C H A P T E R 5

Maintenance

This chapter provides maintenance procedures for the Cisco 7010 router and its components. Your Cisco 7010 is configured to your order and ready for installation and startup when it leaves the factory. In the future, as your communication requirements change, you may want to upgrade your system, add components, or change the initial configuration. This chapter describes the procedures for installing, replacing, and reconfiguring interface processors, and for adding and replacing internal system components. Software and microcode component upgrades require specific part numbers and other frequently updated information; therefore, only basic hardware replacement guidelines are included in this publication. Detailed, up-to-date instructions (called *configuration notes*) are shipped with the replacement parts or upgrade kits.

The replaceable system components fall into two categories: those that support online insertion and removal (OIR) and those that require you to shutdown the system power before replacement. Because interface processors support OIR, you can remove and replace them while the system is operating. However, you *must* shutdown the system power before removing the RP, the SP (or SSP), RSP7000, RSP7000CI, or any of the internal components (the fan tray, power supply, and arbiter). Access to the internal components also requires that you remove the chassis cover panel and power harness cover in the noninterface processor end of the router, which exposes the power supply backplane connection. If the power is not shutdown, the high current present in the wiring, and on the backplane if the backplane cover is removed, becomes a hazard. Therefore, always make sure that the system power switch is turned off before removing any internal components or interior chassis panels.

This chapter contains information on the following:

- RP, SP, SSP, RSP7000, RSP7000CI, and interface processor installation and configuration (general instructions for installing, replacing, upgrading, and reconfiguring the processor modules and associated components and, when necessary, instructions for using software configuration commands)

- Internal chassis component replacement (instructions for accessing the chassis interior to replace the following components):

  — Fan tray

  — Power supply

  — Arbiter

Warning Before performing any procedures in this chapter, review the section "Safety Recommendations" in the chapter "Preparing for Installation."

Installing and Configuring Processor Modules

This section provides installation and removal procedure for all processor modules, which include the RP, SP, SSP, RSP7000, RSP7000CI, and CxBus interface processors. This section also includes instructions for replacing spares on the interface processors, for configuring jumpers, and for using basic configuration commands that you may need when setting up new interfaces.

On the RP, you can change the settings of the hardware configuration register and Flash memory write-protection jumpers to define boot instructions, set broadcast addresses and console baud rates, and set (or remove) write protection for the contents of Flash memory.

On the FSIP, you can replace a port adapter if one fails, and with software commands you can change the rate or direction timing signals, change the default NRZ to NRZI format, or change the default 16-bit error correction cyclic redundancy check (CRC) to 32-bit on individual interfaces.

EPROM replacement procedures are included in this section in case replacement is necessary for some unforeseen reason. An EPROM component on the SP (or SSP) and each interface processor contains a default microcode image. The router supports downloadable microcode, so it is unlikely that you will ever need to replace the microcode EPROM.

Each RP, SP (or SSP), RSP7000, RSP7000CI, and interface processor contains a bus-type connector that mates with the system backplane. Each card connector comprises a set of tiered pins, in three lengths. The pins send specific signals to the system as they make contact with the backplane. The system assesses the signals it receives and the order in which it receives them to determine what event is occurring and what task it needs to perform, such as reinitializing new interfaces or shutting down removed ones. For example, when inserting an interface processor, the longest pins make contact with the backplane first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them. The system expects to receive signals from the individual pins in this logical sequence, and the ejector levers help to ensure that the pins mate in this sequence.

> ⚠ **Caution**   Only CxBus interface processors support online insertion and removal (OIR). Do not remove or install the RP or SP (or SSP) while the system is powered on. Doing so can cause a system crash and can destroy memory files.

System software upgrades also can contain upgraded microcode images, which will load automatically when the new software image is loaded. Although most upgrades support the downloadable microcode feature and are distributed on floppy disk or Flash memory card, some may require ROM replacement. If replacement is necessary, refer to the section "Microcode Component Replacement" in this chapter. Also, specific up-to-date replacement and configuration instructions will be provided with the replacement component in the upgrade kit.

Online Insertion and Removal Information

All CxBus interface processors (AIP, CIP, EIP, FIP, FSIP, HIP, MIP, and TRIP) support online insertion and removal (OIR), which allows you to install, remove, replace, and rearrange the interface processors without turning off the system power. When the system detects that an interface processor has been installed or removed, it automatically runs diagnostics and discovery routines, acknowledges the presence or absence of the interface processor, and resumes system operation without any operator intervention. You do not need to notify the software or shutdown the system power.

When you remove or insert an interface processor, the backplane pins send signals to notify the system, which then performs as follows:

1 Rapidly scans the backplane for configuration changes and does not reset any interfaces.

2 Initializes all newly inserted interface processors, noting any removed interfaces and placing them in the administratively shutdown state.

3 Brings all previously configured interfaces on the interface processor back to the state they were in when they were removed. Any newly inserted interfaces are put in the administratively shutdown state, as if they were present (but unconfigured) at boot time. If a similar interface processor type has been reinserted into a slot, then its ports are configured and brought online up to the port count of the original interface processor.

OIR functionality enables you to add, remove, or replace interface processors with the system online, which provides a method that is seamless to end users on the network, maintains all routing information, and ensures session preservation.

When you insert a new interface processor, the system runs a diagnostic test on the new interfaces and compares them to the existing configuration.

If this initial diagnostic test fails, the system remains off line for another 15 seconds while it performs a second set of diagnostic tests to determine whether or not the interface processor is faulty and if normal system operation is possible.

If the second diagnostic test passes, which indicates that the system is operating normally and the new interface processor is faulty, the system resumes normal operation but leaves the new interfaces disabled. If the second diagnostic test fails, the system crashes, which usually indicates that the new interface processor has created a problem on the bus and should be removed.

The system brings online only interfaces that match the current configuration and were previously configured as up; all other interfaces require that you configure them with the **configure** command. On interface processors with multiple interfaces, only the interfaces that have already been configured are brought online.

For example, if you replace a single-PCA CIP with a dual-PCA CIP, only the previously configured interface is brought online automatically; the new interface remains in the administratively shutdown state until you configure it and bring it online.

![caution triangle icon] **Caution** When removing or replacing interface processors, you can avoid erroneous failure messages by allowing at least 15 seconds for the system to reinitialize before removing or inserting another interface processor.

Tools Required

You will need a number 1 Phillips or 3/16-inch flat-blade screwdriver to remove any blank interface processor carriers (fillers) and to tighten the captive installation screws that secure the interface processor in its slot. (Most interface processor carriers use slotted screws, but some were manufactured with Phillips screws.) Whenever you handle interface processors, use a wrist strap or other grounding device to prevent ESD damage. (See the section "Preventing Electrostatic Discharge Damage" in the chapter "Preparing for Installation.")

Ejector Levers

The function of the ejector levers is to align and seat the card connectors in the backplane. Failure to use the ejector levers and insert the interface processor properly can disrupt the order in which the pins make contact with the backplane. Follow the installation and removal instructions carefully, and review the following examples of incorrect insertion practices and results:

- Using the handle to force the interface processor all the way into the slot can pop the ejectors out of their springs. If you then try to use the ejectors to seat the interface processor, the first layer of pins (which are already mated to the backplane) can disconnect and then remate with the backplane, which the system interprets as a board failure.

- Using the handle to force or slam the interface processor all the way into the slot can also damage the pins on the board connectors if they are not aligned properly with the backplane.

- When using the handle (rather than the ejectors) to seat the interface processor in the backplane, you may need to pull the interface processor back out and push it in again to align it properly. Even if the connector pins are not damaged, the pins mating with and disconnecting from the backplane will cause the system to interpret a board failure. Using the ejectors ensures that the board connector mates with the backplane in one continuous movement.

- Using the handle to insert or remove an interface processor, or failing to push the ejectors to the full 90-degree position, can leave some (not all) of the connector pins mated to the backplane, a state which will hang the system. Using the ejectors and making sure that they are pushed fully into position ensures that all three layers of pins are mated with (or free from) the backplane.

It is also important to use the ejector levers when removing an interface processor to ensure that the board connector pins disconnect from the backplane in the logical sequence expected by the system. Any RP, SP (or SSP), or interface processor that is only partially connected to the backplane can hang the bus. Detailed steps for correctly performing OIR are included in the following procedures for installing and removing interface processors.

Following are detailed steps for removing and replacing interface processors and successfully performing OIR. Figure 5-1 shows the functional details of the ejector levers, which you must use properly when inserting or removing interface processors.

Figure 5-1 **Ejector Levers and Captive Installation Screws**

Interface processor
card slot

Ejector
lever

Interface processor card
carrier guide (black)

a

b

Captive
installation
screw

c

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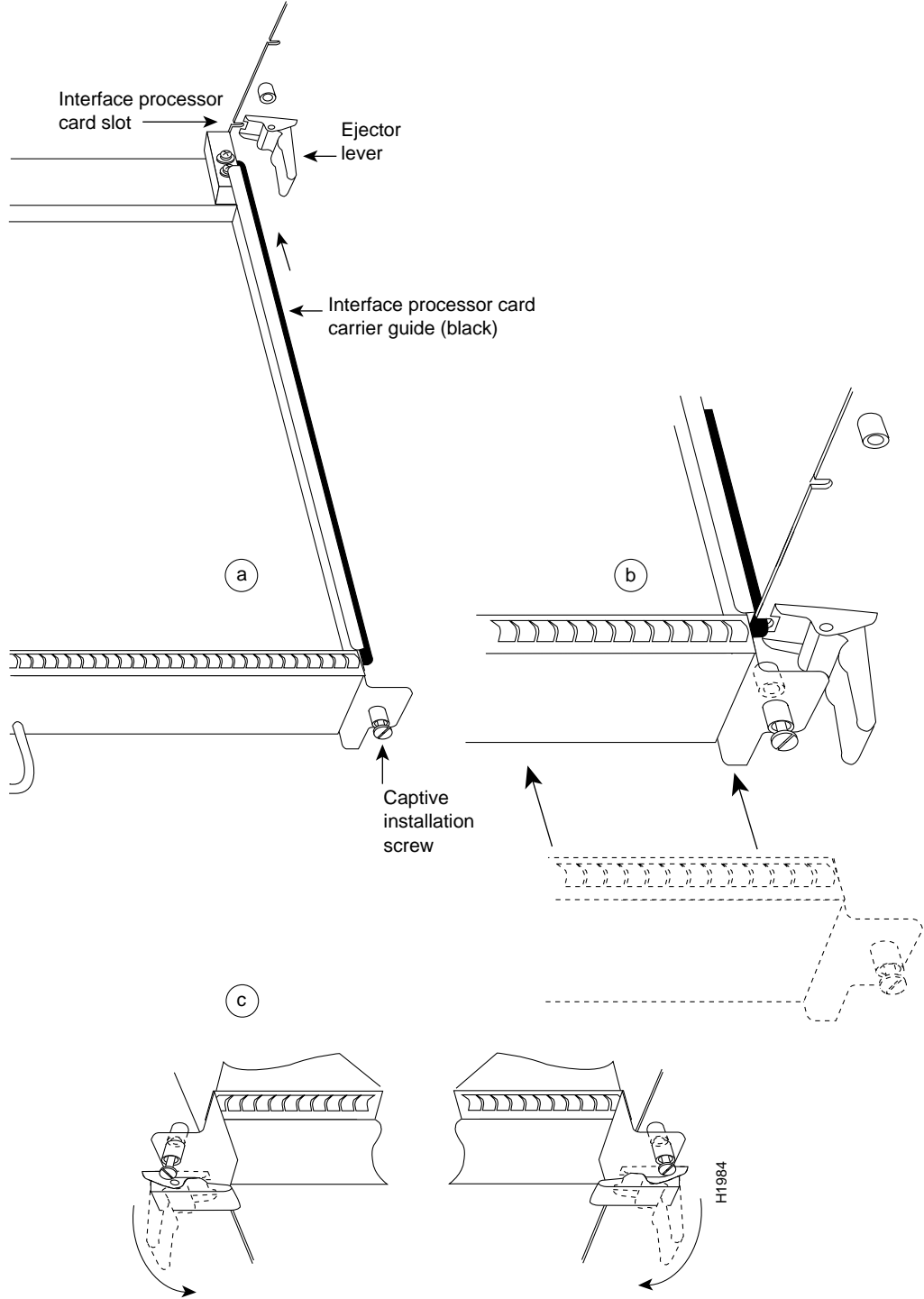
Removing and Replacing the RP, SP or SSP, RSP7000, or RSP7000CI

The RP, SP (or SSP), RSP7000, and RSP7000CI do not support OIR, because they are all required system components. Removing these boards without first shutting down the system will cause an abrupt system shutdown and can damage or destroy memory files.

To remove or replace one of these processor modules, first shut down all system power, then follow the procedures in the following sections, "Removing CxBus Interface Processors" and "Installing CxBus Interface Processors."

Caution   Before removing the RP, SP or SSP, RSP7000, or RSP7000CI, make sure the system is shut down and the power switch is OFF.

Removing CxBus Interface Processors

To remove a CxBus interface processor, follow these steps:

Step 1   If you will not immediately reinstall the interface processor you are removing, or if there is not enough slack in the network interface cables to remove the interface processor without straining the cables, disconnect any cables attached to the interface ports.

Step 2   You must pull processor modules straight out of the slot. Ensure that there are no obstructions that will prevent you from doing so, such as a power strip on a rack post, network connection devices attached to adjacent interface processors, or extensive cabling in front of the processor slots.

Step 3   Use a screwdriver to loosen the captive installation screws at the both ends of the interface processor. (See Figure 5-1a.)

Step 4   Place your thumbs on the ejector levers on both ends of the interface processor (see Figure 5-1c) and simultaneously pull them both outward to release the interface processor from the backplane connector.

Step 5   Grasp the interface processor handle with one hand and place your other hand under the carrier to support it. Pull the interface processor straight out of the slot keeping it at a 90-degree orientation to the backplane. (See Figure 5-2.)

Step 6   Place the removed interface processor on an antistatic mat or immediately install it in another slot.

Step 7   If the slot is to remain empty, install a blank interface processor filler (MAS-7KBLANK) to keep dust out of the chassis, to maintain proper air flow through the interface processor compartment, and to maintain the EMI integrity of the system.

Caution   Always install blank interface processor fillers in empty processor slots to maintain the proper flow of cooling air through the chassis.

Caution   The RP, SP (or SSP), RSP7000, and RSP7000CI are required system components; removing any of them without first shutting down the system will cause an abrupt system shutdown and can damage or destroy memory files. To remove or replace them, first shutdown system power, then follow removal and insertion procedures to ensure that the processor module is seated properly.

Installing CxBus Interface Processors

You can install interface processors in any of the three interface processor slots, numbered 0 through 2 from the bottom slot upward when viewing the chassis from the interface processor end. (See Figure 1-3.) The top slot contains the RP, and the slot directly below the RP contains the SP (or SSP). Blank interface processor fillers are installed in slots without interface processors to maintain consistent air flow through the interface processor compartment.

Following are installation steps for the CxBus interface processors, which support OIR and can be removed and installed while the system is operating. The RP, SP (or SSP), RSP7000, or RSP7000CI are required system components. You must turn off the system power before removing or installing them. After you have turned the system power off, the installation steps for the RP, SP (or SSP), RSP7000, and RSP7000CI are the same as those for the interface processors.

Figure 5-2   Handling an Interface Processor during Installation
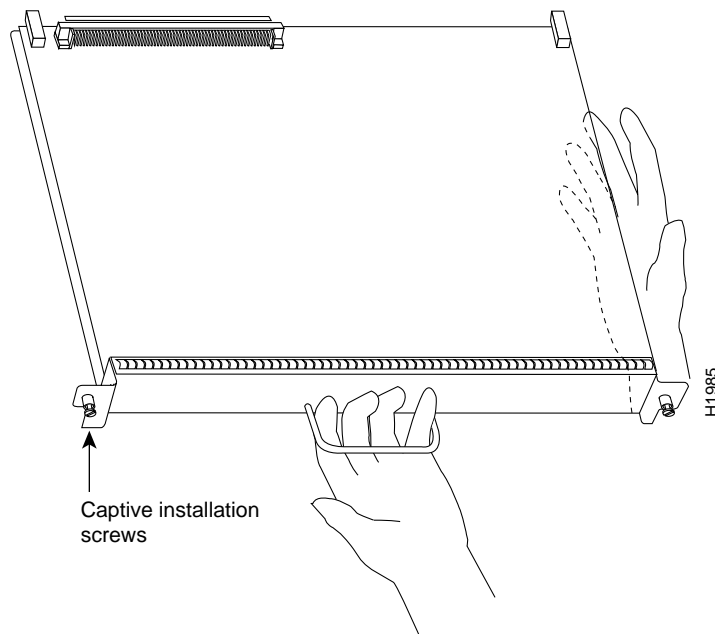
Captive installation screws

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⚠ **Caution**   Handle interface processors by the handles and carrier edges only to prevent ESD damage.

Step 1   Choose a slot for the new interface processor and ensure that there is enough clearance to accommodate any interface equipment that you will connect directly to the interface processor ports. (For example, 10BASE-T Ethernet transceivers that connect directly to EIP ports may be wider than the interface processor and can obstruct connections on adjacent interface processors.)

Step 2   Interface processors are secured with two captive installation screws. Use a number 1 Phillips or a 1/4-inch flat-blade screwdriver to loosen the two captive installation screws and remove the interface processor filler (or the existing interface processor) from the slot to be filled.

Step 3   Hold the interface processor handle with one hand, and place your other hand under the carrier to support it. (See Figure 5-2.) Avoid touching the board.

Step 4 Place the back of the interface processor in the slot and align the carrier guides along the sides of the interface processor with the grooves in the side of the slot. (See Figure 5-1a.)

Step 5 While keeping the interface processor at a 90-degree orientation to the backplane, carefully slide the interface processor into the slot until the interface processor faceplate makes contact with the ejector levers.

Step 6 Using your thumbs, simultaneously push both ejector levers inward until they push the interface processor completely into the slot. The ejectors should be in approximately the same orientation as the interface processor faceplate. (See Figure 5-1c.)

Step 7 Use a screwdriver to tighten both of the captive installation screws.

Step 8 Attach network interface cables or other devices to the interface ports.

Step 9 Check the status of the interfaces as follows:

- If this installation is a replacement interface processor, use the **show interface** or **show controllers** [*type*] command to verify that the system has acknowledged the new interfaces and brought them up.

- If the interfaces are new, use the **configure** command or the **setup** command facility to configure the new interface(s). This does not have to be done immediately, but the interfaces will not be available until you configure them.

Note Always use the ejector levers when installing or removing processor modules. A module that is partially seated in the backplane will cause the system to hang and subsequently crash.

Caution You must turn OFF power to the system before removing or installing an RP or SP (or SSP). After the chassis power has been turned OFF, the installation and removal procedure is the same as the preceding steps for replacing interface processors.

