IP21 Board Upgrade Installation Instructions

Document Number 108-0122-003

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Introduction

This document describes the procedures for upgrading an existing Silicon Graphics® CHALLENGE® or Onyx™ system to a POWER CHALLENGE™ or POWER Onyx™ system by installing the IP21 CPU board and IRIX™ 6.1 or later software. The IP21 board contains a 75-MHz or 90-MHz, 64-bit R8000 RISC chip set that features a tightly coupled, but physically separate floating point (FP) and integer units with supporting logic.

This manual was written for Silicon Graphics system support engineers (SSEs) and third-party field support groups responsible for product installation and testing.

What This Document Contains

This manual is divided into three chapters and two appendices:

Chapter 1	"Upgrade Overview" provides a summary of the IP21 features and components.
Chapter 2	"Installing the Upgrade" discusses how to install the upgrade.
Chapter 3	"Returning the Old CPU board" describes how to return the IP19 for proper credit.
Appendix A	"Installing an External CD-ROM" shows how to connect a CD-ROM drive to the system to download software.
Appendix B	"Running the BBCC Chip Tests" describes how to check the BBCC chip revision level through software.

Safety Information

Be sure to read the following information before you begin installation.

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

Caution: This equipment is extremely sensitive and susceptible to damage caused by electrostatic discharge (ESD). ESD is an electrical discharge caused by the build-up of electrostatic potential on clothing and other materials. You must use proper ESD preventive measures.

Follow these ESD-preventive measures:

- Connect a ground strap to your wrist when installing and removing 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, and only when you are working on the board or installing it.
- Do not use an ohmmeter on a board.

Typographical Conventions

These type conventions and symbols are used throughout this manual:

Italics Filenames, variables, IRIX command arguments, command flags, titles of publications, icon names.

`Screen type` Code examples, file excerpts, and screen displays (including error messages).

`Bold Screen type`
User input

(Parentheses) Following IRIX commands, they surround the reference page (man page) section where the command is described.

[Brackets] Surrounding optional syntax statement arguments.

IRIX shell prompt for the superuser (*root*).

<Angel brackets>
Non-printing keys or variables such as <Enter>.

Chapter 1

Upgrade Overview

This chapter highlights the features of the IP21 board upgrade and provides a block diagram description and component drawing.

Caution: This upgrade requires a 64-bit operating system such as IRIX 6.1 or later. It should be performed only on *stable* systems that do not have any unresolved hardware or software problems.

1.1 IP21 Features

The IP21 board has one or two R8000 chip sets running internally at 75 MHz or 90 MHz. The IP21 is a triple-height, full-depth, Eurocard board that connects to the existing CHALLENGE and Onyx backplanes. The board contains a mixture of surface-mount and through-hole packaged integrated circuits (ICs).

The IP21 board has the following major functional elements:

- an advanced superscalar architecture that supports four instructions per cycle with peak performances of 300 MFLOPS and 300 MIPS for the IP21/75 MHz CPU, and 360 MFLOPS and 360 MIPS for the IP21/90 MHz version
- optimized floating-point performance with a separate floating-point (FP) chip and integer unit (IU) chip that are supported by large load and store data queues
- a true 64-bit microprocessor with 64-bit integer operations, floating-point operations, and registers
- an on-IC memory management unit (MMU)
- a 40-bit physical address that enables accessing up to 16 GB of physical memory plus memory-mapped I/O resources
- an on-IC, 16 KB instruction cache and 16 KB data cache with 128-bit wide secondary cache interface that supports a secondary 4 MB cache
- a streaming cache of 4 MB with four-way interleaving
- 256 KB of EPROM

1.2 IP21 Power Consumption

The IP21 board dissipates almost exactly the same amount of power as the IP19 board. There are no additional power requirements for CHALLENGE and Onyx systems (such as additional power boards and OLSs). Customer-site power and cooling requirements are also unchanged.

1.3 Board Components

Figure 1-1 shows the physical layout of the IP21 board. Notice that the R8000 CPU consists of two separate ICs: an integer unit and a floating-point unit.

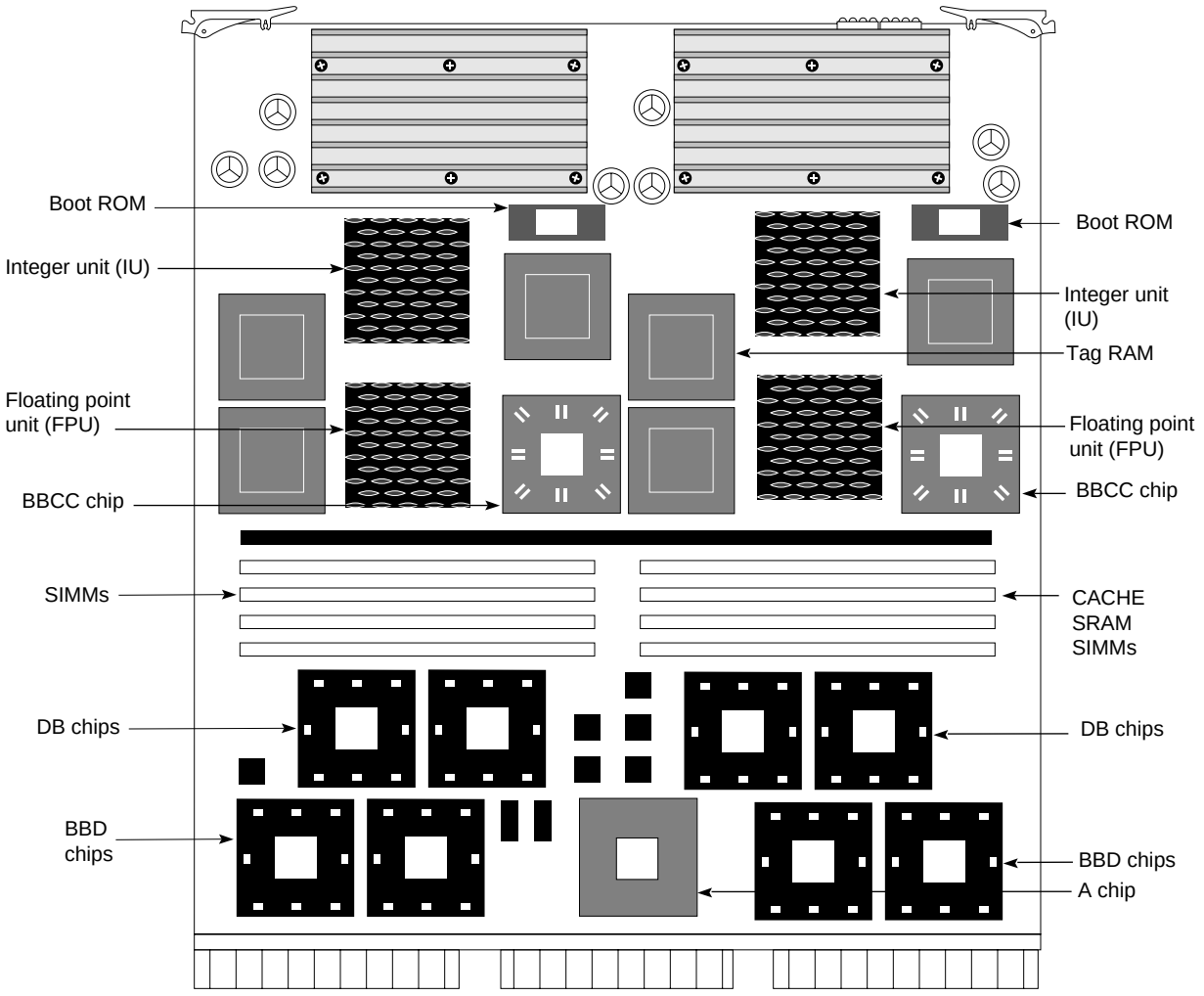

Figure 1-1 IP21 Board Component Layout

1.4 Processor Subsystem

The IP21 is a multiprocessor CPU board that can support one or two R8000 microprocessors. Figure 1-2 provides a functional block diagram of the CPU board. The board logic is divided so that each of the microprocessors has its own dedicated supporting logic. This processor *slicing* allows each microprocessor to run independently of the other. The only portion of the CPU board circuitry that is shared by the resident microprocessors is the system bus arbitration logic. The system bus is also known as the Everest bus or POWERpath-2™ system bus.

As shown in Figure 1-2, each CPU has its own secondary cache and "blackbird" cache controller (BBCC) chip. Each CPU is also connected to the Ebus through the address path (A) ASIC and four data path (D) ASICs. The D ASICs are the BBD (blackbird data) chips shown in Figure 1-1.

Note: "Blackbird" and "TFP" are the in-house code names for the IP21 project.

Each processor employs a pair of data buffers, the DB ASICS, that load and store to main memory. The DB chips are designed to minimize load latency.

The cache controller implements a duplicate set of secondary cache tags that handle and arbitrate cache requests on the Ebus. The A ASIC services the address requests of all the processors on the CPU board. The D ASIC provides a bit-sliced data path that narrows the 256-bit Ebus data to a 128-bit bus to match the size of the R8000 series interface bus.

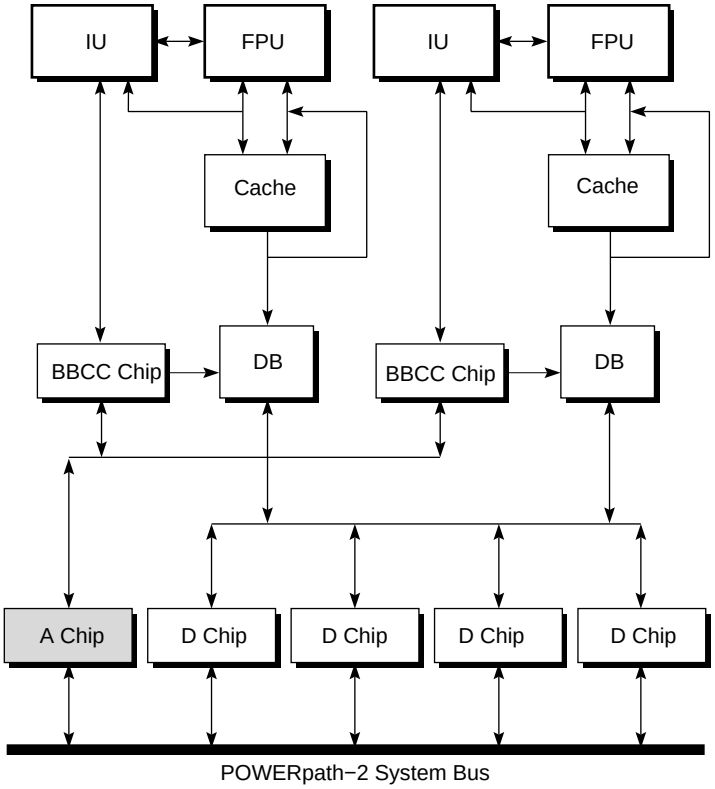

Figure 1-2 IP21 Functional Block Diagram

1.4.1 R8000 Chip Set

The R8000 has a separate floating-point unit (FPU) and integer unit (IU) (see Figure 1-3). This is different from the single-chip processor R4400 in the IP19 board.

The major advantage of the two-chip implementation of the R8000 is that the main processor (the IU) is no longer tied up performing both integer and floating-point operations. Floating point tasks are now executed by a separate FPU in the R8000. The IU and FPU also have dedicated support busing and logic so that their operations can take place simultaneously for maximized CPU board throughput (see Table 1-1).

Note: The R8000 has dedicated load and store data buses, while single-chip processors such as the R4000 have only one load and store data bus.

Other differences between the R8000 and R4400 systems are highlighted in Table 1-1.

The major internal bus of the R8000 chipset is the 80-bit, 75/90 MHz Tbus, which connects the IU, FPU, and the cache controller. Ownership of the Tbus changes depending on the operation being performed.

