218-004	DG1 board
1	030-0160-001	RI5 board
1	030-0232-001	GM3B board
1	013-0451-003	EFI plate assembly
1	018-0183-001	Video / stereo cable assembly
2	7270119	4-40 x 1 / 4 screws
4	7270132	4-40 x 7 / 16 thumb screws

Table 2-11 PowerVision Graphics (VGX) Board Kit

Note: The kit contents for VGXT are the same as for VGX, except that the VGXT has an RM3 board instead of an RM2 board.

2.8 RealityEngine Upgrade Kit

The RealityEngine upgrade kit for Crimson (product code HU-REALDH) upgrades the Crimson server to RealityEngine graphics. The upgrade kit contains the items listed in Table 2-12.

Quantity	Part Number	Description
1	090-0068-001	Box packaging, 12.25 x 9.25 x 3
1	090-0088-001	Shipping box
1	7570801	Static bag, 16 x 20
1	090-0048-002	Shipping container, 20 x 20 x 25
1	026-0769-001	Hardware kit for HU-PWRCHN
1	026-0729-002	PROM / PAL kit, IO3 upgrade
1	026–0784–001	RealityEngine graphics board kit
1	013-0564-001	6-fan tray assembly
1	018-0285-001	External cable assembly, 15’ 13W3 to 13W3
1	018-0286-001	External cable assembly, 15’ 13W3 to RGB
1	030-0224-003	PCB assembly, RM4
1	026-0783-001	Upgrade label kit
1	090-0064-xxx	Shipping container, 20” x 20” x 6”
1	026-0727-005	PROM / PAL kit, 2x40MHz CPU upgrade

Table 2-12 RealityEngine Kit Contents

The RealityEngine Graphics Board Kit (PN 026-0784-001) includes the items listed in Table 2-13.

Quantity	Part Number	Description
1	013-0518-xxx	EF4 board
1	030-0223-xxx	DG2 board
1	030-0225-xxx	GE8 board
1	030-0338-xxx	RM4T board
1	030-0233-xxx	DI1 front plane
1	030-0233-xxx	DI3 front plane board
1	015-0131-xxx	Swap ready harness
1	015-0132-xxx	StereoView harness
3	7270119	Screw

Table 2-13 RealityEngine Graphics Board Kit

Chapter 3

Installing the Upgrade

This chapter describes the specific steps required to successfully install the different Crimson graphics upgrade kits. The steps are listed in the order in which they should be performed. The sections in this chapter discuss:

- safety
- tools and materials
- upgrade path
- chassis preparation
- Entry, Elan, and Extreme Graphics upgrades
- XS to XS24 upgrade
- z-buffer upgrade
- PowerVision Graphics (VGX or VGXT) upgrade
- RealityEngine upgrade
- completing the installation

Warning: **Installation of these upgrades requires specific training and technical knowledge. These instructions are provided for use by Silicon Graphics system support engineers or other Silicon Graphics trained personnel only. This equipment utilizes electrical power internally that is hazardous if the equipment is improperly disassembled.**

3.1 Safety

This equipment is extremely sensitive and is susceptible to damage caused by electrostatic discharge (ESD). ESD is an electrical discharge (spark) caused by the buildup of electrical potential on clothing and other materials. You must use proper ESD preventive measures, as follows:

- Connect a ground strap to your wrist when connecting or disconnecting peripherals.
- Be sure that you and all of the electrical equipment that you handle during this installation remain at a ground potential of zero to avoid damage from ESD.
- Remove a board from its antistatic bag only when you are properly grounded with a ground strap.
- Do not use an ohmmeter on the boards.

3.2 Tools and Materials

You will need the following tools and equipment to perform the upgrade:

- 1/4-inch hex nut driver
- No. 2 Phillips-head screwdriver
- flat-blade screwdriver
- antistatic mat and ground strap
- alternate console for testing

3.3 Upgrade Path

As described in Chapter 1, there are three basic upgrade paths for the Crimson system: graphics system upgrades, graphics board upgrades, and a complete system upgrade. Each upgrade path has its specific requirements which are described in the following paragraphs.

Note: If you are upgrading the Crimson system from a server, IRIX operating system software version 4D1-4.0.4 or later must be reinstalled after performing the upgrade. For RealityEngine, 4D1-4.0.5F or later must be installed; for the Extreme Graphics board set, 4D1-4.0.5H must be installed. Absence of the proper operating system software will prevent you from being able to run the appropriate diagnostics.

3.3.1 Graphics System Upgrades

The graphics system upgrades convert a Crimson server to Entry, Elan, Extreme, VGX/VGXT, or RealityEngine graphics. In each case, the procedure follows the same general sequence, as described in the following steps.

1. Verify that you have all of the required components.
2. Verify that the customer's current system has been backed up.
3. Power down the system.
4. Open the front door and I/O door on the system (Figures 3-1 and 3-2).
5. Insert the upgraded graphics board assembly into the appropriate slot(s) of the card cage.
6. Install any required cabling.
7. Reinstall and verify IRIX version 4D1-4.0.4 (or later; 4D1-4.0.5F for Reality Engine; 4D1-4.0.5H for Extreme graphics) of the operating system software.
8. Run IDE diagnostics, and verify the new configuration as described in Chapter 4, "Testing the Boards."
9. Pack and return old boards and cable assemblies.

3.3.2 Graphics Board Upgrades

The graphics board upgrades are used to upgrade the XS and XS24 graphics boards. The procedures follow the same general sequence, as described in the following steps.

Note: These boards are not currently part of the Crimson graphics upgrade package. However, this upgrade is for those customers who already have one of these boards and wish to increase its capabilities.

1. Verify that you have all of the required components.
2. Verify that the customer's current system has been backed up.
3. Power down the system.
4. Open the front door and I/O door on the system (Figures 3-1 and 3-2).

   Caution: Make sure you are wearing your grounding strap.
5. Disconnect the cable(s) from the graphics board to the I/O panel.
6. Remove the board and place it on a static mat.
7. Remove the VM2 boards or z-buffer board from the static bag(s) and place them on a static mat.
8. Install the z-buffer and/or VM2 boards in the correct connector.
9. Reinstall the board in the card cage
10. Reconnect the cable(s) from the graphics board to the I/O panel.
11. Reinstall and verify version 4.0.4 (or later) of the operating system software.

12. Run IDE diagnostics, and verify the new configuration as described in Chapter 4, “Testing the Boards.”
13. Pack and return old boards and cable assemblies.

3.3.3 Professional Series to Crimson Upgrade

This procedure upgrades the older twin tower Professional Series chassis to a Crimson Elan graphics system. The older monitor, keyboard, mouse, and peripherals are maintained. The older chassis, processor, and I/O boards are discarded. The basic procedure is described in the following steps.

1. Verify that you have all of the required components, including *MODFLR Upgrade Installation Instructions*, document number 108-7014-010.
2. Verify that the customer’s current system has been backed up.
3. Power down the system.
4. Disconnect all cabling.

   Caution: Make sure you are wearing your grounding strap.
5. Remove the customer’s disk and tape peripherals.
6. Install the Crimson chassis in the customer’s area.
7. Install the disk and tape peripherals into the Crimson chassis.

   Note: You must add rails to the disk and tape drives so they will fit into the new chassis. Refer to the *MODFLR Upgrade Installation Instructions*, document number 108-7014-010.
8. Connect the old monitor, keyboard, and mouse.
9. Reinstall and verify version 4.0.4 (or later) of the operating system software.
10. Run IDE diagnostics, and verify the new configuration as described in Chapter 4, “Testing the Boards.”
11. Pack and return the old chassis, processor, and I/O boards.

3.4 Chassis Preparation

Perform the following steps to prepare the chassis for upgrading:

1. Verify that all data has been backed up to tape or other removable media. It is recommended that customers verify the backups of their data.
2. Use the correct procedure to shut down the operating system and power down the workstation. Disconnect the AC power cable from the back of the workstation.
3. Open the front door and the I/O door on the chassis as shown in Figures 3-1 and 3-2.

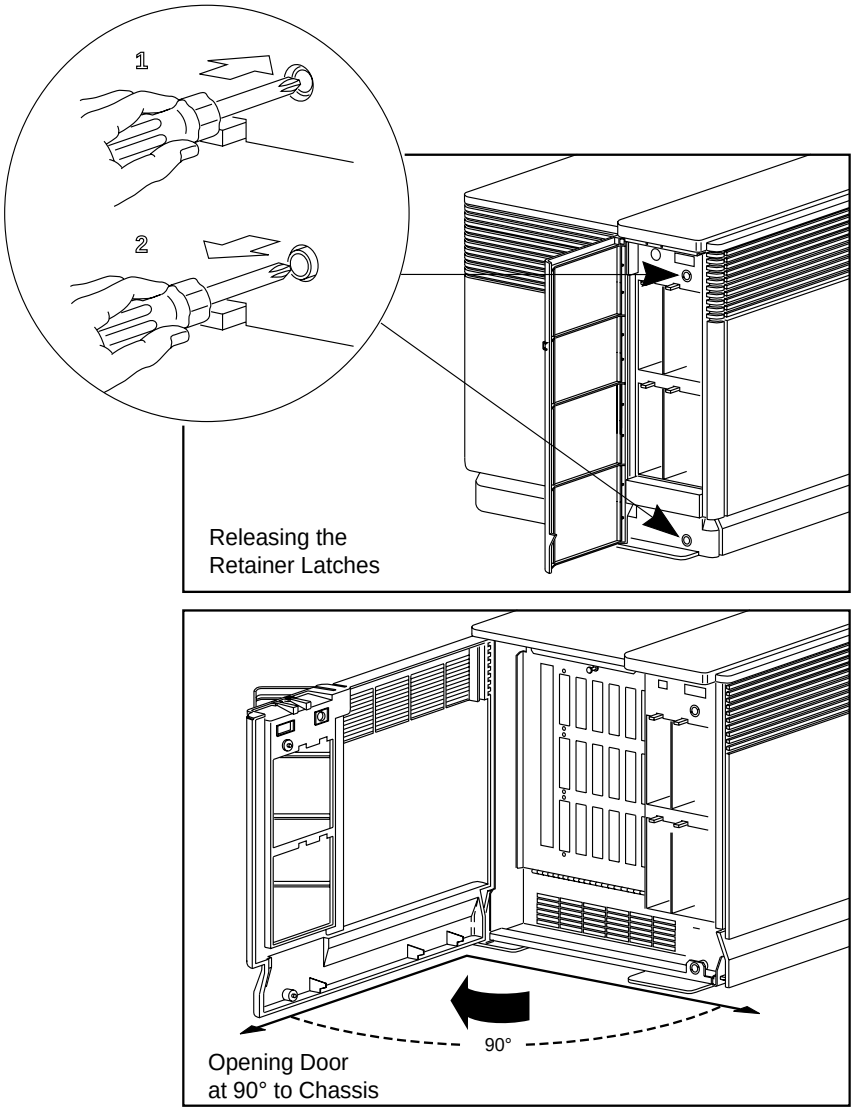


Figure 3-1 Opening the Front Door

Note: You can disconnect the external cables from the I/O door to make opening the I/O door easier.

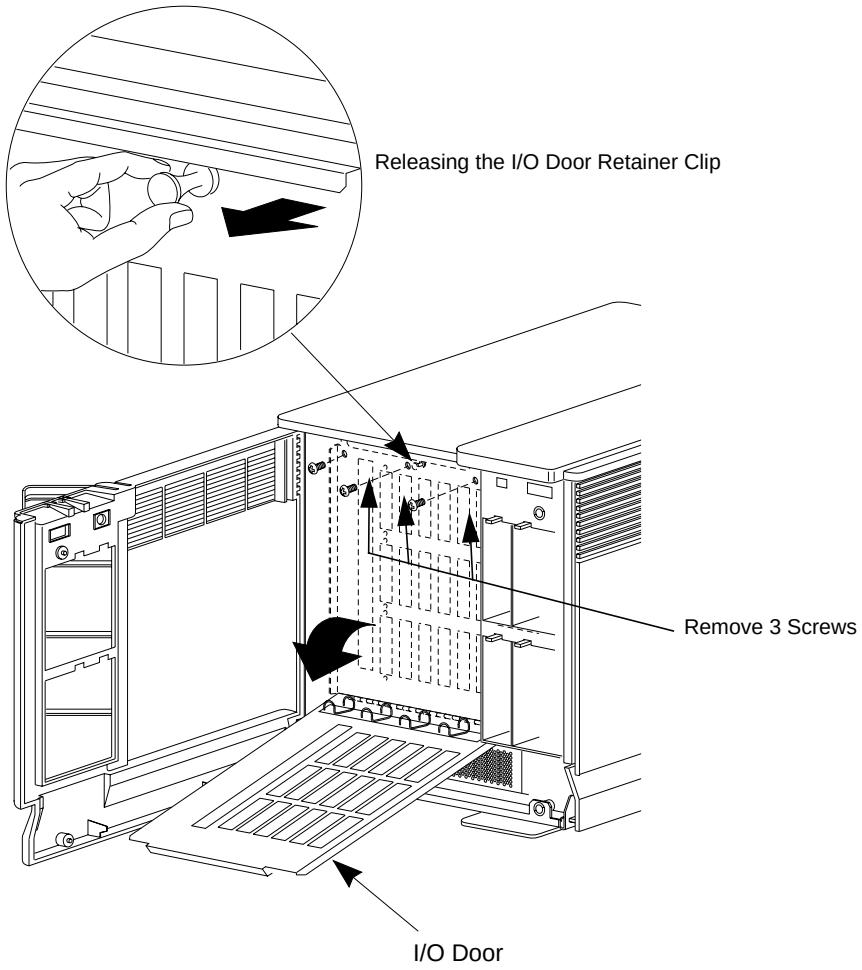


Figure 3-2 Opening the I/O Door

3.5 Entry, Elan, and Extreme Graphics Upgrades

The upgrade procedures for Entry, Elan, and Extreme graphics are very similar. All three graphics systems are single-slot upgrades using an MG1/graphics board set. Entry, Elan, and Extreme graphics upgrades are installed in slot 9, as shown in Figure 3-3.

The following sections cover all of the different upgrade options for Entry, Elan, and Extreme graphics. It is assumed that you have opened the front door and the I/O door as described above and that you are following the safety instructions described in Section 3.1, “Safety.”

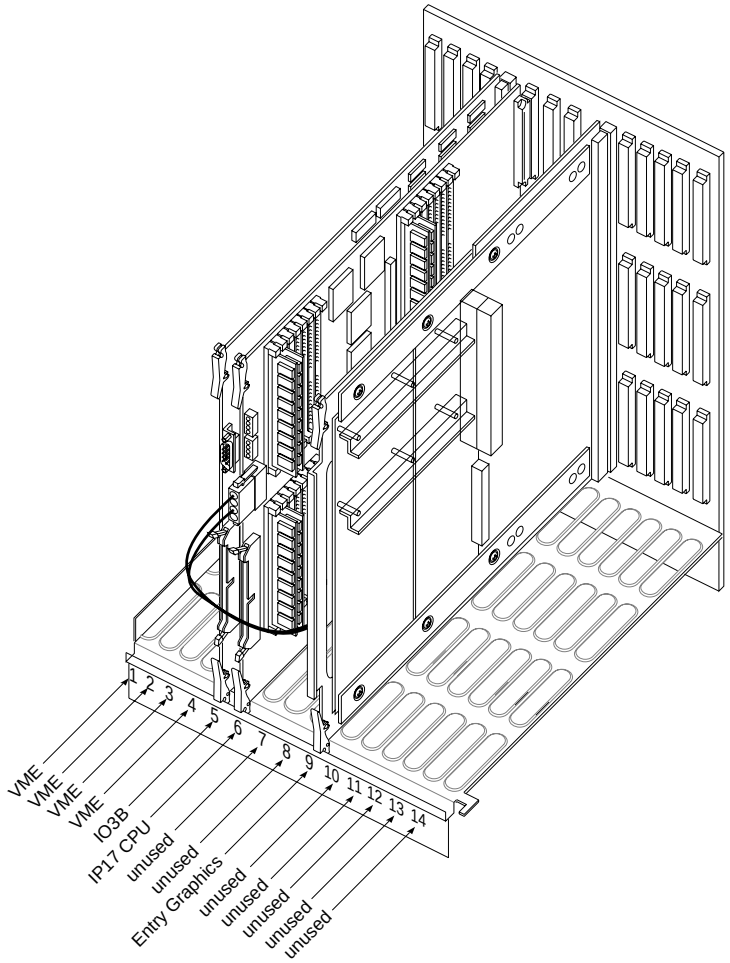


Figure 3-3 Entry, Elan, and Extreme Graphics Slot Assignment

3.5.1 Entry Graphics Installation

Before proceeding with the installation, verify that you have all of the required components. Then follow the steps described below.

1. Ground yourself as described in Section 3.1.
2. Unpack the upgrade board and remove it from its antistatic bag.
3. Place the board on top of the antistatic bag with the chips facing up.
4. Install the MG1/Entry graphics board set into slot 9 of the card cage. Ensure that the MG1 board connectors are properly seated. Lock the board assembly into place with the ejector tabs.