Sample Screen Display for OIR

When you remove and replace CxBus interface processors, the system provides status messages across the console screen. The messages are only informational. In the following sample display, the events logged by the system show that an EIP was removed from slot 0, the system reinitialized the remaining interface processors, and marked the EIP that was removed from slot 0 as *down*. When the EIP was reinserted, the system marked the interfaces as *up* again.

```
7010#

%OIR-6-REMCARD: Card removed from slot 0, interfaces disabled
%LINK-5-CHANGED: Interface TokenRing2/0, changed state to initializing
%LINK-5-CHANGED: Interface Ethernet0/1, changed state to administratively down
%LINK-5-CHANGED: Interface Ethernet0/5, changed state to administratively down
%LINK-5-CHANGED: Interface TokenRing2/0, changed state to up

7010#

%OIR-6-INSCARD: Card inserted in slot 0, interfaces administratively shut down
%LINK-5-CHANGED: Interface TokenRing2/0, changed state to initializing
%LINK-5-CHANGED: Interface Ethernet0/1, changed state to up
%LINK-5-CHANGED: Interface Ethernet0/5, changed state to up
%LINK-5-CHANGED: Interface TokenRing2/0, changed state to up
```
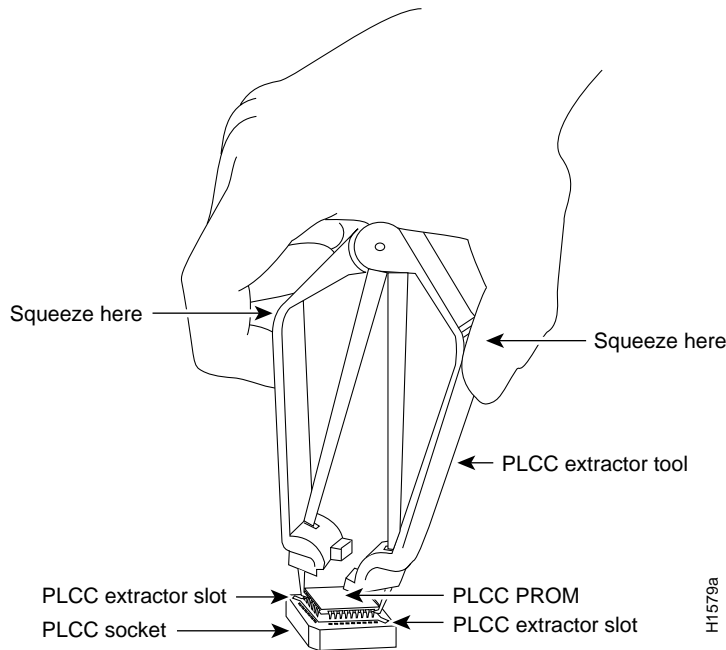
Microcode Component Replacement

The SP (or SSP) and each interface processor contain default microcode, which is an image of board-specific software instructions on a single ROM device on each board. Microcode operates with the system software and controls features and functions that are unique to an interface processor type. New features and enhancements to the system or interfaces are often implemented in microcode upgrades. Although each processor type contains the latest available microcode version (in ROM) when it leaves the factory, updated microcode images are periodically distributed with system software images to enable new features, improve performance, or fix bugs in earlier versions. The latest available microcode version for each interface processor type is bundled with each new system software maintenance upgrade; the bundled images are distributed as a single image on floppy disk or a Flash memory card.

Note We strongly recommend that the microcode bundled with the system software be used as a package. Overriding the bundle could possibly result in incompatibility between the various interface processors in the system.

Although most upgrades support the downloadable microcode feature and are distributed on floppy disk, some images may require ROM replacement. If necessary, use the following instructions to replace an interface processor EPROM in case Flash memory is damaged or otherwise not available, or to change the default microcode on a board for any other reason. The replacement procedures are the same for each board with the exception of the FSIP, which uses a PLCC-type package for the microcode.

You must use a PLCC extractor to remove the FSIP microcode component. (See Figure 5-3.) You cannot use a small flat-blade screwdriver to pry it out of the socket as with the older type of integrated circuits (ICs). A PLCC IC does not have legs or pins that plug into the socket; instead, the contacts are on the sides of the IC and along the inner sides of the socket. When the IC is seated in the socket, the top of the IC is flush with the top of the socket. Forcing a small screwdriver or other tool between the IC and the sides of the socket to pry out the IC will damage the component or the socket or both, and you will have to replace them.

Figure 5-3   Removing a Microcode Component from a PLCC-Type Package

Squeeze here

Squeeze here

PLCC extractor tool

PLCC extractor slot → PLCC PROM
PLCC socket → PLCC extractor slot

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Tools Required

You need the following tools to replace the microcode component:

- Chip extractor or puller (you need a PLCC-type extractor to remove the FSIP component)

- Antistatic mat or foam pad

- ESD-preventive grounding strap (a disposable wriststrap is included in microcode upgrade kits)

Replacing the ROM

Following are the steps for replacing the microcode ROM device on the SP (or SSP) and any interface processor. Refer to the illustrations of the individual interface processors in the section "Interface Processors" in the chapter "Product Overview" for socket locations.

⚠ **Caution** Handle interface processors by the handles and carrier edges only, and always use a grounding strap to prevent ESD damage.

Step 1 If you are replacing the component on an interface processor, check the state of each interface before removing the interface processor and note any that are shutdown.

Step 2 If you are removing and reinserting the SP (or SSP), shutdown the system.

Step 3 Follow the steps in a previous section "Removing CxBus Interface Processors" to remove the interface processor or SP (or SSP) from the chassis. You can leave the cables connected if you perform the replacement close to the chassis to avoid straining the interface cables attached to an adjacent interface processor. Otherwise, label the cables before disconnecting them to avoid crossing them later.

Step 4 Place the removed interface processor on an antistatic mat or foam.

Step 5 Locate the microcode component; refer to the appropriate SP (or SSP) or interface
processor illustrations in the chapter "Product Overview" for socket locations. The socket
designators for each interface processor follow:

- AIP: U111

- CIP: U37 (contains the microcode boot image; the entire microcode image is in the
  software/microcode bundle)

- EIP: U101

- FEIP: U37

- FIP: U23

- FSIP: U81

- HIP: U133

- MIP: U41

- SP: U173

- SSP: U231

- TRIP: U41

Step 6 Note the orientation of the notch on the existing microcode component so that you can
install the new component with the same orientation.

Step 7 Use a chip or PLCC-type extractor (for the FSIP) to remove the microcode component from
the socket. Place the removed component on antistatic foam or into an antistatic bag.

Step 8 Insert the new microcode component in the socket with the notched end in the same
orientation as the previous component.

Step 9 Follow the steps in the section "Installing CxBus Interface Processors" in this chapter, to
replace the interface processor, SP, or SSP.

Step 10 Verify that the enabled LED on the interface processor, SP, or SSP goes on and remains on.
If it does not, eject the board and reinstall it in the slot. Turn OFF power before ejecting the
SP or SSP.

Step 11 Connect any network interface cables that were removed.

Step 12 If the system power is OFF, turn it back ON.

Verifying the Microcode Version

The system automatically reloads the microcode when you insert an interface processor online or
restart the system. The system default is to load the ROM microcode for all processor types.
However, because microcode upgrades are usually distributed as files to be stored and loaded from
Flash memory, the system may be configured to bypass the ROM image for a particular processor
type and load an image from a Flash memory file instead. (This can be true for any or all processor
types.) To determine whether the interface processor you just upgraded is loading the new ROM
microcode or an image from Flash memory, issue the **show controller cxbus** command. The first
line of the status display for the SP (or SSP) and for each interface processor displays the currently
loaded and running microcode version for that particular processor type. The following example
shows that the EIP in slot 0 is running EIP Microcode Version 1.0:

```
7010# show cont cxbus
 EIP 0, hardware version 5.1, microcode version 1.0
  Interface 0 - Ethernet0/0, station addr 0000.0c02.d0ec (bia 0000.0c02.d0cc)
```

If the microcode version in the display is different from the ROM version you just installed, use the **microcode** *card-type* **rom** configuration command to change the configuration so the system loads the ROM microcode for that processor type. Verify that the new microcode version is loading from ROM and, if necessary, correct the configuration with the following steps:

Step 1   Verify that the system boots correctly. If the enabled LED on the SP (or SSP) or interface processor you just reinstalled does not go on, repeat the steps in the preceding section, "Replacing the ROM."

- Ensure that the ROM is installed with the notch at the correct end and that none of the pins are bent.

- If a pin is bent, remove the ROM, straighten the pin, and try the installation again.

- If a ROM is installed backwards and power is turned ON, the ROM is damaged and needs replacement.

Step 2   Check the state of the interfaces with the LEDs and verify that the interfaces return to the same state they were in before you removed the interface processor (some may have been shutdown).

Step 3   Enter the **show controller cxbus** command to display the status of the SP (or SSP) and all interface processors.

Step 4   If the display indicates that the new ROM image is the currently running microcode version, your installation is complete. If a different (older) version is displayed, the microcode is still loading from a Flash memory file. Proceed with the following steps to configure the ROM microcode to load.

Step 5   Enable the privileged level of the EXEC command interpreter (which usually requires a password) and enter the configuration mode from the terminal:

```
7010> enable
Password:
7010# configure terminal
```

Step 6   Enter the command **microcode** *card-type* **rom** to negate the instruction to load from Flash memory, then issue the **microcode reload** command to reload the microcode with the new instructions. The following example shows the command used to load EIP microcode from ROM:

```
microcode eip rom
microcode reload
```

Step 7   Press **Ctrl-Z** (**^Z**) to return to the system prompt, and save (write) the new configuration to memory with the **write terminal** command.

```
^Z
write terminal
[OK]
```

Step 8   Enter the **show controller cxbus** command again. The first line of the display for the interface processor (and for all interface processors of the same type) should show the new ROM microcode version.

The replacement procedure is complete. If the Enabled indicator does not go on after a second installation attempt, or if any of the interfaces fail to return to their previous state, refer to the troubleshooting procedures in the chapter "Troubleshooting the Installation."

RP and RSP7000 Configurations

This section describes the following maintenance aspects of the RP and RSP7000, with differences noted:

- Changing RP jumper settings

Note The RSP7000 uses the software configuration register feature exclusively; there are no user-configurable jumpers on the RSP7000. For the RSP7000's configuration register functions, refer to the section "Software Configuration Register," later in this chapter.
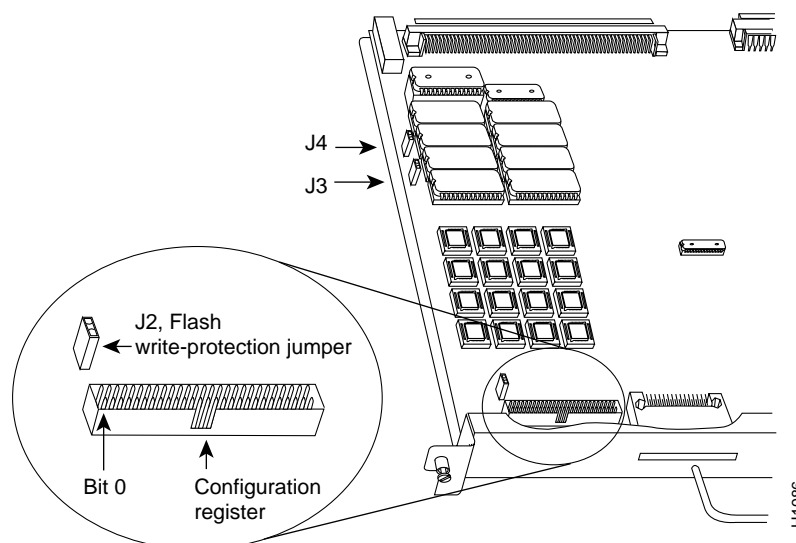

- Changing software configuration register settings
- Replacing system software EPROMs
- Replacing DRAM SIMMs

Most system software upgrades are distributed on floppy disk or Flash memory cards. However, occasionally it might be necessary to replace the system software ROMs to ensure proper operation with a newer software release.

Configuring Jumpers

The RP contains the hardware configuration register and the Flash memory write-protect jumper, both of which are shown in Figure 5-4. Jumpers installed on the hardware configuration register define boot instructions and set broadcast addresses and console baud rates. Jumper J2, when removed, protects the contents of Flash memory by preventing any information to be written to Flash memory. Jumpers J3 and J4 (see Figure 5-4) are set according to the size of the eight software EPROMs on the RP. These jumpers correspond to the EPROMs only and *not* to the software image size; you do not need to reset the jumpers when loading a larger software image into Flash memory. (See Figure 5-8 for jumper settings.)

**Figure 5-4   RP Jumper Locations**

Hardware Configuration Register Settings

The hardware configuration register (see Figure 5-4) comprises the upper 32 pins of a 50-pin jumper block located above the Flash memory card port on the RP. You can define system boot instructions, set broadcast addresses and console baud rates, or instruct the router to perform factory diagnostics at startup by installing jumpers on specific pins. Jumper bit (or position) 0 is the top pair of pins. To set a bit to 1, insert a jumper. To clear a bit to 0, remove the jumper.

To change configuration register settings, you must turn off the system power and remove the RP. Figure 5-5 shows the configuration register with the factory default setting, with jumpers installed on bits 0 and 8. Bit 0 instructs the system to boot from ROM; bit 8 instructs the system to ignore the Break key on the console terminal keyboard.

Figure 5-5   Configuration Register Factory Default Settings
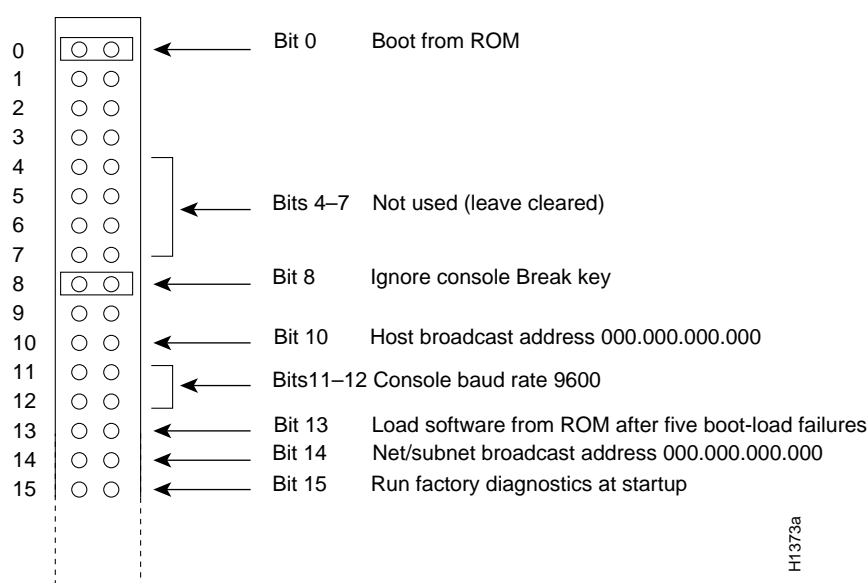
The lowest four bits of the configuration register (bits 3 through 0) form the boot field. The boot field specifies a number in binary. When the boot field is set to either 0 or 1 (0-0-0-0 or 0-0-0-1) the system ignores any boot instructions in the configuration file. When the boot field is set to 0, you must boot the operating system manually by giving a b (or **boot**) command to the system bootstrap program or *rom monitor*. You can enter the **boot** command only, or include additional boot instructions with the command such as the name of a file stored in Flash memory or a file that you specify for netbooting. If you use the **boot** command only, without specifying a file or any other boot instructions, the system boots from the ROM image. Otherwise, you can instruct the system to boot from a specific image such as a Flash file (**boot system flash** *filename*), or to netboot by sending broadcast TFTP requests (**boot system** *filename*) or a direct TFTP request to a specific server (**boot system** *filename address*). When the boot field is set to 1 (the factory default), the system boots from ROM. Boot field settings of 0 and 1 both override any boot instructions in the system configuration file.

If you set the boot field to any bit pattern other than 0 or 1, the system uses the resulting number to form a file name for netbooting. To form the file name, the system starts with *cisco* and links the octal equivalent of the boot field value (jumper setting) and the processor type in the format *cisco<jumpervalue>-<processorname>*. (Table 5-1 lists the default boot file names or actions for the RP.) The system uses the default filename for netbooting. However, if the configuration file contains any boot instructions, the system uses those boot instructions instead of the filename it computed from the jumper settings.

Table 5-1   Default Boot Filenames—Boot Field Jumpers

Action/Filename	Bit 3	Bit 2	Bit 1	Bit 0
bootstrap mode	0	0	0	0
ROM software	0	0	0	1
cisco2-rp1	0	0	1	0
cisco3-rp1	0	0	1	1
cisco4-rp1	0	1	0	0
cisco5-rp1	0	1	0	1
cisco6-rp1	0	1	1	0
cisco7-rp1	0	1	1	1
cisco10-rp1	1	0	0	0
cisco11-rp1	1	0	0	1
cisco12-rp1	1	0	1	0
cisco13-rp1	1	0	1	1
cisco14-rp1	1	1	0	0
cisco15-rp1	1	1	0	1
cisco16-rp1	1	1	1	0
cisco17-rp1	1	1	1	1

Note   The four bits after the boot field (bits 4 through 7) in the configuration register are not used and must be left cleared (0).

Bit 8 in the configuration register controls the console Break key. Setting bit 8 to 1 (the factory default) causes the processor to ignore the console Break key. Clearing bit 8 to 0 causes the processor to interpret Break as a command to force the system into the bootstrap monitor, thereby suspending normal operation.

Bit 9 in the configuration register is not used.

Bit 10 in the configuration register controls the host portion of the Internet broadcast address. Setting bit 10 causes the processor to use all zeros; clearing bit 10 (the factory default) causes the processor to use all ones. Bit 10 interacts with bit 14, which controls the network and subnet portions of the broadcast address. Table 5-2 shows the combined effect of bits 10 and 14.

Table 5-2   Configuration Register Settings for Broadcast Address Destination

Bit 14	Bit 10	Address (<net><host>)
out	out	<ones><ones>
out	in	<zeros><zeros>
in	in	<net><zeros>
in	out	<net><ones>

Bits 11 and 12 in the configuration register determine the console port baud rate. Table 5-3 shows the bit settings for the four available baud rates. (The factory default is 9600.)

Table 5-3   System Console Terminal Baud Rate Settings

Baud	Bit 12	Bit 11
9600	0	0
4800	0	1
1200	1	0
2400	1	1

Bit 13 in the configuration register determines the system's response to a boot-load failure. Setting bit 13 causes the system to load operating software from ROM after five unsuccessful attempts to load a boot file from the network. Clearing bit 13 causes the system to continue attempting to load a boot file from the network indefinitely. By factory default, bit 13 is cleared to 0.