Table 1-1 Differences Between IP21-Based Systems and IP19-Based Systems

Features	CHALLENGE (IP19)	POWER CHALLENGE (IP21)	Onyx (IP19)	POWER Onyx (IP21)
Maximum CPUs	36 (XL) 12 (L)	18 (XL) 6 (L)	24 (XL) 4 (L)	12 (XL) 2 (L)
Maximum IP19/IP21 boards	9 boards (XL) 3 boards (L)	9 boards (XL) 3 boards (L)	6 boards (XL) 1 board (L)	6 boards (XL) 1 board (L)
CPUs per Board	2 or 4	1 or 2	2 or 4	1 or 2
L2 Cache	1 MB, Direct Map	4 MB, 4-set associative	1 MB, Direct Map	4 MB, 4-set associative
Maximum memory	16 GB (limited to 2 GB in IRIX 5.2 and earlier)	16 GB	16 GB (limited to 2 GB in IRIX 5.2 and earlier)	16 GB
Processor speed	150 MHz	75 MHz or 90 MHz	150 MHz	75 MHz or 90 MHz
Issue rate	1 per clock	4 per clock	1 per clock	4 per clock
Peak MFLOPS	~50	300 (IP21/75) or 360 (IP21/90)	~50	300 (IP21/75) or 360 (IP21/90)
Memory references per clock	1	2	1	2
Data path to memory, or from the system bus	64 bits @ 50 MHz	128 bits @ 75 MHz	64 bits @ 50 MHz	128 bits @ 75 MHz
Kernel operation modes	32 or 64 bits	64 bits	32 or 64 bits	64 bits
User operation modes (See note.)	32 or 64 bits	32 or 64 bits	32 or 64 bits	32 or 64 bits

Note: The 64-bit user operations will be supported for the R4400 (IP19) in a future software release.

1.4.2 Memory

The integer unit (IU) in Figure 1-3 provides a memory management unit (MMU) that uses an on-chip translation lookaside buffer (TLB) to translate virtual addresses to physical addresses.

The TLB is dual-ported and can receive two virtual addresses and come up with two real addresses each cycle. The R8000 TLB is larger than TLBs used in earlier Silicon Graphics systems. The TLB supports 384 entries and is three -set associative.

In addition, two tag RAMs store address information for even and odd data banks of the interleaved 4 MB streaming cache with dedicated busing logic (see Figure 1-3).

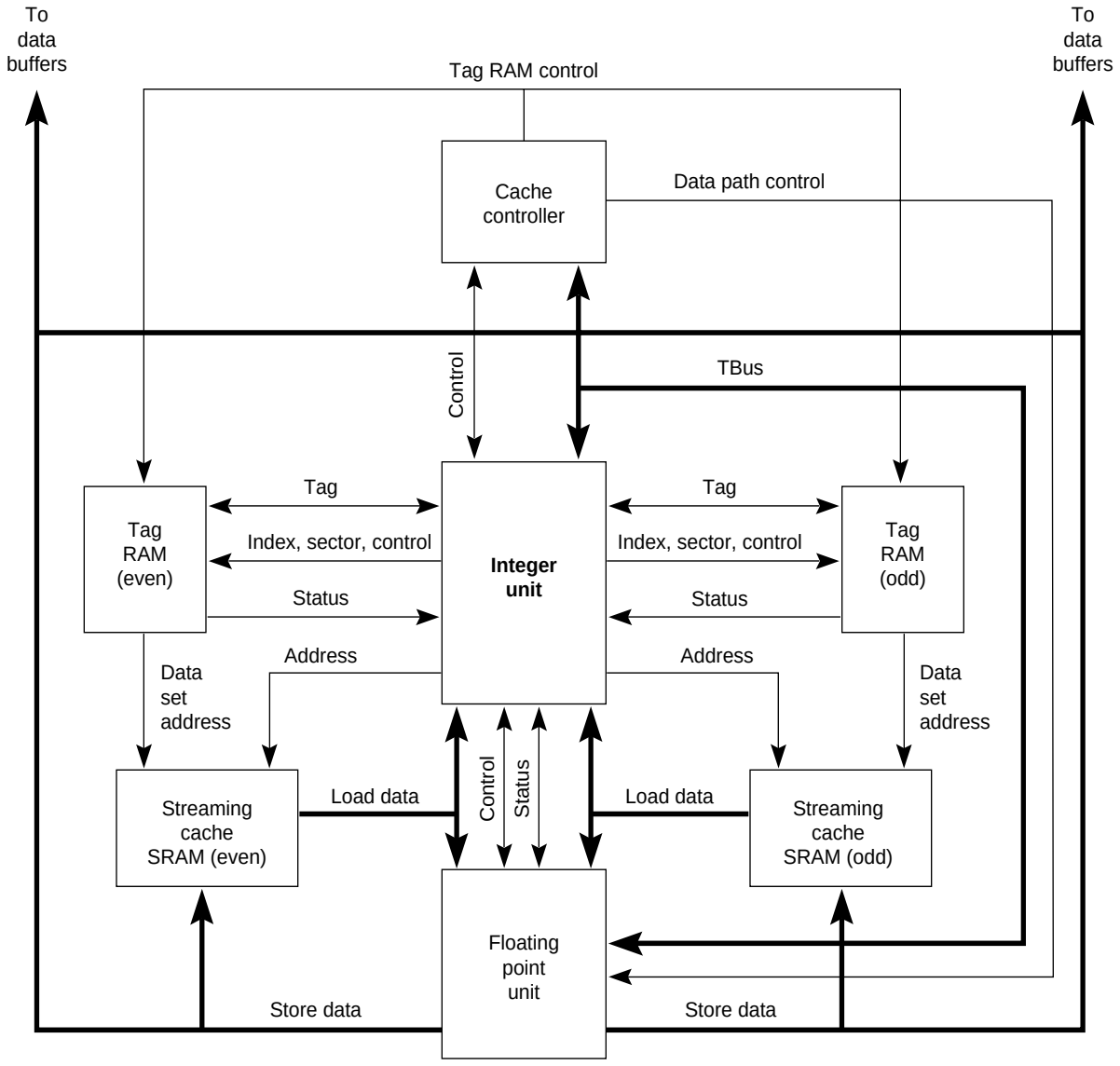

Figure 1-3 R8000 Chip Set Block Diagram

Chapter 2

Installing the Upgrade

This chapter describes how to upgrade an existing CHALLENGE, POWER CHALLENGE, Onyx, or POWER Onyx with an IP21 CPU board.

2.1 Installation Overview

Figure 2-1 provides an overview of the IP19-to-IP21 upgrade. Figure 2-2 provides an overview for upgrading an IP21/75 MHz and IRIX 6.0 or 6.0.1 configuration to an IP21/90 MHz system *with* IRIX 6.1.

Caution: To upgrade a CHALLENGE or Onyx system to a POWER CHALLENGE or POWER Onyx model, the existing system must be running IRIX 5.2 or 5.3.