5. Mount the connector plates to the I/O door as shown in Figure 3-4.

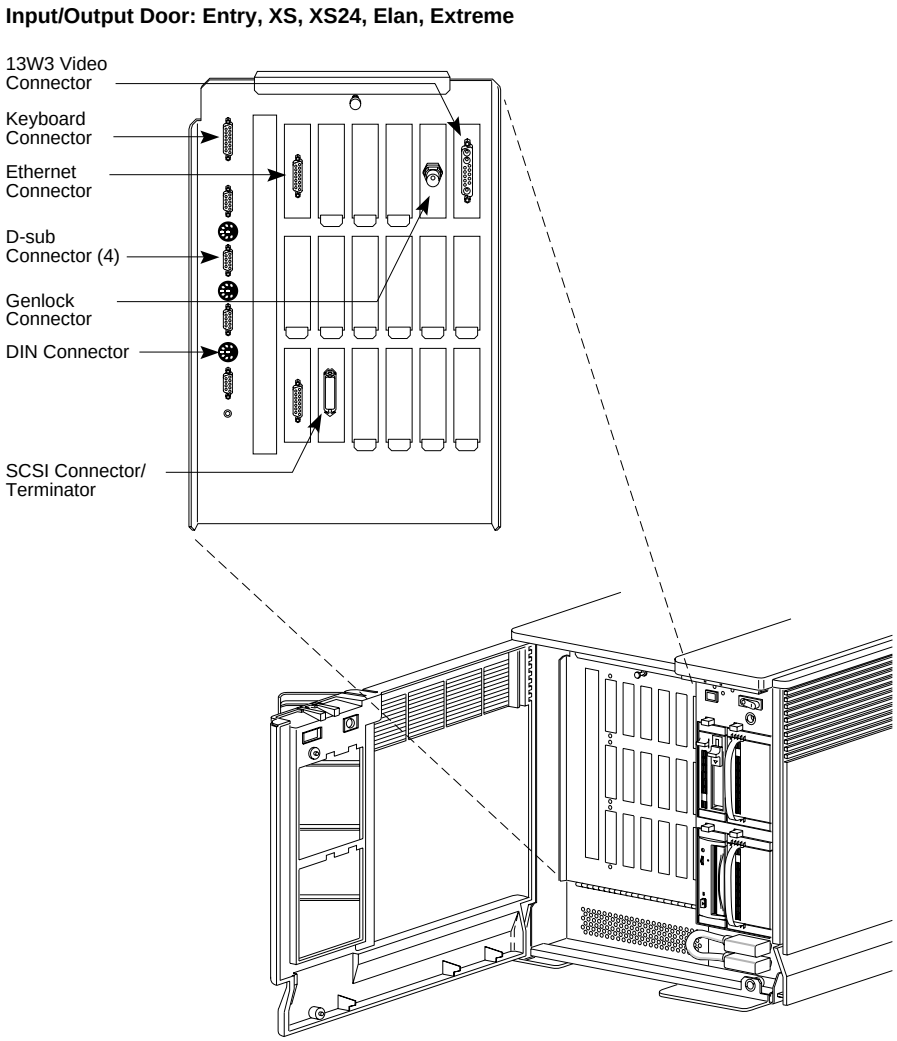


Figure 3-4 Cable Routing to I/O Panel

6. Connect the monitor to the 13W3 connector, as shown in Figure 3-5.

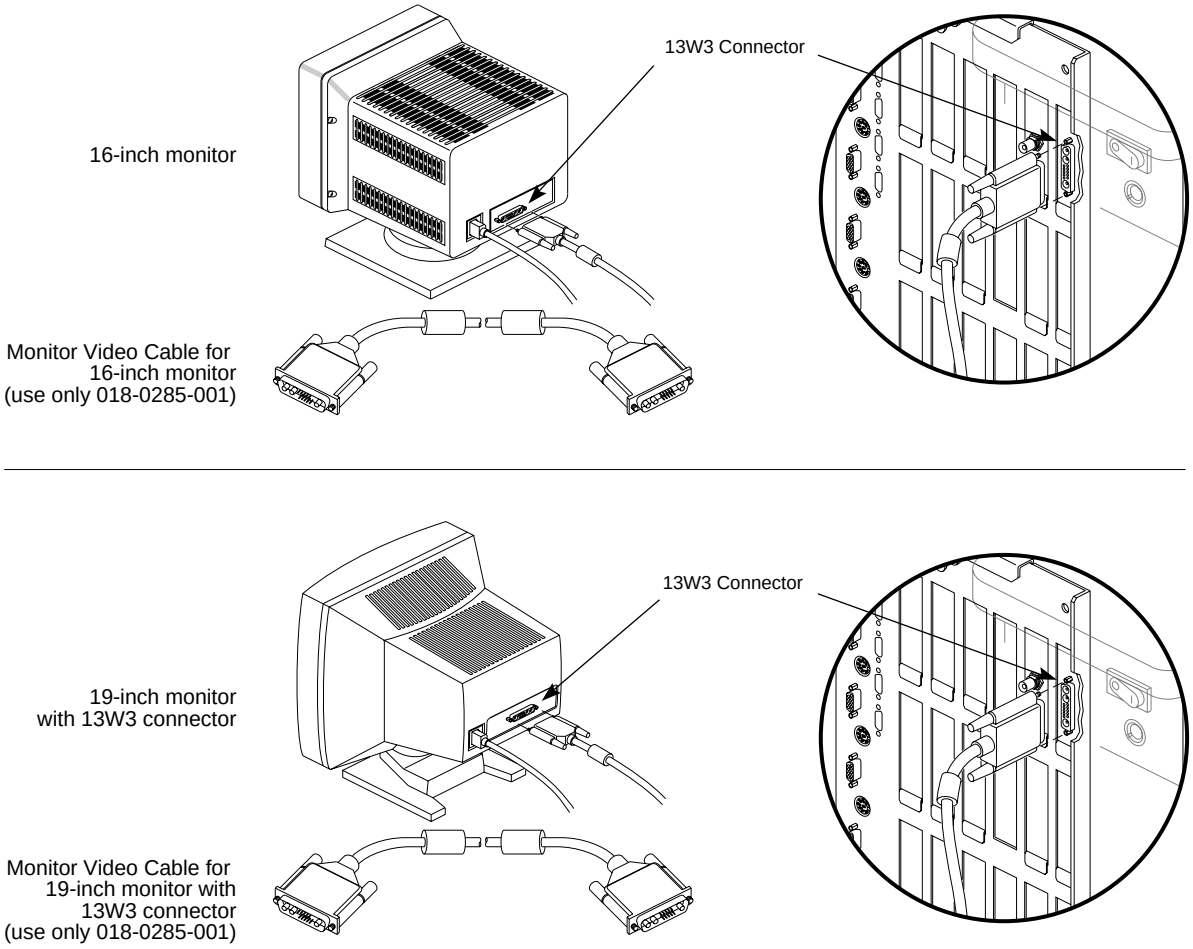


Figure 3-5 Connecting a Monitor

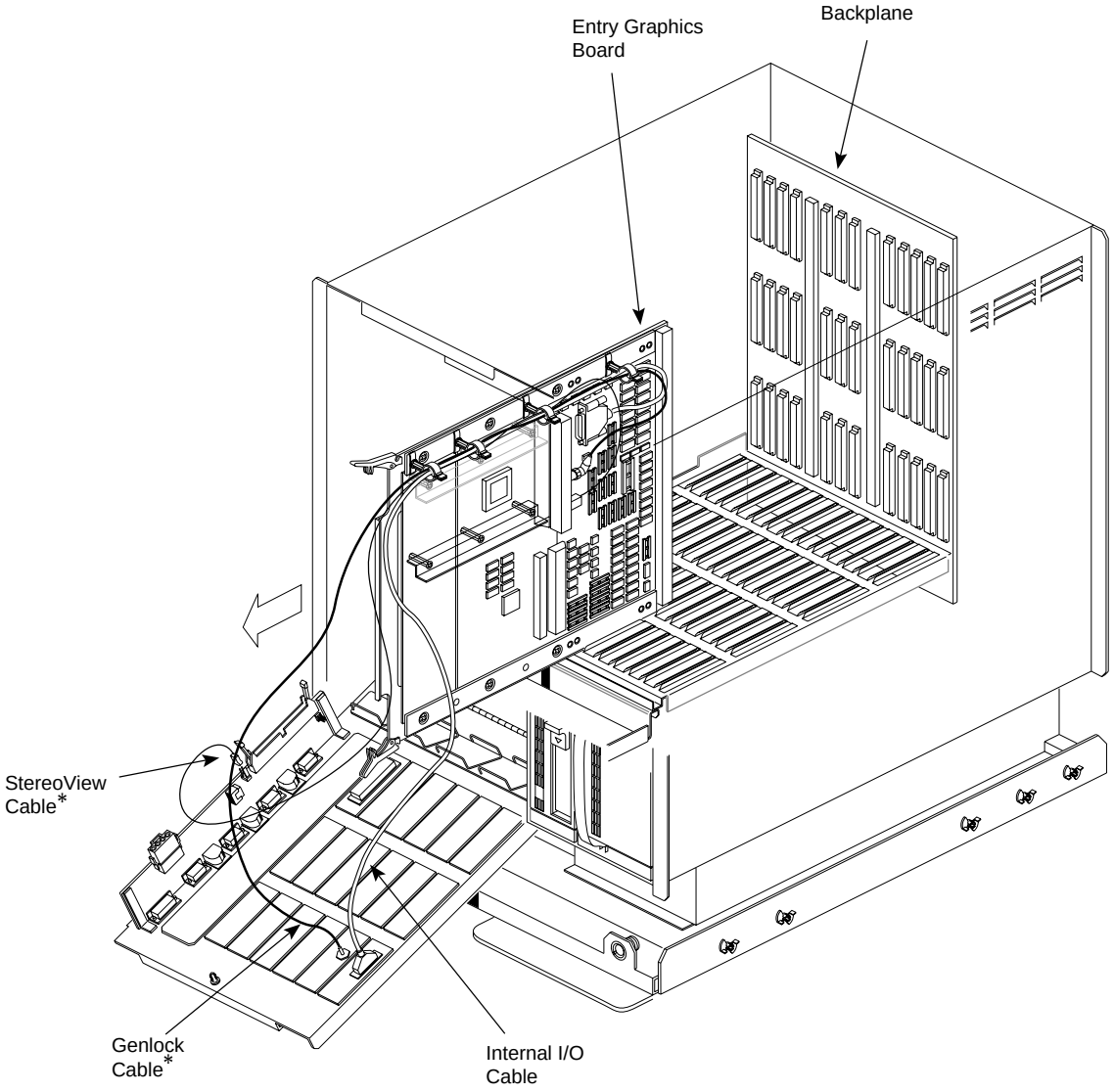
7. Connect the keyboard, mouse, and power connectors.
8. Install and verify the Version 4.0.4 operating system (4.0.5H for Extreme) software.
9. Run IDE diagnostics, and verify the new configuration using the *hinv* command (see Chapter 4).

After you have run the diagnostics and verified operation, install the new system labels to reflect the new configuration. Reassemble the system for customer use. See Section 3.7, “Z-buffer Upgrade.”

3.5.2 Elan Graphics Installation

The Elan graphics upgrade is installed in the same manner as the Entry graphics upgrade. Refer to Section 3.5.1, “Entry Graphics Installation,” for details on slot assignments and installation procedures.

If you are upgrading from Entry, XS, or XS24 graphics, you must remove the current graphics board from slot 9, as shown in Figure 3-6. You must also remove any Entry graphics cables attached to the system I/O door. Leave these cables attached to the Entry graphics board and remove them along with the Entry graphics board.



* The StereoView and Genlock cables are not installed on the Entry Graphics board.

Figure 3-6 Removing Entry Graphics Board

3.5.3 Extreme Graphics Installation

The Extreme graphics upgrade is installed in the same manner as the Entry graphics upgrade. Refer to Section 3.5.1, “Entry Graphics Installation,” for details on slot assignments and installation procedures.

If you are upgrading from Entry, Elan, XS, or XS24 graphics, you must remove the current graphics board from slot 9, as shown in Figure 3-6. You must also remove any Entry graphics cables attached to the system I/O door. Leave these cables attached to the Entry graphics board and remove them along with the Entry graphics board.

3.6 XS to XS24 Upgrade

Upgrading an XS graphics system to XS24 graphics requires installing two additional Video Memory(VM2) boards to the graphics board. The XS graphics board has a single 8-bit VM2 board installed on connector P14. The XS24 has two additional VM2 boards installed in the adjacent connectors.

The VM2 boards are pressed into their connectors and locked in place with a metal holder, as shown in Figure 3-7. Follow the steps below to correctly install these boards.

1. Remove the VM2 boards from their packing. Check the board connectors for bent pins or other damage.
2. Insert the connector pins of the VM2 boards into the slots located in the corner of the graphics board, as shown in Figure 3-7.
3. Press the board gently into the connector until the pins are fully seated in the connector.

4. Press the holder against the board so the tab fits into the notch on the side of the board.

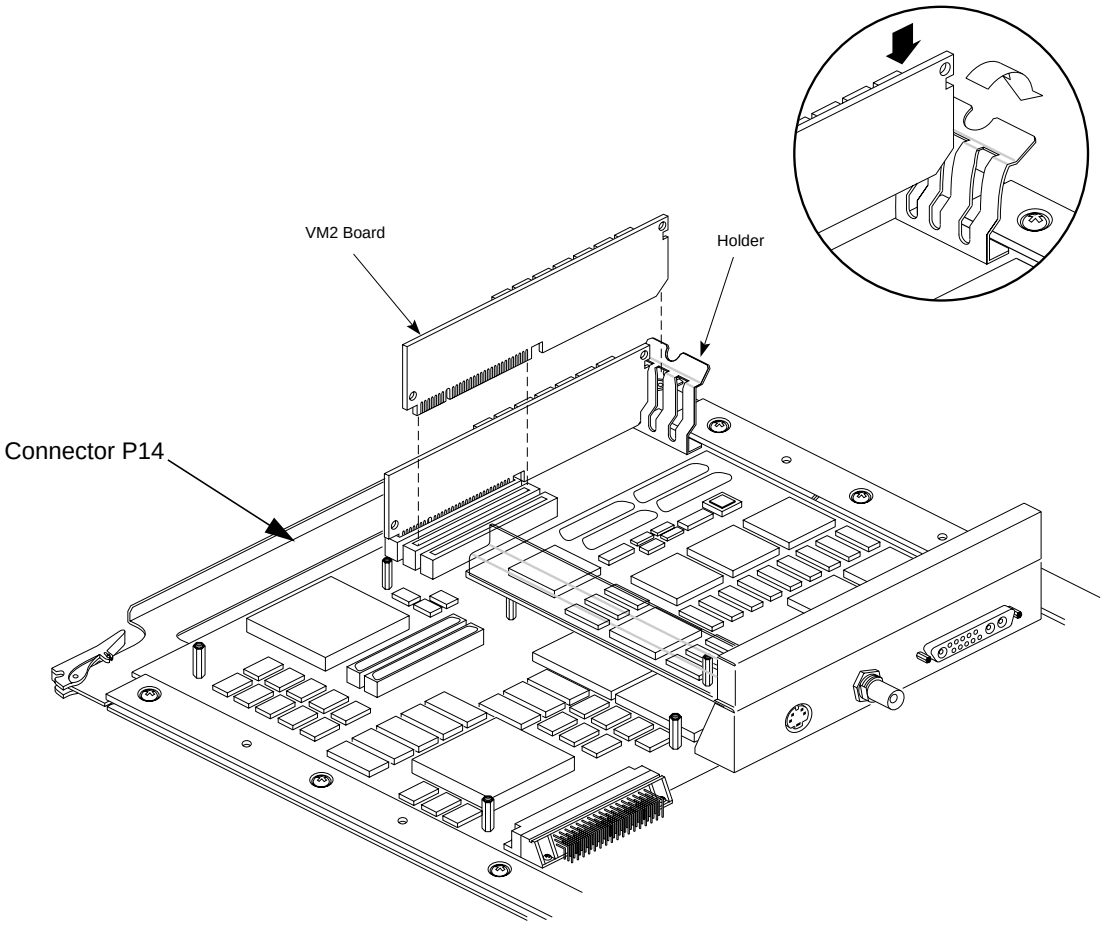


Figure 3-7 Installing Video Memory

3.7 Z-buffer Upgrade

The z-buffer upgrade kit upgrades XS or XS24 graphics with a 24-bit hardware z-buffer. Follow the procedure described below to install the z-buffer daughter board onto the graphics board.

1. Remove the z-buffer board from its antistatic packing.
2. Remove the graphics board (XS or XS24) from the card cage. Make sure that any cables are disconnected before sliding the board out of the card cage.

   Note: Remove the cable connector plates at the I/O door to allow the board to come completely out of the chassis.

3. Place the graphics board flat on an antistatic mat, with the component side up.

4. Hold the z–buffer board above the graphics board so that the connectors on the bottom of the z–buffer board are aligned with their respective connectors on the graphics board.
5. Align the four screw holes in the z–buffer board with the four metal posts on the graphics board, as shown in Figure 3-8. By lining up the screw holes with the posts, the connectors underneath the board should line up automatically.

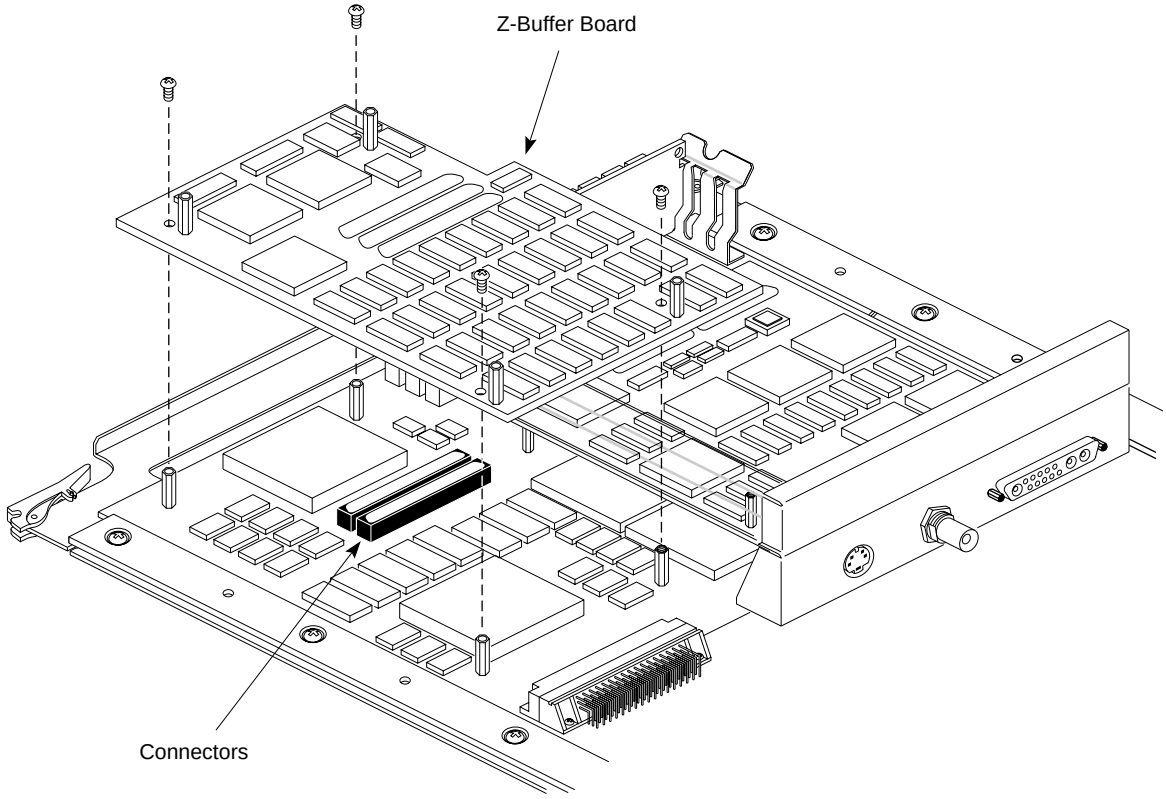


Figure 3-8 Installing the Z–buffer Board

6. Press the z–buffer board down onto the connectors on the graphics board.

   Caution: Make sure the connectors are fully seated before inserting the screws. With the graphics board solidly supported underneath, and resting on an antistatic mat, press down firmly on the z-buffer board in the area of the connectors until you feel them seat completely in the graphics board.

7. Insert the four screws through the holes in the z-buffer board and into the metal posts on the graphics board.

   Caution: Do not overtighten the screws. The boards should fit together firmly but should not be forced.

8. Tighten the four screws until the board is firmly in place.
9. Install the board in the card cage, following instructions in Section 3.5.1.