Bit 14 in the configuration register controls the network and subnet portions of the Internet broadcast address. Setting bit 14 causes the system to include the network and subnet portions of its address in the broadcast address. Clearing bit 14 causes the system to set the entire broadcast address to all ones or all zeros, depending on the setting of bit 10. By factory default, bit 14 is cleared to 0. See Table 5-2 for the combined effect of bits 10 and 14.
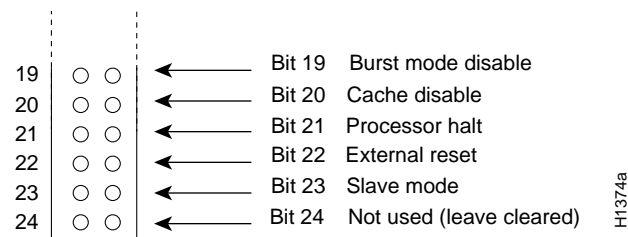
Bit 15 in the configuration register controls factory diagnostic mode in the system. Setting bit 15 causes the system to produce detailed CPU self-check messages, to automatically prompt for interface addresses (not look for addresses on the network), to *not* read configuration files or nonvolatile memory, and to automatically set to diagnostic tracing modes using the debug commands. Clearing bit 15 (the factory default) causes the system to operate normally.

Bits 16 through 18 are not used and should remain cleared.

Bit 19 disables the fast page burst mode from the DRAM to the MC68EC040 processor.

Bits 20 through 23 (the four pairs of pins on the far left of the 50-pin header) are not used in normal operation; however, they can be used to invoke the cache disable, processor halt, external reset, and slave mode functions. (See Figure 5-6.)

Figure 5-6   Optional Configuration Register Settings


```
19  ○ ○  ←――――  Bit 19   Burst mode disable
20  ○ ○  ←――――  Bit 20   Cache disable
21  ○ ○  ←――――  Bit 21   Processor halt
22  ○ ○  ←――――  Bit 22   External reset
23  ○ ○  ←――――  Bit 23   Slave mode
24  ○ ○  ←――――  Bit 24   Not used (leave cleared)
```
H1374a

Note   Configuration register setting changes take effect when the system restarts.

Flash Memory Write Protection

The Flash memory write-protection option protects the contents of Flash memory against accidental erasure or reprogramming. The factory default, with a jumper installed on J2, is to allow programming (writing) to Flash memory. To protect the contents, remove the jumper from J2. You can later replace the jumper to enable Flash memory programming. The location of J2 is shown in Figure 5-4.

Software Configuration Register

This section describes the software (virtual) configuration register that is used with the RP in a system running Cisco Internetwork Operating System (Cisco IOS) Release 10.0 or later. Its functions are identical to the hardware configuration register except the settings are changed through the command line interface.

Following is the information included in this section:

- Software configuration register settings

- Explanation of boot field

- Changing configuration register settings

- Software configuration register bit meanings

- Default boot filenames

- Software configuration register settings for broadcast address destination

- System console terminal baud-rate settings

- Enabling booting from Flash

- Copying to Flash

Software Configuration Register Settings

Settings for the 16-bit software configuration register are written into the NVRAM. Following are some reasons for changing the software configuration register settings:

- Force the system into the bootstrap program.

- Select a boot source and default boot filename.

- Enable or disable the Break function.

- Control broadcast addresses.

- Set the console terminal baud rate.

- Load operating software from ROM.

- Enable booting from a Trivial File Transfer Protocol (TFTP) server.

Table 5-4 lists the meaning of each of the software configuration memory bits, and Table 5-5 defines the boot field.

Caution   To avoid confusion and possibly halting the router, remember that valid configuration register settings might be combinations of settings and not just the individual settings listed in Table 5-4. For example, the factory default value of 0x0101 is a combination of settings.

Table 5-4   Software Configuration Register Bit Meanings

Bit No.[1]	Hexadecimal	Meaning
00 to 03	0x0000 to 0x000F	Boot field (see Table 5-5)
06	0x0040	Causes system software to ignore NVRAM contents
07	0x0080	OEM bit enabled[2]
08	0x0100	Break disabled
09	0x0200	Use secondary bootstrap
10	0x0400	Internet Protocol (IP) broadcast with all zeros
11 to 12	0x0800 to 0x1000	Console line speed (default is 9,600 baud)
13	0x2000	Boot default ROM software if network boot fails
14	0x4000	IP broadcasts do not have network numbers
15	0x8000	Enable diagnostic messages and ignore NVRAM contents

1. The factory default value for the configuration register is 0x0101. This value is a combination of the following: bit 8 = 0x0100 and bits 00 through 03 = 0x0001 (see Table 5-5).
2. OEM = original equipment manufacturer.

Table 5-5   Explanation of Boot Field (Configuration Register Bits 00 to 03)

Boot Field	Meaning
00	Stays at the system bootstrap prompt
01	Boots system image in system ROM
02 to 0F	Specifies a default netboot filename Enables boot system commands that override the default netboot filename

Changing Settings

Some common reasons to modify the value of the software configuration register are as follows:

- Recover a lost password.

- Change the console baud rate.

- Enable or disable Break.

- Allow you to manually boot the operating system using the **b** command at the bootstrap program (ROM monitor) prompt.

- Force the router to boot automatically from the system bootstrap software (boot ROM image) or from its system image in Flash memory, and read any **boot system** commands that are stored in the configuration file in NVRAM. If the router finds no **boot system** commands, it uses the configuration register value to form a filename from which to netboot a default system image stored on a network server. (See Table 5-6.)

To change the configuration register while running the system software, follow these steps:

Step 1   Enter the **enable** command and your password to enter privileged level, as follows:

```
Router> enable
Password:
router#
```

Step 2   At the privileged-level system prompt (router #), enter the command **configure terminal.** You will be prompted as shown in the following example:

```
Router# conf term
Enter configuration commands, one per line. End with CTRL/Z
```

Step 3   To set the contents of the configuration register, enter the **config-register** *value* configuration command where *value* is a hexadecimal number preceded by 0x (see Table 5-4), as in the following:

```
config-register 0xvalue
```

Step 4   Exit the configuration mode by entering **Ctrl-Z**. The new value settings will be saved to memory; however, the new settings do not take effect until the system software is reloaded by rebooting the router.

Step 5   To display the configuration register value currently in effect and the value that will be used at the next reload, enter the **show version** EXEC command. The value will be displayed on the last line of the screen display, as in the example following:

```
Configuration register is 0x141 (will be 0x101 at next reload)
```

Step 6   Reboot the router. The new value takes effect. Configuration register changes take effect only when the server restarts, such as when you switch the power OFF and on or when you issue a **reload** command from the console.

If the boot ROMs do not support the software configuration register (not Release 10.0 or later), the following message will be displayed:

```
Boot ROMs do not support software configuration register.
Value not written to NVRAM.
```

Bit Meanings

The lowest four bits of the software configuration register (bits 3, 2, 1, and 0) form the boot field. (See Table 5-5.) The boot field specifies a number in binary form. If you set the boot field value to 0, you must boot the operating system manually by entering the b command at the bootstrap prompt as follows:

```
> b [tftp] flash filename
```

Definitions of the various **b** command options follow:

- **b**—Boots the default system software from ROM

Note   The RSP7000 does not use ROM devices to run Cisco IOS images.

- **b flash**—Boots the first file in Flash memory
- **b slot0:** *filename*—Boots the file *filename* from the Flash memory card in the PCMCIA Slot on the faceplate
- **b** *filename [host]*—Netboots using TFTP
- **b flash** *[filename]*—Boots the file *filename* from Flash *memory*

For more information about the b [tftp] flash filename command, refer to the set of router products configuration publications.

If you set the boot field value to 0x2 through 0xF, and there is a valid system boot command stored in the configuration file, then the router boots the system software as directed by that value. If you set the boot field to any other bit pattern, the router uses the resulting number to form a default boot filename for netbooting. (See Table 5-6.)

In the following example, the software configuration register is set to boot the router from Flash memory and to ignore Break at the next reboot of the router:

```
Router# conf term
Enter configuration commands, one per line. End with CTRL/Z.
config-register 0x102
boot system flash [filename]
^z
Router#
```

The server creates a default boot filename as part of the automatic configuration processes. To form the boot filename, the server starts with the name cisco and adds the octal equivalent of the boot field number, a hyphen, and the processor-type name. Table 5-6 lists the default boot filenames or actions for the processor.

Table 5-6   Default Boot Filenames—Boot Field Jumpers

Action/Filename	Bit 3	Bit 2	Bit 1	Bit 0
bootstrap mode	0	0	0	0
ROM software	0	0	0	1
cisco2-rp1	0	0	1	0
cisco3-rp1	0	0	1	1
cisco4-rp1	0	1	0	0
cisco5-rp1	0	1	0	1
cisco6-rp1	0	1	1	0
cisco7-rp1	0	1	1	1
cisco10-rp1	1	0	0	0
cisco11-rp1	1	0	0	1
cisco12-rp1	1	0	1	0
cisco13-rp1	1	0	1	1
cisco14-rp1	1	1	0	0
cisco15-rp1	1	1	0	1
cisco16-rp1	1	1	1	0
cisco17-rp1	1	1	1	1

Note   A **boot system** configuration command in the router configuration in NVRAM overrides the default netboot filename.

Bit 8 controls the console Break key. Setting bit 8 (the factory default) causes the processor to ignore the console Break key. Clearing bit 8 causes the processor to interpret the Break key as a command to force the system into the bootstrap monitor, thereby halting normal operation. A break can be sent in the first 60 seconds while the system reboots, regardless of the configuration settings.

Bit 9 controls the secondary bootstrap program function. Setting bit 9 causes the system to use the secondary bootstrap; clearing bit 9 causes the system to ignore the secondary bootstrap. The secondary bootstrap program is used for system debugging and diagnostics.

Bit 10 controls the host portion of the IP broadcast address. Setting bit 10 causes the processor to use all zeros; clearing bit 10 (the factory default) causes the processor to use all ones. Bit 10 interacts with bit 14, which controls the network and subnet portions of the broadcast address. Table 5-7 shows the combined effect of bits 10 and 14.

Table 5-7   Configuration Register Settings for Broadcast Address Destination

Bit 14	Bit 10	Address (<net> <host>)
Off	Off	<ones> <ones>
Off	On	<zeros> <zeros>
On	On	<net> <zeros>
On	Off	<net> <ones>

Bits 11 and 12 in the configuration register determine the baud rate of the console terminal. Table 5-8 shows the bit settings for the four available baud rates. (The factory-set default baud rate is 9,600.)

Table 5-8   System Console Terminal Baud Rate Settings

Baud	Bit 12	Bit 11
9,600	0	0
4,800	0	1
1,200	1	0
2,400	1	1

Bit 13 determines the server response to a boot-load failure. Setting bit 13 causes the server to load operating software from ROM after five unsuccessful attempts to load a boot file from the network. Clearing bit 13 causes the server to continue attempting to load a boot file from the network indefinitely. By factory default, bit 13 is cleared to 0.

Enabling Booting from Flash Memory

To enable booting from Flash, set configuration register bits 3, 2, 1, and 0 to a value between 2 and 15 in conjunction with the **boot system flash** [*filename*] configuration command.

To enter configuration mode while in the system software image and specify a Flash filename from which to boot, enter the **configure terminal** command at the enable prompt, as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL/Z.
boot system flash [filename]
```

To disable Break and enable the **boot system flash** command, enter the **config-register** command with the value shown in the following example:

```
config-reg 0x102
^Z
router#
```

Copying to Flash Memory

Copying a new image to Flash memory might be required whenever a new image or maintenance release becomes available. To copy a new image into Flash (write to Flash), you must first reboot from ROM and then copy the new image into Flash. You *cannot* copy a new image into Flash while the system is running from Flash. Use the **copy tftp flash** command for the copy procedure.

Following is the sample output for reloading the router and then copying a file (called 7K10020Z) to Flash memory from a TFTP server (called server1):

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL/Z.
config-reg 0x101
^Z
```

The configuration register setting 0x0101 tells the system to boot from ROM, but does *not* reset the Break disable.

```
Router# reload
...
router# copy tftp flash
IP address or name of remote host [255.255.255.255]? server1
Name of tftp filename to copy into flash []? 7K10020Z
copy 7K10020Z from 131.131.101.101 into flash memory? [confirm] <Return>
xxxxxxxx bytes available for writing without erasure.
erase flash before writing? [confirm] <Return>
Clearing and initializing flash memory (please wait)####...
Loading from 101.2.13.110: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!... [OK - 324572/524212 bytes]
Verifying checksum...
VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV..
Flash verification successful. Length = 1204637, checksum = 0x95D9

router# config term
Enter configuration commands, one per line. End with CTRL/Z.
config-reg 0x102
^Z
```

The configuration register setting 0x102 tells the system to boot from ROM, disable Break, and check for a default netboot filename.

```
Router# reload
 ...
```

The system is now ready to be configured to boot from the new image you copied to Flash. For more information on the **copy tftp flash** command, and other related commands, refer to the set of router products configuration publications.

Recovering a Lost Password

An overview of recovering a lost password follows:

- Enter the **show version** command to note the existing software configuration register value.
- Break to the bootstrap program prompt (ROM monitor).
- Change the configuration register to 0x0141 (ignore Break; ignore NVRAM; boot from ROM).

Note   A key to recovering a lost password is to set the configuration register so that the contents of NVRAM are ignored (0x0040), allowing you to see your password.

- Enter privileged level in the system bootstrap program.
- Enter the **show configuration** command to display the enable password.
- Change the configuration register value back to its original setting.

Note   To recover a lost password if Break is disabled on the router, you must have physical access to the router.

To recover a lost password, follow these procedures.

Step 1   Attach an ASCII terminal to the router console port, which is located on the rear panel.

Step 2   Configure the terminal to operate at 9600 baud, 8 data bits, no parity, 2 stop bits (or to whatever settings the router is set).

Step 3   Enter the **show version** command to display the existing configuration register value. Note this value for later use in Step 14.

Step 4   If Break is disabled, power cycle the router. (Turn the router OFF, wait five seconds, and then turn it ON again.) If Break is enabled on the router, press the Break key or send a break and then proceed to Step 5.

Step 5   Within 60 seconds of turning on the router, press the Break key. This action causes the terminal to display the bootstrap program prompt (>).

Step 6   To reset the configuration register to boot from the boot ROMs and ignore NVRAM, enter **o/r** at the bootstrap prompt as follows:

```
> o/r
```

Note   If the boot ROMs do not support the software configuration register—that is, they are not Release 10.0 or later—this command will not be recognized and the current hardware configuration register value will display.

Step 7   Initialize the router by entering the **i** command as follows:

```
> i
```

The router will power cycle, the configuration register will be set to 0x141, and the router will boot the boot ROM system image and prompt you with the system configuration dialog as follows:

```
--- System Configuration Dialog ---
```

Step 8   Enter **no** in response to the system configuration dialog prompts until the following system message is displayed:

```
Press RETURN to get started!
```

Step 9   Press **Return**. After some interface information, the boot ROM prompt appears as follows:

```
Router>
```

Step 10   Enter the **enable** command to enter the EXEC mode in the boot ROM image. The prompt changes to the following:

```
Router#
```

Step 11   Enter the **show configuration** EXEC command to display the enable password in the configuration file and to display any **boot system** commands.

Step 12   Enter the **configure terminal** command at the EXEC prompt. You are prompted as follows:

```
Router# conf term
Enter configuration commands, one per line. End with CTRL/Z.
```

Step 13   Enter **no** in response to any **boot system** command in the configuration file.

Step 14   Using the **config-register** 0x<*value*> command, change the configuration register value back to its original value (noted from Step 3) or change it to a value of 0x0101 (factory default).

Step 15   Exit configuration mode by entering **Ctrl-Z**.

Step 16   Reboot the router and enable it using the recovered password.

Saving and Retrieving the Configuration File

This section describes the procedures for saving and retrieving the system configuration using a Trivial File Transfer Protocol (TFTP) server.

The procedures for saving and retrieving the configuration file might be required for the following scenarios:

- Upgrading the Cisco 7000 to operate with the 7000 Series Route Switch Processor (RSP7000), which requires you to remove the RP (and SP or SSP) and replace them with the RSP7000 and 7000 Series Chassis Interface (RSP7000CI). Removing the RP effectively removes the configuration file that is stored in the RP's NVRAM, making it necessary to first save the configuration file to a TFTP server. In addition, you cannot read the RP's Flash card with the RSP7000. This requires that you use a TFTP server to save and retrieve the file.

- Replacing a failed RP (or RSP7000), which requires you to remove the RP (or RSP7000) and install a new processor module. Removing the RP (or RSP7000) effectively removes the configuration file that is stored in NVRAM, making it necessary to first save the configuration file to a TFTP server. You can also use the procedures for copying files between NVRAM and a Flash memory card.

- Troubleshooting a configuration problem, which occasionally requires you temporarily store your configuration file in a safe place, while you test different configuration options to solve a system problem.

Configuration information resides in two places when the router is operating: the default (permanent) configuration in NVRAM, and the running (temporary) memory in RAM. The default configuration always remains available; NVRAM retains the information even when the power is shut down. The current information is lost if the system power is shut down. The current configuration contains all nondefault configuration information that you added with the **configure** command, the **setup** command facility, or by editing the configuration file.

The **copy running-config startup-config** command adds the current configuration to the default configuration in NVRAM, so that it will also be saved when power is shut down. Whenever you make changes to the system configuration, issue the **copy running-config startup-config** command to ensure that the new configuration is saved.

You also replace the entire configuration in NVRAM. If you copy the configuration file to a remote server before removing the RP (or RSP7000), you can retrieve it later and write it back into NVRAM. If you do not copy the configuration file, you will have to use the **configure** command or the **setup** command facility to reenter the configuration information after you install the RP (or RSP7000). This procedure requires privileged-level access to the EXEC command interpreter, which usually requires a password. Refer to the description that follows and contact your system administrator to obtain access, if necessary.

Using the EXEC Command Interpreter

Before you use the **configure** command, you must enter the privileged level of the EXEC command interpreter using the **enable** command. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, enter the privileged level as follows:

Step 1 At the EXEC prompt (>), enter the **enable** command. The EXEC command interpreter prompts you for a privileged-level password, as follows:

```
Router> enable

Password:
```

Step 2 Enter the password (the password is case sensitive). For security purposes, the password is not displayed.

Step 3 When you enter the correct password, the system displays the privileged-level system prompt (#) as follows:

```
Router#
```

The pound sign (#) at the system prompt indicates that you are at the privileged level of the EXEC command interpreter; you can now execute the EXEC-level commands that are described in the following sections.

Using the ping Command to Verify Server Connectivity

Before you attempt to copy or retrieve a file from a remote host, ensure that the connection is good between the router and the remote server, by using the packet internet groper (ping) program. The ping program sends a series of echo request packets to the remote device and waits for a reply. If the connection is good, the remote device echoes them back to the local device.

The console terminal displays the results of each message sent: an exclamation point (!) indicates that the local device received an echo, and a period (.) indicates that the server timed out while awaiting the reply. If the connection between the two devices is good, the system displays a series of exclamation points (! ! !) or [ok]. If the connection fails, the system displays a series of periods (. . .) or [timed out] or [failed].

To verify the connection between the router and a remote host, issue the **ping** command followed by the name or Internet Protocol (IP) address of the remote server; then press **Return**. Although the **ping** command supports configurable options, the defaults, including interface processor as the protocol, are enabled when you enter a host name or address on the same line as the **ping** command. For a description of the configurable options, refer to the appropriate software documentation.