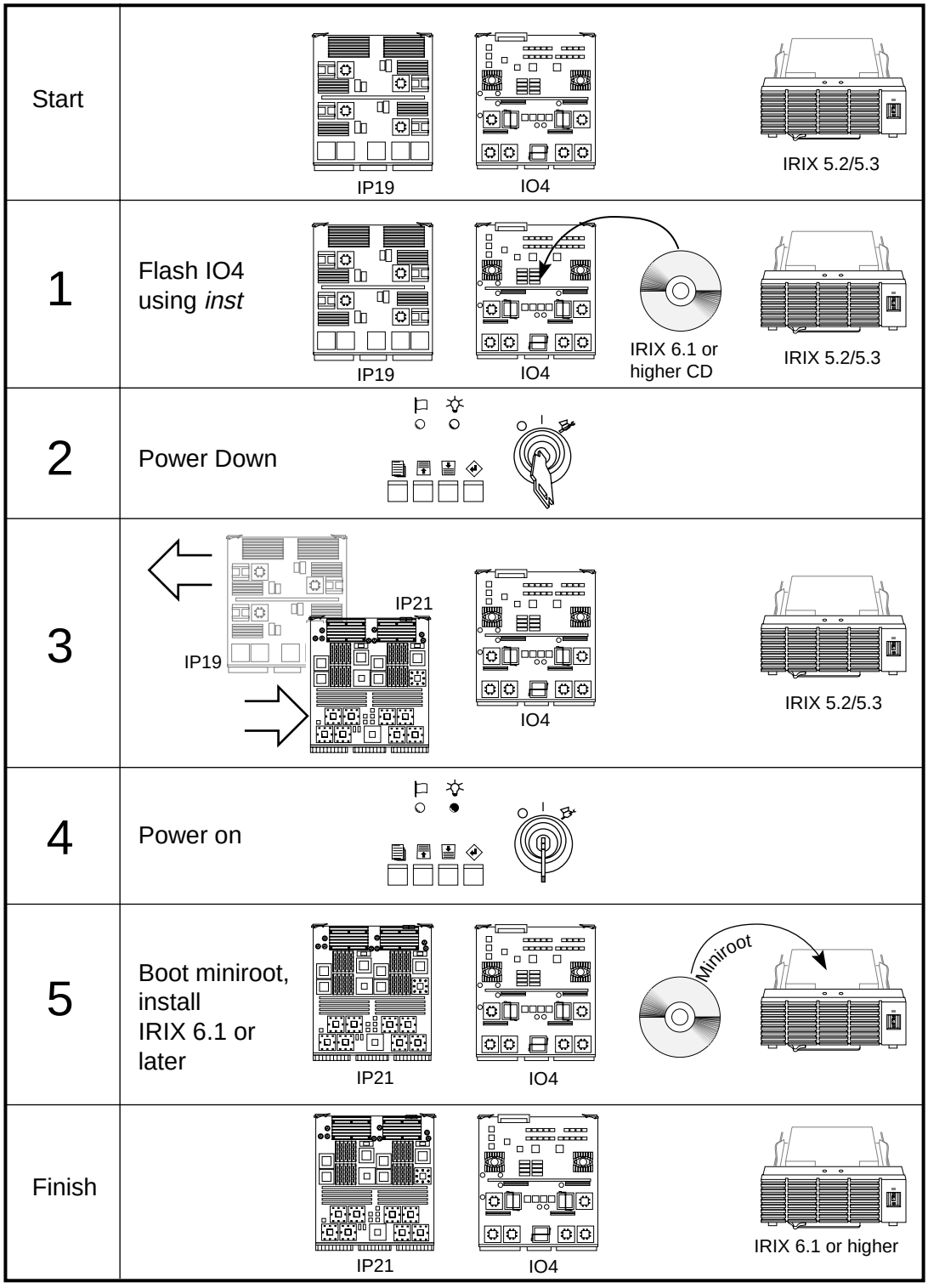

Figure 2-1 Overview of the IP21 Upgrade

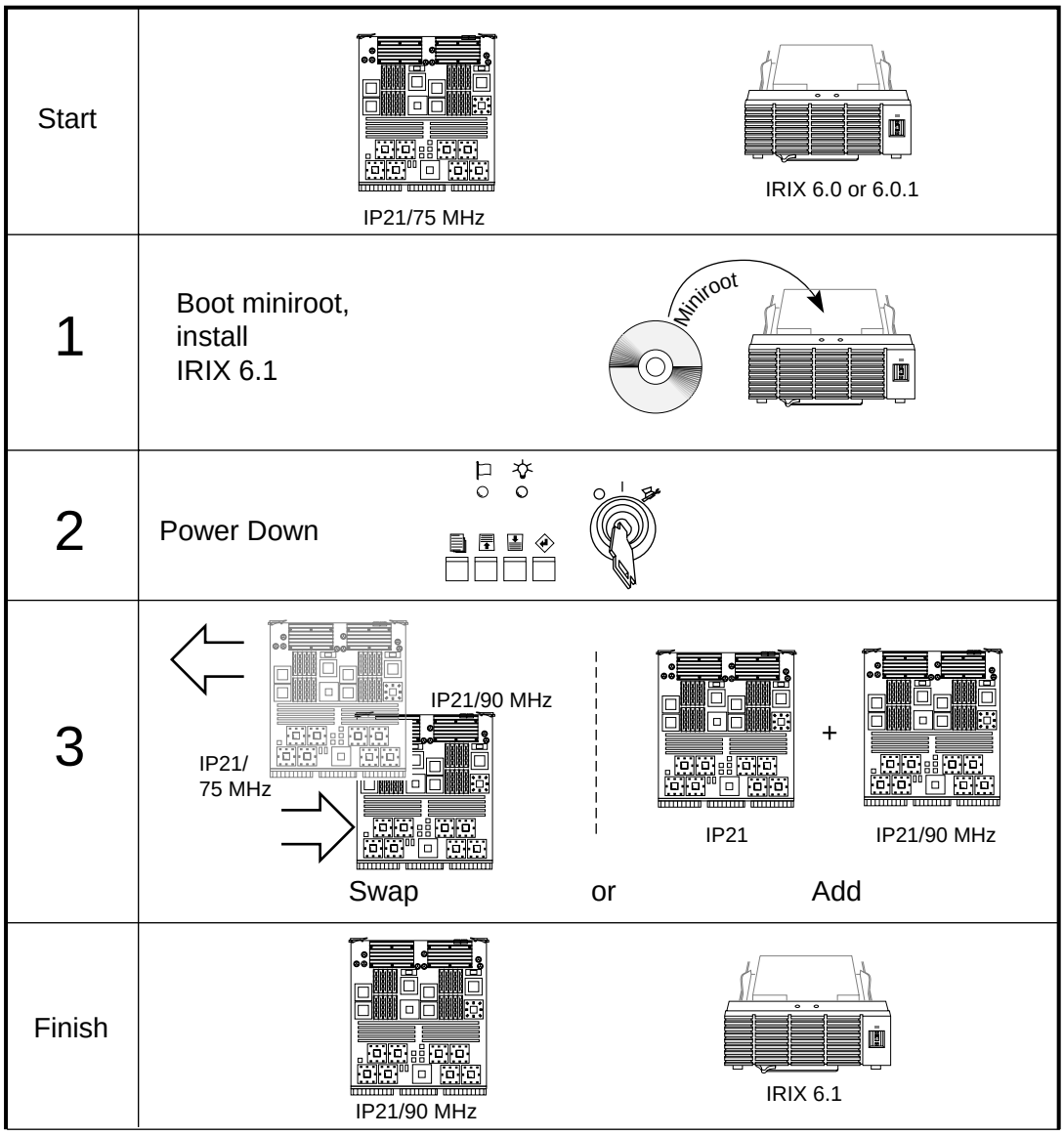

Figure 2-2 Upgrading From IP21/75 MHz and IRIX 6.0 or 6.0.1 to IP21/90 MHz and IRIX 6.1

Note: If you are upgrading from an IP21/75 MHz to an IP21/90 MHz board, or from IRIX 6.0 or 6.0.1 to IRIX 6.1, you do not need to reflash the IO4 PROM.

2.1.1 Upgrading From an IP19 System to an IP21 System

The steps to upgrade the system are given below. It is crucial that you perform these steps in the correct order to help ensure a successful installation.

1. Ensure that the system is stable and does not have any known problems. In addition, ensure that the system already has the required retrofit modifications. See the *CHALLENGE and Onyx Retrofit II Requirements* (p/n 802-0113-001).

   Note: To upgrade a CHALLENGE or Onyx system to a POWER CHALLENGE or POWER Onyx model, the existing system must be running IRIX 5.2 or 5.3.

2. Verify that the customer's system has been backed up in a way that the customer understands and can verify.
3. Verify that you have all of the required components before proceeding with the installation. See Section 2.2, "Checking the Kit Contents."
4. Verify the minimum board and operating system revision levels. See Section 2.3, "Verifying Operating System and Board Revision Levels."
5. Flash the PROM on the master IO4 board with the IO4 PROM software from the IRIX 6.1 or later distribution media. See Section 2.4, "Flashing the IO4 PROM."
6. Power off the system and replace the old IP19 board with the IP21 board(s). See Section 2.5, "Installing the IP21 Board." (You cannot use both IP19 and IP21 boards in the same system.)
7. Power on the system and verify the new configuration by using the *hinv* command and stand-alone diagnostics. See Section 2.7, "Testing the IP21 Board Installation."
8. Boot the IRIX 6.1 or later miniroot from CD-ROM and install IRIX 6.1 or later and associated patch software. See Section 2.8, "Software Installation."

   Caution: Also ensure that the proper application software for 6.1 or later is installed.

9. Pack and return the old IP19 board(s) with its SRAM SIMMs in place. See Chapter 3, "Returning the Old CPU Board."

2.1.2 Upgrading From IP21/75 MHz to IP21/90 MHz

The following describes how to upgrade or add the IP21/90 MHz board or boards to a system with existing IP21/75 MHz board(s). There are two types of upgrades:

- upgrading or adding just the IP21/90 MHz board(s)
- upgrading with both the IP21/90 MHz board(s) and IRIX 6.1 software

2.1.2.1 Upgrading From IP21/75 MHz to IP21/90 MHz (No IRIX Upgrade)

If you are upgrading from an IP21/75 MHz board(s) to the IP21/90 MHz board(s), and the system already has or doesn't require IRIX 6.1, the general procedure is to swap out or add the applicable boards.

Note: The IP21/75 MHz board and the IP21/90 MHz board are compatible and may coexist in the same system.

It is crucial that you perform these steps in the correct order to help ensure a successful installation.

Here are the specific steps to follow:

1. Ensure that the system is stable and does not have any known problems.
2. Verify that the customer's system has been backed up.
3. Verify that you have all of the required components before proceeding with the installation.
4. Power off the system and replace the old IP21/75 MHz board with the IP21/90 MHz board(s), as applicable. See Section 2.5, "Installing the IP21 Board."
5. Power on the system and verify the new configuration by using the *hinv* command. See Section 2.7, "Testing the IP21 Board Installation."
6. Pack and return the old IP21 board(s), with its SRAM SIMMs in place, if applicable. See Chapter 3, "Returning the Old CPU Board."

2.1.2.2 Upgrading to the IP21/90 MHz Board(s) and IRIX 6.1 Software

If you are upgrading from an IP21/75 MHz to an IP21/90 MHz board, and you are also switching from IRIX 6.0 or 6.0.1 to 6.1, it is recommended that you *install IRIX 6.1 before* you install the IP21/90 MHz board(s). If a problem occurs after software and hardware installation, the trouble is most likely due to a bad IP21/90 MHz board and not because of an improper software installation.

The steps to upgrade the system are given below. It is crucial that you perform these steps in the correct order to help ensure a successful installation.

1. Ensure that the system is stable and does not have any known problems.
2. Verify that the customer's system has been backed up.
3. Verify that you have all of the required components before proceeding with the installation.
4. Boot the IRIX 6.1 miniroot from CD-ROM and install IRIX 6.1 and associated patch software. See Section 2.8, "Software Installation."
5. Power off the system and add or swap out the IP21 board(s). See Section 2.5, "Installing the IP21 Board." (The IP21/75 MHz and IP21/90 MHz boards are compatible.)

6. Power on the system and verify the new configuration by using the *hinv* command. See Section 2.7, “Testing the IP21 Board Installation.”
7. Pack and return the old IP21 board(s), if applicable. See Chapter 3, “Returning the Old CPU Board.”

2.1.3 Safety

Be sure to follow the safety guidelines outlined in this section, before proceeding with the installation procedures.

Warning: **Installation of these upgrades requires specific training and technical knowledge. These instructions are provided for 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.**

Caution: This equipment is extremely sensitive and is susceptible to damage caused by electrostatic discharge (ESD). ESD is an electrical discharge caused by the build-up of electrical potential on clothing and other materials. You must use proper ESD-preventive measures.

Follow these ESD preventive measures:

- Use a ground strap when installing and removing peripherals.
- Be sure that you and all of the electrical equipment that you handle during this installation remain at a common ground potential.
- Remove a board from its antistatic bag only when you are properly grounded with a ground strap, and only when you are working on the board or installing it.
- Do not use an ohmmeter on a board.

2.1.4 Important Site Guidelines

The following subsections discuss upgrade issues that affect sites.

2.1.4.1 IP21 Power Consumption

The power consumption of the IP21 board is almost identical to that of the IP19. There are no changes in the system power requirements (such as the number of OLSs and power boards) and no changes in the site power or cooling requirements as a result of the IP21 upgrade.

2.1.4.2 IRIX Revisions

It is recommended that IRIX 6.1 or later be used with the IP21 upgrade. Be aware that IRIX 6.1 does not work on an IP19-based system. If you back out an upgrade and reinstall the IP19 board, you must also reinstall IRIX 5.2. See Section 2.9, “If Problems Occur.”

2.1.4.3 IP21 Boards for Servers Only

POWER CHALLENGE (server) systems and upgrades may ship with IP21 boards (such as p / n 030-0625-107) that cannot be used in POWER Onyx (graphics) MP systems or in POWER CHALLENGE MP systems with the Data Visualization Console.

Note: There are different versions of the IP21 board (see Table 2-1 and Table 2-1 for more information).

Be sure to double-check the identity of these server-only boards by examining both BBCC chips. The locations of the BBCC chips on the IP21 board are shown in Figure 1-1. Each chip is marked with a part number, which is just visible beside the heat sink. (The first digits may be covered). Figure 2-3 shows the part number location on one of the BBCC chips.

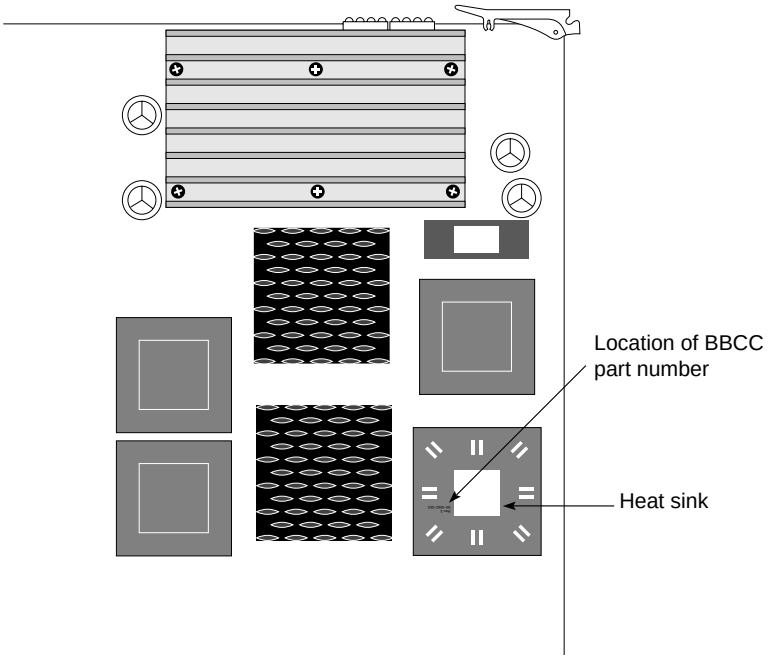

Figure 2-3 Location of Part Number on BBCC Chip

Note: Figure 2-3 shows only one of the two BBCC chips, but you should examine both BBCC chips to verify their part numbers.

Table 2-1 and Table 2-1 list the part numbers and their uses.

Table 2-1 IP21 / 75 and BBCC Versions Use in Server and Graphics Systems

IP21/75 MHz Board Part Number	BBCC Part Number	Graphics Use	Server Use
030-0625-107 and 030-0625-109 (dual-processor version for CHALLENGE only) (Note: These versions appear in earlier IP21 systems and upgrades)	099-0062-003 (Revision C)	No	Yes

Table 2-1 (continued) IP21/75 and BBCC Versions Use in Server and Graphics Systems

IP21/75 MHz Board Part Number	BBCC Part Number	Graphics Use	Server Use
030-0625-108, 030-0625-110 through 030-0625-112 (or higher, dual-processor version)	099-0062-004 (Revision D)	Yes	Yes
030-0636-007 or higher (single-processor board for CHALLENGE, Onyx, or Extreme systems)	099-0062-003 (Revision C)	Yes	Yes

Table 2-2 IP21/90 and BBCC Part Number Use in Server and Graphics Systems

IP21/90 MHz Board Part Number	BBCC Part Number	Graphics Use	Server Use
030-0702-002 (dual-processor version)	099-0062-003 (Revision C)	No	Yes
030-0858-001 (dual processor) and 030-0703-002 (single processor)	099-0062-004 (Revision D)	Yes	Yes

All IP21-based systems shipped from the factory adhere to this restriction. All dual-processor spares that use the later (-004 and later) revision of the BBCC chip can be used in either server or graphics systems.