3.8 PowerVision Graphics (VGX/VGXT) Upgrade

These procedures assume that you have already opened the Crimson chassis and are following the ESD safety procedures described in Section 3.1. Start the installation by unpacking the shipping container, which contains the VGX or VGXT board set as well as smaller boxes containing the associated hardware and cables.

The PowerVision graphics boards use slots 9, 10, 13, and 14; slot 12 is reserved for an additional RM2 board if ten-span VGX graphics are installed. The slot assignments for the specific boards are listed in Table 3-1 and are shown in Figure 3-9.

Slot	PowerVision (VGX)
9	GM3B
10	GE6
12	Optional RM upgrade
13	RM2 (VGX) or RM3 (VGXT)
14	DG1

Table 3-1 PowerVision (VGX/VGXT) Board Slot Assignments

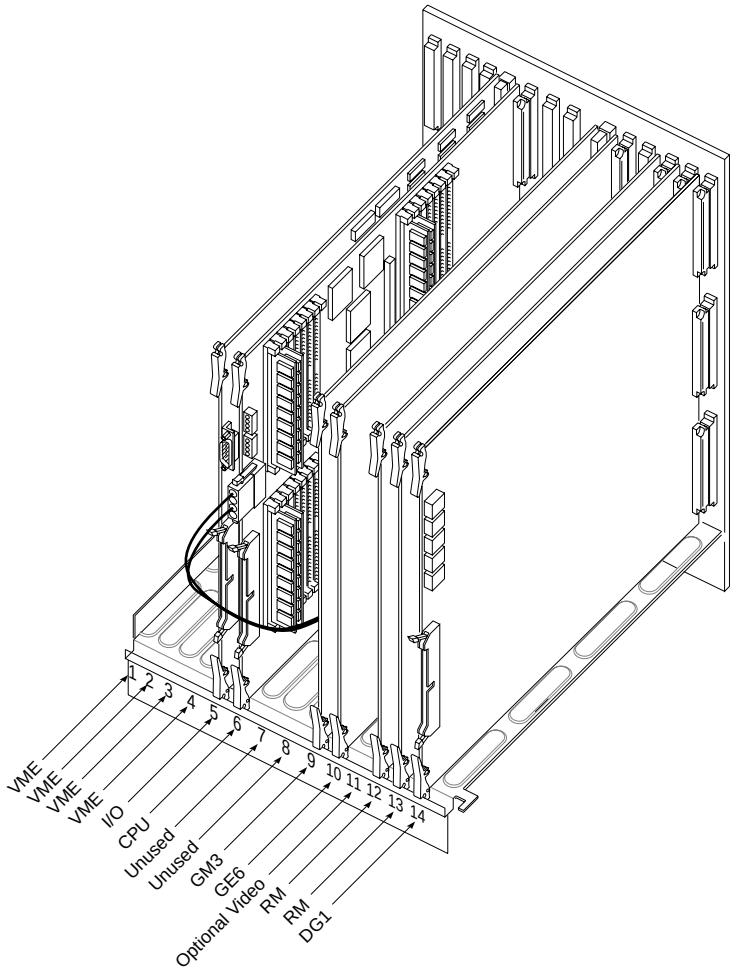


Figure 3-9 PowerVision (VGX/VGXT) Board Slot Assignments

Perform the following steps to install the PowerVision Graphics (VGX/VGXT) upgrade:

1. Slide the PowerVision board set into the appropriate slots in the card cage.
2. Install the two front plane interface boards (G13 and R15).
3. Install the cabling.

3.8.1 Installing the Front Planes

Connect the G13 and R15 interface boards as follows:

1. Attach the 120-pin connector on the G13 board to jumper J1 on the GM3 board in slot 9 and to J1 on the GE6 board in slot 10.
2. The R15 board connects two or three PowerVision boards together, depending on whether the PowerVision board set is a five or ten span set. Connect the 180-pin connector of the R15 board to position J1 on the first RM2 board (slot 13) and to jumper J1 on the DG1 board (slot 14).
3. If the optional RM2 board is installed in slot 12, connect the R15 board to J1 on this board as well.

Caution: The connector has an **UP** designation. Make sure that the connector is correctly oriented when you install it on the boards.

The G13 and R15 front plane connectors have a large number of pins. It requires a great deal of force to seat these pins securely in the PowerVision boards. Make sure that the front plane connectors are properly seated before continuing with the installation.

3.8.2 Installing the Cables

The cables connect to the DG1 board in slot 14. The connectors and cable functions are listed in Table 3-2 and are shown in Figure 3-10.

DG1 Connector	Cable Function
J2	Genlock RGB input when configured with sync on green (only when EV1 option is installed)
J3	Encoded composite video and super VHS output (only when EV1 option is installed)
J4	RGB and sync output
J5	Alpha and stereo output
J6	Genlock sync input (only when EV1 option is installed)

Table 3-2 Cable Connector Assignments

Input/Output Door: VGX, VGXT

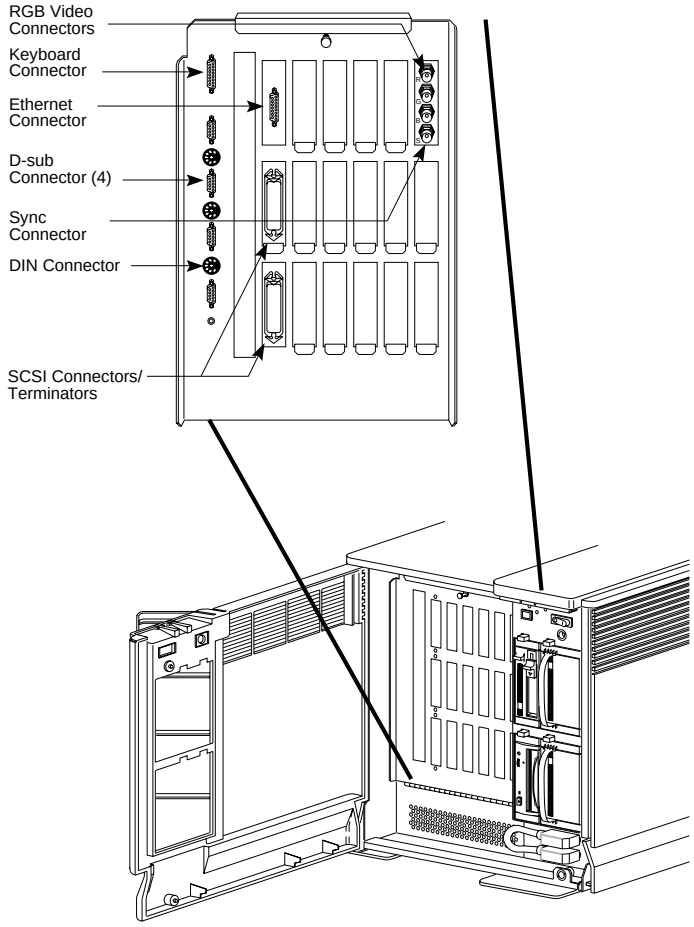


Figure 3-10 VGX / VGXT Cable Connections

3.9 RealityEngine Upgrade

These procedures assume that you have already opened the Crimson chassis and are following the ESD safety procedures described in Section 3.1. Start the installation by unpacking the shipping container, which contains the RealityEngine board set as well as smaller boxes containing the associated hardware and cables.

The RealityEngine graphics boards use slots 9, 10, 12, and 14, as listed in Table 3-3 and shown in Figure 3-11.

Slot	RealityEngine
9	GE8
10	DG2
12	RM4
13	Not used
14	RM4T

Table 3-3 RealityEngine Slot Assignment

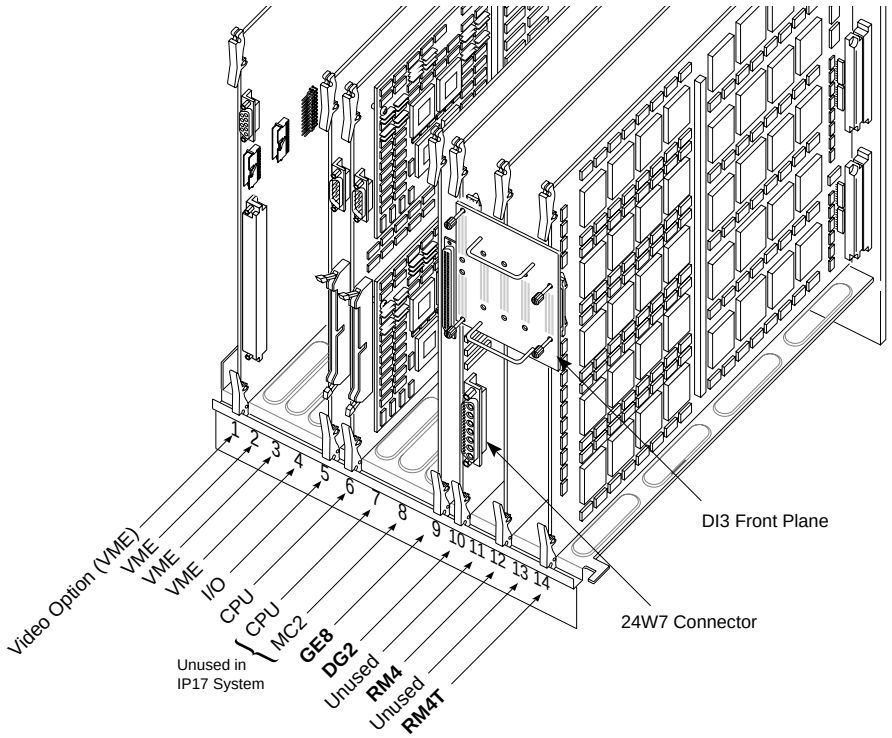


Figure 3-11 RealityEngine Slot Assignments

Installing RealityEngine in the Crimson consists of these tasks:

- replacing the fan module
- resetting fan speed
- inserting the boards
- attaching internal cables
- upgrading the IO3 PROMs
- attaching external cables

3.9.1 Replacing the Fan Module for RealityEngine

To cool the Crimson system properly for RealityEngine, replace the existing fan tray module with the six-fan tray in the upgrade kit. Follow these steps:

1. Disconnect the internal cables from their controllers.
2. Remove the screws holding the I/O door vent panel to the chassis.
3. Carefully remove the I/O door from the chassis to prevent damage to the EMI wipes (silver-colored strops running vertically along the I/O door's closed position); route the power harness out of the notch in the lower left corner of the I/O door. See Figure 3-12.

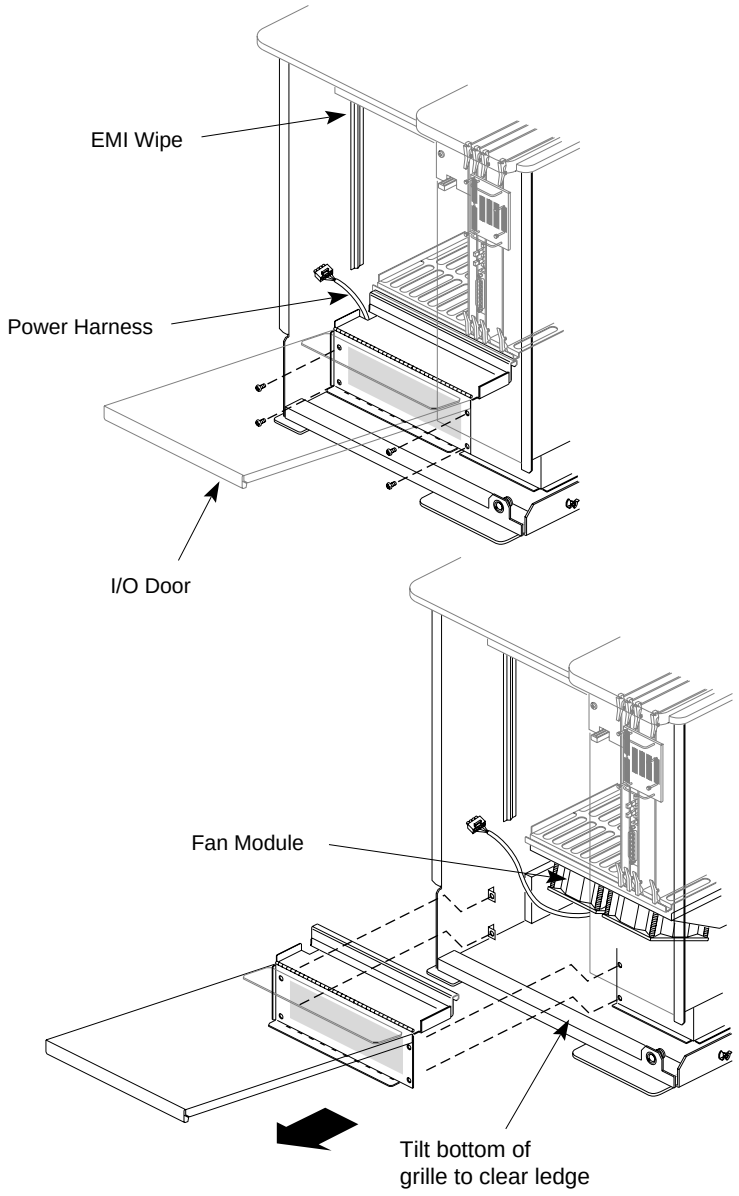


Figure 3-12 Removing the I/O Door

4. Slide the four-fan tray module out of the chassis, being careful not to damage the EMI wipes, if they are in the way. See Figure 3-13.

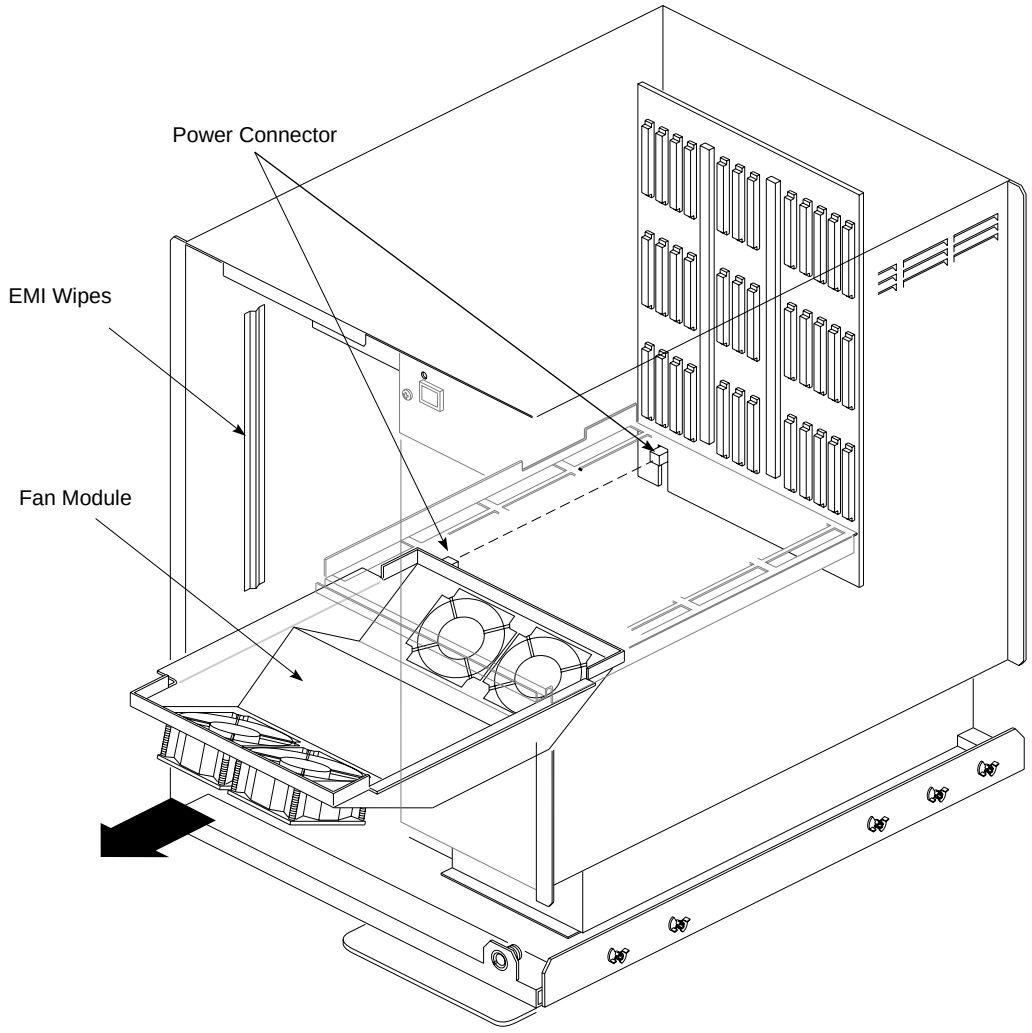


Figure 3-13 Removing the Four-fan Module for RealityEngine

5. Position the new six-fan module so that the wide lip and power connector are on the left side of the chassis, as shown in Figure 3-14. The power connector should be the first part of the fan assembly to enter the chassis.

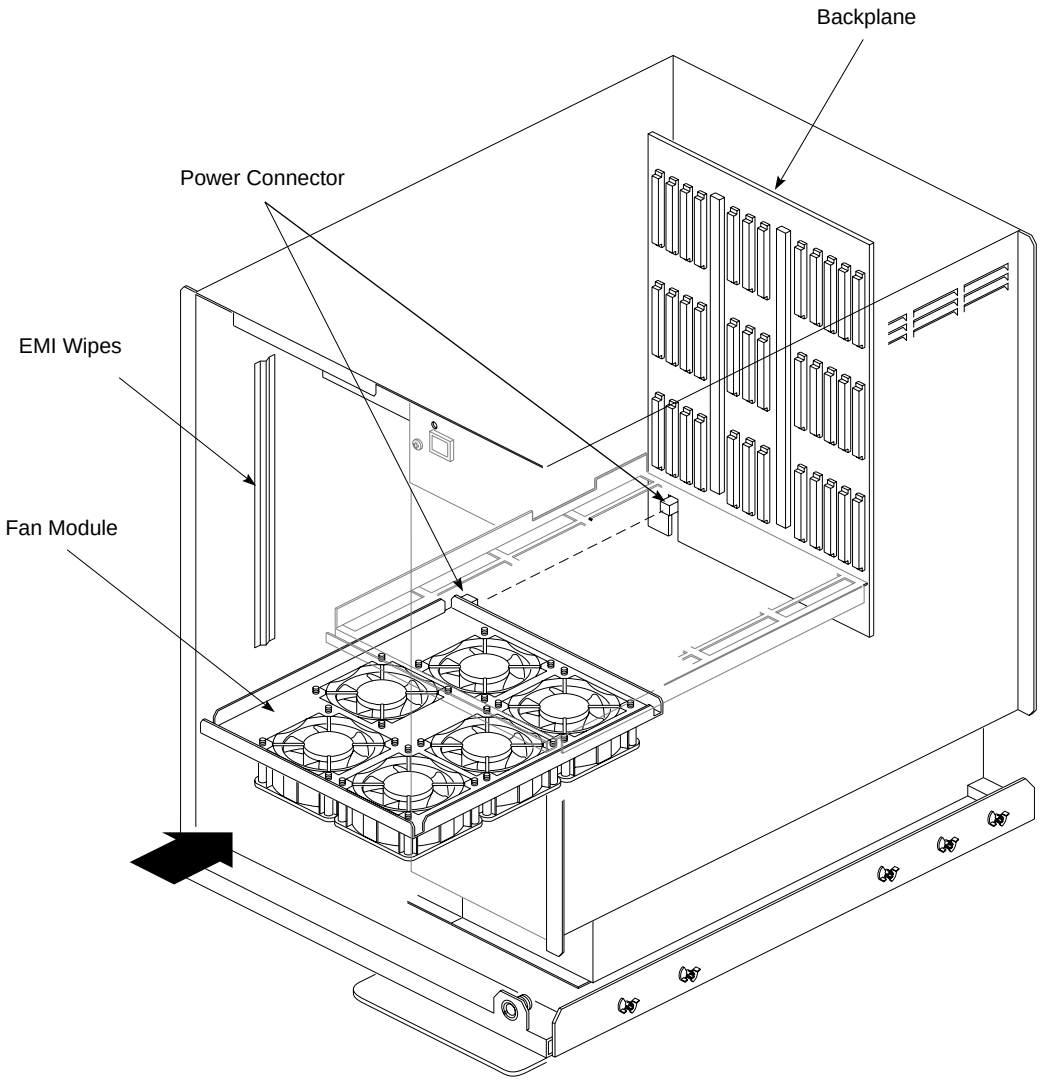


Figure 3-14 Installing the Six-fan Module for RealityEngine

6. Slide the new fan module into the chassis until the fan power connector fully engages; make sure that the PP2 power cable lies in the gap between the fan module and the left side of the chassis.
7. Reinstall the I/O door and cables; close the front door.