The following example shows a successful **ping** operation:

```
Router# ping 1.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/12/12 ms
Router#
```

The following example shows the results of a failed **ping** operation:

```
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
Router#
```

If the connection fails, check the physical connection to the remote file server and verify that you are using the correct address or name, then ping the server again. If you are unable to establish a good connection, contact your network administrator or refer to the end of this document for instructions on contacting technical assistance.

Copying the Configuration File

Before you copy the running configuration to the TFTP file server, ensure the following:

- You have a connection to the router either with a console terminal connected to the RP (or RSP7000) console port, or remotely through a Telnet session.

- The router is connected to a network supporting a file server (remote host).

- The remote host supports the TFTP application.

- You have the interface processor address or name of the remote host available.

To store information on a remote host, enter the **copy startup-config tftp** privileged EXEC command. The command prompts you for the destination host's address and a filename, then display the instructions for confirmation. When you confirm the instructions, the router sends a copy of the currently running configuration to the remote host. The system default is to store the configuration in a file called by the name of the router with -*confg* appended. You can either accept the default filename by pressing **Return** at the prompt, or enter a different name before pressing **Return**.

Follow these steps to copy the currently running configuration to a remote host:

Step 1   The system prompt should display a pound sign (#) to indicate the privileged level of the EXEC command interpreter. If it does not, follow the steps in the section "Using the EXEC Command Interpreter on page 25 to enable the privileged level.

Step 2   Use the **ping** command to check the connection between the router and the remote host. (See the previous section "Using the ping Command to Verify Server Connectivity.")

Step 3   Issue the **show running-config** (or **write term**) command to display the currently running
configuration on the terminal, and ensure that the configuration information is complete
and correct. If it is not, use the **configure** command to add or modify the existing
configuration. (Refer to the appropriate software documentation for descriptions of the
configuration options available for the system and individual interfaces, and for specific
configuration instructions.)

Step 4   Issue the **copy startup-config tftp** command. The EXEC command interpreter prompts
you for the name or interface processor address of the remote host that is to receive the
configuration file. (The prompt might include the name or address of a default file server.)

```
Router# copy startup-config tftp
Remote host []?
```

Step 5   Enter the name or interface processor address of the remote host. In the following example,
the name of the remote server is *servername*:

```
Router# copy startup-config tftp
Remote host []? servername
Translating "servername"...domain server (1.1.1.1) [OK]
```

Step 6   The EXEC command interpreter prompts you for the name of the file that will contain the
configuration. By default, the system appends *-confg* to the router's name to create the new
filename. Press **Return** to accept the default filename, or enter a different name for the file
before pressing **Return**. In the following example, the default is accepted:

```
Name of configuration file to write [Router-confg]?
Write file Router-confg on host 1.1.1.1? [confirm]
Writing Router-confg .....
```

Step 7   Before the router executes the copy process, it displays the instructions you entered for
confirmation. If the instructions are not correct, enter **n** (no) then **Return** to abort the
process. To accept the instructions, press **Return**, or **y** and then **Return**, and the system
begins the copy process. In the following example, the default is accepted:

```
Write file Router-confg on host 1.1.1.1? [confirm]
Writing Router-confg: !!!! [ok]
```

While the router copies the configuration to the remote host, it displays a series of
exclamation points (! ! !) or periods (. . .). The !!!! and [ok] indicate that the operation is
successful. A display of . . . [timed out] or [failed] indicates a failure, which would probably
be due to a network fault or the lack of a writable, readable file on the remote file server.

Step 8   If the display indicates that the process was successful (with the series of ! ! ! and [ok]), the
copy process is complete. The configuration is safely stored in the temporary file on the
remote file server.

If the display indicates that the process failed (with the series of . . . as shown in the
following example):

```
Writing Router-confg .....
```

your configuration was not saved. Repeat the preceding steps, or select a different remote
file server and repeat the preceding steps.

If you are unable to copy the configuration to a remote host successfully, contact your network
administrator or refer to the end of this document for instructions on contacting technical assistance.

Retrieving the Configuration File

After you reinstall the RP (or RSP7000), you can retrieve the saved configuration and copy it back to NVRAM. To retrieve the configuration, enter configuration mode and specify that you will configure the router from the network. The system prompts you for a host name and address, the name of the configuration file stored on the host, and confirmation to reboot using the remote file.

You can access the router through a console terminal attached directly to the RP (or RSP7000) console port, or you can configure an interface port and Telnet to the router from a remote terminal.

Follow these steps to retrieve the currently running configuration from a remote host:

Step 1   On the console terminal, the system prompt should display a pound sign (#) to indicate the privileged level of the EXEC command interpreter. If it does not, follow the steps in the section "Using the EXEC Command Interpreter on page 25 to enable the privileged level.

Note   Until you retrieve the previous configuration, the router will be running from the default configuration in NVRAM. Therefore, any passwords that were configured on the previous system will not be valid until you retrieve the configuration.

Step 2   Use the **ping** command to verify the connection between the router and the remote host. (See the section "Using the ping Command to Verify Server Connectivity on page 25 .)

Step 3   At the system prompt, issue the **copy tftp startup-config** command and press **Return** to enter the configuration mode and specify that you will configure the system from a network device (instead of from the console terminal, which is the default).

```
Router# copy tftp startup-config
```

Step 4   The system prompts you to select a host or network configuration file. The default is host; press **Return** to accept the default.

```
Host or network configuration file [host]?
```

Step 5   The system prompts you for the interface processor address of the host. Enter the interface processor address or name of the remote host (the remote file server to which you copied the configuration file.

```
IP address of remote host [255.255.255.255]? 1.1.1.1
```

Step 6   The system prompts you for the name of the configuration file. When copying the file, the default is to use the name of the router with the suffix *-confg* (*router-confg* in the following example). If you specified a different filename when you copied the configuration, enter the filename; otherwise, press **Return** to accept the default.

```
Name of configuration file [router-confg]?
```

Step 7   Before the system reboots with the new configuration, it displays the instructions you entered for confirmation. If the instructions are not correct, enter **n** (no), and then press **Return** to cancel the process. To accept the instructions, press **Return**, or **y**, and then **Return**.

```
Configure using router-confg from 1.1.1.1? [confirm]
Booting router-confg from 1.1.1.1: ! ! [OK - 874/16000 bytes]
```

While the router retrieves and boots from the configuration on the remote host, the console display indicates whether or not the operation was successful. A series of !!!! and [OK] (as shown in the preceding example) indicates that the operation was successful. A series of . . .

and [timed out] or [failed] indicate a failure (which would probably be due to a network fault or an incorrect server name, address, or filename). The following is an example of a failed attempt to boot from a remote server:

```
Booting Router-confg ..... [timed out]
```

Step 8 If the display indicates that the process was successful, proceed to the next step.

If the display indicates that the process failed, verify the name or address of the remote server and the filename, and repeat the preceding steps. If you are unable to retrieve the configuration, contact your network administrator or refer to the end of this document for instructions on contacting technical assistance.

Step 9 Issue the **copy startup-config tftp** command to display the currently running configuration on the terminal. Review the display and ensure that the configuration information is complete and correct. If it is not, verify the filename and repeat the preceding steps to retrieve the correct file, or use the **configure** command to add or modify the existing configuration. (Refer to the appropriate software documentation for descriptions of the configuration options available for the system and individual interfaces and specific configuration instructions.).

Step 10 When you have verified that the currently running configuration is correct, issue the **copy running-config startup-config** command to save the retrieved configuration in NVRAM. Otherwise, the new configuration will be lost if you restart the system.

This completes the procedure for retrieving the configuration file.

Copying Files Between NVRAM and a Flash Memory Card

Copying a configuration file to a Flash memory card in the PCMCIA slot might be required if you do not have access to a TFTP server on which you can temporarily store your configuration file. You can then copy the configuration file back to NVRAM as required. Use the following sections to first copy the configuration file to a Flash memory card, and then to copy the configuration from the Flash memory card back to NVRAM.

Copying a Configuration File from NVRAM to a Flash Memory Card

Following is the procedure for copying your configuration file in NVRAM, to a Flash memory card. You can use the command **copy startup-config** [**slot0** | **slot1**]:*filename* for the copy procedure where s**tartup-config** is the file's source (NVRAM) and [**slot0** | **slot1**]:*filename* is the file's destination, in either of the Flash memory cards. However, the environmental variable CONFIG_FILE must be pointing (set) to NVRAM, which is the system default.

Use the **show boot** command to display the current setting for the environmental variable CONFIG_FILE as follows:

```
Router# show boot
(display text omitted)

CONFIG_FILE variable =
Current CONFIG_FILE variable =

(display text omitted)
```

Note The preceding example shows that the environmental variable CONFIG_FILE is set for NVRAM, by default.

An example of the **copy startup-config slot0:**_filename_ command follows:

```
Router# copy startup-config:myfile1 slot0:myfile1
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet1/0): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!![OK - 7799951/15599616 bytes]
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Router#
```

Note   In the preceding example, the exclamation points (!!!) appear as the file is copied. The "C" characters signify calculation of the checksum, which is a verification that the file has been correctly copied.

Copying a Configuration File from a Flash Memory Card to NVRAM

Following is the procedure for copying your configuration file from the Flash memory card in the PCMCIA slot, back to NVRAM. Use the command **copy** [**slot0** | **slot1**]:_filename_ **startup-config** for this copy procedure, where [**slot0** | **slot1**]:_filename_ is the source of the file (Flash memory card) and s**tartup-config** is the destination (NVRAM).

An example of the **copy slot0:**_filename_ **startup-config** command follows:

```
Router# copy slot0:myfile1 startup-config
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet1/0): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!![OK - 7799951/15599616 bytes]
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Router#
```

Note   In the preceding example, the exclamation points (!!!) appear as the file is copied. The "C" characters signify calculation of the checksum, which is a verification that the file has been correctly copied.

Replacing System Software EPROMs

This section describes the procedure for upgrading the system software by replacing the eight erasable programmable read-only memory (EPROM) components on the RP and, if necessary, changing the positions of the jumpers on J3 and J4. (The components actually are EPROMs; however they are commonly known as the _software_ or _boot ROMs_.) Although most system software

maintenance releases for the Cisco 7000 series are distributed on floppy disk instead of on replacement EPROMs, some releases may require ROM replacement. System software images also can be netbooted.

The system software resides on a set of eight EPROMs on the RP. The EPROMs are labeled with a ROM number that corresponds to the RP EPROM socket in which it should be installed. The sockets have labels too, although obscure, on the silk-screen portion of the RP board. Each EPROM has a notch cut on one end to indicate proper orientation. It should be placed so that its notch faces the same direction as the notch in the EPROM socket. Do not rely on the orientation of the EPROM labels to indicate the correct position of the EPROMs on the board. Figure 5-7 shows the location and socket numbers of the EPROMs on the RP.

The jumpers on J3 and J4, which are shown in Figure 5-7, correspond to the size (capacity) of the EPROMs installed on the RP. If you replace the system software ROMs with new EPROMs of a different size (for example, if you replace 2-MB EPROMs with 4-MB EPROMs), you will also need to change the jumper settings on J3 or J4.

Figure 5-7 shows the orientation of J3 and J4 on the RP when set for 2 MB, the factory default. Figure 5-8 shows the jumper settings for each EPROM size with the jumpers oriented as in Figure 5-7. For example, if you are installing a new image that resides on 4-MB EPROMs, you will need to move the jumper on J3 from the upper two posts to the lower two posts. This is not required if you upgrade by downloading a new software image into Flash memory; it is only necessary when you physically replace the EPROMs.

Follow these steps to upgrade the EPROMs in the RP:

Step 1 Disconnect any devices connected to the RP console and auxiliary ports.

Step 2 Turn OFF the system power.

Step 3 Follow the steps in the section "Removing CxBus Interface Processors" to remove the RP from the slot and place it on an antistatic mat or foam pad.

Step 4 On the RP, locate the eight system software EPROMs. (See Figure 5-7.) The label on each installed EPROM indicates the EPROM number (1 through 8), as shown in Figure 5-7. Note the orientation of the notches on the end of each EPROM to aid in inserting the new ones. Do not rely on the orientation of the labels on the new EPROM for correct positioning.

Caution The correct placement of the EPROM is crucial. If improperly positioned, the EPROM could be damaged when the system is powered on. Also, to prevent damage to the board or any of the components from electrostatic discharge, be sure to follow the ESD procedures described in "Preventing Electrostatic Discharge Damage" in the chapter "Preparing for Installation."

Figure 5-7 **System Software EPROM Sockets and Jumpers J3 and J4**
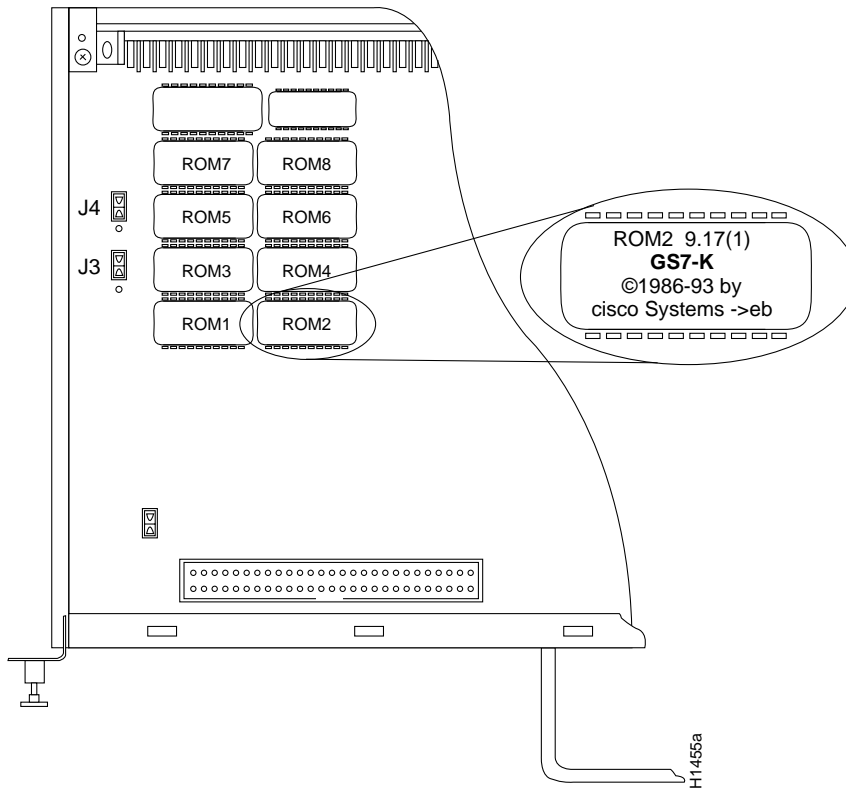
Figure 5-8 **Jumper Settings for Software EPROM Sizes**

Jumper	EPROM Types	27010	27020	27040	27080
	Memory	1 Mb	2 Mb	4 Mb	8 Mb
J4		1	1	1	1
J3		1	1	1	1

Step 5 Use a chip extractor to remove the first EPROM from its socket. If you do not have a chip extractor available, use the tip of a screwdriver blade to gently pry the EPROM out of its socket.

Step 6 Install the new EPROM in the same numbered socket as old EPROM you just removed. Observe the correct notch orientation for the new EPROM.

Step 7 Repeat Steps 5 and 6 until all new EPROMs are installed. Be careful not to bend or break any of the pins. Use needlenose pliers to straighten a bent pin. If a pin breaks, you must obtain a replacement.

Step 8 If you installed ROMs of a different capacity than those that were previously installed, check Figure 5-8 and reset jumpers J3 or J4 if necessary (notification of a new ROM size will be included with the replacement EPROMs if applicable).

Step 9 Follow the Steps in the section "Installing CxBus Interface Processors" to reinstall the RP. Be sure to use the ejector levers to install the RP, then tighten the top and bottom captive installation screws.

Step 10 Reconnect any console or auxiliary port cables to the connectors on the RP.

Step 11 Turn ON the system for an installation check, which is described in "Starting the Router" in the chapter "Installing the Router."

Note If you power up a system when one or more of the EPROMs is incorrectly inserted, the system may print a message on the console port reporting a checksum error. If this happens, locate the EPROM that might be incorrectly inserted, remove it, straighten pins as required, then reinsert the EPROM and restart the system. If an EPROM is inserted backwards and power is turned ON, the EPROM is damaged and requires replacement.

Replacing RP SIMMs (Upgrading DRAM)

The system DRAM resides on four single inline memory modules (SIMMs) on the RP. The default DRAM configuration is 16 MB (four 4 MB x 9 SIMMs). This section provides the steps for increasing the amount of DRAM from 16 MB to 64 MB by replacing the four 4 MB SIMMs with four 16 MB SIMMs that you obtain from an approved vendor. Some (earlier) RPs do not support 16 MB SIMMs; before upgrading, use the prerequisites in the following section to ensure that your RP will support the larger SIMMs. You must use SIMMs that you obtain from an approved vendor; otherwise, Cisco Systems cannot ensure proper operation.

Compatibility Requirements

Before replacing SIMMs to increase the amount of DRAM available in your system, ensure that your RP supports 16 MB SIMMs and that you obtain the replacement SIMMs from an approved vendor.

Only RPs that meet the following prerequisites support the larger (16 MB) SIMMs:

- If your system contains Software Release 9.17, the minimum requirements are:

  — System Software Release 9.17(8) (or a later 9.17 image) in ROM

  — System Bootstrap Version 4.6(7.3) (or a later 4.6 bootstrap version)

  — RP board revision B0 or later

- If your system contains Software Release 9.21, the minimum requirements are:

  — System Software Release 9.21(3) (or a later 9.21 image) in ROM

  — System Bootstrap Version 4.7(2.1) (or a later 4.7 bootstrap version)

  — RP board revision B0 or later

Bootstrap Version 4.6 is used exclusively with Software Release 9.17, and Bootstrap Version 4.7 is used exclusively with Software Release 9.21. The revision numbers (indicated within parentheses) for each version are revised independently of other bootstrap versions. Therefore, 4.6(7) can be a later version than 4.7(2).

Software Release 9.17(8), RP board revision B0, and System Bootstrap Version 4.6(7.3) began shipping as the default for Cisco 7000 series systems in March 1994.

RPs that shipped from the factory with Release 9.17(7) or earlier in ROM do *not* support 16 MB SIMMs. To verify that your RP supports the larger SIMMs, issue the following commands:

- Use the **show version** command to display the System Bootstrap Version.

```
7010# show version
GS Software (GS7), Version 9.17(8.1)
Copyright (c) 1986-1994 by cisco Systems, Inc.
Compiled Fri 04-Feb-94

System Bootstrap, Version 4.6(7.3)
```

  If the display indicates that the System Bootstrap Version is an earlier version of 4.6 than 4.6(7.3), or an earlier version of 4.7 than 4.7(2.1), your RP will not support 16 MB SIMMs. Contact a customer service representative for information about the RP upgrade.