As a precaution, do not move server-only IP21 boards from server systems to graphics systems without verifying the board and BBCC part number in Table 2-1 and Table 2-1.

Note: You can also check the BBCC chip revision level through software. See Appendix B for more information. The operating system restricts operation to single-processor level if incorrect BBCC revisions are present (see Section 2.8.6).

2.1.4.4 Large POWER CHALLENGE Systems

POWER CHALLENGE systems with more than seven IP21 boards (14 total CPUs) may be affected with a flow control congestion deadlock in an earlier revision of the EPC chip (on the IO4). This results in degradation of Ethernet performance, because the integral Ethernet port ceases to receive data packets.

There are two solutions to this problem. One is to use the new IO4 with Rev C of the EPC; "PCA IO4B," 030-0646-104. All new systems can be expected to ship with this revision.

The other solution is to use an EFAST VMEbus Ethernet controller board instead of the Ethernet controller on the IO4 board. Systems shipped before the EPC Rev C was available, shipped with the EFAST board (see Section 2.6).

Note: The IRIX 6.0 or later operating system running on R8000 processors permits larger memory configurations (beyond 2 GB, up to 16 GB) than earlier 5.2 operating systems.

If a system develops memory problems after you have installed an IP21 upgrade or upgraded the memory beyond 2 GB, submit a logged hardware error report with a SIMM inventory to Customer Service for evaluation.

Customer service will determine if a newer version of the MC3 board (030-0614-005 or later) would improve the situation. (In some cases, the SIMMs may be the problem.)

2.1.4.5 Large Power Onyx Systems

POWER Onyx systems with more than four IP21 CPU boards are subject to the same restrictions as outlined in Section 2.1.4.4, "Large POWER CHALLENGE Systems," above.

2.1.4.6 GE10 Board, Flash Revisions, and Backing Out an Upgrade

The GE10 board *is not flashed* at any time during the upgrade. Only the IO4 board is flashed. If you back out an upgrade and reinstall an IP19 board, no additional steps are required to make the GE10 work with the IP19 board. See Section 2.9, "If Problems Occur," for information on backing out an upgrade.

2.2 Checking the Kit Contents

This section lists the major contents of the IP21 upgrade kit:

- IP21 board

  Note: There are a number of different revision levels of this board. See Table 2-1 and Table 2-1 for additional information regarding differences among the boards.

- IRIX 6.1 or later CD-ROM
- Shipping box in which to pack the old IP19 or IP21 boards
- RMA labels for old IP19s
- SC4-S4D-6.1 or later (software for server systems)
- SC4-W4D-6.1 or later (software for graphics systems)

2.3 Verifying Operating System and Board Revision Levels

Note: Section 2.1.4, "Important Site Guidelines," contains information about IO4 board revisions in large CHALLENGE installations.

Caution: To upgrade a CHALLENGE or Onyx system to a POWER CHALLENGE or POWER Onyx model, the existing system must be running IRIX 5.2 or 5.3.

The system you are upgrading must be at the Retrofit II level or later. Even though all existing systems should have already been retrofitted with the proper hardware and

firmware, you should verify that the system you are upgrading meets the minimum requirements. See the *CHALLENGE and Onyx Retrofit II Requirements* (p/n 802-0113-001).

2.4 Flashing the IO4 PROM

The next part of the IP19-to-IP21 upgrade process is flashing the IO4 PROM using code contained on the IRIX 6.1 or later CD. This new PROM code is necessary for the IO4 board to work with the IP21 board.

Note: If you are upgrading from an IP21/75 MHz to an IP21/90 MHz board, or from IRIX 6.0 or 6.0.1 to IRIX 6.1, you do not need to reflash the IO4 PROM. However, if you are upgrading an IP19 system that is running a beta version of IRIX 6.0, contact the regional beta site coordinator for special instructions on how to flash the IO4 PROM.

There are two ways to flash the IO4 PROM:

- under the IRIX operating system using *inst -f*
- through the command monitor (IO4 prompt) using *flash -T*

Either method produces the same result. However, the *inst -f* method is recommended, since it allows the system to have limited operability in case of a problem (see Section 2.4.1 for additional information). Just make sure that you do not reboot or issue the *halt* command if a failure should occur.

2.4.1 Flashing the IO4 Under IRIX (inst -f)

This is the recommended IO4 flashing method. Follow the steps given below in this section to flash the IO4 PROM with IRIX running.

Caution: If the installation fails, do *not* reboot or halt the system. Instead, retry the installation. If installation continues to fail, continue running the system until a replacement IO4 board can be obtained**.**

It is very important to have the system running, so that the operating system tools and commands can be available to diagnose failures.

1. Using an ASCII terminal, boot the system and log in as root.

   Note: It is possible to run this procedure using a graphics monitor; however, it is generally safer to run the steps through an ASCII terminal in case the graphics subsystem fails during installation.

2. (*Optional*) On a laptop computer, turn on the record option, or open up a script file so that you can record and later review problems that may occur during the upgrade.

3. Create a copy of the current IO4 flash code by typing the following command:

   # **`cp /usr/cpu/firmware/IO4prom.bin /usr/cpu/firmware/io4prom.bin.save`**

   Note: If the installation fails, you can use the original code to reflash the IO4 board.

4. If a CD-ROM drive is not already installed on the system, install it now. If the system does not have a single-ended SCSI bus with an available ID for the drive, turn to Appendix A, “Installing an External CD-ROM Drive,” for instructions.

5. If required, mount the CD-ROM drive as shown in the following example:

   mount -r /dev/dsk/dks0d*n*s7/CDROM

   where *n* is the address of the CD-ROM reader.

6. Install the IO4 PROM software from the 6.1 or later distribution media using *inst*:

   inst -f /CDROM/dist/io4prom

   This copies a new PROM image from the distribution CD and reflashes the contents of the flash PROM in the IO4. This new flash code is required to boot the IP21 board and is backwards-compatible with the IP19 board. If multiple IO4 boards are present, all of these boards are flashed with the new PROM contents as well.

   Note: The newly flashed IO4 board can operate with either the IP19 or IP21. No further steps are required to reflash any of the boards, including the IO4, GE10, or the old IP19. In addition, IRIX 6.1 or later does not officially support the IP19 board. You should normally install IRIX 5.2 or 5.3 to operate with the IP19 board.

7. You should then see a display similar to the following:

```
Default location of new software is xxxxxx

If you are a first-time inst user, give the command “help beginner”.

Inst Main Menu

 1. from [source]               Specify location of software to be installed
 2. list [keywords] [names]     Display information about software subsystems
 3. go                          Perform software installation and removal now
 4. install [keywords] [names]  Select subsystems to be installed
 5. remove [keywords] [names]   Select subsystems to be removed
 6. keep [keywords] [names]     Do not install or remove these subsystems
 7. step [keywords] [names]     Enter interactive mode for instal/remove/keep
 8. versions [args]             Get information about installed software
 9. help [topic]                Get help in general or on a specific word
10. admin                       Go to the Administrative Commands Menu
11. quit                        Terminate software installation
```

8. At the *inst* main menu, enter **list** to verify the software:

```
Inst> list

Reading installation history database
Reading product description from /CDROM/dist/io4prom:

io4prom IO4prom for 64bit OS systems, 6.1

i = installation requested           I = already installed
r = removal requested                X = older version installed
k = no action/keep existing version  N = newer version installed

* = default subsystem at initial installation
@ = subsystem must be installed from the miniroot
+ = subsystem required for basic system functionality
```

```
Subsystems available for installation (list installable):

Subsystem Description

i io4prom.sw.prom * IO4prom binary
```

9. After verifying that the correct software is called out, enter **go** to begin installation.

```
Inst> go

Computing disk space changes:

Installing new versions of selected io4prom.sw subsystems

Installation and/or removal succeeded.
You can insert another tape or CD-ROM now.
Type “quit” if you are ready to leave the installation tool.
```

10. When the installation has completed, enter **quit**.

```
Inst> quit
#
```

If you see the following error message during this process, the IO4 board may be bad:

```
IO4 was not flashed correctly
```

If you see this message, do not reboot or halt the system until you can replace the IO4 board with a new board. After the IO4 board is replaced, return to this procedure to reflash the replacement IO4.

11. When the IO4 is successfully flashed, shut down IRIX with the *shutdown* command:

```
shutdown 0
```

12. Power off the system by turning the key on the System Controller panel.
13. Shut off the circuit breaker on the back of the system chassis.

You are now ready to swap out the IP19 boards and replace them with IP21 boards. Proceed with Section 2.5, “Installing the IP21 Board.”

2.4.2 Flashing the IO4 Through the Command Monitor (flash -T)

A second way to flash the IO4 PROM is to use the *flash -T* command through the command monitor. Some SSEs may prefer the command monitor method since it flashes only the microcode in the IO4 PROM, whereas the *inst-f* method flashes the microcode in both the IO4 PROM and the system disk.

If you have a flashing failure while using the *inst-f* method, you can potentially damage both the IO4 board and the hard disk. However, this problem is unlikely to occur. If you have a flashing failure using the command monitor method, the problem is limited to the IO4 board.

Follow these steps to flash the IO4 PROM through the command monitor:

1. Using an ASCII terminal, boot the system and log in as root.

   Note: It is possible to run this procedure using a graphics monitor; however, it is safer to run the steps through an ASCII terminal in case the graphics subsystem fails during installation.

2. Load the 6.1 or higher CD-ROM into the drive. If you do not have a CD-ROM, see steps 4 and 5 in Section 2.4.1, “Flashing the IO4 Under IRIX (inst -f).”

3. At the command monitor (IO4) prompt, enter:

   >> version

   You should see a display similar to the following.

   ```
   IO4 PROM Monitor SGI Version 1.17 Rev A IP19
   ```

   Note: The version number, 1.17, indicates that the IO4 PROM has been previously flashed with an IRIX 5.2. If the PROM has been flashed with a IRIX 6.1 or higher, you should see the version number 3.16 (or higher).

4. Enter **hinv** to find the controller number and ID number of the CD-ROM. You should see a display line similar to the following:

   ```
   SCSI controller 0 cdrom(5)
   ```

   Note: The display line specifies the controller number 0 and the ID number 5. This is *very important* information. You need to use these numbers later to access the contents of the CD-ROM to flash the IO4 PROM.

5. Check if you can communicate with the CD-ROM by typing the following:

   >> ls dksc(scsi controller#**,**CD-ROM ID**#,8)**

   Note: The number 8 is the volume header section.

   Using the values obtained in our example, the command line would be:

   ```
   >> ls dksc(0,5,8)io4prom
   ```

   You should see a listing of the contents of the 6.1 or higher CD-ROM similar to the following:

   ```
   sgi label io4prom mr sash64
   ```

6. If you are able to communicate with the CD-ROM, flash the IO4 with the following command:

   >> flash -T dksc(scsi controller#**,**CD-ROM ID**#,8)io4prom**

   Using the values obtained in our example, the command line would be:

   ```
   >> flash -T dksc(0,5,8)io4prom
   ```

   Caution: Be sure to specify the -T (total) option. If you don’t, only a portion of the IO4 PROM is erased by the *flash* command. As a result, there may not be enough memory space for the new IO4 PROM image and the flashing process will then fail.

7. Reboot or reset the system after the flashing process is complete and proceed to Section 2.5, “Installing the IP21 Board.”

2.5 Installing the IP21 Board

Install the IP21 board shown in the following steps.