3.9.2 Resetting RealityEngine Fan Speed

This section explains how to reset the fans to run continuously at high speed; their default speed is low.

Caution: If the fans inside the Crimson are not set to high, the Crimson could overheat because of the additional heat dissipation from the RealityEngine board set.

1. With the system powered down, remove the back plastic panel.
2. Unscrew the screws holding the sheet-metal cover to remove the cover from the chassis.
3. Locate the fan controller board, which is mounted just above the backplane, as shown in Figure 3-15.

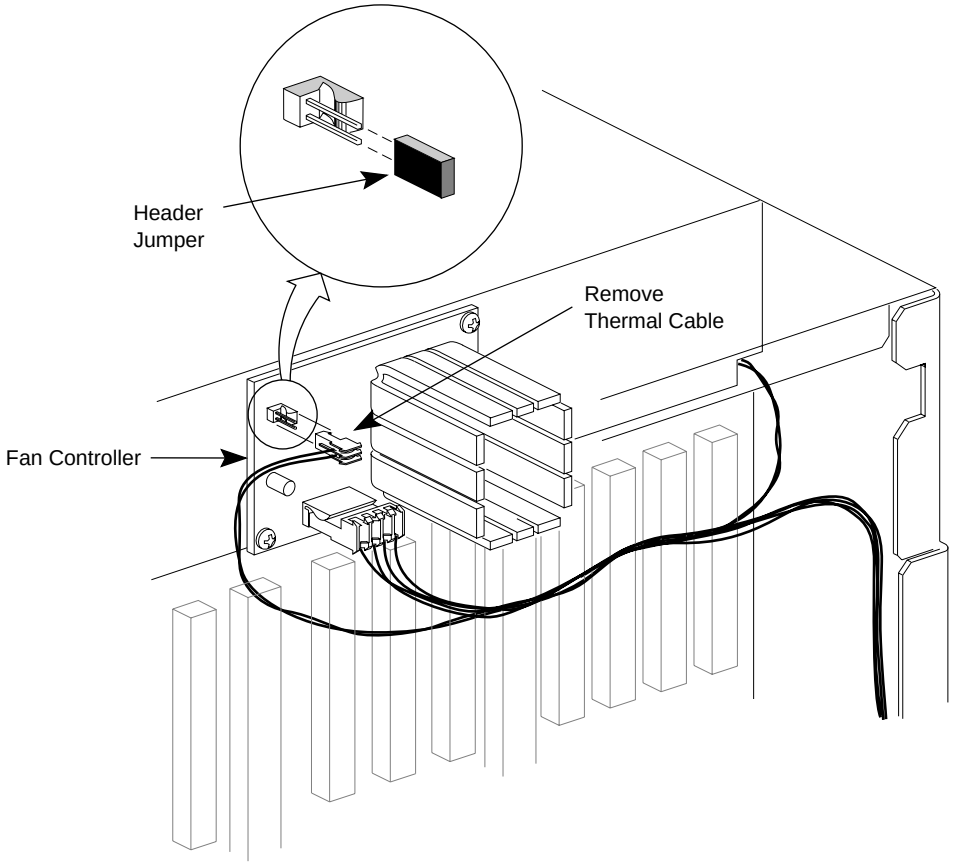


Figure 3-15 Jumpering the Thermal Shutdown Header for RealityEngine

4. Remove the thermal sense connector from the two-pin header on the fan controller board, as shown in Figure 3-15.
5. Place a jumper across the pins, as shown in Figure 3-15.

Caution: If you do not place a jumper across the header, the fans will always run at low speed, even under adverse conditions.

6. Tie-wrap the thermal shutdown harness cable out of the way; replace the sheet-metal cover and rear plastic panel.
7. Power up the system and check for high-speed fan operation. The fan noise should be significantly louder and will not spin down after powerup.

3.9.3 Inserting the RealityEngine Boards

To install the RealityEngine graphics boards, follow these steps:

1. Verify customer backup of data files.
2. Power down the system and open the I/O door.
3. Remove any existing graphics and video board from slot 9.
4. Install the:
   - GE8 board in slot 9
   - DG2 board in slot 10
   - RM4 board in slot 12
   - RM4T board in slot 14
5. Install the front plane DI3 by securing the jack screws into the corresponding thread holes on the RM4T and DG2 boards, as shown in Figure 3-16.

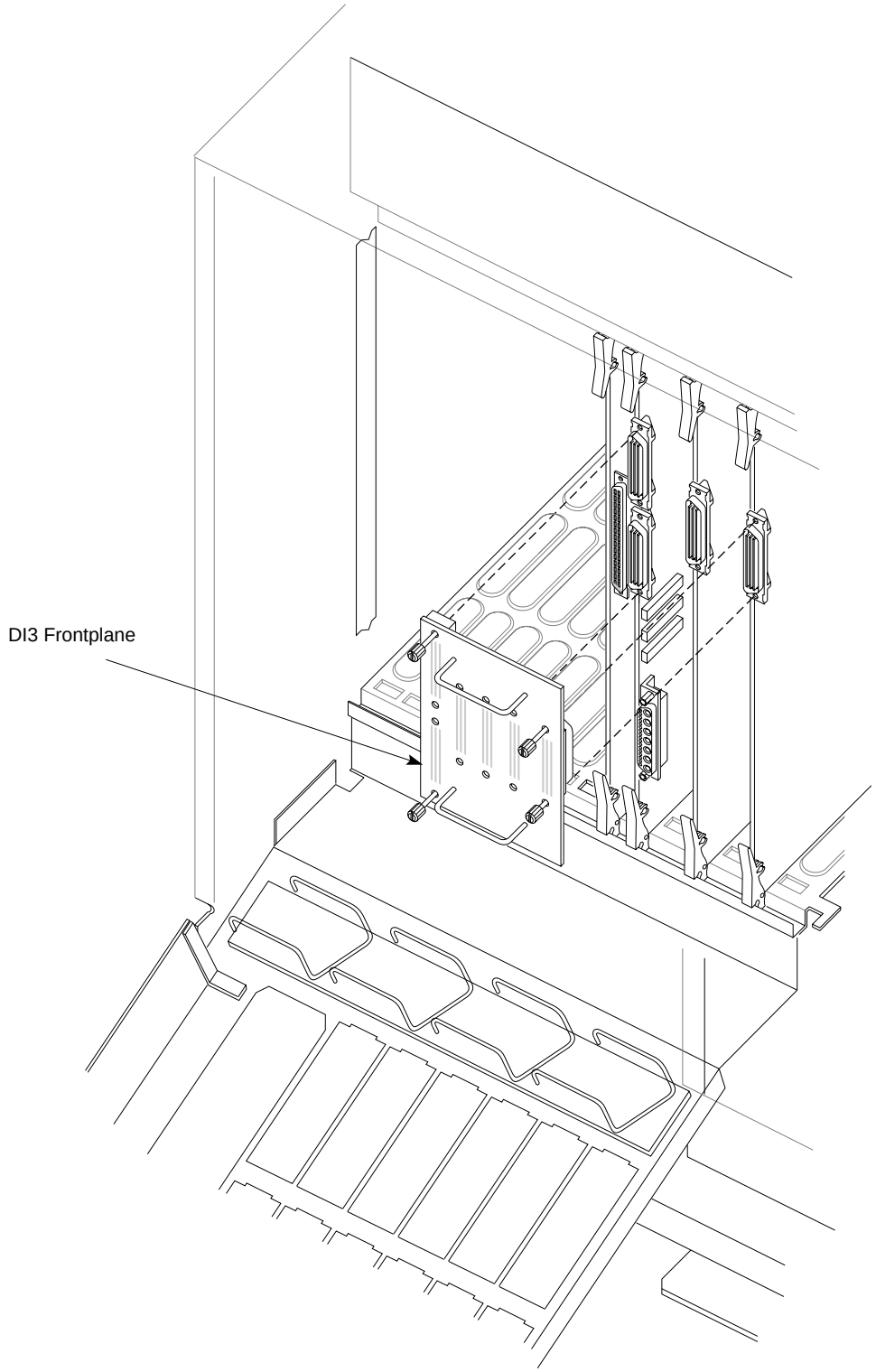


Figure 3-16 Installing the DI3 Front Plane for RealityEngine

3.9.4 Connecting RealityEngine Internal Cables

Follow these steps to connect the internal chassis cabling:

1. Remove existing internal RGB cables and plates, if present.
2. Remove two side-by-side pairs (total of four) spare I/O plates from the door, as shown in Figure 3-17. Use the vacated GRB plate slot if possible. Save the screws for installing the new connector plates.

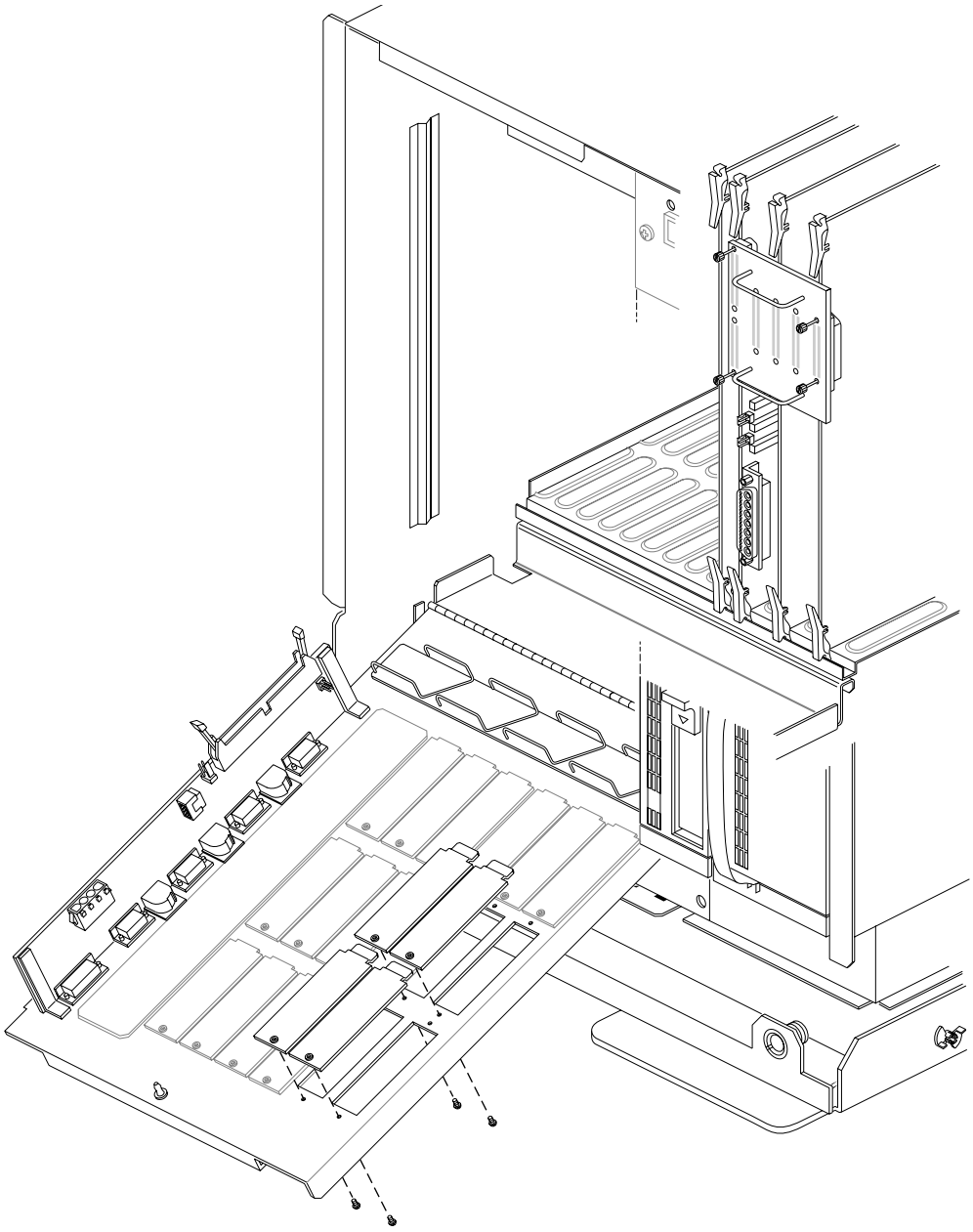


Figure 3-17 I/O Door Plate Removal for RealityEngine

3. Using three screws (not four), connect the EF4 board to the I/O door by using two open slots, as shown in Figure 3-18.

   One end of the analog video cable has a 24W7 connector only. The other end has an I/O bracket attachment as well as a 24Wy connector. Be sure to route the analog video cable under the wire racks on the I/O door.

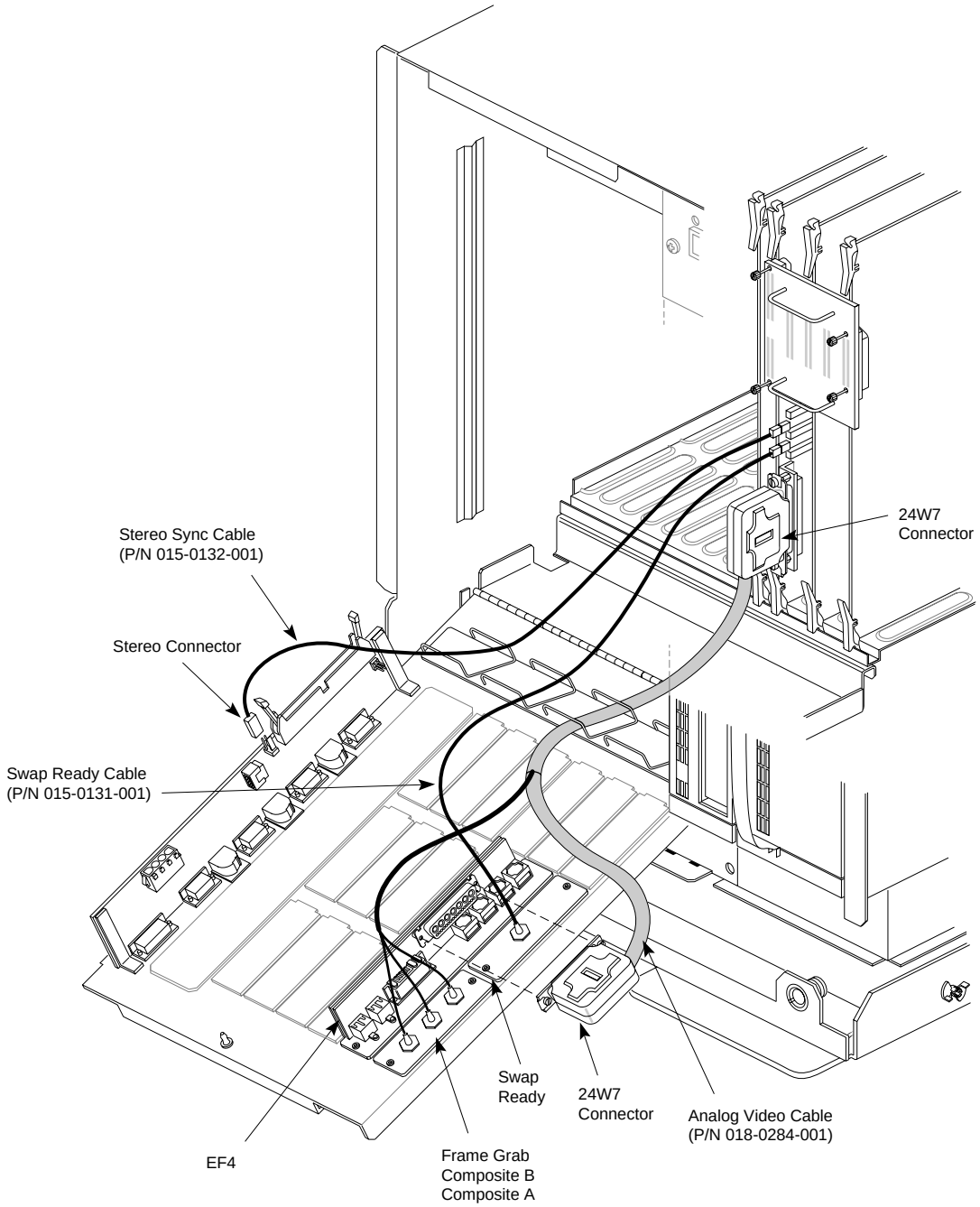


Figure 3-18 24W7 I/O Door Bracket Connection for RealityEngine

4. Attach the composite video and frame grab connector bracket on the analog video cable to one of the adjacent slots on the I/O door, as shown in Figure 3-18. Screw the connector in place.
5. Attach the other 24W7 connector on the analog video cable to the EF4 board, as shown in Figure 3-18. Screw the connector in place.
6. Connect the stereo sync cable (part number 015-0132-001) to the upper two-pin header on the DG2 board, as shown in Figure 3-18.
7. Connect the other end of the stereo sync cable to the two-pin connector on the PP2 board.
8. Attach the connector end of the swap ready cable (part number 015-0131-001) to the lower two-pin header on the DG2 board.
9. Connect the analog video cable (part number 018-0284-001) to the DGB2 board and screw the connector in place, as shown in Figure 3-18.
10. Install the swap ready connector plate to the other adjacent slot on the I/O door.
11. Reroute the internal cables in place under the wire frames on the I/O door.