- Use the **show diag** *slot* command to display current hardware and diagnostic information about the processor installed in the slot you specify. Because the RP always resides in the same (RP) slot, specify slot 4 for a Cisco 7010 chassis. The third line of the display shows the current hardware (HW) and board revisions. (Do not confuse the HW revision with the board revision; you need only verify that the *board* revision is B0 or later.)

```
7010# show diag 4

Slot 4:
        EEPROM format version 1
        Route Processor, HW rev 1.1, board revision B0
        Serial number: 00809933  Part number: 73-0877-04
```

  If the display indicates that the RP board revision is earlier than B0, your RP will not support 16 MB SIMMs. Contact a service representative for information about the RP upgrade.

- You must obtain the replacement SIMMs from an approved vendor. To ensure that you obtain the latest available product and vendor information, obtain the list from one of the following sources:

  — Customer Information Online (CIO). If you have a CIO account, you can access the list remotely.

  — Technical Assistance Center at 800 553-2447, 408 526-7209, or send an e-mail message requesting the list of approved vendors to tac@cisco.com.

  — Customer Response Center at 800 553-6387, 408 526-7208, or send an e-mail message requesting the list of approved vendors to cs-rep@cisco.com.

- Although the SIMM specifications are defined in the manufacturers' part numbers, which are included in the list of approved vendors, the SIMMs must meet the following requirements:

  — SIMMs must be obtained from an approved vendor.

  — SIMMs must be the nine-module type, 16 MB x 9.

  — Minimum speed is 70 ns.

  — Maximum height of one inch.

  All four SIMM sockets must be filled, and all must contain SIMMs of the same capacity and speed. The RP supports only 4 MB x 9 SIMMs (for a total of 16 MB) or 16 MB x 9 SIMMs (for a total of 64 MB). The RP does not support 32MB of DRAM because 8MB x 9 SIMMs are not available.

Parts and Tools

In addition to the tools you need to remove and replace the RP, you will also need the following tools and parts to replace SIMMs. If you need additional equipment, contact a service representative for ordering information.

- Four 16 MB x 9, 70 ns SIMMs from an approved vendor

- Antistatic mat or pad for the removed RP

- SIMM extraction tool manufactured by AMP, Inc. (AMP Part Number 382264-1). The toll-free phone number for AMP product information is 800 526-5142.

Removing SIMMs

Because the SIMMs on the RP are not intended to be replaced often, if at all, the SIMM sockets do not use the thumb tabs that are often used in PCs and other computer equipment. Each RP SIMM socket has two metal retaining springs, one at each end. (See Figure 5-9.)When a SIMM is fully seated in the socket, the retaining springs snap upward into the holes at the ends of the SIMM to lock it in the socket. You need the AMP extraction tool to remove the SIMMs from this type of socket. The extraction tool has an embossed tip specifically designed to depress the retaining spring while wedging the SIMM out of the socket.

Figure 5-9   RP SIMM Sockets
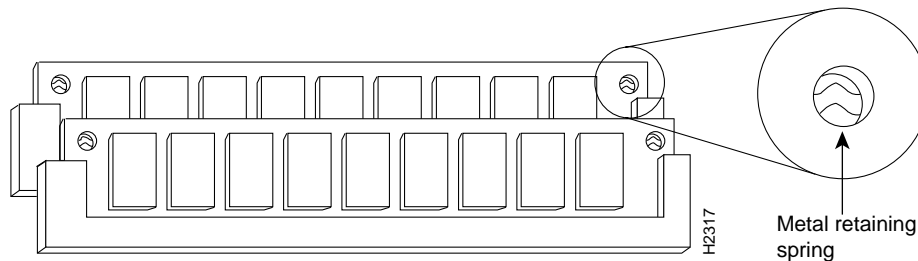
Metal retaining spring

Caution   Handle SIMMs by the card edges only. SIMMs are sensitive components that can be shorted by mishandling. All four SIMM sockets must be filled, and all must contain SIMMs of the same size (capacity) and speed. You cannot mix SIMMs of different sizes or speeds in the four sockets.

Follow these steps to remove the existing 4 MB SIMMs:

Step 1   Turn OFF the system power and disconnect any devices connected to the RP console and auxiliary ports.

Step 2   Follow the steps in the section "Removing CxBus Interface Processors" to remove the RP from the slot and place it on an antistatic mat or foam pad.

Step 3   Place the RP on an antistatic mat or pad, and ensure that you are wearing an antistatic device, such as a wriststrap. Position the RP so that the backplane edge is closest to you, and the handle is away from you. The RP should be rotated 180 degrees from the orientation shown in Figure 5-7.

Step 4   Locate SIMMs in sockets U35, U36, U58, and U59. You will remove the SIMM from the socket closest to you first, then work backward to remove the remaining SIMMs.

Step 5 While holding the extraction tool at the handle (at the top of the *T*), insert the embossed tip into the hole in the right side of the SIMM. (See Figure 5-10a.)

Figure 5-10   Using the SIMM Extraction Tool

Insert extraction
tool into SIMM
socket and depress
retaining spring

Orient tool
as shown

Orient tool
as shown

H2318
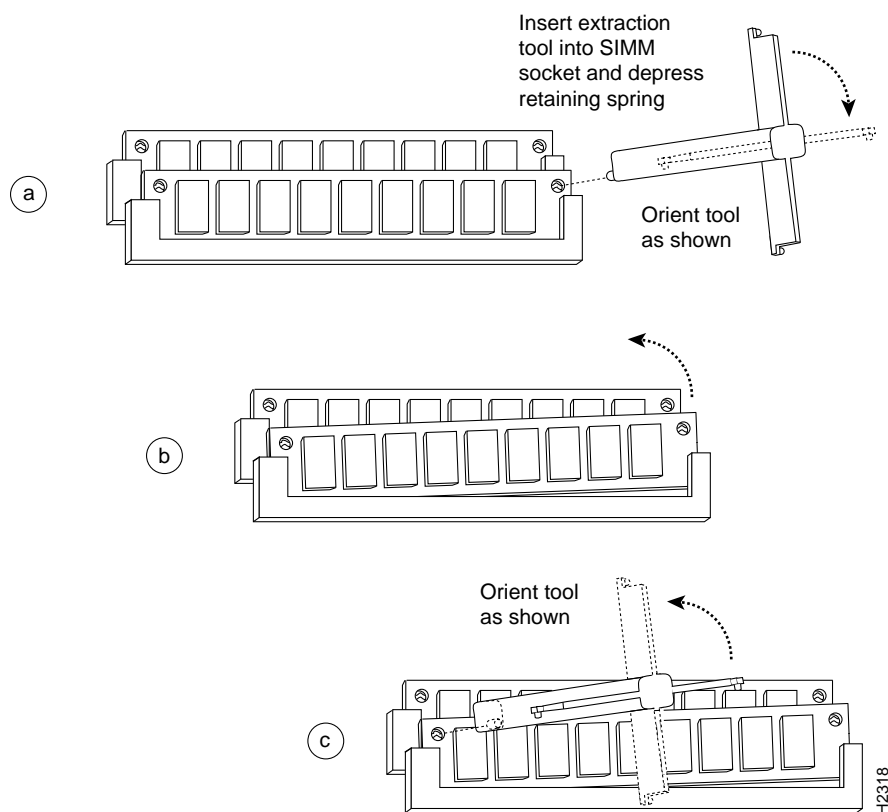
Step 6 While pressing the tool downward (to keep the retainer spring depressed), rotate the tool clockwise until the right side of the SIMM is partially released from the socket. (See Figure 5-10b.)

Step 7 Remove the tool from the right side, and insert the embossed tip into the hole in the left side of the same SIMM.

Step 8 While pressing the tool downward, rotate the tool counterclockwise until the left side of the SIMM is released from the socket. (See Figure 5-10c.)

Step 9 When both ends of the SIMM are released from the socket, grasp the ends of the SIMM with your thumb and forefinger and pull the SIMM completely out of the socket. Handle the edges of the SIMM only; avoid touching the memory module or pins, and the metal traces or fingers along the socket edge.

Step 10 Place the SIMM in an antistatic bag to protect it from ESD damage.

Step 11 Repeat Steps 4 through 10 for the remaining SIMMs.

This completes the SIMM removal procedure. Proceed to the next section to install the new SIMMs.

Installing New SIMMs

SIMMs are sensitive components that are susceptible to ESD damage. Handle SIMMs by the edges only; avoid touching the memory modules, pins, or traces (the metal *fingers* along the connector edge of the SIMM). (See Figure 5-11.)

Figure 5-11   Handling a SIMM
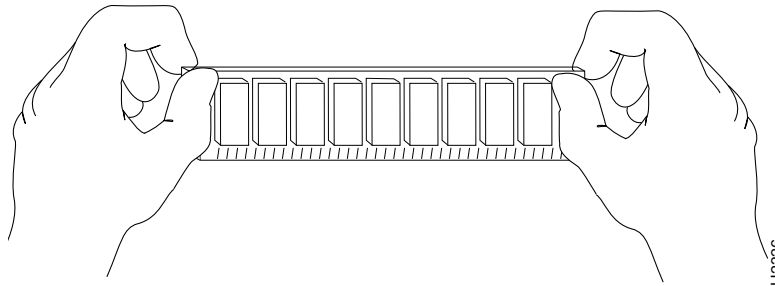
Caution   Handle SIMMs by the card edges only. SIMMs are sensitive components that can be shorted by mishandling.

Follow these steps to install the new SIMMs:

Step 1   With the RP in the same orientation as the previous procedure (with the backplane edge closest to you), install the first SIMM in the socket farthest from you. Then work from front to back, and install the last SIMM in the socket closest to you.

Step 2   Remove a new SIMM from the antistatic bag.

Step 3   Hold the SIMM component side up, with the connector edge (the metal *fingers*) closest to you.

Step 4   Hold the sides of the SIMM between your thumb and middle finger, with your forefinger against the far edge, opposite the connector edge. (See Figure 5-11.)

Step 5   Tilt the SIMM to approximately the same angle as the socket and insert the entire connector edge into the socket.

Caution   When inserting SIMMs, use firm but not excessive pressure. If you damage a socket, you will have to return the RP to the factory for repairs.

Step 6   Gently push the SIMM into the socket until the retaining springs snap into the holes in the SIMM. If necessary, rock the SIMM gently back and forth to seat the SIMM properly.

Step 7   Repeat Steps 2 through 6 for the remaining SIMMs.

Step 8   When all four SIMMs are installed, check all eight alignment holes (two on each SIMM), and ensure that the spring retainer is visible. If it is not, the SIMM is not seated properly. If any SIMM appears misaligned, carefully remove it and reseat it in the socket. Push the SIMM firmly back into the socket until the retainer springs snap into place.

Step 9 Follow the steps in the section "Installing CxBus Interface Processors" to reinstall the RP. Be sure to use the ejector levers to install the RP, then tighten the top and bottom captive installation screws.

Step 10 Reconnect any console or auxiliary port cables to the connectors on the RP.

Step 11 Turn ON the system for an installation check, which is described in the section "Starting the Router" in the chapter "Installing the Router."

If the system fails to boot properly, or if the console terminal displays a checksum or memory error, check the following:

- Ensure that all four SIMMs are installed correctly. If necessary, shutdown the system and remove the RP. Check the SIMMs by looking straight down on them and then at eye level. The SIMMs should all be aligned at the same angle and the same height when properly installed. If a SIMM appears to stick out, or rest in the socket at a different angle than the others, remove the SIMM and reinsert it. Then replace the RP and reboot the system for another installation check.

- All four sockets must contain SIMMs of the same size and speed, or the system will not operate. The SIMMs should have the following characteristics:

    — SIMMs must be the 16 MB x 9 type. Each SIMM should contain nine small memory components, as shown in Figure 5-9. (The actual layout of the SIMM can be different; it is only important that there are nine components.)

    — SIMMs must be 70 ns or faster. The speed is usually silkscreened along one edge of the SIMM.

If after several attempts the system fails to restart properly, contact a service representative for assistance. Before you call, make note of any error messages, unusual LED states, or any other indications that might help solve the problem.

Note The time required for the system to initialize (boot) varies by router configuration. Routers with 64 MB of DRAM will take longer to boot than those with 16 MB of DRAM.

Replacing RSP7000 SIMMs (Upgrading DRAM)

The system DRAM resides on up to four SIMMs on the RSP7000. The DRAM SIMM sockets are U4 and U12 for bank 0, and U18 and U25 for bank 1. The default DRAM configuration is 16 MB (two 8-MB SIMMs in bank 0). (See Figure 5-12.)

Note The total number of memory devices per SIMM differs for each manufacturer. The SIMMs in the following illustrations are generic representations of the actual DRAM SIMMs for your RSP7000. To be sure that you are using the correct SIMMs, refer to the specific part or product numbers indicated in the approved vendor list (AVL) and by your DRAM upgrade requirements.

This section describes the steps for increasing the amount of DRAM by replacing up to four SIMMs that you obtain from an approved vendor.

Figure 5-12   RSP7000 DRAM SIMMs
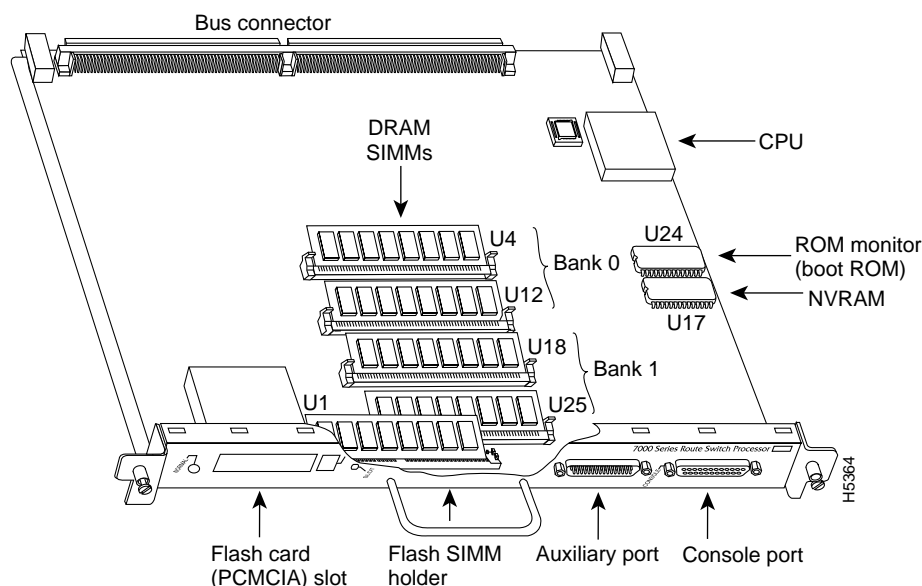
The SIMM sockets use the thumb tabs that are often used in PCs and other computer equipment. Each RSP7000 SIMM socket has two metal retaining springs, one at each end. (See Figure 5-13.) When a SIMM is fully seated in the socket, the retaining springs snap over the ends of the SIMM to lock it in the socket.

Before proceeding, ensure that you have the proper tools and ESD-prevention equipment available. To upgrade DRAM, you install SIMMs in one or two banks. Table 5-9 lists the various configurations of DRAM SIMMs that are available. Note which banks are used given the combinations of available SIMM sizes and the maximum DRAM you require. SIMMs must be 60 ns or faster and no taller than one inch.

Note   Depending on your router configuration, Cisco IOS Release 11.1(1) might require more than 16 MB of DRAM for your RSP7000. Upgrade your system DRAM based on your current configuration and this potential requirement.

Table 5-9   RSP7000 DRAM SIMM Configurations

DRAM Bank 0	Quantity	DRAM Bank 1	Quantity	Total DRAM	Product Names
U4 and U12	2 8-MB SIMMs	U18 and U25	–	16 MB	MEM-RSP-16M
U4 and U12	2 8-MB SIMMs	U18 and U25	2 4-MB SIMMs	24 MB[1]	MEM-RSP-24M
U4 and U12	2 16-MB SIMMs	U18 and U25	–	32 MB	MEM-RSP-32M(=)
U4 and U12	2 32-MB SIMMs	U18 and U25	–	64 MB	MEM-RSP-64M(=)
U4 and U12	2 32-MB SIMMs	U18 and U25	2 32-MB SIMMs	128 MB	MEM-RSP-128M(=)

1. The 24-MB DRAM configuration is also available as an 8-MB upgrade to the standard 16-MB configuration, by adding DRAM-Product Number MEM-RSP-8M= (consisting of two, 4-MB DRAM SIMMs), for a total of 24 MB.

⚠ **Caution** To prevent DRAM errors, each DRAM bank used must contain no less than two SIMMs of the same type. You must install either two SIMMs in bank 0 or four SIMMs in two banks.

Removing SIMMs

Place removed SIMMs on an antistatic mat and store them in an antistatic bag. You can use the SIMMs that you remove in compatible equipment.

⚠ **Caution** To prevent ESD damage, handle SIMMs by the card edges only.

Follow these steps to remove the existing SIMMs:

Step 1 Turn OFF the system power and follow the steps in the section "Removing and Replacing the RP, SP or SSP, RSP7000, or RSP7000CI." Note that the RSP7000 does not support OIR.

Step 2 Place the RSP7000 on an antistatic mat or pad, and ensure that you are wearing an antistatic device, such as a wrist strap. Position the RSP7000 so that the handle is away from you, and the edge connector is toward you; opposite of the position shown in Figure 5-12.

Step 3 Locate SIMMs. The DRAM SIMMs occupy U4 and U12 in bank 0, and U18 and U25 in bank 1. (See Figure 5-12.)

Step 4 Release the spring clips from the SIMM that you wish to remove and release the SIMM from the socket. (See Figure 5-13.)

Figure 5-13   Releasing the SIMM Spring Clips

Pull the tabs away with your thumbs, bracing your forefingers against the posts. Raise the SIMM to a vertical position.

Faceplate edge of the system card

Polarization notch

DRAM SIMM

Step 5   When both ends of the SIMM are released from the socket, grasp the ends of the SIMM with your thumb and forefinger and pull the SIMM completely out of the socket. Handle the edges of the SIMM only; avoid touching the memory module or pins, and the metal traces, or *fingers*, along the socket edge.

Step 6   Place the SIMM in an antistatic bag to protect it from ESD damage.

Step 7   Repeat Steps 4 through 6 for the remaining SIMMs, as required for your upgrade.

This completes the SIMM removal procedure. Proceed to the next section to install the new SIMMs.

Installing New SIMMs

SIMMs are sensitive components that are susceptible to ESD damage. Handle SIMMs by the edges only; avoid touching the memory modules, pins, or traces (the metal fingers along the connector edge of the SIMM).(See Figure 5-14.)

Figure 5-14   Handling a SIMM

H2326

> ⚠️ **Caution** Handle SIMMs by the card edges only. SIMMs are sensitive components that can be shorted by mishandling.

Follow these steps to install the new SIMMs:

Step 1 With the RSP7000 in the same orientation as the previous procedure (with the handle away from you and the edge connector toward you), install the first SIMM in the socket farthest from you. Then install the last SIMM in the socket closest to you.

Step 2 Remove a new SIMM from the antistatic bag.