Caution: The IP19 and IP21 cannot operate together. Ensure that you have removed all the old IP19 boards before installing the IP21 boards.

1. Shut down IRIX and power off the system.
2. Check the IP21 connectors for bent pins or other damage. Then insert the IP21 board into the CPU slot.
3. Reconnect any cables that were disconnected during this installation.
4. Slide the new board into the chassis until it is completely seated. Use a bright light to inspect the inside of the chassis for any loose connections or fallen parts.

2.6 Using the Optional EFAST Board

This section is retained for historical reasons. Initial shipments of the IP21 boards to systems requiring a large number of CPU boards may have used the optional EFAST board.

Large CHALLENGE systems (with more than 14 total CPUs) or large Onyx systems (with more than 8 total CPUs) must either have the EFAST VMEbus Ethernet controller or the new IO4 with Rev C of the EPC; "PCA IO4B," p / n 030-0646-104. This is because the R8000 generates a high volume of Ebus traffic, especially in large, multiprocessor systems.

Note: IO4 boards with part numbers 030-0646-104 (or later) and 030-0646-004 (or later) have the newer EPC (Everest peripheral controller) chip and do not require the EFAST board for systems with large numbers of CPUs.

All new systems can be expected to ship with this revision and do not need the optional EFAST board. However, check the IO4 part number as a precaution.

For information on installing the EFAST board, see the *EFAST Network Controller Installation Instructions* (p / n 108-0101-001).

2.7 Testing the IP21 Board Installation

Follow these procedures to test for proper hardware installation of an IP21 board.

2.7.1 Running hinv

Follow these steps to run *hinv* at the Command Monitor (IO4 prompt) level.

1. Power up the system.
2. From the System Maintenance Menu, enter the Command Monitor.

3. At the Command Monitor prompt (>>), use the *hinv* command to check the board installation:

   hinv -v

   You should see a display similar to the following:

```
             System: IP21
          Processor: 75 <or> 90 Mhz R8000, 4M secondary cache
Primary I-cache size: 16 Kbytes
Primary D-cache size: 16 Kbytes
Secondary cache size: 4 Mbytes
          Processor: 75 <or> 90Mhz R8000, 4M secondary cache, (cpu 1)
Primary I-cache size: 16 Kbytes
Primary D-cache size: 16 Kbytes
Secondary cache size: 4 Mbytes
         Memory size: 64 Mbytes
           SCSI Disk: scsi(0)disk(1)
           SCSI Disk: scsi(1)disk(2)
```

   Note: The *hinv* command from the PROM monitor reports if the IP21 board is present, but does not indicate if an incorrect board version is installed. The *hinv* command at the IRIX prompt indicates if the correct IP21 board version is installed. See Section 2.8 for more information.

4. Using the System Controller LCD display, check for proper voltages and proper blower RPM levels.

5. After you are satisfied that the board is recognized by *hinv* and the system is running normally, run the Gcache tests in Section 2.7.2.

6. Verify the serial number.

2.7.2 Running Diagnostics

This section describes how to install and run the Gcache diagnostic tests, which augment the main IP21 IDE diagnostics. For a description of the main diagnostic tests, consult the IP21 training material from the Customer Service Education group.

Note: All IP21 boards are carefully screened at the factory; however, it is recommended that you run the diagnostic tests as part of the installation process.

2.7.2.1 Installing Gcache Diagnostics

Follow these instructions to load the *field_diag.1* tests onto the upgrade system.

Note: An earlier version of these diagnostics is called *field_diag*.

1. Connect to the remote source location at an IRIX shell:

   rlogin guest@patches.csd

   This connects you with the patches server.

2. Type **getpatch**. You should see a display similar to the following:

```
--- OS VERSION MENU ---
```

```
1 - Pre-5.2 (ie. 4.0.5) patches (current default)
2 - 5.2 patches
3 - 5.3 patches
4 - 6.0 patches
5 - 6.0.1 patches
6 - 6.1 patches

 Please select an OS level or "q" to quit:
```

3. Select option **6**. Afterwards, you should see a display similar to the following:

```
 --- MAIN MENU ---

 L - List all 6.1 patches
 O - Change the OS version number
 C - Show Customer version of README for a patch (one at a time)
 S - Show SGI internal only README (one at a time)
 D - Deliver/log delivery of a patch (multiple allowed)

 Please select a menu item, or "q" to quit:
```

4. Select option **D** and specify the name of the patch (diagnostic) by typing:

   field_diag.1

5. At the menu prompts, enter the applicable registration information (name, mail stop, and customer name and address).

   Note: Don't forget to end the customer address input with a period (.). You may have to enter a period twice, to get to the next prompt.

6. After entering the registration information, you then receive the following menu:

```
Do you want to:

 L - Log information only, do not transfer data
 R - RCP tar file with patch
 M - Mail a uuencoded patch
 T - Make a TAR tape of the patch

 Please select a menu item, or "q" to quit:
```

7. Enter **R** to *rcp* the patch. The following prompt appears.

   System to "rcp" patch to: [<your system name>]

8. Type in the system name if different from the one shown or press <**Enter**>. This produces the next prompt.

   Directory to "rcp" patch to: [/usr/tmp]

9. Press <**Enter**> to specify the "usr to *rcp* the patch" as guest. The *getpatch* program then copies over the files.

10. When the copying is done, quit and exit the *patches.csd* system to return to an IRIX shell on the customer's system.

11. Go the directory that contains the patch and "un-tar" the file.

    tar -xvf patch_field_diag.1.tar

12. Copy the files to the */stand* directory or another convenient location.

2.7.2.2 Running the Gcache Diagnostics

The *field_diag.1* tests download a special diagnostics kernel (dk) to test the IP21 Gcache RAM. The diagnostics run five tests sequentially and take about 20 minutes to run on a Gcache error-free system. If the tests detect problems, the tests take longer to run (depending on the error).

Caution: You *must run* these tests to help ensure proper system operation. Unlike DRAM soft errors, one Gcache error is usually sufficient reason to replace the IP21 board.

The *field_diag.1* tests consists of two major tests:

- the 20-minute *g* test
- the 4-hour *run* test

The *run* test continuously loops the *g* test for a 4 hour period and should only be performed as time permits.

The *g* and *run* tests execute the following subtests:

- *dk core test*—This test boots the diagnostics kernel (dk) and runs a quick test to make sure that the processor is running properly before running any more diagnostic tests.
- *bcopy*—This test checks the IU (integer unit) of the processor and the environmental control unit mounted on the board.
- *wg_db diag*—This test checks the write gatherer (WG) buffers in the DB chip. The WGs are essential for running graphics programs.
- *gcache4.1 diag*—This test targets the SIMMS and checks the integrity of the global cache (Gcache) with some worst-case test patterns.
- *dcache1.0*—This test checks the data retention of the data cache (Dcache) for the R8000 integer unit (IU). The test writes a special pattern in the Dcache, waits awhile, then reads back the data for correctness.

Use these procedures to run the tests:

1. Go to the */stand* directory or wherever the diagnostics are installed.
2. Enter one of the following:

   `g` or **`run`**

   The *g* test takes 20 minutes to complete.

   Caution: The *run* test takes about 4 hours to complete, so plan your testing schedule accordingly. In addition, do *not* execute the *run* test between 8 p.m. and 12 a.m. (midnight). A bug in the program causes the test to run indefinitely during this time slot.

3. If the tests succeed, go to Section 2.8, “Software Installation.” If the tests fail, see Section 2.7.2.3.

   Exit the tests by resetting the system.

2.7.2.3 If You Encounter Gcache Problems

If you experience an error, see Section 2.9, “If Problems Occur.” In addition, if you have more than one IP21 CPU board, you can disable the bad IP21 board from the POD mode and continue operation with fewer CPU boards (until a replacement board arrives).

Enter the POD mode either by manually selecting the System Maintenance Menu (the recommended method) or by using the System Controller debug settings menu. To manually select POD mode, select option 5 from the System Maintenance Menu and then enter **pod**. To enter POD using the System Controller, set bit 5 in the Debug Settings menu to 1.

Note: The POD mode prompt is `POD` *xx/yy>*, where *xx* is the slot number of the current processor and *yy* is the CPU on the IP21 board.

At the POD prompt, use the *fdisable* command. This command turns the specified processor off by writing to the CPU enable register.

Note: The disabled processor is unable to write and remains disabled until the system is power-cycled, or the control register is rewritten with an “f” and the reset command is typed.

2.7.2.4 Running Diagnostics at a Secure Site Location

To run the Gcache diagnostics at a security-sensitive installation that does not allow the normal network access, copy the diagnostics to a local system, and then bring the diagnostics (on tape) to the site. Follow these instructions:

1. Copy the diagnostic tests from *patches.csd* onto a local station and *tar* the diagnostics onto tape.
2. Load the diagnostics tape into the */usr/local/boot* directory on the customer system.
3. At the miniroot (IO4 prompt), type the following:

   >> **`boot dksc(1,1,6)local/boot/field_diag`**
4. Follow the procedure in Section 2.7.2 to continue the tests.

2.8 Software Installation

The next major step in the IP21 upgrade procedure is to install IRIX 6.1 or later and any associated patches. You must perform these installations from the miniroot.

Caution: To install IRIX 6.1 or later, the existing system must currently be running IRIX 5.2, 5.3, 6.0, or 6.0.1.

2.8.1 Upgrading From IRIX 5.2 or 5.3 to IRIX 6.1

Follow these steps to boot the miniroot and install IRIX 6.1.

1. Verify that the CD-ROM drive is still attached to the system and that the IRIX 6.1 or later CD is installed in the drive.
2. At the System Maintenance Menu, select option **2**, `Install System Software`.

   You should see the following prompt:

   ```
   Load software from local CD-ROM? (y/n) [y]
   ```

3. Press <**Enter**> to boot the miniroot from the CD-ROM drive.

   After a while, you see the Inst prompt. A default set of subsystems is selected for installation. You may wish to add or delete subsystems depending upon your customer's needs.

4. After you have selected the appropriate subsystems, enter **go** at the Inst prompt.
5. Install any application CDs as required.

   Caution: Ensure that the customer system has all the required replacement software applications to run on IRIX 6.1 or later. Otherwise, you could receive an error statement similar to the following when you boot the system.

   ```
   incompatible SW products
   ```

   If this occurs and you do not have the replacement application software, you need to remove the existing application.

6. Install applicable software patches (see Section 2.8.5). If no patches are required, go to Section 2.8.6.

2.8.2 Changing From IRIX 5.3 to IRIX 6.0.1

This section is retained for historical reasons. This information does not apply for upgrades from IRIX 5.3 to IRIX 6.1.

Since IRIX 5.3 is a newer operating system version than IRIX 6.0.1, you cannot upgrade directly from IRIX 5.3 to IRIX 6.0.1 using the normal *Inst* sequence (described in Section 2.8.1). The IRIX 5.3 version has a newer installation database that will not be understood by the *Inst* program in IRIX 6.0.1. As a result, key subsystems such as the database history files in IRIX 5.3 must be removed before IRIX 6.0.1 can be installed.

There are two methods for removing or wiping out the required files in order to install IRIX 6.0.1:

- Performing an *mkfs* on the / (root directory) and the */usr* filesystems. This is the *recommended* method, since it is faster and more efficient. The *mkfs* command performs a "clean install" that completely wipes out these subsystems and creates new ones.
- Performing a *versions remove* command to erase the database history files. This method should be used *only* on systems that either have large filesystems, many *nfs*-mounted files, or a filesystem that is generally difficult or very time-consuming to reinstall from backups.

Caution: If you try to install IRIX 6.0.1 without first removing required files or without recreating the */* and */usr* filesystems in IRIX 5.3, you get the following error message when you try and reboot.

```
File structure not recognized. Use newer version of Inst.
```

2.8.2.1 Using the *mkfs* Command to Create New Filesystems

This section is retained for historical reasons. This information does not apply for upgrades from IRIX 5.3 to IRIX 6.1.