Caution: When closing the I/O door, ensure that the cables are not pinched against the boards. Cable damage could result.

3.9.5 Upgrading the IO3 PROM for RealityEngine

The I/O board must have the -010 or higher PROMs to support the RealityEngine board set.

Caution: The components are extremely sensitive to ESD. Use proper antistatic procedures while handling all components.

Follow these steps to upgrade the IO3 PROMs:

1. Verify customer backup of data files; power down the system. Remove the I/O board from slot 5; place the board on an antistatic surface.
2. Remove the four IO3 PROMs at locations M8J6, N5J6, N5I0, and M8I0, as shown in Figure 3-19.

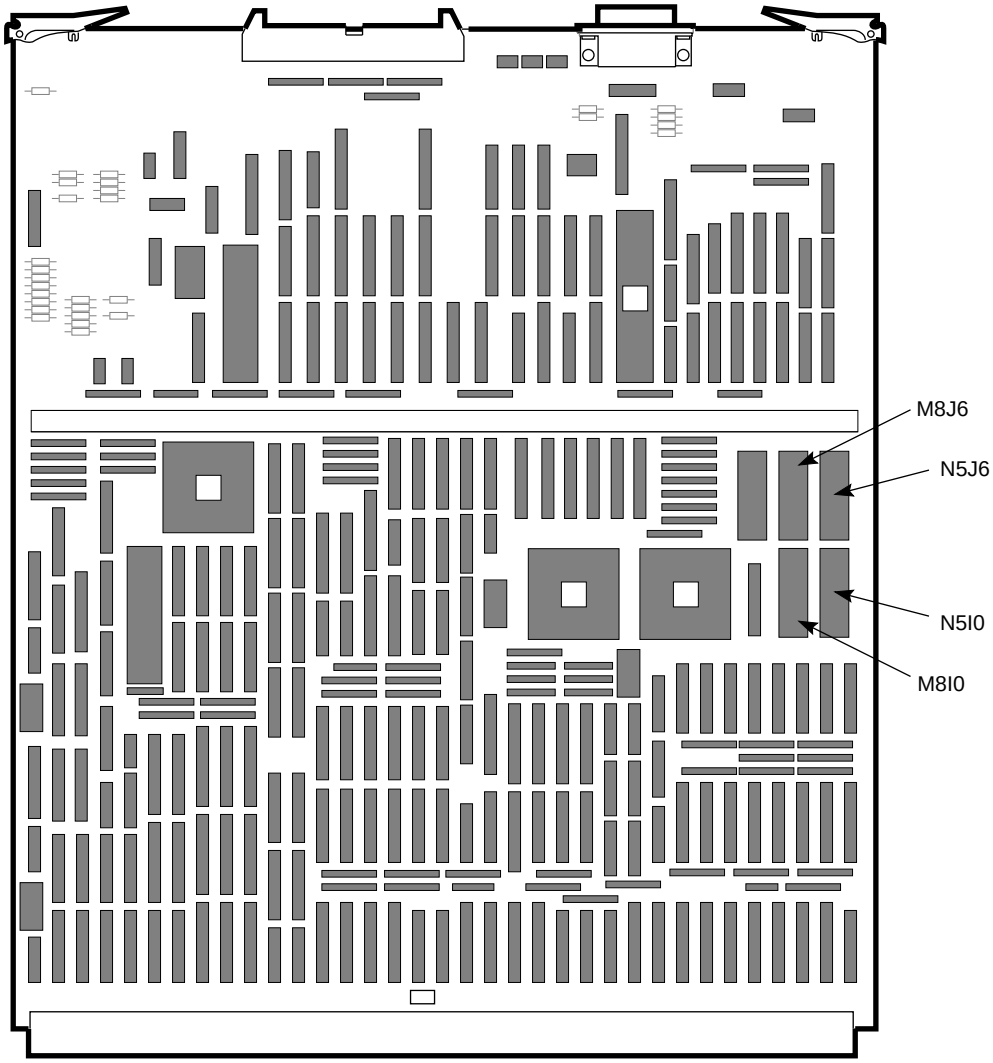


Figure 3-19 IO3 PROM Locations for RealityEngine

3. Insert the new PROMs into their proper locations, as shown in Table 3-4. Do not bend the pins; remember to follow proper ESD precautions.

Part Number	Location
070-0357-010 or higher	M8J6
070-0356-010 or higher	N5J6
070-0358-010 or higher	N5I0
070-0359-010 or higher	M8I0

Table 3-4 IO3 PROM Locations

3.9.6 Attaching RealityEngine External Cables

This section describes the external connectors for the RealityEngine board set. Table 3-5 summarizes the connectors.

Connector	Function
SVHS	Super VHS. These two electrically separate output channels enable you to connect an SVHS recorder on one port and a monitor on the other port. The channels are interchangeable.
13W3	Replaces the RGB BNC connectors on earlier Silicon Graphics workstations.
SYNC	Provides an external sync signal for non-Silicon Graphics monitors, as required.
GEN IN	Allows the system to line-lock to an external video source.
GEN OUT	Enables the master sync source to loop through the system to other equipment.
ALPHA	Provides output for transparent or color blending renderings.
CMPST A / CMPST B	Provide a composite video output signal for a recording device and monitor. The channels are interchangeable.
FRAME GRAB	Provides acquisition control.
SWAP READY	Enables multiple systems to be slaved together to provide synchronous frame display.

Table 3-5 RealityEngine Connector Functions

Figure 3-20 shows I/O door connector placement.

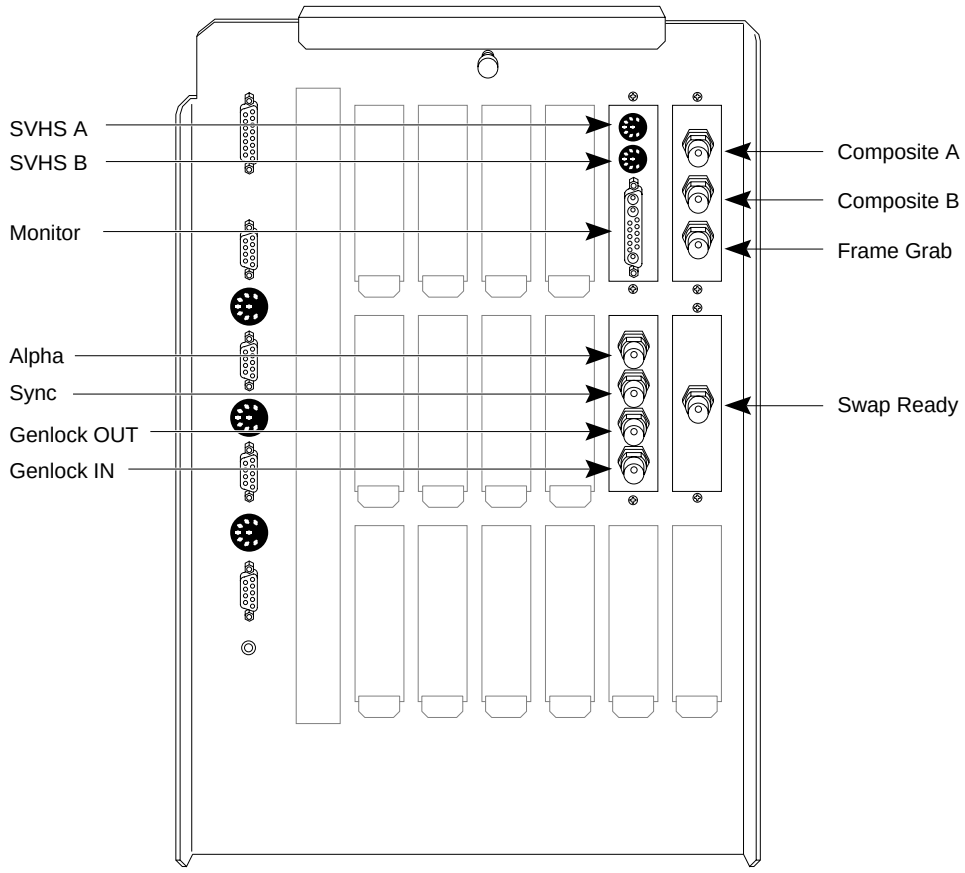


Figure 3-20 RealityEngine External Connectors

Figure 3-21 illustrates a sample video setup. The SVHS, CMPST A, and CMPST B outputs enable the user to view and record simultaneously. The 13W3 connector uses either a 13W3-to-13W3 or a 13W3-to-BNC external cable, depending on the monitor connector.

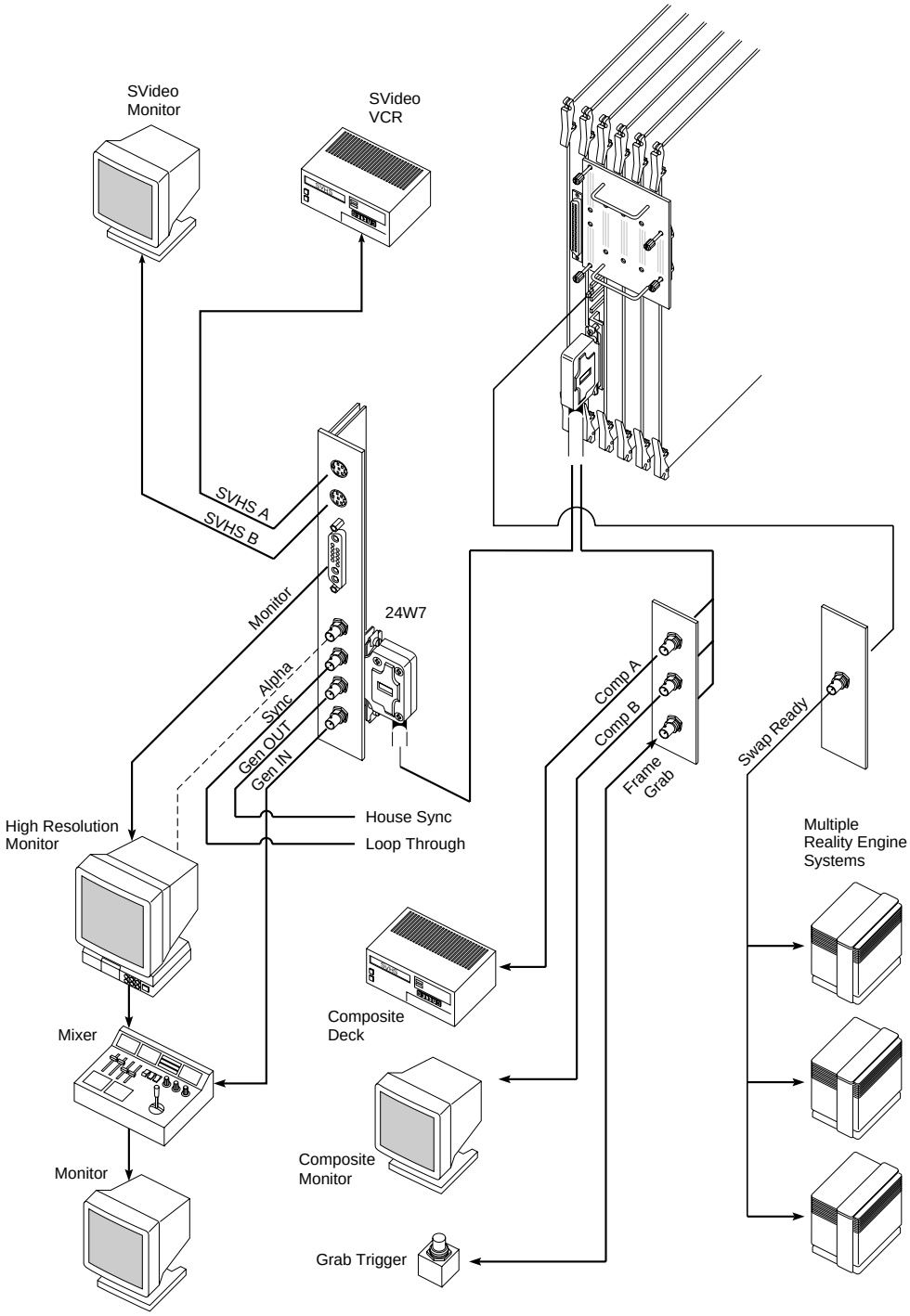


Figure 3-21 Sample Video Setup Using RealityEngine Graphics

3.10 Completing the Installation

The system labels must be replaced to reflect the new system configuration. In addition, the system must be reassembled for customer use. Follow these steps:

1. Peel the existing labels off the chassis. One way to remove the top hat label is to insert a paper clip into the small hole under the label. The label pops right off. This works better than trying to peel off the label (see Figure 3-22).
2. Use the new top hat and system labels to reflect the new system configuration.

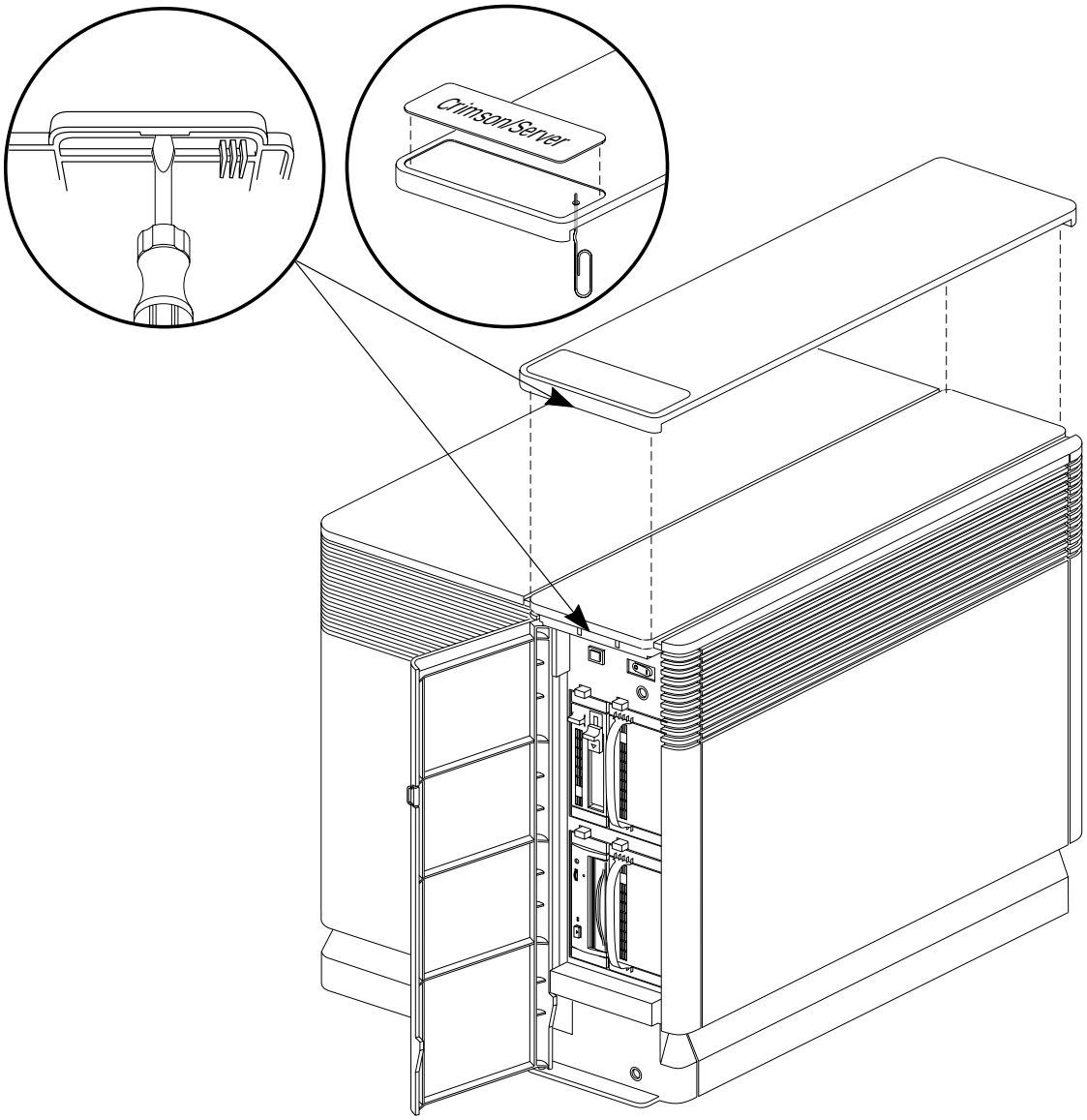


Figure 3-22 Top Hat Label Replacement

3. Install the new system labels on the back of the cabinet, as shown in Figure 3-23.

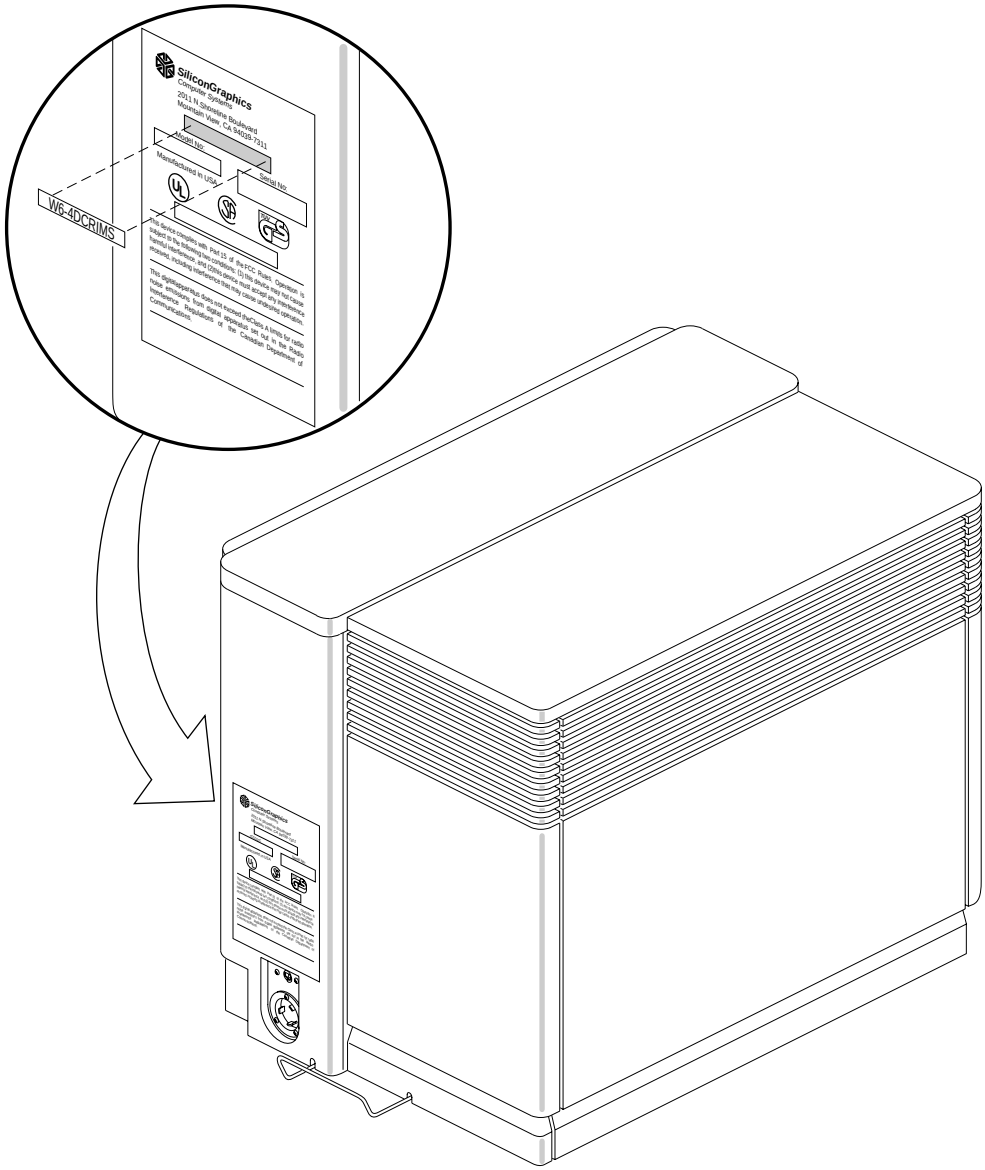


Figure 3-23 Installing New System Labels

4. Close the I/O door.
5. Close the front and/or rear doors on the chassis and replace any skins removed during this installation. Replace all of the I/O panel cables.
6. Connect the power cord to the receptacle; turn on the circuit breaker and the power switch.