Step 3 Hold the SIMM component side up, with the connector edge (the metal fingers) closest to you.

Step 4 Hold the sides of the SIMM between your thumb and middle finger, with your forefinger against the far edge, opposite the connector edge. (See Figure 5-14.)

Step 5 Tilt the SIMM to approximately the same an angle as the socket and insert the entire the connector edge into the socket.

> ⚠️ **Caution** When inserting SIMMs, use firm but not excessive pressure. If you damage a socket, you will have to return the RSP7000 to the factory for repair.

Step 6 Gently push the SIMM into the socket until the spring clips snap over the ends of the SIMM. If necessary, rock the SIMM gently back and forth to seat it properly.

Step 7 Repeat Steps 2 through 6 for the remaining SIMMs.

Step 8 When all SIMMs are installed, check all alignment holes (two on each SIMM), and ensure that the spring retainer is visible. If it is not, the SIMM is not seated properly. If any SIMM appears misaligned, carefully remove it and reseat it in the socket. Push the SIMM firmly back into the socket until the retainer springs snap into place.

This completes the SIMM replacement procedure.

Proceed to the section "Removing and Replacing the RP, SP or SSP, RSP7000, or RSP7000CI" to replace the RSP7000 in the chassis and restart the system for an installation check. Note that the RSP7000 does not support OIR

If the system fails to boot properly, or if the console terminal displays a checksum or memory error, check the following:

- Ensure that all SIMMs are installed correctly. If necessary, shut down the system and remove the RSP7000. Check the SIMMs by looking straight down on them and then inspecting them at eye level. The SIMMs should all be aligned at the same angle and the same height when properly installed. If a SIMM appears to stick out or rest in the socket at a different angle from the others, remove the SIMM and reinsert it. Then replace the RSP7000 and reboot the system for another installation check.

- Each DRAM SIMM bank must contain SIMMs of the same size and speed or the system will not operate. SIMMs must be 60 ns or faster. The speed is printed along one edge of the SIMM.

If after several attempts the system fails to restart properly, contact a service representative for assistance. Before you call, make note of any error messages, unusual LED states, or any other indications that might help solve the problem.

Note   The time required for the system to initialize varies with different router configurations. Routers with 128 MB of DRAM will take longer to boot than those with 16 MB of DRAM.

Replacing RSP7000 DRAM SIMMs

The system DRAM resides on up to four SIMMs on the RSP7000. The DRAM SIMM sockets are U4 and U12 for bank 0, and U18 and U25 for Bank 1. The default DRAM configuration is 16 MB (two 8-MB SIMMs in bank 0). (See Figure 5-15.)

Note   The total number of memory devices per SIMM differs for each manufacturer. The SIMMs in the following illustrations are generic representations of the actual DRAM SIMMs for your RSP7000. To be sure that you are using the correct SIMMs, refer to the specific part or product numbers indicated in the approved vendor list (AVL) and by your DRAM upgrade requirements.

This section describes the steps for increasing the amount of DRAM by replacing up to four SIMMs that you obtain from an approved vendor.

Figure 5-15   RSP7000 DRAM SIMMs
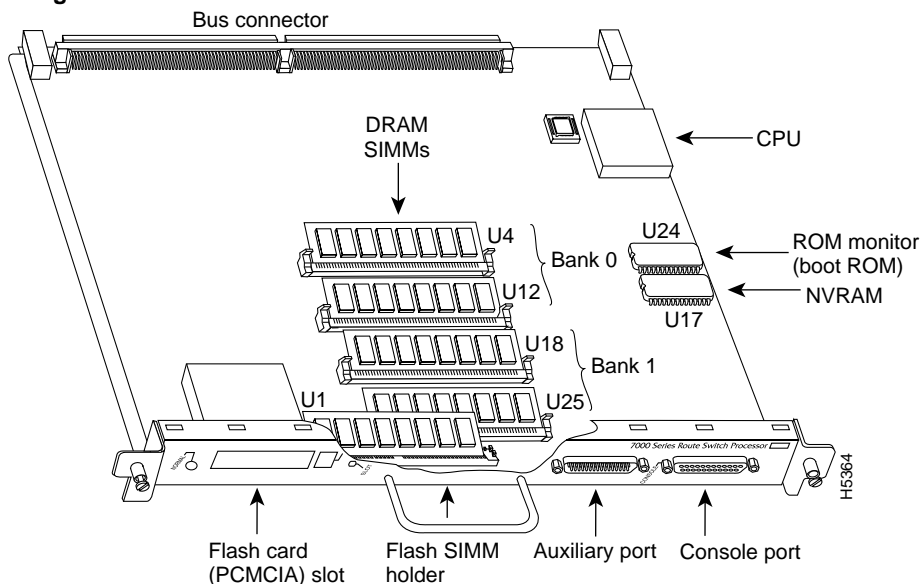
The SIMM sockets use the thumb tabs that are often used in PCs and other computer equipment. Each RSP7000 SIMM socket has two metal retaining springs, one at each end. (See Figure 5-16.) When a SIMM is fully seated in the socket, the retaining springs snap over the ends of the SIMM to lock it in the socket.

Before proceeding, ensure that you have the proper tools and ESD-prevention equipment available. To upgrade DRAM, you install SIMMs in one or two banks. Table 5-10 lists the various configurations of DRAM SIMMs that are available. Note which banks are used given the combinations of available SIMM sizes and the maximum DRAM you require. SIMMs must be 60 ns or faster and no taller than one inch.

> **Note** Depending on your router configuration, Cisco IOS Release 11.1(1) might require more than 16 MB of DRAM for your RSP7000. Upgrade your system DRAM based on your current configuration and this potential requirement.

Table 5-10   DRAM SIMM Configurations

DRAM Bank 0	Quantity	DRAM Bank 1	Quantity	Total DRAM	Product Names
U4 and U12	2 8-MB SIMMs	U18 and U25	–	16 MB	MEM-RSP-16M
U4 and U12	2 8-MB SIMMs	U18 and U25	2 4-MB SIMMs	24 MB[1]	MEM-RSP-24M
U4 and U12	2 16-MB SIMMs	U18 and U25	–	32 MB	MEM-RSP-32M(=)
U4 and U12	2 32-MB SIMMs	U18 and U25	–	64 MB	MEM-RSP-64M(=)
U4 and U12	2 32-MB SIMMs	U18 and U25	2 32-MB SIMMs	128 MB	MEM-RSP-128M(=)

1. The 24-MB DRAM configuration is also available as an 8-MB upgrade to the standard 16-MB configuration, by adding DRAM-Product Number MEM-RSP-8M= (consisting of two, 4-MB DRAM SIMMs), for a total of 24 MB.

> **Caution** To prevent DRAM errors, each DRAM bank used must contain no less than two SIMMs of the same type. You must install either two SIMMs in bank 0 or four SIMMs in two banks.

Removing SIMMs

Place removed SIMMs on an antistatic mat and store them in an antistatic bag. You can use the SIMMs that you remove in compatible equipment.

> **Caution** To prevent ESD damage, handle SIMMs by the card edges only.

Follow these steps to remove the existing SIMMs:

Step 1   Turn OFF the system power and follow the steps in the section "Removing and Replacing the RP, SP or SSP, RSP7000, or RSP7000CI." Note that the RSP7000 does not support OIR.

Step 2   Place the RSP7000 on an antistatic mat or pad, and ensure that you are wearing an antistatic device, such as a wrist strap. Position the RSP7000 so that the handle is away from you, and the edge connector is toward you, opposite of the position shown in Figure 5-15.

Step 3   Locate SIMMs. The DRAM SIMMs occupy U4 and U12 in bank 0, and U18 and U25 in bank 1. (See Figure 5-15.)

Step 4   Release the spring clips from the SIMM that you want to remove and release the SIMM from the socket. (See Figure 5-16.)

Figure 5-16   Releasing the SIMM Spring Clips

Pull the tabs away with your thumbs, bracing your forefingers against the posts. Raise the SIMM to a vertical position.

Faceplate edge of the system card

Polarization notch

DRAM SIMM

H2017

Step 5   When both ends of the SIMM are released from the socket, grasp the ends of the SIMM with your thumb and forefinger and pull the SIMM completely out of the socket. Handle the edges of the SIMM only; avoid touching the memory module or pins, and the metal traces, or *fingers*, along the socket edge.

Step 6   Place the SIMM in an antistatic bag to protect it from ESD damage.

Step 7   Repeat Steps 4 through 6 for the remaining SIMMs, as required for your upgrade.

This completes the SIMM removal procedure. Proceed to the next section to install the new SIMMs.

Installing New SIMMs

SIMMs are sensitive components that are susceptible to ESD damage. Handle SIMMs by the edges only; avoid touching the memory modules, pins, or traces (the metal fingers along the connector edge of the SIMM). (See Figure 5-17.)

Figure 5-17   Handling a SIMM

> ⚠ **Caution**   Handle SIMMs by the card edges only. SIMMs are sensitive components that can be shorted by mishandling.

Follow these steps to install the new SIMMs:

Step 1   With the RSP7000 in the same orientation as the previous procedure (with the handle away from you and the edge connector toward you), install the first SIMM in the socket farthest from you. Then install the last SIMM in the socket closest to you.

Step 2   Remove a new SIMM from the antistatic bag.

Step 3   Hold the SIMM component side up, with the connector edge (the metal fingers) closest to you.

Step 4   Hold the sides of the SIMM between your thumb and middle finger, with your forefinger against the far edge, opposite the connector edge. (See Figure 5-17.)

Step 5   Tilt the SIMM to approximately the same an angle as the socket and insert the entire the connector edge into the socket.

> ⚠ **Caution**   When inserting SIMMs, use firm but not excessive pressure. If you damage a socket, you will have to return the RSP7000 to the factory for repair.

Step 6   Gently push the SIMM into the socket until the spring clips snap over the ends of the SIMM. If necessary, rock the SIMM gently back and forth to seat it properly.

Step 7   Repeat Steps 2 through 6 for the remaining SIMMs.

Step 8   When all SIMMs are installed, check all alignment holes (two on each SIMM), and ensure that the spring retainer is visible. If it is not, the SIMM is not seated properly. If any SIMM appears misaligned, carefully remove it and reseat it in the socket. Push the SIMM firmly back into the socket until the retainer springs snap into place.

This completes the SIMM replacement procedure.

Proceed to the section "Removing and Replacing the RP, SP or SSP, RSP7000, or RSP7000CI" to replace the RSP7000 in the chassis and restart the system for an installation check. Note that the RSP7000 does not support OIR

If the system fails to boot properly, or if the console terminal displays a checksum or memory error, check the following:

- Ensure that all SIMMs are installed correctly. If necessary, shut down the system and remove the RSP7000. Check the SIMMs by looking straight down on them and then inspecting them at eye level. The SIMMs should all be aligned at the same angle and the same height when properly installed. If a SIMM appears to stick out or rest in the socket at a different angle from the others, remove the SIMM and reinsert it. Then replace the RSP7000 and reboot the system for another installation check.

- Each DRAM SIMM bank must contain SIMMs of the same size and speed or the system will not operate. SIMMs must be 60 ns or faster. The speed is printed along one edge of the SIMM.

If after several attempts the system fails to restart properly, contact a service representative for assistance. Before you call, make note of any error messages, unusual LED states, or any other indications that might help solve the problem.

Note The time required for the system to initialize varies with different router configurations. Routers with 128 MB of DRAM will take longer to boot than those with 16 MB of DRAM.

FSIP Configurations

The FSIP supports EIA/TIA232, EIA/TIA449, V.35, and X.21 electrical interfaces in both DTE and DCE mode, and EIA-530 interfaces in DTE mode. The port adapter cable connected to each port determines the electrical interface type and mode of the port. To change the electrical interface type or mode of a port, you replace the port adapter cable and use software commands to reconfigure the port for the new interface. At system startup or restart the FSIP polls the interfaces and determines the electrical interface type of each port (according to the type of port adapter cable attached). However, it does not necessarily repoll an interface when you change the adapter cable online. To ensure that the system recognizes the new interface type, you must shutdown and reenable the interface after changing the cable. When setting up a new DCE interface or changing the mode of an interface from DTE to DCE, or when setting up a loopback test, you must also set the clock rate on the interface. If necessary, you can also use software commands to invert the clock to compensate for phase shifts caused by circuit delays or variances in cable lengths.

The default configuration for serial ports is DCE mode, NRZ format, and 16-bit CRC error detection. All serial interfaces support nonreturn to zero inverted (NRZI) format and 32-bit error detection, both of which are enabled with a software command.

Note This section contains brief descriptions and examples of software commands that you may need when installing or changing the configuration of serial interface ports. For complete command descriptions and instructions, refer to the related software documentation.

Configuring Timing (Clock) Signals

To use an FSIP port as a DCE interface, you must connect a DCE port adapter cable and set the clock speed with the **clockrate** command. You must also set the clock rate to perform a loopback test. This section describes how to use software commands to set the clock rate on a DCE port and, if necessary, how to invert the clock to correct a phase shift between the data and clock signals.

Setting the Clock Rate

All DCE interfaces require a noninverted internal transmit clock signal, which is generated by the FSIP. The default operation on an FSIP DCE interface is for the DCE device (FSIP) to generate its own clock signal (TxC) and send it to the remote DTE. The remote DTE device returns the clock signal to the DCE (FSIP port). When using DCE interfaces, you must connect a DCE-mode adapter cable to the port and specify the rate of the internal clock with the **clockrate** configuration command followed by the bits-per-second value. In the following example, the first serial interface on an FSIP in interface processor slot 2 (2/0) is defined as having a clock rate of 2 Mbps.

```
7010# configure terminal
interface serial 2/0
clockrate 2000000
^z
```

Following are acceptable clockrate settings:

1200, 2400, 4800, 9600, 19200, 38400, 56000, 64000, 72000, 125000, 148000, 500000, 800000, 1000000, 1300000, 2000000, or 4000000

Speeds above 64 kbps (64000) are not appropriate for EIA/TIA-232; use EIA/TIA-449 on faster interfaces. Note that the faster speeds might not work if your cable is too long. If you change an interface from DCE to DTE, you can use the **no clockrate** command to remove the clock rate although it is not necessary to do so. The port automatically recognizes the DTE cable and ignores the clock rate until a DCE cable is attached to the port again.

The FSIP ports support full duplex operation at DS1 (1.544 Mbps) and E1 (2.048 Mbps) speeds. Each four-port module (see the section "Fast Serial Interface Processor (FSIP)" in the chapter "Product Overview") can support an aggregate bandwidth of 6.132 Mbps.

Because each four-port module shares a processor, you can delegate bandwidth to a single port and leave the other ports idle to optimize speed and bandwidth on a single interface. For example, you can configure four T1 interfaces on a module (one T1 on each port) such that they do not exceed 6.132 Mbps, or you can configure one port to operate at up to 6.132 Mbps, and leave the remaining three ports shut down. The type of electrical interface, the amount of traffic processed, and the types of external data service units (DSUs) connected to the ports affect actual rates.

Inverting the Clock Signal

Systems that use long cables may experience high error rates when operating at the higher speeds. Slight variances in cable length, temperature, and network configuration can cause the data and clock signals to shift out of phase. Inverting the clock can often correct this shift. The **invert-transmit-clock** configuration command inverts the TxC clock signal for DCE interfaces. This prevents phase shifting of the data with respect to the clock. To change the clock back to its original phase, use the **no invert-transmit-clock** command. In the example that follows, the clock is inverted for the first serial port on an FSIP in interface processor slot 2:

```
7010# configure terminal
interface serial 2/0
invert-transmit-clock
^z
```

Configuring NRZI Format

The default for all interface types is for nonreturn to zero (NRZ) format; however, all types also support nonreturn to zero inverted (NRZI). NRZ encoding is most common. NRZI encoding is used primarily with EIA/TIA232 connections in IBM environments. To enable NRZI encoding on any

interface, specify the slot and port address of the interface followed by the command **nrzi-encoding**. In the example that follows, the first serial port on an FSIP in interface processor slot 2 is configured for NRZI encoding:

```
7010# configure terminal
interface serial 2/0
nrzi-encoding
^z
```

To disable NRZI encoding on a port, specify the slot and port address and use the **no nrzi-encoding** command.

For a brief overview of NRZ and NRZI, refer to "NRZ and NRZI Formats" in the chapter "Preparing for Installation." For complete command descriptions and instructions, refer to the related software documentation.

Configuring 32-Bit Cyclic Redundancy Check (CRC)

All interfaces (including the HIP) use a 16-bit cyclic redundancy check (CRC) by default but also support a 32-bit CRC.

Note To determine if your HIP will support a 32-bit CRC, use the **show diag** command. If the resulting display indicates Part Number 81-0050-01, Hardware Version 1.0, you *cannot* use the CRC-32 feature. If the display indicates Part Number 81-0050-02, Hardware Version 1.1, you *can* use the CRC-32 feature.

CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. Because 32-bit CRC transmits longer data streams at faster rates, it provides better ongoing error detection with less retransmits. However, both the sender and the receiver must use the same setting.

The default for all serial interfaces is for 16-bit CRC. To enable 32-bit CRC on an interface, specify the slot and port address of the interface followed by the command **crc32**. In the example that follows, the first serial port on an FSIP in interface processor slot 2 is configured for 32-bit CRC:

```
7010# configure terminal
interface serial 2/0
crc32
^z
```

To disable 32-bit mode and return to the default 16-bit setting on a specific interface, specify the slot and port address of the interface and use the **no crc32** command.

For a brief overview of CRCs, refer to the section "Cyclic Redundancy Checks (CRCs)" in the chapter "Preparing for Installation." For complete command descriptions and instructions, refer to the related software documentation.

Configuring 4-Bit Cyclic Redundancy Check

The E1-G.703/G.704 interface supports 4-bit CRC in framed mode only. CRC-4 is not enabled by default.

To enable CRC-4 on the E1-G.703/G.704 interface, specify the slot and port address of the interface followed by the command **crc4**. In the example that follows, the top port on an FSIP in interface processor slot 3 is configured for CRC:

```
Router# configure terminal
interface serial 3/0
crc4
^z
```

To disable CRC-4 and return to the default of no CRC error checking, specify the slot and port address and use the **no crc4** command. For complete command descriptions and instructions, refer to the related software documentation.

Replacing Serial Port Adapter Cables

The port adapter cable connected to each FSIP port determines the electrical interface type and mode of the port. The FSIP ports are not configured for either DTE or DCE mode by default. When there is no cable attached to a port, the software identifies the port as *Universal, Cable Unattached* rather than either a DTE or DCE interface. When a cable is attached, the port recognizes the mode and automatically uses the clock signal from the appropriate source (external for DTE or internal for DCE).

Although you do not have to configure a clock *source* for the ports, you do have to define the clock *speed* the first time you configure a port as a DCE interface. Because the ports automatically use the appropriate clock source for the type (mode) of cable it detects, you can configure a clock rate for a DCE interface and later replace the DCE cable with a DTE cable; the FSIP will ignore the internal clockrate unless it detects that a DCE cable is attached. This configuration allows you to perform a loopback test on a serial port without a port adapter cable attached.