The *mkfs* command completely wipes out and then recreates new, but blank filesystems. It is recommended over the *versions remove* command The *mkfs* command is faster and easier to use. Remember, after IRIX 6.0.1 installation, the user must then re-install the */* and */usr* files from the backup media.

Caution: Make sure that the */* (root directory) and */usr* filesystems are backed up before continuing with the software installation.

Follow these steps to boot the miniroot and IRIX 6.0.1:

1. Verify that the CD-ROM drive is still attached to the system and that the IRIX 6.0.1 CD is installed in the drive.
2. At the System Maintenance Menu, select option **2**, `Install System Software`.

   You should see the following prompt:

   ```
   Load software from local CD-ROM? (y/n) [y]
   ```

3. Press <**Enter**> to boot the miniroot from the CD-ROM drive.

   After a while, you see the Inst prompt. A default set of subsystems is selected for installation. You may wish to add or delete subsystems depending upon your customer's needs.

4. From the Inst Main Menu, select option **11**, `admin`.

   Caution: Make sure that the */usr* and */* filesystems are backed up.

5. At the Administrative Commands Menu, choose option **10**, `mkfs` (make a new filesystem).

   Note: If you do not specify a block device, the *mkfs* command automatically creates a new */* (root directory) and */usr* filesystem.

6. Return to the main Inst menu. A default set of subsystems is selected for installation. You may wish to add or delete subsystems depending upon your customer's requirements.
7. After you have selected the appropriate subsystems, enter **go** at the Inst prompt.
8. Install any application CDs as required.

   Caution: Ensure that the customer system has all the required replacement software applications to run on IRIX 6.0.1. Otherwise, you could receive an error statement similar to the following when you boot the system:

   ```
   incompatible SW products
   ```

If this occurs and you do not have the replacement application software, you need to remove the existing application.

9. Install applicable software patches (see Section 2.8.5). If no patches are required, go to Section 2.8.6.

2.8.2.2 Using the Versions Remove Command to Purge Files

This section is retained for historical reasons. This information does not apply for upgrades from IRIX 5.3 to IRIX 6.1.

As stated earlier, certain filesystems must be removed before IRIX 6.0.1 can be installed. Follow these steps to remove the files and install 6.0.1.

Caution: Make sure that the filesystems are backed up before continuing with the software installation.

1. At an IRIX 5.3 shell, as superuser, use the *version remove* command to remove all the files in the */var/inst* directory. These files contain the file history information**.**

   ```
   # versions remove <filenames>
   ```

   After these files have been purged, you can boot the miniroot to install IRIX 6.0.1.

2. Verify that the CD-ROM drive is still attached to the system and that the IRIX 6.0.1 CD is installed in the drive.

3. At the System Maintenance Menu, select option **2**, `Install System Software`.

   You should see the following prompt:

   ```
   Load software from local CD-ROM? (y/n) [y]
   ```

4. Press <**Enter**> to boot the miniroot from the CD-ROM drive.

   After a while, you see the Inst prompt. A default set of subsystems is selected for installation. You may wish to add or delete subsystems depending upon your customer's needs.

5. After you select the appropriate subsystems, enter **go** at the Inst prompt.

6. If the IRIX 6.0.1 installation initially fails, you may need to use preferences commands such as the *override_space_check* and the *set neweroverride* to help force the installation of IRIX 6.0.1 over IRIX 5.3 (see note below).

   Note: Since IRIX 6.0.1 is an older operating system than IRIX 5.3, it may be necessary to specify certain override commands at the Inst prompt to help complete software installation. The required override commands differ from system to system. A list of the available override commands and preferences are covered in the Software Installation Admininstrator's Guide (p / n 007-1364-*xxx*). In addition, the Inst help menus should also provide some guidance on the appropriate course of action.

7. After a successful operating system installation, install any application CDs as required.

Caution: Ensure that the customer system has all the required replacement software applications to run on IRIX 6.0.1 or later. Otherwise, you could receive an error statement similar to the following when you boot the system:

```
incompatible SW products
```

If this occurs and you do not have the replacement application software, you need to remove the existing application.

8. Install applicable software patches (see Section 2.8.5). If no patches are required, go to Section 2.8.6.

2.8.3 Upgrading From IRIX 6.0 or 6.0.1 to IRIX 6.1

If you are upgrading software from IRIX 6.0 to 6.0.1 and you are upgrading the hardware from the IP21/75 MHz to the IP21/90 MHz, make sure you install the operating system *before* you install the hardware (see also Section 2.1.2).

Follow these instructions to install IRIX 6.1:

1. Verify that the CD-ROM drive is still attached to the system and that the IRIX 6.1 or later CD is installed in the drive.
2. At the System Maintenance Menu, select option **2**, `Install System Software`.

   You should see the following prompt:

   ```
   Load software from local CD-ROM? (y/n) [y]
   ```

3. Press <**Enter**> to boot the miniroot from the CD-ROM drive.

   After a while, you see the Inst prompt. A default set of subsystems is selected for installation. You may wish to add or delete subsystems depending upon your customer's needs.

4. After you have selected the appropriate subsystems, enter **go** at the Inst prompt.
5. Install any application CDs as required.

   Caution: Ensure that the customer system has all the required replacement software applications to run on IRIX 6.1 or later. Otherwise, you could receive an error statement similar to the following when you boot the system:

   ```
   incompatible SW products
   ```

   If this occurs and you do not have the replacement application software, you need to remove the existing application.

6. Install applicable software patches (see Section 2.8.5). If no patches are required, go to Section 2.8.6.

2.8.4 Upgrading From an IRIX 6.1 (Beta) to IRIX 6.1 (MR)

If you are upgrading an existing IRIX 6.1 beta site, you must use the *set neweroverride on* command, before you install the new operating system. See the following instructions:

1. Verify that the CD-ROM drive is still attached to the system and that the IRIX 6.1 CD is installed in the drive.
2. At the System Maintenance Menu, select option **2**, `Install System Software`.

   You should see the following prompt:

   ```
   Load software from local CD-ROM? (y/n) [y]
   ```

3. Press <**Enter**> to boot the miniroot from the CD-ROM drive.

   After a while, you see the Inst prompt. A default set of subsystems is selected for installation. You may wish to add or delete subsystems depending upon your customer's needs.

4. Before you install the new operating system, enter the following at the Inst prompt:

   ```
   inst> set neweroverride on
   ```

5. After you have selected the appropriate subsystems, enter **go** at the Inst prompt.
6. Install any application CDs as required.

   Caution: Ensure that the customer system has all the required replacement software applications to run on IRIX 6.1 or later. Otherwise, you could receive an error statement similar to the following when you boot the system:

   ```
   incompatible SW products
   ```

   If this occurs and you do not have the replacement application software, you need to remove the existing application.

7. Install applicable software patches (see Section 2.8.5). If no patches are required, go to Section 2.8.6.

2.8.5 Installing the S/W Patch CD

You may be required to install additional software patches from the patch CD. This should generally be done after you have installed the main IRIX CD.

The patch software installs through the miniroot. Follow these steps to select a patch for installation:

1. At the Inst prompt, enter:

   `Inst>` **`install patchSG`***`xxxxxxx`*

   where *xxxxxxx* is the number of the patch you wish to install.

   Caution: You must specify each required patch, since you cannot install all the patches at one time. For example, if you give the command *install default*, you see the error `desktop_tools.sw.tools requires desktop_eoe.sw.fam 1019999999`.

   Select the desired patches for installation.

2. Once all the patches are installed, enter **`quit`** to exit from Inst.

2.8.6 Completing Software Installation

After you have installed all the system software, follow these instructions to complete software installation:

1. Reboot the system and watch the display messages carefully to verify a normal boot process.

   If you have an Onyx or Extreme system, check for the following error statements:

   ```
   NOTICE: Downrev BBCC on IP21 in slot #
   ```

   ```
   NOTICE: Downrev BBCC chip doesn't support MP operation with graphics
   NOTICE: Automatically disabling all but one CPU.m to multiuser mode.
   ```

   Caution: This message indicates that an IP21 server board (p / n 030-0625-107 or -109) has been redirected and installed in a graphics system. You need p / n 030-0625-108 or -110 (or later) to run a graphics system.

   When the 030-0625-107 or -109 dual-processor board is installed in a graphics system, it causes IRIX to shut down one of the two processors to continue operation.

2. Log in and enter the following command to verify the installation and that the operating system is IRIX 6.1 or later:

   ```
   uname -a
   ```

   If *uname* reports that the system is running IRIX 6.1 or later, the installation is successful.

3. (*Optional*) To reverify that the correct dual-processor version of the IP21 board is installed (on a graphics system), run *hinv* and check the first line of the display. For example, if you have five dual-processor IP21 boards, the display indicates 10 processors as shown below:

   ```
   10 75 MHZ IP21 Processors
   CPU: MIPS R8000 Processor Chip Revision: 2.2
   FPU: MIPS R8010 Floating Point Chip Revision: 0.1
   Data cache size: 16 Kbytes
   .......
   ```

   If the *hinv* display shows fewer processors than are actually present, this probably indicates that an older dual-processor IP21 board or boards are installed. Remove the older board(s) and then install the correct version (p / n 030-0625-108 or -110 or later).

   After successful hardware and software installation, the system is ready for operation. If you have any additional problems, see Section 2.9.

2.9 If Problems Occur

If an IP21 board is bad and you have a multiple CPU board system, it is recommended that you disable the failed board(s) as described in Section 2.7.2.3 and continue operation with fewer CPU boards. If you have a single CPU board system or if all the IP21 boards are bad, follow these steps:

1. Remove the bad IP21 board and reinstall the IP19.

   Caution: Remember that you cannot install both IP21 and IP19 boards in the same system.

2. Reinstall IRIX 5.2 or 5.3 to change the system back to an IP19 configuration.
3. Update the hardware inventory.

These are examples of Gcache error messages:

```
WARNING:CPU 1 G-cache(even)parityerror:
   hardware error(CPU0inslot4),CAUSE10000SR222007ff03 OF ERROR MESSAGES

HARDWARE ERROR STATE:
 + Cpu Board in slot 3
 + CC in Cpu Slot 3, cpu 0
 + CC ERTOIP Register: 0x101
 + 0:DB chip Parity error DB0
 + 8:Data Sent Error Wback Channel
PANIC: CPU 0: Bus Error in Kernel mode, eframe:0xfffffffffff35d8
 EPC:0xa800000000172420
```

2.9.1 Bad Software Installation?

If you have a bad software installation, check for the following messages:

```
Autoconfig: cannot find /usr/sbin/lboot or
cannot find /usr/etc/lboot
```

This indicates that the software was not properly installed. Reinstall the software and try again.

2.9.2 Reinstalling IRIX 5.2 or 5.3

The general steps for reinstalling IRIX 5.2 or 5.3 are:

1. Back up the system.
2. Verify the backups.
3. Verify that the CD-ROM drive is still attached to the system and that an IRIX 5.2 or 5.3 CD is installed in the drive.
4. At the System Maintenance Menu, select option **2**, `Install System Software`."

   You see the following prompt:

   ```
   Load software from local CD-ROM? (y/n) [y]
   ```

5. Press <**Enter**> to boot the miniroot from the CD-ROM drive.

   After a while you see the Inst prompt (`Inst>`).

6. Enter the following command:

   `Inst>` **`versions remove *`**

7. Reinstall IRIX using the following commands:

```
Inst> install default
```

```
Inst> install other_subsystems
```

In the above command, *other_subsystems* are any other subsystems that the customer needs that are not included as part of the default selection.

8. After you select the appropriate subsystems, start the installation with the *go* command:

   ```
   Inst> go
   ```

9. When the installation is complete, quit Inst*:*

   ```
   Inst> quit
   ```

10. Boot the system, then log in as root and reconfigure the system as necessary (for example, the password file, system name, IP address, and so forth).

2.9.3 Updating the Hardware Inventory

After removing the bad IP21 board, reinstalling the IP19 board, and reinstalling IRIX, you should also update the hardware inventory. If you do not, the system displays a message about the IP21 board that though not harmful, may be confusing to the customer. Updating the hardware inventory prevents this message from displaying at boot time.