Chapter 4

Testing the Boards

This chapter describes important procedures for performing diagnostic tests of the graphics boards:

- bringing up the system
- installing diagnostics
- testing Crimson Entry, XS, XS24, Elan, Extreme, and MG1 board sets
- testing the VGX / VGXT board sets
- testing RealityEngine board sets
- using diagnostic commands

Note: If you have upgraded a Crimson Server, you must reinstall the software prior to running the diagnostics. When the software is installed on the server, it tests to see which boards are installed and configures itself accordingly. Because no graphics boards are installed in the server, the diagnostics to test graphics boards have not been loaded.

4.1 Bringing Up the System

After you have installed the hardware, follow the steps below to bring up the system:

1. Connect the main power cord to the system.
2. Connect an ASCII terminal to a serial port on the system. Ensure that the terminal is set with the following parameters:
   a. 9600 baud
   b. full duplex
   c. XON / XOFF handshaking
   d. 8 bits
   e. 1 stop bit

   Note: It is strongly recommended that you use an ASCII terminal to run diagnostics.

3. Once you have powered on the machine, the System Maintenance Menu appears on the ASCII terminal:

```
System Maintenance Menu

1) Start System
2) Install System Software
3) Run Diagnostics
4) Recover System
5) Enter Command Monitor

Option?
```

4. Type `5` and press `<Enter>` to invoke the Command Monitor. Then type **`hinv`** (hardware inventory) at the prompt and press `<Enter>` to ensure that the backplane and boards are recognized upon powerup. After you type `hinv` and press `<Enter>`, a display like the following should appear.

   Note: You may not have exactly the same configuration as shown here.

```
1 50 MHZ IP17 Processor
FPU: MIPS R4010 VLSI Floating Point Chip Revision: 3.0
CPU: MIPS R4000 Processor Chip Revision: 2.0
Data cache size: 64 Kbytes
Instruction cache size: 64 Kbytes
Main memory size: 16 Mbytes
VGX Graphics option installed
Integral Ethernet controller: Version 3B
Integral SCSI controller 1: Version WD33C93A
Integral SCSI controller 0: Version WD33C93A
Tape drive: unit 7 on SCSI controller 0: QIC 150
Disk drive: unit 1 on SCSI Controller 0
```

   Note: After you load and boot the operating system, the *hinv* command (executed at the IRIX shell) should list most of the system hardware options. Nevertheless, the kernel may still not recognize many video products. If the Extreme graphics option is installed, it may be listed as Elan. The PROM monitor may not recognize some hardware options (such as a network board); these options will not be listed by the *hinv* command in this situation.

   After installing the operating system, type the following at the IRIX prompt for details on the graphics subsystem, if present:

   /usr/gfx/gfxinfo

   You will see a display similar to the following:

```
Graphics board 0 is “GR2MP” graphics.

Managed ((“:0.0”) 1280x1024

1 GE, 24 bitplanes, 4 auxplanes, 4 cidplanes, no z-buffer

GR2 revision 2, VB1.1

HQ2 rev A, GE7 rev B, rRE3 rev D, VC1 rev B,

19” monitor
```

   Note: `GR2` refers to the XS, XS24, Elan, or Extreme configuration. “LG1” refers to the Entry system.

5. After you verify the basic system configuration, go to Section 4.2, “Installing Diagnostics.”

4.2 Installing Diagnostics

The Crimson diagnostic tests are an extension of the integrated diagnostics environment (IDE) test suite. These diagnostic tests provide a thorough examination of the Entry, Elan, Extreme, VGX or VGXT, and RealityEngine graphics boards. Two categories of diagnostic tests are used to test the Crimson graphics boards:

- Entry, XS, XS24, Elan, Extreme, MG1 board and system-level tests
- VGX/VGXT graphics and system-level tests
- RealityEngine graphics and system-level tests

Note: Standalone diagnostics that test the IP17 processor board are covered in a separate document. Refer to the *IRIS POWER Series R4000–50 Upgrade Installation Instructions* for more information.

You can install the software by downloading across a network, or by using a CD-ROM or tape locally. Refer to the appropriate software installation instructions for specific information about loading the system software.

The Crimson system provides an easy method to load diagnostics. You can now install the diagnostics directly from the following sources:

- 1/4-inch tape
- CD-ROM

Note: The diagnostic programs are automatically stored on the hard disk after initial installation. You can invoke the diagnostics from the hard disk, thereafter.

Use the ASCII terminal to run diagnostics. The terminal settings are described in Section 4.1, “Bringing Up the System.”

Caution: Standalone diagnostics for the IP17 and for VGX and VGXT graphics can be run from a graphics terminal. However, it is strongly recommended that the Crimson Entry, Elan, and Extreme graphics standalone diagnostics be run from an ASCII terminal. RealityEngine diagnostics must be run from an ASCII terminal.

4.2.1 Loading Graphics and System-level Diagnostics

Use the following procedures to load graphics diagnostics (Entry, XS, XS24, Elan, Extreme, PowerVision (VGX/VGXT), or RealityEngine) from CD-ROM or 1/4-inch tape. A separate CD-ROM or 1/4-inch tape contains the diagnostics files. Use the *inst* program to load the graphics diagnostics. After installation, the system loads the diagnostics tests into the */usr/diags* directory.

Note: You must install the operating system before you can run the graphics diagnostics. Refer to your operating system documentation for information on loading the software.

1. After you install the operating system software, bring up System Maintenance Menu and select option 2, `Install System Software`.
2. Install the diagnostics files from CD-ROM or 1/4-inch tape.

4.2.2 Installing Diagnostics from 1/4-inch Tape or CD–ROM

Follow the steps below to install diagnostics from the 1/4–inch tape or the CD–ROM:

1. Power on the system and bring up the System Maintenance Menu.
2. Select option 3, `Run Diagnostics`. You will see the following display:

```
Running diagnostics ...
Type “y” to select, anything else to skip to the next selection.
```

Note: If the system detects a CD–ROM, it displays the following message.

```
Boot diags from CD-ROM? or
Boot diags from 1/4” tape? or
Boot diags from hard disk?
```

3. Load the operating system tape or CD–ROM.
4. Select the appropriate peripheral.
5. After you select, you will see the following display:

```
Loading diagnostics ... (Press <ESC> to return to the menu)

.

.

.

Note: Disk Write Mode is OFF (some tests which write to disk
partition 1 are not going to run)

If you want to run these tests, please use “f k l” to turn Disk Write
Mode on, and use “f w 0” to turn the Warning Message Mode off.

DIAGS:
```

After you complete installation, return to the System Maintenance Menu and select option 1, `Start System`. Go to Section 4.3, “Testing Crimson Entry, XS, XS24, Elan, Extreme, and MG1 Board Sets,” or to Section 4.4, “Testing the VGX and VGXT Board Sets” to invoke the diagnostics.

4.3 Testing Crimson Entry, XS, XS24, Elan, Extreme, and MG1 Board Sets

These diagnostics verify the integrity of the MG1 and graphics hardware by executing the following classes of tests:

- MG1 board diagnostics
- Entry, XS, XS24, Elan, and Extreme graphics diagnostics
- screen compare checksum tests
- system level tests

4.3.1 Invoking the Diagnostics

After installing the diagnostics (see Section 4.2, “Installing Diagnostics”), follow these procedures to invoke the tests:

1. After the system reboot, bring up the System Maintenance Menu and select option 1, `Start System`.
2. At the login prompt, type **`diag`**. The system displays the following:

   ```
   TERM = (vt100)
   ```

3. Press **`<Enter>`**; the system displays the following:

   ```
   Crimson Graphics:
   Automatically run Crimson [Entry, XS, XS24, Elan, Extreme]
   diag?(y or n)
   ```

   Note: The kernel should know what type of graphics the system has.

4. Type **`Y`** to display the following menu:

```
   CRIMSON [ENTRY, XS, XS24, ELAN, EXTREME} SYSTEMS DIAGNOSTICS
   ------------------------------------------------------------

   1- Quick System check
      2- Full System check
   3- Quick Server check
   4- Full Server check
   5- Quick Graphics check
      6- Full Graphics check
   7- MG1 Board Diagnostics
   8- [Entry, XS, XS24, Elan, Extreme] Board Diagnostics
   9- System Screen Compares
   10- System Options Check
   11- View Results of diagnostics tests
   12- Automatically run selected Graphics Demos
   13- EXIT Crimson [Entry, XS, XS24, Elan, Extreme] Systems
Diagnostics

   Please choose an item (1-11) >
```

4.3.2 Test Descriptions

Table 4-1 gives a brief description of the Entry and Elan tests.

Test	Description	Screen Compare Result
1. Quick System Check	Runs kernel, stress tests, floating point processor tests, I/0, memory, and screen compares. No IDE tests are run.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics log
2. Full System Check	Runs all of the above tests and all the IDE tests.	Same as above.
3. Quick Server Check	Runs a subset of the IP17 board tests including kernel stress test, I/O, memory and system level tests.	None
4. Full Server Check	Runs extended IP17 tests	None
5. Quick Graphics Check	Runs the IDE graphics tests.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics log
6. Full Graphics Check	Runs the IDE graphics tests using multiple passes.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics logo
7. MG1	Tests the MG1 hardware.	None
8. Entry, XS, XS24, Elan, Extreme Diagnostics	Tests the hardware on the graphics board.	None
9. System Screen Compares	Performs a pixel-by-pixel comparison of images.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics logo
10. System Options Check	Exercises system peripherals such as the tape drive, printer, and other devices.	None
11. View Results	Displays results of all tests.	None
12. Automatically run selected Graphics Demos	Displays a series of graphic images in window screens.	No screen compare test is performed.

Table 4-1 Entry and Elan Diagnostic Test Descriptions

4.3.3 Running Diagnostics

Run option 2, `Full System Check`, to verify proper operation of the hardware after installation. If you encounter any error messages, recheck the installation, and take the appropriate action to replace the failed hardware. It is recommended that you test for one loop or pass only.

Note: Options 1, 2, 3, and 4 request the name of a remote host for an Ethernet test. To bypass this test, press **<Enter>**.

This section explains the following diagnostics programs:

- log file results
- screen compare tests
- MG1 tests
- manual diagnostics

Log File Results

The diagnostics program creates a log file in the *usr/tmp* directory that contains results for each test. An example of a log file is */usr/tmp/quickgr.log*. This particular file corresponds to the Quick System Check test. To view the results of the log file, type the following command at the IRIX prompt.

more <*log file name*>

To return to the main menu type **main.ide** or type **menu**. Table 4-2 lists other important commands.

Command	Action
<Ctrl> c	Quit testing
<Ctrl> s	Pause screen display
<Ctrl> q	Continue screen display
<Ctrl> z	Suspend current process
fg test#	Restart diags in foreground
check */usr/tmp/fullsys.log0*	Check diagnostics log

Table 4-2 Diagnostics Commands

Screen Compare Tests

The screen compare tests verify the functionality of the graphics by displaying an image and comparing the values generated by the image against the checksums expected for that image. The diagnostics use *gold* file checksums to check if the graphics subsystem displays the proper screen image.

The graphics monitor displays the images while the ASCII terminal shows a running log of the test in progress. As you are running the tests, you should see a display similar to the following on the ASCII terminal.

```
    .
    .
    .
INFO:  400: CP microcode RAM data test
INFO:  410: CP ucode addr test
INFO:  410: CP microcode RAM address test
INFO:  420: CP ucode full test
INFO:  420: CP microcode RAM full test
    .
    .
    .
```

MG1 Tests

Option 7 tests the integrity of the MG1 hardware by executing types of tests shown in Table 4-3.

Command	Action
address test	Uses a walking one bit to generate and test unique addresses
data test	Checks for shorts on the data bus through a walking one bit test and a pattern test
pattern test	Determines proper operation of the memory modules

Table 4-3 MG1 Tests

Data can be written out to the GIO bus through the command mapper (for three-way transfers), directly to the FIFOs, or through the special bypass registers. See the *IRIS Crimson Installation and Configuration Guide* for more information on the MG1 architecture.

The following display appears when you select option 7:

```
MG1 Tests
1. All MG1 Tests
2. Mg1 Reset
3. Mg1 Control Reg Test
4. Command Mapper Test
5. EEprom Test
6. PIO Test
7. Fifo Tests
8. 3 Way Test
9. Stress Test
10. GIO Test
11. Exit from Menu
```

Run option 10, `Full System Test`, for a complete checkout of the MG1 hardware. Run the individual tests to isolate problems as required.

Table 4-4 summarizes the MG1 diagnostic tests.

Test	Description
1. Full System	Executes all of the tests below.
2. MG1 Reset	Resets the MG1 and graphics boards, and checks if the boards return in stable condition. This test also determines if the board returns the correct ID.
3. MG1 Control Reg	Checks the two control registers using a write-read-compare program with different data patterns.
4. Command Mapper	Tests the address and data lines by writing, then reading for expected values at address 0 of the command mapper. The test checks for any *stuck* bits. The test also writes alternating patterns to each location in the command mapper, then reads and verifies the data.
5. EEprom	Reads and verifies the current contents of the flash EEPROM. This test does not destroy the contents of the EEPROM.
6. PIO	Transmits programmed I/O through the bypass register, then reads the bypass register.
7. FIFO	Checks the address and data FIFO by writing values, then checking the read registers for the expected values. This test also fills the FIFOs with unique values to check for high and low water mark filling and emptying capability.
8. 3-Way	Initializes the command mapper, writes GIO addresses to the FIFOs, then checks the FIFO for the correct address.
9. Stress	Places the board in different operational modes and checks if the board returns in stable condition.
10. GIO	Writes a value to the GIO address register, then reads register 1. The test checks that the eight high-order bits contain the same value as the GIO address register.

Table 4-4 MGI Test Descriptions

Manual Diagnostics

The */usr/diags/scripts* directory has a set of manual diagnostics commands that you can use in place of the menu-driven selections. These diagnostics test specific areas of the graphics hardware such as the geometry engines.

Table 4-5 shows a list of screen compare commands:

Test	Description
compge	Tests the geometry engine (GE) circuitry
ccompppep	Checks the pp / ep (poly processing and edge processing)
ccompras	Tests the raster system
ccompspin	Spins and rotates objects
ccomploop	Executes a specified number of test loops for either the previous screen compare test or a new screen compare test. See note below for more information.

Table 4-5 Screen Compare Commands

The *ccomploop* command uses the format:

ccomploop [cn] [count]

where:

- [c] indicates *continue* with the previous test command; the previous pass / fail counts in the log file will not be cleared.
- [n] indicates *new* test. The user must then specify a screen compare command such as *ccompge* afterwards. With this option, the previous pass / fail counts in the log file will not be cleared.
- [count] determines the number of test loops.

These screen compare tests provide either a PASS or FAIL result, followed by possible error location information. The test also gives test results for each span where appropriate.

This completes the testing of the Entry and Elan board sets. Check *usr/tmp/fullsys.log*0 for any failures.

4.4 Testing the VGX and VGXT Board Sets

Testing the PowerVision (VGX and VGXT) graphics board sets is explained in the following sections:

- Using Test Menus
- Invoking PowerVision Diagnostics
- Running Board Tests

4.4.1 Using Test Menus

The diagnostics provide two types of menus:

- board diagnostics
- screen compare images

Board Diagnostics

These tests check the GM3, GE6, RM2, and DG1 circuitry functionality by writing data patterns into SRAM, DRAM, VLSI devices and control registers. The tests then read back the data and compare it against expected values. These microcode tests also check data paths, control logic and signal lines for correct operation. These tests produce test messages that point to suspect circuitry and / or boards.

Note: Some tests interact with more than one board at a time. Consider this carefully during troubleshooting.

Screen Compare Tests

The VGX / VGXT compare scripts use CRC codes to verify that the VGX or VGXT board set is sending out images correctly instead of huge gold files. The images that appear on the graphics terminal will be the last images placed in the frame buffer before the testing begins, so you will see random images flickering on the graphics terminal until the screen displays appear. See Table 4-6 for a list of screen displays that should appear.

The screen compares verify the functionality of the VGX or VGXT board set by displaying an image (for example X-29, wireframe jet, or PowerVision soda can) and comparing the values generated by each image against the CRC codes expected for that image. The diagnostics use CRC codes to check whether or not the image has been properly displayed; you don't have to verify the image visually.

Note: The diagnostics load the microcode (if required) from the */usr/diags/usr/gfx/ucode* file.

Test	Time	Description	Screen Compare Results
1. Quick Graphics Check	18 minutes	Runs a subset of the full IDE tests. Tests all the boards in the VGX.	Smooth silver X-29 on blue-gray background, wireframe jet and PowerVision soda can.
2. Entire Graphics Test	30 minutes	Runs all the IDE tests, followed by screen compare.	Smooth silver X-29 on blue-gray background, wireframe jet and PowerVision soda can.
3. GM3 Test	6 minutes	Runs the IDE tests on the 68020 host interface, the triangle engine, and pixel bus interface. If you run this diagnostic with the -q option, the full DRAM tests and 3-way combination tests are skipped.	None
4. GE6 Test	6 minutes	Runs the IDE tests to check the GE, PE, CD, VR, and TE interface.	None
5. RM2 Test	20 minutes	Runs the RM2 IDE tests.	None
6. DG1 Test	2 minutes	Runs the DG1 IDE tests.	None
7. Screen Compares	2 minutes	Checks generated images against expected CRC codes.	Smooth silver X-29 on blue-gray background, wireframe jet and PowerVision soda can.