Following is an example of the **show controller cxbus** command that shows an interface port (2/0) that has an EIA/TIA232 DTE cable attached, and a second port (2/1) that does not have a cable attached:

```
7010# show controller cxbus

Switch Processor 7, hardware version 11.1, microcode version 1.4
  512 Kbytes of main memory, 128 Kbytes cache memory, 299 1520 byte buffers
  Restarts: 0 line down, 0 hung output, 0 controller error
 FSIP 2, hardware version 3, microcode version 1.0
  Interface 16 - Serial2/0, electrical interface is RS-232 DTE
    31 buffer RX queue threshold, 101 buffer TX queue limit, buffer size 1520
    Transmitter delay is 0 microseconds
  Interface 17 - Serial2/1, electrical interface is Universal (cable unattached)
    31 buffer RX queue threshold, 101 buffer TX queue limit, buffer size 1520
```

To change the electrical interface type or mode of a port on line, replace the serial adapter cable and use software commands to restart the interface and, if necessary, reconfigure the port for the new interface. At system startup or restart, the FSIP polls the interfaces and determines the electrical interface type of each port (according to the type of port adapter cable attached). However, it does not necessarily repoll an interface when you change the adapter cable on line. To ensure that the system recognizes the new interface type, shutdown and reenable the interface after changing the cable.

Perform the following steps to change the mode or interface type of a port by replacing the adapter cable. If you are replacing a cable with one of the same interface type and mode, these steps are not necessary. (Simply replace the cable without interrupting operation.)

Step 1 Locate and remove the adapter cable to be replaced.

Step 2 Connect the new cable between the FSIP port and the network connection. Tighten the thumbscrews at both ends of the cable to secure it in the ports.

Step 3 At the privileged level of the EXEC, specify the port address, shutdown the interface, and write the configuration to NVRAM. Add additional configuration commands, if any, before you exit from the configuration mode (before you press **Ctrl-Z**.

```
7010> en
Password:
7010# configure terminal
int serial 2/5
shutdown
^z

7010# write mem
```

Step 4 Enter the configuration mode again and bring the port back up.

```
7010# configure terminal
int serial 2/5
no shutdown
^z
```

These steps will prompt the system to poll the interface and recognize the new interface immediately.

When configuring a port for a DCE interface for the first time, or when setting up a loopback test, you must set the clock rate for the port. When you connect a DCE cable to a port, the interface will remain down, the clock LEDs will remain off, and the interface will not function until you set a clock rate (regardless of the DCE mode default).

If you are changing the mode of the interface from DCE to DTE, you do not need to change the clock rate for the port. After you replace the DCE cable with a DTE cable and the system recognizes the interface as a DTE, it will use the external clock signal from the remote DCE device and ignore the internal clock signal that the DCE interface normally uses. Therefore, once you configure the clock rate on a port for either a DCE interface or loopback, you can leave the clock rate configured and still use that port as a DTE interface.

Replacing Serial Port Adapters

Serial port adapters provide the high-density ports for FSIP serial interfaces. Each port adapter provides two ports, and each port supports any one of the available interface types: EIA/TIA232, EIA/TIA449, V.35, X.21, and EIA-530. The adapter cable connected to the port determines the electrical interface type and mode (DTE or DCE) of the interface. Each FSIP is shipped from the factory with four or eight port adapters installed. Port adapters are field replaceable; if you have spares on hand and have a failure, you can replace interfaces without having to return the FSIP to the factory. You cannot, however, add ports to an FSIP by installing additional port adapters. The four-port FSIP supports only one 4-port module. To change the electrical interface type or mode of a port, you need only replace the adapter cable and reset the interface. When setting up DCE port, you must also set the clock rate. Although DCE is the default mode, you do not need to specify the mode when configuring DTE interfaces. When the port recognizes the DTE interface cable, it automatically uses the clock signal from the remote DCE device.

⚠ **Caution** Remove and install port adapters only when it is necessary to replace interfaces. Do not attempt to isolate faults or to troubleshoot FSIPs or serial interfaces by swapping port adapters. The surface-mount circuitry on the port adapters will not tolerate excessive handling.

All serial interface types support NRZI format and 32-bit CRC, both of which you set with software commands. (Refer to the section "Replacing RSP7000 DRAM SIMMs" earlier in this section.) For complete command descriptions and instructions, refer to the related software documentation.

Tools Required

You need the following tools to complete this procedure:

- Number 1 Phillips or 3/16-inch flat-blade screwdriver

- 3/16-inch nut driver

- Wrist strap or other grounding device to prevent ESD damage

Removing the FSIP

Two or four port adapters (each port adapter provides two ports) are installed on each FSIP at the factory, so in order to install a new port adapter (or to replace an existing one), you need to remove an existing port adapter. Each four-port module on an FSIP is driven by a CPU; four-port FSIPs contain one processor, and eight-port FSIPs contain two processors. You *cannot* add additional ports to a four-port FSIP to upgrade it to eight ports.

Follow these steps to remove and replace the FSIP:

Step 1   Disconnect all network interface cables attached to the FSIP ports.

Step 2   Put on a grounding strap and attach the equipment end to one of the captive installation screws on the rear of the chassis.

Step 3   Use a screwdriver to loosen the two captive installation screws on the FSIP.

Step 4   Place your thumbs on the upper and lower ejector levers and simultaneously push the top lever up and the bottom lever down to release the FSIP from the backplane connector.

Step 5   Grasp the FSIP handle with one hand and place your other hand under the carrier to support and guide the FSIP out of the slot. Avoid touching the board.

Step 6   Carefully pull the FSIP straight out of the slot, keeping your other hand under the carrier to guide it. (See Figure 5-2.) Keep the FSIP at a 90-degree orientation to the backplane.

Step 7   Place the removed FSIP on an antistatic mat or antistatic foam and proceed to the section "Removing Port Adapters."

Removing Port Adapters

Port adapters are installed on each FSIP at the factory. You must remove an existing port adapter in order to replace or install a new one. Each port adapter is anchored to the FSIP with two double-row vertical board-to-board (BTB) connectors and two Phillips-head screws that extend down into the standoffs. (See Figure 5-18.) The port adapter is also anchored to the carrier faceplate with four jackscrews with lock washers (two per port).

Caution   The surface-mounted components on the port adapters are extremely susceptible to ESD damage. Keep each port adapter in a separate antistatic bag until you are ready to install it. Always wear a ground strap and handle boards as little as possible. When you must handle the board, limit contact to the board edges only, avoiding contact between the board and clothing.

To remove a port adapter from the FSIP perform the following steps:

Step 1   Ensure that the FSIP is resting on an antistatic mat or on antistatic foam. You should still be wearing an ESD-prevention ground strap.

Step 2   Position the FSIP so that it is in the same orientation as shown in Figure 5-18.

Step 3   Locate the port adapter to be replaced. Use a 3/16-inch nut driver to loosen the four jackscrews, one on either side of both serial connector ports.

Step 4   Remove the jackscrews and washers and put them aside. You may need them to install the new port adapter.

Step 5   Use a Phillips screwdriver to loosen and remove the two standoff screws. (See Figure 5-18.) You will need the standoff screws to install the new port adapter.

Step 6   While avoiding contact with any traces or components on the board, insert your thumb and forefinger into the finger holes on the sides of the port adapter and gently lift it upward to dislodge the BTB connectors. If the port adapter resists, rock it very slightly from side to side until it pulls free of the FSIP connector.

Figure 5-18   Removing FSIP Port Adapters
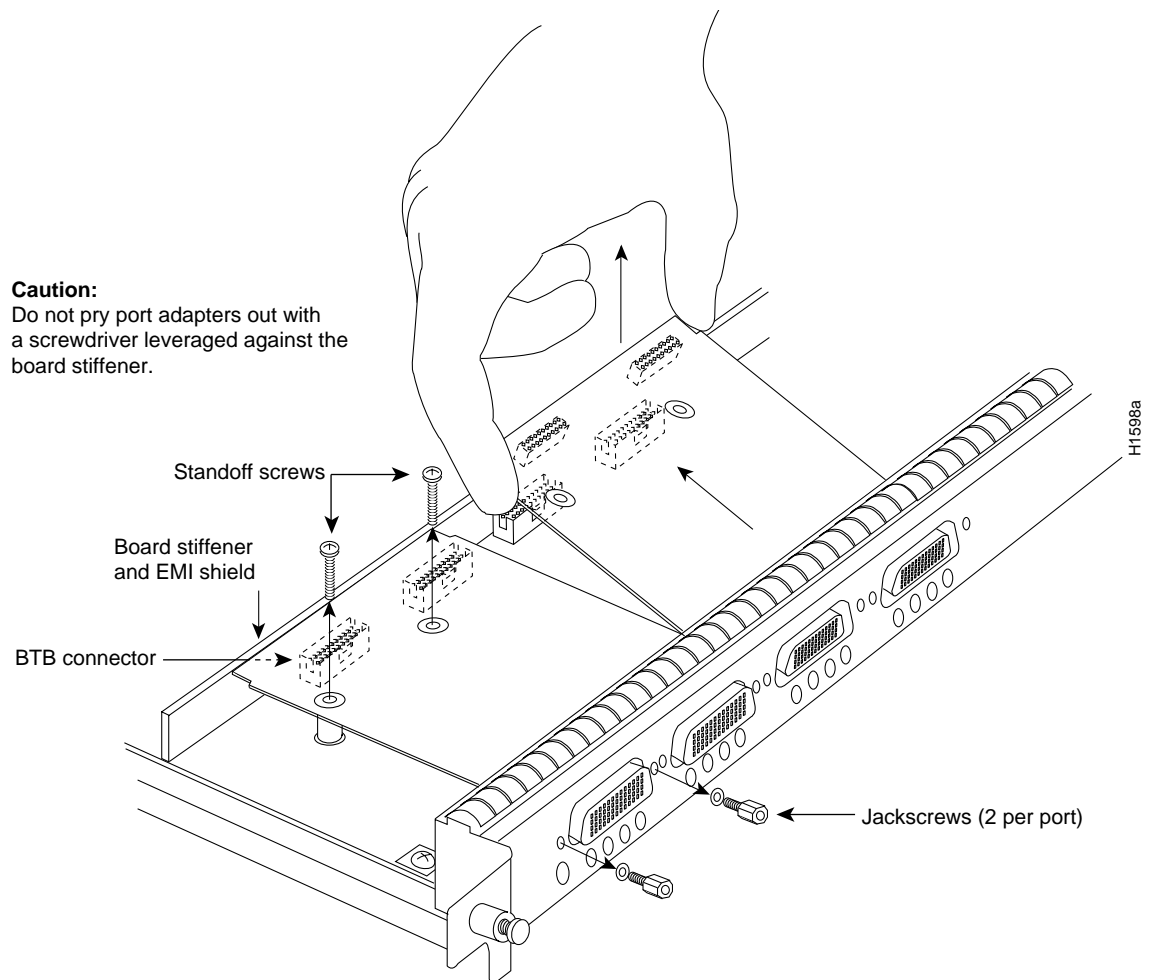
Caution   Do not use a screwdriver or other tool to pry the port adapter up or out of the BTB connectors. In particular, do not use the board stiffener for leverage, or you will damage the FSIP board.

Step 7 When the port adapter BTB connector is completely disconnected from the BTB connector on the FSIP, tilt the back of the port adapter up at about a 70-degree angle from vertical and slowly pull it upward and outward (up and out using the orientation shown in Figure 5-18) away from the faceplate. The serial port connector will pull out of the cutouts in the faceplate.

Step 8 Immediately place the removed port adapter into an antistatic bag.

Step 9 Proceed to the next section to install a new port adapter.

Caution Do not reinstall the FSIP in the chassis unless all port adapters are in place. The empty port will allow cooling air to escape freely through the cutouts in the faceplate, which could misdirect the airflow inside the chassis and allow components on other boards to overheat.

Installing Port Adapters

The FSIP should already be out of the chassis and have an empty space available for the new port adapter. If it is not, refer to the two previous sections to remove the FSIP from the chassis and remove a port adapter from the FSIP. Refer to Figure 5-19 while performing the following steps.

Step 1 Ensure that the FSIP is resting on an antistatic mat or on antistatic foam, and position it with the same orientation as that shown in Figure 5-19. You should still be wearing an ESD-prevention ground strap.

Step 2 Carefully remove the new port adapter from its antistatic bag. Handle the port adapter by the board edges only.

Step 3 If jackscrews are installed on the sides of the connectors, remove them and the four lock washers by turning them counterclockwise. If necessary, use a 3/16-inch nut driver to loosen them. Put the screws and washers aside.

Step 4 While still handling the board edges only, position the port adapter so that it is in the orientation shown in Figure 5-19: at about a 70-degree angle from vertical, component side down, standoffs on the underside, and the external interface port connectors facing the inside of the carrier faceplate.

Step 5 As shown in Figure 5-19, *partially* insert the port connectors through the back of the cutouts in the carrier faceplate. Do not force the connectors through the cutouts until the standoffs and BTB connectors are aligned.

Step 6 With the port connectors partially inserted into the faceplate cutouts, slowly lower the back (opposite) side of the port adapter and continue to ease the port connectors through the cutouts until the BTB connectors on the FSIP and port adapter meet, and the standoffs on the underside of the port adapter are aligned with the standoff holes in the FSIP. Shift the port adapter until the port connectors are fully inserted through the cutouts, and the standoffs are aligned with the standoff holes.

Caution Before seating the port adapter onto the FSIP, ensure that the port adapter is aligned properly with the BTB connectors and the standoffs. Forcing a misaligned port adapter into place can damage the port adapter or the FSIP and cause immediate or intermittent failures.

Step 7 Place your fingers along the back edge of the port adapter board and press down firmly until the BTB connectors mate. If the connectors resist, do not force them. Shift the port adapter around until the connectors mate properly.

Step 8 Insert the two long Phillips-head screws through the two standoffs and finger-tighten them. These screws extend through the standoffs and the FSIP board and thread into the metal carrier.

Step 9 Install a lockwasher on each of the four jackscrews.

Step 10 On the front of the carrier faceplate, insert the four jackscrews through the front of the faceplate and into the holes on either side of both port connectors.

Step 11 When all screws and connectors are aligned properly, use a Phillips screwdriver to tighten the standoff screws and a 3/16-inch nut driver to tighten the four jackscrews. Do not overtighten any of the screws.

Step 12 Proceed to the next section to reinstall the FSIP in the chassis.

Figure 5-19   Installing FSIP Port Adapters

Board stiffener
and EMI shield

H1599a
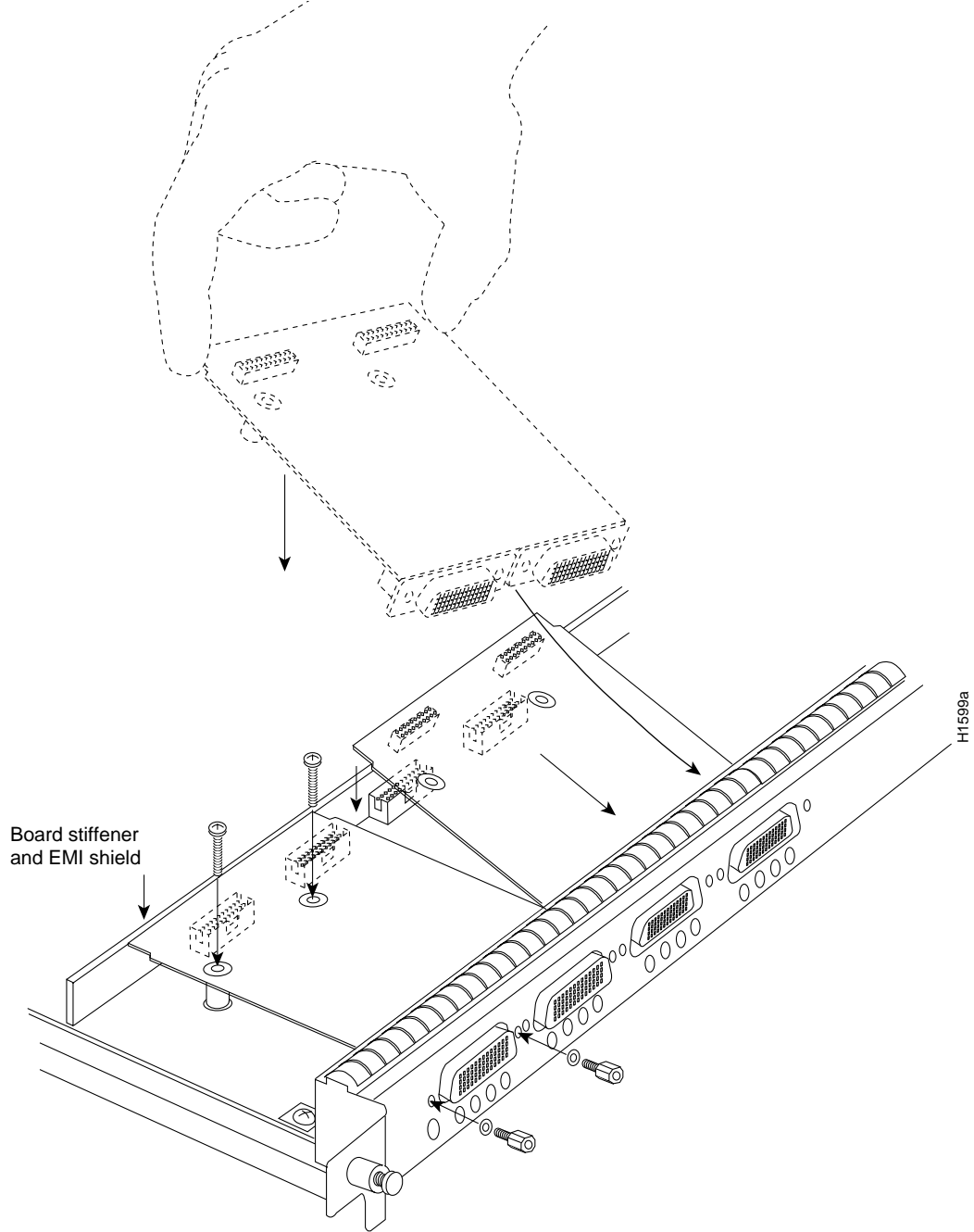
Replacing the FSIP in the Chassis

There should now be four or eight port adapters installed on the FSIP. If there are not, do not install the FSIP until you install all port adapters or until you install a blank interface processor filler in the FSIP slot.

Caution   Handle interface processors by the handles and carrier edges only to prevent ESD damage.

⚠ **Caution**   Do not reinstall the FSIP unless all port adapters are installed. The empty port will allow cooling air to escape freely through the cutouts in the faceplate, which could misdirect the airflow inside the chassis and allow components on other boards to overheat.

Step 1   Grasp the FSIP handle with one hand and place your other hand under the carrier to support the FSIP and guide it into the slot. (See Figure 5-2.) Avoid touching the board.

Step 2   Place the back of the FSIP in the slot and align the notch on the bottom of the carrier with the groove in the slot. (See Figure 5-1.)