Follow these steps to update the hardware inventory:

1. Shut the system down (if it not shut down already).
2. At the System Maintenance Menu, enter the Command Monitor.
3. At the Command Monitor prompt (>>), enter the following command:

   update

   This updates the hardware inventory.

4. Type **exit** to quit the Command Monitor.

The system is ready to boot to multiuser mode.

Note: The purpose of this inventory is to assist a system administrator in discovering hardware failures. When the current inventory differs from that saved by the last *update* command, the autoboot process is inhibited. This permits the system administrator to evaluate the impact on the site and system.

Chapter 3

Returning the Old CPU Board

All IP19/IP21 boards that have been replaced must be returned. This procedure is mandatory. Shipping boxes are included in the upgrade kit; if you need more board boxes, you must to order them before all of the boards can be returned.

3.1 Packing the Board

Pack the old CPU board in the box and antistatic bag provided. Ensure that the board is packed to withstand the rigors of surface and air freight transportation.

Caution: Boards must be shipped in antistatic bags.

3.2 Labeling

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

Silicon Graphics, Inc.
Receiving Department
Building 11, Dock B
2081 N. Shoreline Blvd.
Mountain View, CA 94043

RMA number

3.3 North American Shipping Instructions

Use the following instructions to return the old IP19 board in the U.S. and Canada:

1. Call Federal Express at their toll-free number: (800) 238-5355.
2. Provide the carrier with the following information:
   - RMA number
   - sales order number

- number of pieces to ship
- total weight
- Silicon Graphics destination address

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

3.4 International Shipping Instructions

Use the directions described in this section to ship the old IP19 board from an international site (not the U.S. or Canada). The general shipping instructions are as follows:

1. Pack the board in the shipping container provided.
2. Complete the shipping documentation.
3. Contact the applicable SkyNet branch in your region (see Table 3-1). SkyNet is the required shipping vendor.
4. Give the package to SkyNet and retain the gold copy (last sheet) of the airway bill as your receipt.

3.4.1 Shipping Documentation

You must provide three types of shipping documents to the SkyNet shipper:

- a commercial invoice
- an international SkyNet Airway bill
- a Declaration of Free Entry of Returned American Goods

  Note: This declaration should already be completed for you.

3.4.1.1 Commercial Invoice

Complete the following information:

1. Fill in the “Shipper/Exporter” section of the commercial invoice with the following information:
   - company name of customer
   - address
   - city and country
2. Indicate the desired shipping date.
3. List the total number of boxes for shipment.
4. Sign your name in the signature section of the invoice.

3.4.1.2 International SkyNet Airway Bill

Complete the form as follows:

1. Fill in the date.
2. Provide the following information:
   - company name of customer
   - address
   - city and country
   - Provide your telephone number.
3. Sign the airway bill in the “Shipper’s Signature” section.

Afterwards, insert the three documents into the packing slip envelope and be sure to keep the gold copy (last sheet) of the airway bill.

Note: Do not seal the envelope.

3.4.2 SkyNet International Directory

See Table 3-1 to find the applicable SkyNet branch and phone number for your country.

Note: If you cannot find an appropriate SkyNet branch office, or if you have difficulty reaching the SkyNet group, use the following phone number and information: (415) 692-9500 in Burlingame, California. Contact person: Charlene

Table 3-1 International SkyNet Branch Offices and Phone Numbers

City or Country	Company Name	Phone Number
Berlin, Germany	Die Expressboten	4930850088
Bombay, India	Sky Couriers	0226349747
Caracas, Venezuela	Sky Courier Int’l	5827818210
Dusseldorf, Germany	SkyNet	49211370136
Frankfurt, Germany	West Air Courier	4969780087
Geneva, Switzerland	Schneider’s	41227984468
Hamburg, Germany	Der Courier / SkyNet	4940291917
London, England	Sky International	44895445580
Madrid, Spain	Sky Courier Int’l	3417263007
Mexico City, Mexico	SkyNet de Mexico	5256892944
Milan, Italy	Int’l Cargo Systems	392516951
Munich, Germany	SkyNet	498958045
Paris, France	ExtraCom	33140115500
Peru and Chile	SkyNet	094701491

Table 3-1 (continued) International SkyNet Branch Offices and Phone Numbers

City or Country	Company Name	Phone Number
Rome, Italy	Int'l Cargo Systems	03965506008
Sao Paulo, Brazil	Fex Express	55112410344
Seoul, Korea	Air Couriers, Int'l	8223252010
Stockholm, Sweden	Spedman / Courex	46859127290
Sydney, Australia	SkyNet	6123164855
Taipei, Taiwan	Zip Express	88627603729
Tokyo, Japan	Nissin Air Cargo	81476326506
Toronto, Canada	Elite Link	4168471072
Vienna, Austria	ASAP / SkyNet	432227129652
Zurich, Switzerland	Schneider's	41181463699

Appendix A

Installing an External CD-ROM Drive

This chapter describes how to

- attach an external CD-ROM drive to either a Challenge or Onyx deskside or rackmount system
- eject the CD-ROM and disconnect the CD-ROM drive

You need to attach an external CD-ROM drive only if there is no internal CD-ROM drive installed on the system.

A.1 Attaching an External CD-ROM Drive

Installing an external CD-ROM drive consists of these basic tasks:

- Attaching a 68-pin-to-50-pin Centronics® SCSI cable (018-0348-*xxx*) to the CD-ROM drive.
- Installing a 68-pin connector in the Cardcage 2 I/O panel and connecting the attached ribbon cable to the single-ended SCSI connector on the main IO4 board.
- Attaching the 68-pin-to-50-pin Centronics SCSI cable to the newly installed 68-pin connector on the I/O panel.

Caution: Use only Silicon Graphics CD-ROM drives. CD-ROM drives from other manufacturers may have firmware incompatibilities that can cause the operating system to crash.

The following section describes how to attach an external CD-ROM drive to a rackmount system. Instructions for attaching an external CD-ROM drive to a deskside system are in Section A.1.2, "Attaching a Drive to a Deskside System."

A.1.1 Attaching a Drive to a Rackmount System

Follow these steps to attach an external CD-ROM drive to either a Challenge or Onyx rackmount system:

1. If you have not already done so, shut down the system and turn off the chassis power switch.
2. Open the rear chassis door of the rackmount unit.
3. Make sure the CD-ROM drive you are using is terminated.
4. Attach a 68-pin-to-50-pin Centronics SCSI adapter cable (p/n 018-0347-001) to the external CD-ROM drive. Place the CD-ROM drive on top of the rackmount unit or on another convenient, flat surface and plug the CD-ROM drive into a power outlet. Note that the length of the adapter cable limits where you can place the CD-ROM drive.
5. Place the distribution software CD in a CD caddy and load the caddy into the CD-ROM drive.
6. Unlatch the fasteners that hold the Cardcage 2 I/O panel closed, and swing the I/O panel door down.
7. Locate the IO4 board. On a system with multiple IO4 boards, locate the master IO4 board. For Challenge systems, it is in EBus slot 15. For Onyx systems, it is in slot 11.
8. Disconnect the ribbon cable from the single-ended connector on the IO4 board. This is usually the topmost connector on the edge of the board.

   Note: If the system uses the single-ended connector (SCSI Channel 0) for the main system disk, you must use the second SCSI channel (SCSI Channel 1) for the external CD-ROM drive. The IO4 board typically has a differential personality module attached to SCSI Channel 1. The differential module is red and is marked “DIFF” (p/n 030-0304-003). Replace this module with a single-ended module, which is green and is marked “SE” (p/n 030-0305-002). Also, some systems may use differential personality modules on both SCSI channels. You must replace one of the differential modules with a single-ended module and connect the CD-ROM drive to the single-ended module.
9. Remove one of the blanking plates from the I/O panel and set it aside. You will need to replace the blanking plate later when the retrofit is complete.
10. Install the 68-pin SCSI connector (p/n 018-0310-002) in the open space where you removed the blanking plate.
11. Attach the edge connector on the end of the newly installed ribbon cable to the single-ended SCSI connector on the IO4 board. See Figure A-1.

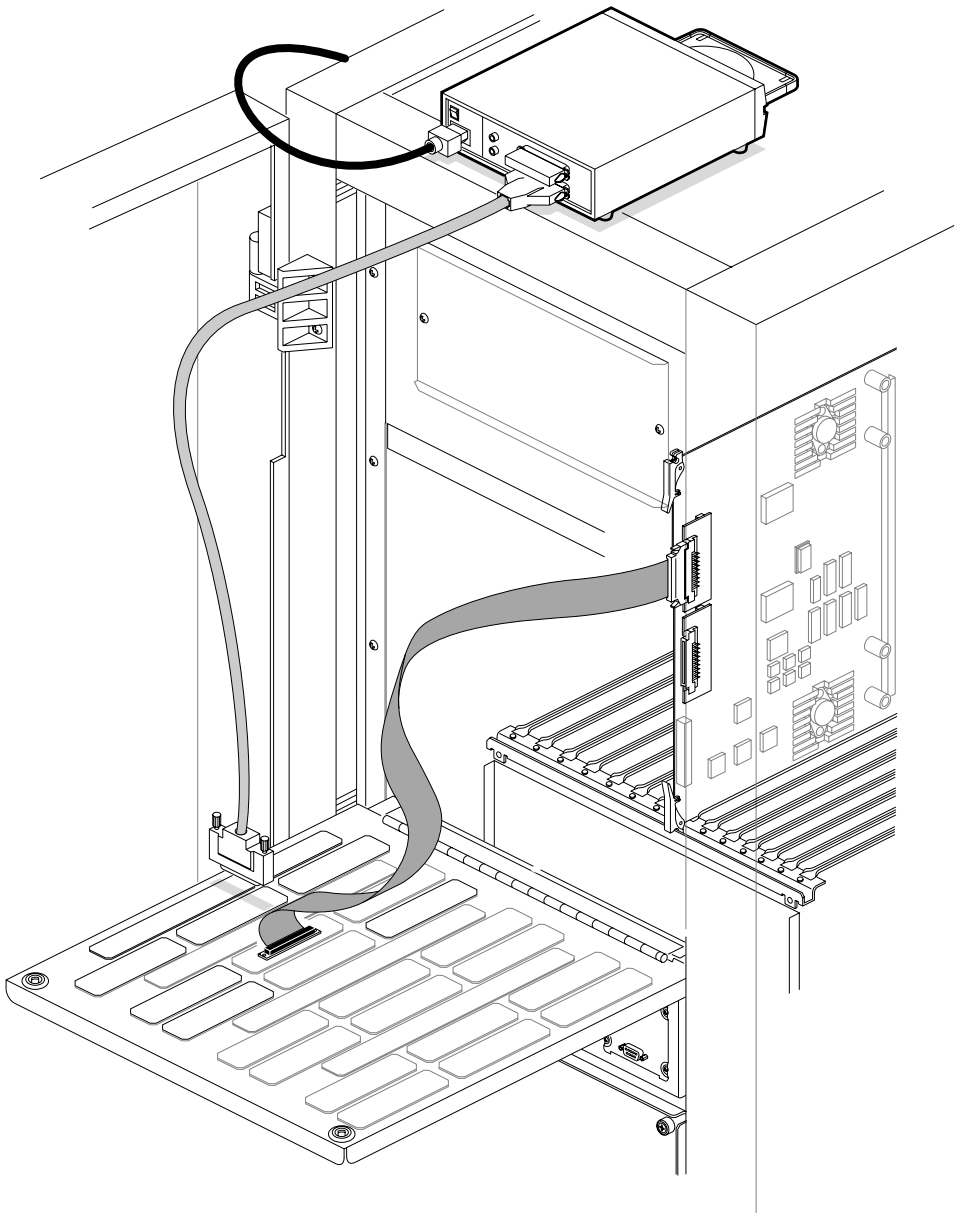

Figure A-1 Cabling the IO4 Board for an External CD-ROM Drive (Rackmount)

12. Close and latch the I/O panel.
13. Connect the 68-pin to 50-pin Centronics SCSI adapter cable to the 68-pin SCSI connector you installed on the I/O panel. See Figure A-2.