Table 4-6 PowerVision (VGX/VGXT) Diagnostic Tests

4.4.2 Invoking PowerVision (VGX/VGXT) Diagnostics

Follow these procedures to invoke the diagnostics.

1. After system reboot, bring up the System Maintenance Menu and select option 1, `Start System`.
2. At the login prompt, type **`diag`**. The system displays the following:

   ```
   TERM = (vt100)
   ```

3. Press **`<Enter>`** and the system displays the following:

   ```
   VGX/VGXT Graphics:10-span Alpha system
   Automatically run Power Vision diagnostics (y or n)?
   ```

4. Type **`Y`** to display the following menu.

   ```
   PowerVision Graphics Diagnostics
   ------------------------------------------------
   (Time estimates apply to 10 span system)
   1- Quick Graphics Subsystem Check1
   2- Test Entire Graphics Subsystem
   3- GM3 Board Diagnostics
   4- GE6 Board Diagnostics
   5- RM2 Board Diagnostics
   6- DG1 Board Diagnostics
   7- CRC System Screen Compares
   8- EXIT PowerVision Diagnostics
   Please choose an item (1-8) >
   ```

Note: The `Entire Graphics Subsystem` test option has the same GM3, GE6, RM2, and DG1 tests (automatically run in sequence) as the individual board tests.

4.4.3 Running the Board Tests

Follow these steps to test the PowerVision board set.

1. After you log in as `diag` and receive the PowerVision diagnostics prompt, type **`y`**. The master PowerVision diagnostic menu will appear, with the VGX or VGXT board set configuration listed at the top of the menu.
2. First verify the basic functionality of the PowerVision board set with option 2, `Quick Graphics Subsystem Check`. This diagnostic test verifies the basic functionality of the PowerVision board set. If you receive error messages, use the appropriate individual board test to isolate failures. Before you begin testing you should check the *ide.log* file in */usr/tmp/ide.log0* for any prior failure entries.

Note: There are two *ide.log* files, 0 and 1. Crimson uses *ide.log0*. Currently, only the dual-headed SkyWriter™ system uses both *ide.log0* and *ide.log1*.

To return to the main menu, type **`main.ide`** or type **`menu`**. See Table 4-2 for other important commands.

3. Type **`1`** during the `Quick Graphics Subsystem Check`, and diagnostic information similar to the following appears:

```
ide>> INFO:  10: GE/PE Stress Tests
INFO:  Background GE Stress Started
INFO:  Background PE Stress Started
INFO:  GE Stress Pattern
INFO:  PE Stress Pattern
INFO:  GE & PE Stress Pattern
INFO:  Background GE Stress Stopped
INFO:  Background PE Stress Stopped
INFO:  GE Stress Clash
INFO:  GE Background       PASS      30267     FAIL     0
INFO:  GE Pattern A        PASS      6000      FAIL     0
INFO:  PE Pattern C        PASS      6000      FAIL     0
```

4. If all the diagnostics run successfully, the `ide` prompt appears and a "passed" message is displayed.

   ```
   Diagnostic Success (<CR> to continue)
   ```

   If any failures occur, they are logged into */usr/tmp/ide.log*.

5. If all the tests pass, the VGX or VGXT board set is operating correctly. However, if you receive failure messages, note the test name description, message, and run the full set of IDE tests. Choose option 2. A display similar to the following appears.

```
Begin GM3 diagnostics
Welcome to unix ide
ide>> INFO:  10: GM PIO Revision ID Test
INFO:        revision level 0
INFO:  11: GM PIO Reset Test
INFO:  12: GM PIO Unreset Test
INFO:  13: GM PIO Initial Cond Test
INFO:  20: GM SRAM Walking 1 Test
INFO:  21: GM SRAM Address Test
INFO:  22: GM SRAM Pattern Test
INFO:  30: GM DRAM Walking 1 Test
INFO:  31: GM DRAM Address Test
INFO:  32: GM DRAM Pattern Test
INFO:  33: GM DRAM Cycle Type Test
INFO:  40: GM PIO DFIFO Control Test
INFO:  41: GM PIO FIFO Control Test
INFO:  42: GM PIO FIFO Walking 1 Test
INFO:  43: GM PIO FIFO Pattern Test
INFO:  50: GM 3WAY FIFO Control Test
             repeating with word swapped
INFO:  51: GM 3WAY FIFO Walking 1 Test
             repeating with word swapped
INFO:  52: GM 3WAY FIFO Pattern Test
             repeating with word swapped
INFO:  53: GM 3WAY FIFO Combo Test
INFO:  60: GM AASRAM Walking 1 Test
INFO:  61: GM AASRAM Address Test
INFO:  62: GM AASRAM Pattern Test
       70: GM AASRAM Walking 1 Test
       71: GM AASRAM Address Test
       72: GM AASRAM Pattern Test
       85: GM DMA swapper test
ide>> pix
INFO:  10: PIX TO Bus Test
INFO:  11: PIX TADDR Test
INFO:  12: PIX BANK Test
INFO:  13: PIX C and Z Bus Test
INFO:  14: PIX Copy Test
INFO:  15: PIX Pattern Control Test
INFO:  16: PIX Stipple Control Test
INFO:  17: PIX Ydone Test
INFO:  18: PIX Xdone Test
INFO:  19: PIX BUFdone Test
INFO:  20: PIX Bye Swizzle Test
Done
Begin GE6 diagnostics
Welcome to unix ide
ide>> INFO:Resetting GE6 board
INFO:  100: GE6 board reset
INFO:  100: GE6 board reset test
INFO:  GE6 board revision 1
INFO:  200: OPSTATE test
INFO:  200: OPSTATE test
INFO:  300: CP map data test
INFO:  300: CP command map RAM data test
INFO:  310: CP map addr test
INFO:  310: CP command map RAM address test
INFO:  320: CP map full test
INFO:  320: CP command map RAM full test
INFO:  400: CP ucode data test
INFO:  400: CP microcode RAM data test
INFO:  410: CP ucode addr test
INFO:  410: CP microcode RAM address test
INFO:  420: CP ucode full test
INFO:  420: CP microcode RAM full test
INFO:  500: GE ssr test
INFO:  500: GE SSR test
INFO:  510: GE ucode data test
INFO:  510: GE microcode RAM data test
INFO:  520: GE ucode addr test
```

6. If all the diagnostic tests are successful, the screen displays the following message at the IDE prompt:

   ```
   Diagnostic Success (<CR> to continue)
   ```

7. The diagnostic detects and indicates an error condition if the tests do not finish, or if you see an “interrupted” or “stopped” message. If an error occurs, enter **n** at the prompt to discontinue testing. Return to the main diagnostic menu and write down the error message shown in the *ide.logfile*. Then select an individual board test from the test menu to verify the failure.

   For example, the screen displays the following error messages caused by a failing RM2 board:

   ```
   INFO:     16: IMP Alphaless Confirmation Test
   INFO:      17: IMP Memory Test
   INFO: Test pass 1 out of 1
   INFO: Writing Bank 0
   INFO: Writing Bank 1
   INFO: Writing Bank 2
   INFO: Writing Bank 3
   INFO: Reading Bank 0
   ERROR: (17) IMP Memory Test (bits 0-31): X:0x0000 Y:0x0000 BANK:0
   (BD0 SP0 IMP0) exp:0xffffffff got:0x006545ff
   <Stopped>
   ide>>
   Errors detected in the ide logfile
   ERROR: (17) IMP Memory Test (bits 0-31): X0x0000 Y:0000 BANK:0
   (BD0 SP0 IMP0) exp:0x
   ```

4.4.4 Running the Screen Compare Tests

After the microcode tests have run successfully, run the screen compare tests from the main PowerVision menu.

Note: The `Quick` or `Entire Graphics Subsystem Check` displays the screen compares at the end of the tests. You do not need to select the screen compares individually from the menu.

If applicable, enter **7** at the prompt to select the screen compares from the menu. As the following displays appear on the ASCII terminal, the graphics monitor will display an X-29, a wireframe jet, a rotating cylinder, and the PowerVision soda can.

```
PowerVision system CRC tests...
loaducode: finished loading gm3.u
loaducode: finished loading cp.u
loaducode: finished loading ge.u
loaducode: finished loading vr.u
loaducode: finished loading pe.u
loaducode: finished loading te.u
loaducode: finished loading aatab.b
gl_init_pipe() only
loaducode: finished loading amRAM.u
5 span system
Comparing files ...
sys.1 PASSED
sys.2 PASSED
num lines: 824
max size: 50
num points: 11534
bounds (-0.975618 -0.089218 -0.574548) to (0.716532 0.274094
0.574548)
sys.3 PASSED
```

This completes the testing of the PowerVision board set. Check *usr/tmp/ide.log* for any failures.

4.5 Testing the RealityEngine Board Sets

The diagnostics for RealityEngine verify the integrity of the system graphics hardware. This section explains RealityEngine diagnostic testing, as follows:

- invoking the diagnostics
- board diagnostics
- screen compare checksum tests
- system-level tests

4.5.1 Invoking the Diagnostics

After installing the diagnostics, follow these procedures to invoke the tests:

1. After system reboot, bring up the System Maintenance Menu, and select option 1, `Start System`.
2. At the login prompt, type **`diag`**. The system displays the following:

   ```
   TERM = (vt100)
   ```

3. Press **`<Enter>`** and the system displays the following:

   ```
   RealityEngine Graphics:
   Automatically run Reality Engine diagnostics?(y or n)
   ```

4. Type **Y** to display the following menu**:**

```
REALITY ENGINE SYSTEMS DIAGNOSTICS TEST TIME (hr:min)
------------------------------------------------------------

(Average test time based on a 16MB 4D420RE system with 10 spans)

 1- Pipe Select
 2- Quick System check ....................... 1:34
 3- Full System check ........................ 2:11/loop
 4- Quick Server check ....................... 2:11
 5- Full Server check ........................ 0:40/loop
 6- Quick Graphics check ..................... 1:05
 7- Full Graphics check ...................... 1:13
 8- GE8 Board Diagnostics .................... Menu
 9- RM4 Board Diagnostics .................... Menu
10- DG2 Board Diagnostics .................... Menu
11- CRC System Screen Compares ............... 0:43
12- System Options Check ..................... Menu
13- View Results of diagnostic tests ......... Menu
14- Automatically run selected Graphics Demos
15- EXIT RealityEngine Systems Diagnostics

Please choose an item (1-15)>
```

It is recommended that you run option 3, `Full System Check`, of the system-level menu to verify proper operation of the hardware after installation. If you encounter any error messages, recheck the installation, then take the appropriate action to replace the failed hardware. Run the test for one loop or pass only, after initial installation.

Note: Options 2 through 5 will request the name of a remote host for an Ethernet test. To bypass this test, press **<Enter>**.

Board-level Tests

Run the individual board diagnostics when you suspect a problem with a particular board. You can invoke these tests by selecting item 8, 9, or 10 on the system menu. Sections 4.5.3 through 4.5.5 describe these diagnostics.

These tests check the GE8, RM4(T), and DG2 circuitry functionality by writing data patterns into SRAMs, ASICs, VLSI devices, and control registers. The tests then read back the data and compare it with expected values. These microcode tests also check data paths, control logic, and signal lines for correct operation. These tests produce test messages that point to suspect circuitry and / or boards.

Note: Some tests interact with more than one board at a time. Consider this carefully during troubleshooting.

If you receive error messages, use the appropriate individual board test to isolate failures. Before you begin testing, you should check the *ide.log* in */usr/tmp/ide.log0* for any prior failure entries.

Note: There are two *ide.log* files, 0 and 1. Crimson uses *ide.log0*. Currently, only the dual-headed SkyWriter™ system uses both *ide.log0* and *ide.log1*.

To return to the main menu, type **menu.RE**.

Screen Compare Tests

The screen compares verify the functionality of the graphics by displaying an image and comparing the values generated by each image against the checksums expected for that image. The diagnostics use *gold* file checksums to check if the graphics subsystem displays the proper screen image.

The RealityEngine compare scripts use CRC codes to verify that the RealityEngine board set is sending out images instead of huge gold files. The images that appear on the graphics terminal will be the last images placed in the frame buffer before the testing begins, so you will see random images flickering on the graphics terminal until the screen displays appear. Table 4-7 (later in this chapter) lists screen displays that should appear.

The screen compares verify the functionality of the RealityEngine board set by displaying an image (for example a jet plane or wine glass) and by comparing the values generated by each image against the CRC codes expected for that image. The diagnostics use CRC codes to check whether or not the image has been properly displayed; you don't have to verify the image visually.

Note: The diagnostics load the microcode (if any is required) from the */usr/diags/usr/gfx/ucode* file.

ASCII Terminal Output

The graphics monitor displays the images while the ASCII terminal shows a running log of the test in progress. As you are running the tests, you should see a display similar to the following on the ASCII terminal:

```
    .
    .
    .
INFO:  400: CP microcode RAM data test
INFO:  410: CP ucode addr test
INFO:  410: CP microcode RAM address test
INFO:  420: CP ucode full test
INFO:  420: CP microcode RAM full test
    .
    .
    .
```

Log File Results

The diagnostics program creates a log file in the *usr/tmp* directory that contains results for each test. An example of a log file is */usr/tmp/quickgr.log*. This particular file corresponds to the “Quick System Check” test. To view the results of the log file, type the following at the IRIX prompt:

more <*log file name*>*ide.log*

Note: To return to the main menu, type **menu.RE**. See Section 4.6, “Using Diagnostic Commands,” for other important commands.

The rest of this section explains:

- system-level graphics tests
- GE8 tests
- RM4 tests
- DG2 tests
- manually run tests

4.5.2 System-level Graphics Tests

Table 4-7 gives a brief description of the system-level graphics tests.

Test	Description	Screen Compare Result
1. Pipe Select	For SkyWriter only. Selects either pipe 0 (right side) or 1 (the left-side).	
2. Quick System Check	Runs kernel, stress tests, floating point processor tests, I/O, memory, and screen compares. No IDE tests are run.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics logo
3. Full System Check	Runs all of the above tests and all the IDE tests.	Same as above.
4. Quick Server Check	Runs a subset of the CPU board tests, including kernel stress test, I/O, memory and system-level tests.	None
5. Full Server Check	Runs extended CPU tests.	None
6. Quick Graphics Check	Runs the IDE graphics tests.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics logo
7. Full Graphics Check	Runs the IDE graphics tests using multiple passes.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics logo
8. GE8 Board Diagnostics	Tests the GE8 hardware.	None
9. RM4 Board Diagnostics	Tests the RM4(T) hardware.	None
10. DG2 Board Diagnostics	Tests the DG2 hardware.	
11. CRC System Screen Compares	Performs a pixel-by-pixel comparison of images.	1. Jet plane 2. Jet plane with red borders 3. Wine glass 4. Silicon Graphics logo
12. System Options Check	Exercises system peripherals such as the tape drive, printer, and other devices.	None
13. View Results of diagnostic tests	Allows you to see the test results of all tests.	None
14. Automatically run selected Graphics Demos	Displays a series of graphic images in window screens.	No screen compare test is performed.

Table 4-7 RealityEngine System Test Descriptions

4.5.3 GE8 Tests

This section describes the geometry engine (GE8) diagnostics test. You will see the following display when you select option 8 on the system menu:

```
RealityEngine Graphics Diagnostics for GE8 - Test Time (min:sec)
------------------------------------------------------------
(Average test times based on a 4D420RE system w. 16MB of memory)

1 - Quick Check of GE8 ............................... 0:41
2 - Full Check of GE8 ................................ 8:56
3 - GE8 - MPG1/PIO Registers Test ..................... 0:23
4 - GE8 - CP2/GEs JTAG Connectivity Test .............. 0:06
5 - GE8 - GEs Connectivity Test ....................... 0:05
6 - GE8 - PIO/CP2 Data Transfer Test .................. 0:25
7 - GE8 - CP2/GEF Connectivity & CP2 Scan Test ......... 0:44
8 - GE8 - 3-Way Basic Data Transfer ................... 0:10
9 - GE8 - ODMA/Host Data Transfer Test ................. 0:19
10- GE8 - IDMA/CP2 Data Transfer Test .................. 0:09
11- GE8 - GEF Functional Test ......................... 4:51
12- GE8 - Intel i860XP Functionality Test .............. 0:07
13- GE8 - CP2 Functionality Test ....................... 0:06
14- GE8 - MPG1 Functionality Test ...................... 0:03
15- GE8 - GE8 Interrupt Test ........................... 0:05
16- GE8 - MP Bus Stress Test ........................... 0:03
17- GE8 - VC Bus Test ................................. 0:26
18- EXIT from menu

Please choose an item (1-18) >
```

Run option 2, `Full Check of the GE8`, for a complete checkout of the GE8 hardware. Run the individual tests to isolate problems as required.

Table 4-8 provides a description of the GE8 diagnostic tests.

Test	Description
1. Quick Check of GE8	Executes a subset of the available GE8 tests by running these types of tests—a PIO register test, a JTAG control test, a GE connect test, a PIO FIFO scan test, a CP ucode scan, a PB scan, a GEF scan, and a three-way transfer test. Each of these tests are described in this table.
2. Full Check of GE8	Executes all of the GE8 tests.
3. MPG1 / PIO Registers Test	Writes and reads the MPG1 registers, walks 1s and 0s through return in stable condition. This test also determines if the board returns the correct ID.
4. CP2 / GEs JTAG Connectivity Test	Verifies the connectivity between the CP (command processor) and the geometry engines (GEs) using the JTAG test. (See note below.)
5. GEs Connectivity Test	Verifies the connectivity between all the GE8s using the JTAG rotocol. These checks include a chain test, an ID code check for each GE, a stuck-bit check, a short check, and clock tests

Table 4-8 GE8 Diagnostic Test Descriptions

Test	Description
6. PIO / CP2 Data Transfer Test	Tests the data transfer between the programmable I / O (PIO) registers and the CP2 (command processor) through various subtests. These include the following tests: • the PIO FIFO registers write, read, and reset tests. • the PB PIO connectivity test that checks the packet buffer (PB) in the GEF ASIC to the PIO by downloading a ping test to an output DMA (ODMA) register test, and a reset test. • the PB DRAM PIO test that checks the GEF DRAMs • the PIO tests that verifies the full connectivity path by checking the links from the host to CP2 to GEF to MPG1 and back to the host.
7. CP2 / GEF Connectivity and CP2 Scan Test	Executes a number of subtests including the following: • CP2 to GEF JTAG test • PIO FIFO scan checks the 33-bit MPG1 output data bus to the CP2 using JTAG tests • CP2 UCODE scan verifies the command processor microcode in SRAM (shadow RAM) using JTAG tests • PB scan downloads a packet buffer (PB) to the GEF diagnostic registers and executes JTAG tests • GEF scan executes a JTAG test to verify a functional handshake to the GEF ASIC
8. 3-Way Basic Data Transfer	Consists of three tests: an offset, command 0, and Pipe 1 tests. The offset test checks four different offset values. The command 0 and pipe 1 tests are *sanity* checks that verify the MPG1 3-way functionality.
9. ODMA / Host Data Transfer Test	Performs several functional tasks such as walking 1s and 0s across the 32-bit bus and testing different settings and offsets of word counts and data.
10. IDMA / CP2 Data Transfer Test	Downloads CP and GE microcodes and then starts the IDMA transfer. The test passes the results through the MPG ODMA word count register.
11. GEF Functional Test	Consists of seven subtests, including a bus give test, a hold bus test, a cache test and a walk test. In each of these tests, a 32-bit word is sent to the output direct memory access (ODMA) word count register and then read by the host through the PIO register.
12. I860 Functional Test	Checks the functionality of the Intel i860XP.