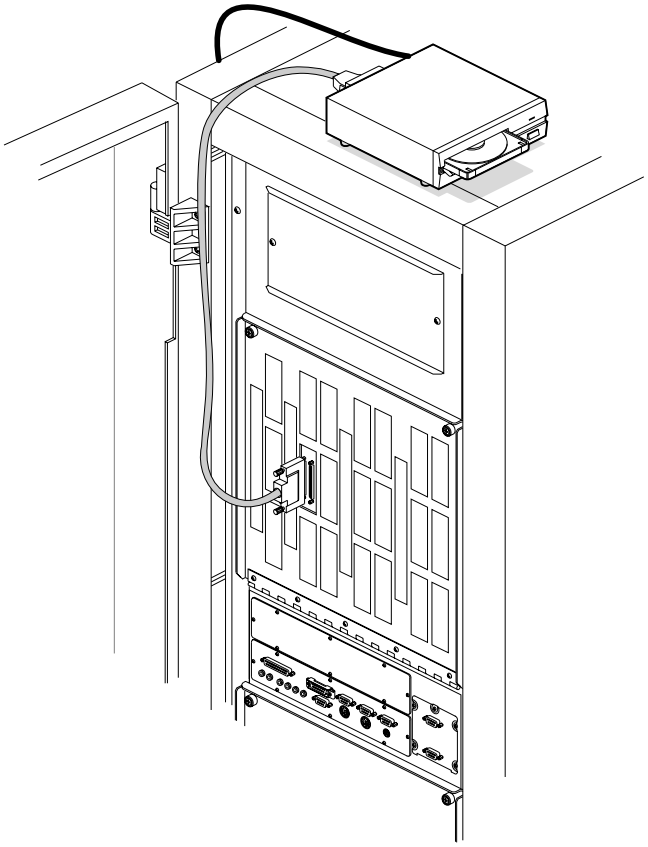

Figure A-2 Attaching the CD-ROM to the I/O Panel (Rackmount)

14. Turn on power to the CD-ROM drive.

The external CD-ROM drive is now attached and ready to use. You are ready to power on the system and use the CD-ROM drive.

A.1.2 Attaching a Drive to a Deskside System

Follow these steps to attach an external CD-ROM drive to either a Challenge or Onyx deskside system:

1. If you have not already done so, shut down the system and turn off the chassis power switch.
2. Make sure the CD-ROM drive is terminated.
3. Open the front chassis door of the deskside unit.

4. Attach a 68-pin-to-50-pin Centronics SCSI adapter cable (p/n 018-0347-001) to the external CD-ROM drive. Place the CD-ROM drive on top of the deskside unit or on another convenient, flat surface and plug the CD-ROM drive into a power outlet. Note that the length of the adapter cable limits where you can place the CD-ROM drive.
5. Place the distribution software CD in a CD caddy and load the caddy into the CD-ROM drive.
6. Unlatch the fasteners that hold the I/O panel closed, and swing the I/O panel door down.
7. Locate the IO4 board. On a system with multiple IO4 boards, locate the master IO4 board. On Challenge systems, it is in slot 5. On Onyx systems it is in slot 3.
8. Disconnect the ribbon cable from the single-ended connector on the IO4 board. This is the topmost connector on the edge of the board.

   Note: If the system uses the single-ended connector (SCSI Channel 0) for the main system disk, you must use the second SCSI channel (SCSI Channel 1) for the external CD-ROM drive. The IO4 board typically has a differential personality module attached to SCSI Channel 1. The differential module is red and is marked "DIFF" (p/n 030-0304-003). Replace this module with a single-ended module, which is green and is marked "SE" (p/n 030-0305-002). Also, some systems may use differential personality modules on both SCSI channels. You must replace one of the differential modules with a single-ended module and connect the CD-ROM drive to the single-ended module.
9. Remove one of the blanking plates from the I/O panel and set it aside. You will need to replace the blanking plate later when the retrofit is complete.
10. Install the 68-pin SCSI connector (p/n 018-0310-002) in the open space where you removed the blanking plate.
11. Attach the edge connector on the end of the newly installed ribbon cable to the single-ended SCSI connector on the IO4 board. See Figure A-3.

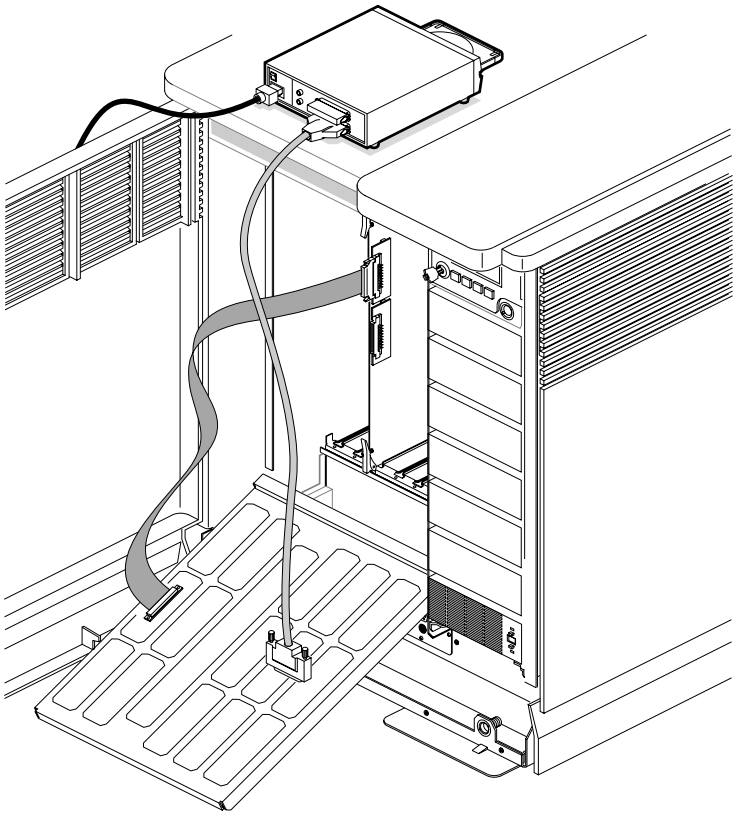

Figure A-3 Cabling the IO4 Board for an External CD-ROM Drive (Deskside)

12. Close and latch the I/O panel.
13. Connect the 68-pin-to-50-pin Centronics SCSI adapter cable to the 68-pin SCSI connector you installed on the I/O panel. See Figure A-4.

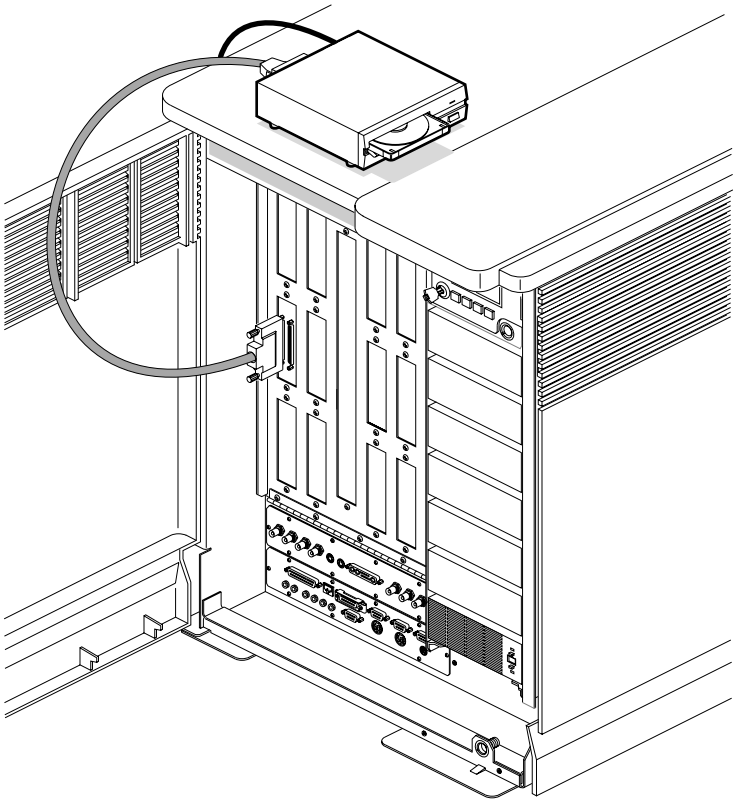

Figure A-4 Attaching the CD-ROM to the I/O Panel (Deskside)

14. Turn on power to the CD-ROM drive.

The external CD-ROM drive is now attached and ready to use. You are ready to power on the system and use the CD-ROM drive.

A.2 Ejecting a CD and Disconnecting the CD-ROM Drive

You cannot use the manual eject button on the front of the drive to eject a CD while the system is booted and running IRIX. The next section describes the steps you should take to eject a CD.

Disconnecting the CD-ROM drive is physically the reverse of connecting the drive.

A.2.1 Ejecting a CD From a CD-ROM Drive

You can eject a CD-ROM from the drive in either of two ways:

1. If the system is booted and you are running IRIX, use the *eject*(1) command. Enter the following command at a shell prompt:

   ```
   eject
   ```

2. If the system is not yet booted, or you are at the PROM level, or the CD-ROM drive is powered on but not attached to the system, eject a CD by pressing the eject button located on the front of the CD-ROM drive.

Note: Do not use the eject button to eject a CD if the system is booted and running IRIX. Often, the CD will not eject if you press the eject button while the system is running. If a CD is mounted as a file system and the CD is ejected while the file system is still mounted, the operating system is left in an inconsistent state. If the system is running UNIX, it is safest to use the *eject* command to eject a CD from the CD-ROM drive.

A.2.2 Disconnecting the CD-ROM Drive

After you have completed the retrofit, you are ready to disconnect the external CD-ROM drive. Follow these steps:

1. Shut down and power off the system. Turn off power to the CD-ROM drive.
2. Disconnect the 68-pin-to-50-pin Centronics SCSI cable from the I/O panel.
3. Remove the CD-ROM drive from the top of the system, disconnect the 68-pin-to-50-pin Centronics SCSI cable from the drive, and unplug the CD-ROM drive power cord.
4. Open the I/O panel and disconnect the ribbon cable from the single-ended connector on the IO4 board.
5. Remove the 68-pin connector you installed in the I/O panel and replace the blanking plate that was originally installed in that slot.
6. Replace any personality modules you changed (for example, if you installed a single-ended module on SCSI Channel 1).
7. Reconnect the proper ribbon cable to its original connector on the IO4 board (for example, to SCSI Channel 0).
8. Close and fasten the I/O panel door and close the chassis door.

You are ready to power on the system.

Appendix B

Running the BBCC Chip Test

The BBCC chip test provides a method for determining the BBCC revision on the IP21 board through software.

To run this program, type the following information into a file script and then run the file.

```
#include <sys/types.h>
#include <sys/syssgi.h>
#include <sys/mips_addrspace.h>
#include <sys/EVEREST/IP21.h>
#include <sys/EVEREST/evconfig.h>

evcfginfo_t evcfg;
evbrdinfo_t *board;
int slot, bad = 0;

main()
{
if (syssgi(SGI_GET_EVCONF, &evcfg) == -1)
 exit(perror("syssgi"));
 for (slot = 0; slot < EV_MAX_SLOTS; slot++) {
 board = &evcfg.ecfg_board[slot];
 if (board->eb_type == EVTYPE_IP21 && board->eb_enabled)
if (board->eb_un.ebun_cpu.eb_ccrev == 4) {
bad = 1;
 printf("BBCC in slot %d is not safe for MP graphics.\n", slot);
}
 }
if (bad == 0)
printf("All BBCC chips are up to graphics ready rev.\n");
}
```

If the test passes, you see this message:

```
"All BBCC chips are up to graphics ready rev."
```

If the test fails, you see this message:

```
BBCC in slot %d is not safe for MP graphics.
```

In this example, `slot %d` is the slot number of the server-only IP21 board.