Table 4-8 (continued) GE8 Diagnostic Test Descriptions

Test	Description
13. CP2 Functional Test	Performs about 22 command processor (CP) subtests including an 8, 12, 16, 32, and 64-bit conversion test, a branch test, a register test, and a shadow RAM (SRAM) test.
14. MPG1 Functional Test	Verifies the functions of the MPG (multiprocessor bus to test graphics) ASIC. Verifications include packing data, converting data, and checking the interaction between the GEFs (geometry engine FIFOs) and the CP (command processor).
15. GE8 Interrupt Test	Tests various GE interrupts such as GEF interrupt, FIFO overrun, and ODMA interrupt. The test sends the interrupts to all the CPUs and then performs walking 1's and 0's across the interrupt status register.
16. MP Bus Stress Test	Checks the MP bus interface and data transfer by loading data into memory and then transferring it to the GE through the PIO, 3-way, and input DMA randomly. The test verifies the data received on the host.
17. VC Bus Test	Tests the interface between the GE8 and DG2 by initializing the DG2 across the VC bus and then executing function manager tests. Note: For a description of the function manager tests, see Section 5.2.6, "DG2 Tests."

Table 4-8 (continued) GE8 Diagnostic Test Descriptions

4.5.4 RM4 Tests

This section describes the raster memory (RM4 and RM4T) tests. You should see a display similar to the following when you select option 9 on the system menu:

```
Results will be logged in: /usr/tmp/rm4.log0
Venice Graphics Diagnostics for RM4 Test Time(min:sec)
-------------------------------------------------------------
(Average test times based on a 420RE system w. 16MB of memory)

1- Quick Check of RM4 ............................... 07:00
2- Full Check of RM4 ................................ 13:30
3- RM4 - Connectivity Test .......................... 00:15
4- RM4 - TBus/RBus/Vbus Connectivity Test ............ 02:00
5- RM4 - TBus Signature Test ........................ 02:40
6- RM4 - IMP (framebuffer) Memory Test .............. 00:40
7- RM4 - IMP Signature Test .......................... 00:50
8- RM4 - TA/TD (texture) Memory Test ................. 00:40
9- RM4 - Configuration Verification Test ............. 00:10
10- RM4 - Reset the RM4 .............................. 00:10
11- EXIT from menu

Please choose an item (1-11) >
```

Table 4-9 provides a description of the RM4 tests.

Test	Description
1. Quick Check of RM4	Executes all the RM4 tests once.
2. Full Check of RM4	Executes all the RM4 tests twice.
3. Connectivity	Tests the chip-to-chip connectivity of the RM4(T) board by executing a number of tests, including the following: id code test - verifies the chip id code for each chip. stuck-at test - drives a logic 0 and 1 on the output of each driver and verifies that it is present at each input pin short test - runs a sect of vectors to test for shorts. status test - ensures that all ASCI ready lines are driven to idle when the board is reset.
4. TBus/RBus/Vbus Connectivity	Checks the TBus and RBus connectivity between the RM4 and GE8 boards by walking a 1 and 0 down the 48 bits of the data bus and 7 bits of the address bus for each GEF on the GE8. The test also checks the read back bus connectivity between the IMP buffers (IBs) on each RM4 and the CP2 on the GE8 board.
5. TBus Signature	Consists of a series of files that test the CRC signatures of the RM4 ASICs. The signature tests diagnose faulty ASICs.
6. IMP (frame buffer)	Tests the frame buffer memory by walking a 1 and a 0 across the data and address lines of each IMP and generating a memory pattern in each 16-bit location.

Table 4-9 RM4 Test Descriptions

Test	Description
7. RM4 - IMP Signature	This test is similar to the TBus signature test. Both tests check the CRC signatures of the RM4 ASICs to diagnose faulty ASICs. However, the IMP signature test also performs a read back. There are no read back checks in the TBus test.
8. TA / TD (texture) Memory Test	Tests the texture address (TA) and texture data (TD) address by walking a 1 and 0 across these buses. The test also writes esta pattern to texture memory then verifies the pattern.
9. Configuration Verification	Checks for the presence of a DG2 board and reports the number RM4 boards available in the system.
10. Reset the RM4	Resets the RM4 board(s) and checks if the boards return in stable condition. This test also determines if the board returns the correct ID.

Table 4-9 (continued) RM4 Test Descriptions

4.5.5 DG2 Tests

This section describes the display generator (DG2) diagnostic tests. When you select option 10 on the system menu, you should receive a display similar to the following:

```
*Results will be logged in: /usr/tmp/dg2.log0
Venice Graphics Diagnostics for DG2 Test Time(min:sec)
-------------------------------------------------------------
(Average test times based on a 420 system w. 16MB of memory)

1- Quick Check of DG2 ................................ 2:00
2- Full Check of DG2 ................................. 2:30
3- Memory Tests....................................... 0:30
4- Register Tests .................................... 0:15
5- Function Manager Sram Tests ....................... 0:15
6- Xmap Memory Tests ................................. 0:30
7- JTag Connectivity Tests ........................... 0:30
8- HV List Tests....................................... 0:30
9- XMAP CRC Tests...................................... 0:30
10- Cursor Tests....................................... 0:30
11- EXIT from menu

Please choose an item (1-11) >
```

Table 4-10 describes the DG2 diagnostics.

Test	Description
1. Quick Check of DG2	Executes a subset of the DG2 tests including a connectivity test: • system connectivity • XMAP CRC • memory • HV list • cursor memory
2. Full Check of DG2	Tests the following areas: • system connectivity • XMAP CRC • memory • registers • DG2 connectivity • HV list • cursor memory
3. Memory Tests	Executes all of the DG2 diagnostics memory tests.
4. Register Tests	Checks the control registers using a write-read-compare program with different data patterns.
5. Function Manager SRAM Tests	Tests the shadow RAM (SRAM) of the function manager by loading test display data into the function manager, then checking the contents of the SRAM after execution.
6. Xmap Memory Test	Tests the Xmap color lookup tables (CLUTs), Xmap display ID tables, and the Xmap control SRAM.
7. JTag Connectivity Test	Performs a component-to-component connectivity test to check for shorts and disconnections.
8. HV List Tests	Checks the HLIST and HLIST functionality by verifying the horizontal (H) and vertical (V) list call process. This test checks if the test calls are present at various memory locations and devices, and if the FIFO flag full activates after a certain amount of calls or events.
9. XMAP CRC Test	Performs a cycle redundancy check on the XMAP ASICs by executing a JTAG and boundary scan tests.
10. Cursor Tests	Tests the cursor glyph controller using various cursor types.

Table 4-10 DG2 Test Descriptions

4.5.6 Running Graphics Tests Manually

The */usr/diags/scripts* has a directory that you can use in place of the menu-driven selections. These diagnostics test specific areas of the graphics hardware such as the geometry engines.

Below is a list of screen compare commands:

ccompge tests the geometry engine (GE) circuitry

ccompppep checks the pp / ep (poly processing and edge processing)

ccompras tests the raster system

ccompspin spins and rotates objects

ccomploop executes a specified number of test loops for either the previous screen compare test or a new screen compare test. See the following note for more information.

Note: The *ccomploop* command uses the following format:

ccomploop [cn] [count]

[c] indicates *continue* with the previous test command.

With this option, the previous pass / fail counts in the log file will not be cleared.

[n] indicates *new* test. The user must then specify a screen compare command, such as *ccompge*.

With this option, the previous pass / fail counts in the log file will not be cleared.

[count] determines the number of test loops.

These screen compare tests will provide either a PASS or FAIL result followed by possible error location information. The test also provides a test result of each of the spans, where appropriate.

This completes the testing of the RealityEngine board set. Check *usr/tmp/fullsys.log*0 for any failures.

4.6 Using Diagnostic Commands

This section briefly explains how to use diagnostics program commands for:

- displaying help
- deleting characters or lines
- displaying the menu
- suspending the test
- exiting the program

Note: Commands are not case-sensitive.

4.6.1 Displaying Help

The diagnostics have a number of options and commands available. To see the list of command and options, type `help`, `h`, or `?` at the `DIAGS` prompt:

```
DIAGS: ?
```

The following information is displayed:

```
COMMANDS:
   help:                    COMMAND(s)]
   auto execute:            a [TEST NAME]
   hardware configuration   c
   dump:                    d [s] [v]
   system configuration:    f [p#][m RANGE][d DEVS][b#][r#][v#][s#][a#]
   help:                    h 'COMMAND(s)]
   init logfile:            i
   print logfile:           l [LINES]
   menu:                    m [MENU(s)]
   quit:                    q
   execute                  x{expression[arg(s)][;expression ...]}*
count
                         where:
                         expression   testname[sequence][*count]
                         sequence     number |
(testnumbers[*loop][,...])
                         testnumbers  number | number1-number2
```

4.6.2 Deleting Characters or Lines

To erase a single character, press **<CTRL-H>** or **<DEL>**.

To delete an entire line, press **<CTRL-U>**.

4.6.3 Displaying the Menu

The menu command `m` displays the tests that can be executed. When invoked with no argument, the menu command displays the test categories. For example, pressing `m` at the diags menu:

```
DIAGS: m
```

displays the following test categories:

```
CPU TEST
BUS TEST
MEM TEST
PATH TEST
IO TEST
FPU TEST

DIAGS
```

4.6.4 Suspending the Test

To suspend the test, press **<CTRL-C>**.

4.6.5 Exiting the Diagnostics Menu

To quit the diagnostics program, enter **q** or **quit** at the prompt:

```
DIAGS: Q
```

You will now be at the System Maintenance Menu, where you can start the system or install the software.

Chapter 5

Packaging and Returning the Excess Hardware

This chapter describes the procedure for returning the Professional Series chassis and replaced graphics, IP, memory, and I/O boards that have been replaced in the original system.

5.1 Returning Items

All IP, memory, and I/O boards that have been replaced must be returned. Three board boxes are included in this upgrade kit; if you need more board boxes, you may have to order them before all of the boards can be returned.

Note: *This procedure is not optional.* The price of the replacement board set was based upon a credit for the returned board set. All replaced boards and front planes must be returned to Silicon Graphics to receive full credit.

Figure 5-1 and Figure 5-2 show a basic overview of the RMA process.

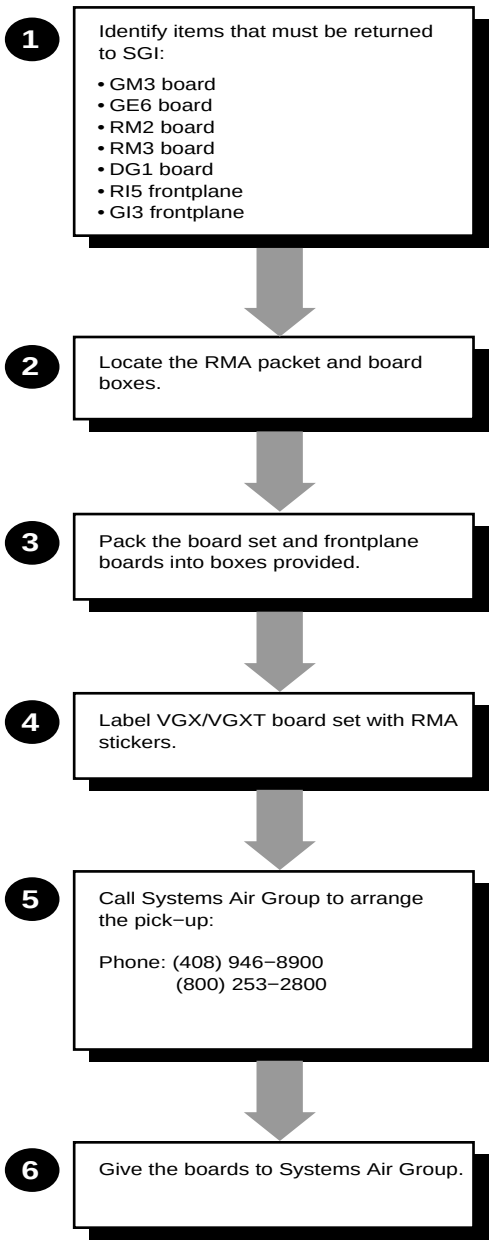


Figure 5-1 North American RMA Procedure

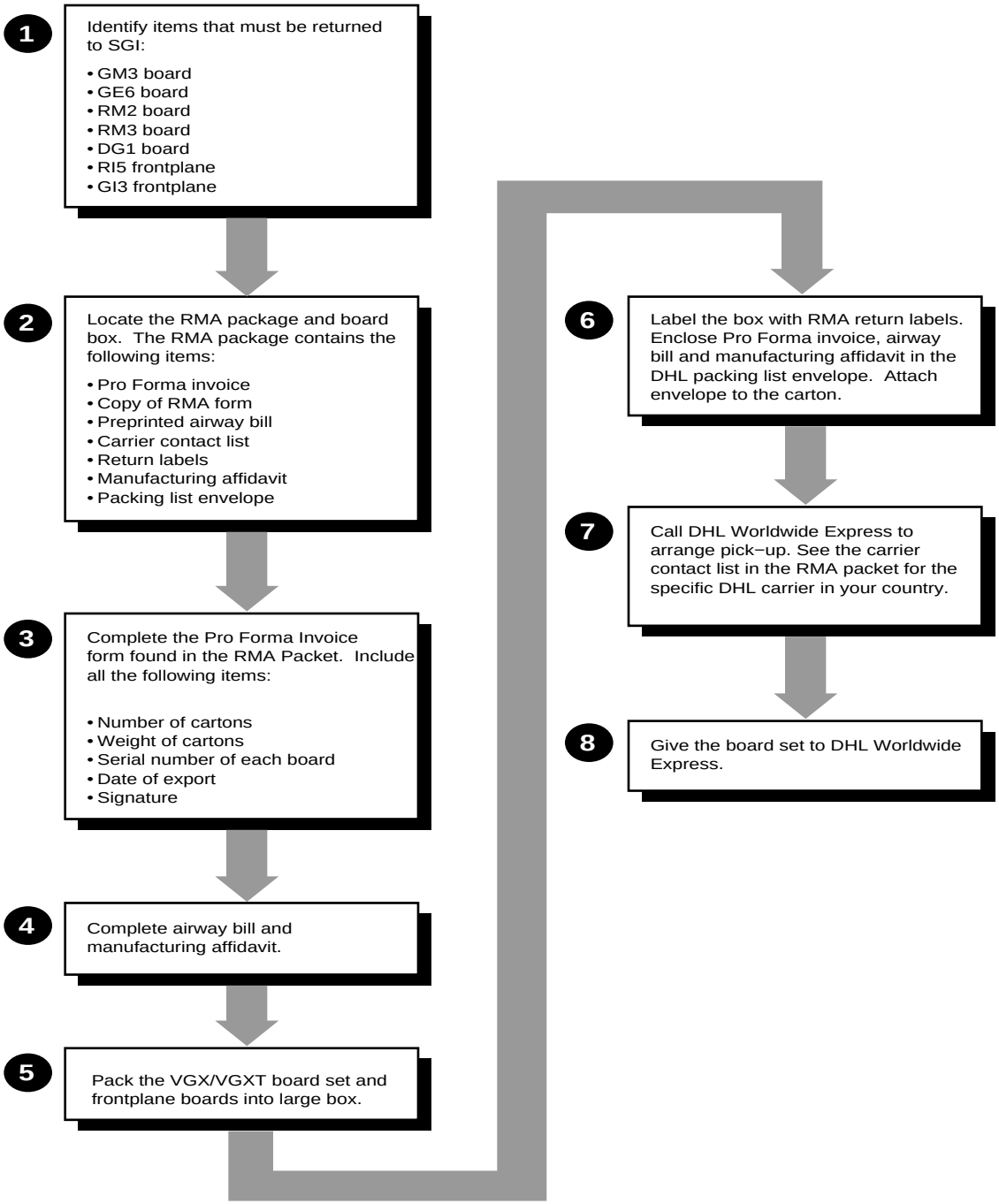


Figure 5-2 International RMA Procedure

5.2 Packing the Board

Pack the return boards in the boxes provided. Ensure that the boards are packed to withstand the rigors of surface and air freight transportation.

Caution: Boards must be shipped in antistatic bags.

5.3 Packing the System Chassis

A special pallet has been provided with the Professional Series upgrade for returning the older chassis. Reuse the remaining packaging from the new Crimson system when returning the excess material.

5.4 Labeling

Label the containers with the RMA labels provided. Make sure that the following address and the RMA numbers are clearly marked on each label:

Silicon Graphics, Inc.
Receiving Department
Building 8, Dock B
2051 North Shoreline Blvd.
Mountain View, CA.
USA 94039

RMA Number A-*XXXXX*

For domestic returns, follow the steps in Section 5.5, “Domestic RMA Procedures.” For international returns, proceed to Section 5.6, “International RMA Procedures.”

5.5 Domestic RMA Procedures

Figure 5-1 summarizes the domestic RMA procedures. Follow these steps:

1. For domestic RMAs contact:

   Systems Air Group
   Phone: (408) 946-8900
   (800) 253-2800

2. When you contact the carrier, identify the RMA number, the sales order number, the number of pieces, total weight, and the Silicon Graphics address as shown above.

5.6 International RMA Procedures

Figure 5-2 summarizes the international RMA procedure. The international RMA packets include several additional forms not included in the domestic RMA packet. They are:

- Pro Forma invoice
- Preprinted airway bill
- Manufacturing affidavit
- RMA copy

Follow these steps:

1. Complete the Pro Forma invoice form. Make sure to complete the following items:
   - date of export
   - number of carton
   - weight of each carton
   - serial number of each return board
   - signature and date
   - date of export
2. Complete the airway bill form. Make sure to complete the following items:
   - number of pieces
   - weight
   - signature
   - date
3. Complete manufacturing affidavit.
4. Insert the completed Pro Forma invoice, completed airway bill, and manufacturing affidavit into the DHL packing list envelope and attach the envelope to the carton.
5. Refer to the carrier contact list to contact DHL in your country. When you contact the carrier, identify the RMA number, the original sales number, the number of pieces, total weight, and the Silicon Graphics address as given earlier in this chapter.

If you need further assistance, call the Silicon Graphics Traffic Department at (415) 390-1243.

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