Step 3   While keeping the FSIP at a 90-degree orientation to the backplane, carefully slide the carrier into the slot until the FSIP faceplate makes contact with the ejector levers. (See Figure 5-1.)

Step 4   Using the thumb and forefinger of each hand, simultaneously push the top lever down and the bottom lever up (as shown in Figure 5-1) to fully seat the FSIP in the backplane connector.

Step 5   Use a number 1 Phillips or a 3/16-inch flat-blade screwdriver to tighten the captive installation screws on the top and bottom of the FSIP.

Step 6   Reconnect the network interface cables or other connection equipment to the FSIP interface ports.

Step 7   When you insert the new FSIP, the console terminal will display several lines of status information about the OIR as it reinitializes the interfaces. Change the state of the interfaces to up and verify that the configuration matches that of the interfaces you replaced.

Step 8   Use the **configure** command or the **setup** command facility to configure the new interfaces. You do not have to do this immediately, but the interfaces will not be available until you configure them and bring them up.

Step 9   After you configure the interfaces, use the **show controller serial** or the **show interfaces** command to display the status of the new interfaces.

This completes the port adapter replacement procedure. For complete command descriptions and instructions, refer to the related software documentation.

MIP Configurations

Following are procedures for configuring T1 and E1 interfaces on the MIP.

Configuring the Interfaces

If you installed a new MIP or if you want to change the configuration of an existing controller, you must enter the configuration mode. If you replaced the MIP that was previously configured, the system will recognize the new MIP and bring it up in the existing configuration.

After you verify that the new MIP is installed correctly (the enabled LED is on), use the privileged-level **configure** command to configure the new MIP controller. Be prepared with the information you will need, such as the following:

* T1 or E1 information, for example clock source (for T1), line code, and framing type

* Channel-group information and timeslot mapping

* Protocols and encapsulations you plan to use on the new interfaces

- Internet protocol (IP) addresses if you will configure the interfaces for IP routing
- Whether the new interface will use bridging

Refer to the *Router Products Configuration Guide* and *Router Products Command Reference* publications for a summary of the configuration options available and instructions for configuring the MIP controller.

Configuring Jumper J6 on the E1 Port Adapter

By default, channelized E1 port adapters are set with capacitive coupling between the receive (Rx) shield and chassis ground. This provides direct current (DC) isolation between the chassis and external devices, as stated in the G.703 specification. Jumper J6 controls this function. To make changes, remove the E1 port adapter from the mother board, place one of the spare jumpers on J6 pins one and two *or* pins two and three (refer to Table 5-11), and replace the port adapter on the mother board. Pin 1 of J6 is designated with a square. (See Figure 5-20.)

For procedures on removing the E1 port adapter from the MIP, refer to the section "Removing and Replacing MIP Port Adapters" in this chapter.

Figure 5-20   Location of Jumper J6 on the E1 Port Adapter—Partial View
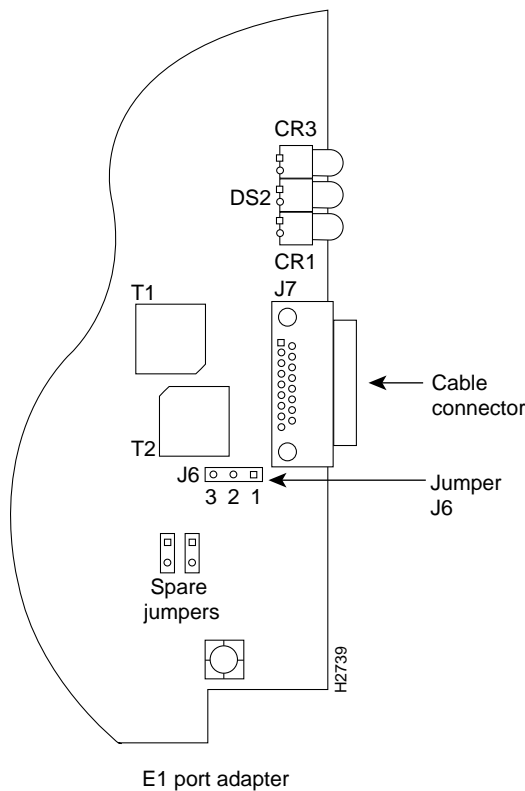
Table 5-11   Jumper Settings and Functions

Jumper	Pins and Impedance	Function
J6	1 and 2 for 120 ohm 2 and 3 for 75 ohm	Controls capacitive coupling for either 120-ohm or 75-ohm operation. An installed jumper directly connects the Rx shield to chassis ground.

Warning   To prevent problems with the E1 interface and to reduce the potential for injury, jumper J6 should be installed by trained service personnel *only*. For either impedance option, a jumper installed at J6 bypasses the AC-decoupling capacitor to ground, thereby coupling the interface directly to AC. This is a setting that could pose a risk of severe injury. By default and for safety, J6 has no jumper installed.

After you set jumper J6, proceed to the section "Removing and Replacing MIP Port Adapters" in this chapter.

Using the EXEC Command Interpreter

Before you use the **configure** command, you must enter the privileged level of the EXEC command interpreter with the **enable** command. The system will prompt you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, enter the privileged level as follows:

Step 1   At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password, as follows:

```
Router> enable

Password:
```

Step 2   Enter the password (the password is case sensitive). For security purposes, the password is not displayed.

Step 3   When you enter the correct password, the system displays the privileged-mode system prompt (#) as follows:

```
Router#
```

Step 4   Proceed to the following section to configure the MIP controller.

Using the **Configure** Commands

Following are instructions for a configuration: enabling a controller and specifying IP routing. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration and the protocols you plan to route on the interface.

The channel-groups must be mapped before the MIP controller can be configured.

For complete descriptions of configuration subcommands and the configuration options available, refer to the *Router Products Configuration Guide* and *Router Products Command Reference* publications, which are available on UniverCD.

Table 5-12 list commands used to map the channel-group, with the default variable is listed first.

Table 5-12   Channel Group Mapping Commands

Commands for T1	Commands for E1
controller t1 *slot/applique*	**controller e1** *slot/applique*
clock source [*line*	*internal*]	Not required for E1
linecode [*ami*	*b8zs*]	**linecode** [*hdb3*	*ami*]
framing [*sf*	*esf*]	**framing** [*crc4*	*no-crc4*]
loopback [*local*	*remote*]	**loopback**
shutdown	**shutdown**
channel-group *number* **timeslots** *list* [speed {56	48	64}] For speed, 56 is the default.[1]	**channel-group** *number* **timeslots** *list* [speed {56	48 |64}] For speed, 64 is the default.[1.]

1. *Number* is the channel-group 0 to 23 for T1 and 0 to 29 for E1.
   Timeslots list is a number between 1 to 24 for T1 and 1 to 31 for E1. It conforms to D3/D4 numbering for T1. Timeslots may be entered individually and separated by commas or as a range that is separated by a hyphen (for example, 1-3, 8, 9-18). For E1 and T1, 0 is illegal.
   Speed specifies the DSO speed of the channel-group: T1 default is 56 kbps and E1 default is 64 kbps.

Note   Cisco 7000 series routers identify channel-groups as serial interfaces by slot number (interface processor slots 0 to 4), applique (0 or 1), and channel-group number (0 to 23 for T1 and 0 to 29 for E1) in the format, *slot/port:channel-group*. For example, the address of the MIP installed in interface processor slot 4, with applique 1 and channel-group 5, would be serial *4/1:5*.

T1 Configuration

The following steps describe a basic T1 configuration. Press the **Return** key after each configuration step.

Step 1   At the privileged-mode prompt, enter the configuration mode and specify that the console terminal will be the source of the configuration subcommands as follows:

```
Router# conf t
Enter configuration commands, one per line. End with CNTL/Z. Router(config)#
```

Step 2   At the prompt, specify the controller to configure by entering the subcommand **cont**, followed by **t1**, *and slot/applique* (interface processor slot number/applique). The example that follows is for the MIP in interface processor slot 4, applique 1:

```
Router(config)# cont t1 4/1
```

Step 3   At the prompt, specify the clock source for the controller. The **clock source** command will determine which end of the circuit provides the clocking.

```
Router(config-controller)# clock source line
```

Note   The clock source should only be set to use the internal clocking for testing the network or if the full T1 line is used as the channel-group. Only one end of the T1 line should be set to internal.

Step 4 At the prompt, specify the **framing** type.

```
Router(config-controller)# framing esf
```

Step 5 At the prompt, specify the **linecode** format.

```
Router(config-controller)# linecode b8zs
Router(config-controller)#
%CONTROLLER-3-UPDOWN: Controller T1 4/1, changed state to up
Router(config-controller)#
```

Step 6 At the prompt, specify the **channel-group** modification command, channel-group and timeslots to be mapped. The example shows channel-group 0 and timeslots 1, 3 through 5, and 7 selected for mapping.

```
Router(config-controller)# channel-group 0 timeslots 1,3-5,7
Router(config-controller)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial4/1:0, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial4/1:0, changed state to up
Router(config-controller)#
Router(config-controller)#
```

Step 7 At the prompt, specify the interface, serial, slot, applique, and channel-group to modify.

```
Router(config-controller)# int serial 4/1:0
```

Step 8 At the prompt, assign an IP address and subnet mask to the interface with the **ip address** configuration subcommand as in the following example:

```
Router(config-if)# ip address 1.1.15.1 255.255.255.0
Router(config-if)#
```

Step 9 Add any additional configuration subcommands required to enable routing protocols and adjust the interface characteristics.

Step 10 After including all of the configuration subcommands, and to complete the configuration, enter **Ctrl-Z** (hold down the Control key while you press Z) to exit the configuration mode.

Step 11 Write the new configuration to memory as follows:

```
Router# write memory
```

The system will display an OK message when the configuration is stored.

Step 12 Exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable
```

```
Router>
```

Step 13 Proceed to the following section to check the interface configuration with **show** commands.

E1 Configuration

The following steps describe a basic E1 configuration. Press the Return key after each step.

Step 1   At the privileged-mode prompt, enter the configuration mode and specify that the console terminal will be the source of the configuration subcommands as follows:

```
Router# conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

Step 2   At the prompt, specify the controller to configure by entering the subcommand **cont**, followed by **e1**, *and slot/applique* (interface processor slot number/applique). The example that follows is for the MIP in interface processor slot 4, applique 1:

```
Router(config)# cont e1 4/1
```

Step 3   At the prompt, specify the **framing** type.

```
Router(config-controller)# framing crc4
```

Step 4   At the prompt, specify the **linecode** format.

```
Router(config-controller)# linecode hdb3
Router(config-controller)#
%CONTROLLER-3-UPDOWN: Controller E1 4/1, changed state to up
Router(config-controller)#
```

Step 5   At the prompt, specify the **channel-group** modification command, channel-group and timeslots to be mapped. The example shows channel-group 0 and timeslots 1, 3 through 5, and 7 selected for mapping.

```
Router(config-controller)# channel-group 0 timeslots 1,3-5,7
Router(config-controller)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial4/1:0, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial4/1:0, changed state to up
Router(config-controller)#
Router(config-controller)#
```

Step 6   At the prompt, specify the interface, serial, slot, applique, and channel-group to modify.

```
Router(config-controller)# int serial 4/1:0
```

Step 7   At the prompt, assign an IP address and subnet mask to the interface with the **ip address** configuration subcommand as in the following example:

```
Router(config-if)# ip address 1.1.15.1 255.255.255.0
Router(config-if)#
```

Step 8   Add any additional configuration subcommands required to enable routing protocols and adjust the interface characteristics.

Step 9   After including all of the configuration subcommands, and to complete the configuration, enter **Ctrl-Z** (hold down the Control key while you press Z) to exit the configuration mode.

Step 10 Write the new configuration to memory as follows:

```
Router# write memory
```

The system will display an OK message when the configuration is stored.

Step 11 Exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable
Router>
```

Step 12 Proceed to the following section to check the interface configuration with **show** commands.

Checking the Configuration

After configuring the new interface, use the **show** commands to display the status of the new interface or all interfaces.

Command Descriptions and Examples

Following are descriptions and examples of the show commands. Descriptions are limited to fields that are relevant for verifying the configuration.

- The **show version** command displays the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images.

```
Router> show version

GS Software (GS7), Version 10.0(5187) (for E1, 10.3[1])
Copyright (c) 1986-1994 by cisco Systems, Inc.
Compiled Wed 02-Feb-94 15:52

ROM: System Bootstrap, Version 4.6(1) [fc2], SOFTWARE

Router uptime is 42 minutes
System restarted by reload
System image file is "wmay/gs7-k", booted via tftp from 131.108.13.111

RP (68040) processor with 16384K bytes of memory. X.25 software, Version 2.0, NET2, BFE
and GOSIP compliant. Bridging software.
1 Switch Processor.
1 EIP controller (6 Ethernet).
1 TRIP controller (4 Token Ring).
1 FSIP controller (4 Serial).
1 MIP controller (1 T1). (or 1 E1, and so forth)
6 Ethernet/IEEE 802.3 interfaces.
4 Token Ring/IEEE 802.5 interfaces.
6 Serial network interfaces.
1 FDDI network interface.
128K bytes of non-volatile configuration memory.
4096K bytes of flash memory sized on embedded flash.
Configuration register is 0x100
```

- The **show controllers cbus** command displays the internal status of the SP and each CxBus interface processor, including the interface processor slot location, the card hardware version, and the currently running microcode version. It also lists each interface (port) on each interface processor including the logical interface number, interface type, physical (slot/port) address, and hardware (station address) of each interface.

The following example shows the MIP installed in interface processor slot 1:

```
Router# show controller cbus

Switch Processor 5, hardware version 11.1, microcode version 170.46
  Microcode loaded from system
  512 Kbytes of main memory, 128 Kbytes cache memory 105 1520 byte buffers,
  75 4496 byte buffers Restarts: 0 line down, 0 hung output, 0 controller error
FIP 0, hardware version 2.2, microcode version 170.12
 Microcode loaded from system
  Interface 0 - Fddi0/0, address 0000.0c03.648b (bia 0000.0c03.648b)
  15 buffer RX queue threshold, 37 buffer TX queue limit, buffer size 4496
  ift 0006, rql 13, tq 0000 01A0, tql 37

(text omitted from example)

MIP 2, hardware version 1.0, microcode version 10.0
 Microcode loaded from system
 Interface 16 - T1 2/0, electrical interface is Channelized T1
   10 buffer RX queue threshold, 14 buffer TX queue limit, buffer size 1580 ift 0001, rql
   7, tq 0000 05B0, tql 14
   Transmitter delay is 0 microseconds
Router#
```

- The **show controller t1** command displays the status of the default T1 (which is specified in RFC 1406). The **show controller t1** *slot/applique* command displays the verbose information for a particular T1.

```
Router# show cont t1
T1 4/1 is up.
  No alarms detected.
  Framing is ESF, Line Code is AMI, Clock Source is line
  Data in current interval (0 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations 0 Slip Secs, 0 Fr Loss Secs,
     0 Line Err Secs, 0 Degraded Mins 0 Errored Secs, 0 Bursty Err Secs,
     0 Severely Err Secs, 0 Unavail Secs
  Total Data (last 79 15 minute intervals):
     0 Line Code Violations, 0 Path Code Violations, 0 Slip Secs, 0 Fr Loss Secs,
     0 Line Err Secs, 0 Degraded Mins, 0 Errored Secs, 0 Bursty Err Secs,
     0 Severely Err Secs, 0 Unavail Secs
Router#
```

- The **show controller e1** command displays the status of the default E1 (which is specified in RFC 1406). The **show controller e1** *slot/applique* command displays the verbose information for a particular E1.

```
Router# show cont e1
E1 4/1 is up.
  No alarms detected.
  Framing is E1-crc, Line Code is hdb3
  Data in current interval (0 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations 0 Slip Secs, 0 Fr Loss Secs,
     0 Line Err Secs, 0 Degraded Mins 0 Errored Secs, 0 Bursty Err Secs,
     0 Severely Err Secs, 0 Unavail Secs
  Total Data (last 79 15 minute intervals):
     0 Line Code Violations, 0 Path Code Violations, 0 Slip Secs, 0 Fr Loss Secs,
     0 Line Err Secs, 0 Degraded Mins, 0 Errored Secs, 0 Bursty Err Secs,
     0 Severely Err Secs, 0 Unavail Secs
Router#
```

- The **show configuration** command displays the contents of the system configuration file stored in NVRAM. This file should reflect all new configuration changes you made and wrote to memory with the **write memory** command.

```
Router# show config

Using 1708 out of 130048 bytes
!
version 10.0 (or 10.3 for E1)
!
hostname Router
!
enable password *****
!
clns routing
!
!
!
controller T1 4/1 (for E1, E1 4/1, and so forth)
framing esf (for E1, crc4, and so forth)
linecode b8zs (for E1, hdb3, and so forth)
channel-group 0 1,3,5,7
channel-group 1 2,4,6,8-10
!
interface Ethernet 1/0
ip address 131.108.43.220 255.255.255.0
no mop enabled
!
interface Ethernet1/1
no ip address
shutdown
!
interface Ethernet1/2
no ip address
shutdown
!
interface Ethernet1/3

    (display text omitted)
```

- The **show protocols** command displays the global (system-wide) and interface-specific status of any configured Level 3 protocol.

```
Router> show protocols

Global values:
    Internet Protocol routing is enabled
CLNS routing is enabled (address 41.0000.0000.0000.0001.0000.0000.00) Fddi0/0 is down,
line protocol is down
Internet address is 1.1.20.1, subnet mask is 255.255.255.0
CLNS enabled
Ethernet1/0 is up, line protocol is up
Internet address is 131.108.43.220, subnet mask is 255.255.255.0


(display text omitted)
```

Using **Show** Commands to Verify the MIP Status

The following procedure describes how to use the **show** commands to verify that the new MIP interface is configured correctly:

Step 1 Use the **show version** command to display the system hardware configuration. Ensure that the list includes the new MIP network interface.

Step 2 Display all of the current CxBus interface processors and their interfaces with the **show controllers cbus** command. Verify that the new MIP appears in the correct slot.

Step 3 Display the T1 and/or E1 alarm condition with the **show controller T1** and/or **show controller E1** command.

Step 4 Specify the new interface with the **show interfaces serial** *slot/port:channel-group* command and verify that the first line of the display specifies the serial interface with the correct slot, port and channel-group number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 5 Display the protocols configured for the entire system and specific interfaces with the command **show protocols**. If necessary, return to the configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 6 Display the entire system configuration file with the **show configuration** command. Verify that the configuration is accurate for the system and each interface.

If the interface is down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you still have problems bringing the interface up, contact a customer service representative for assistance.

This completes the configuration procedure for the new MIP interface.

Removing and Replacing MIP Port Adapters

Port adapters provide the ports for the E1 and T1 interfaces. Each port adapter provides one port. Each MIP is shipped from the factory with one or two port adapters installed. *You cannot add ports to an MIP by installing an additional port adapter. Port adapters are not field-replaceable units (FRUs)*; however, you need to remove an existing E1 port adapter in order to access jumper J6.

Before proceeding, refer to the section "Removing CxBus Interface Processors" in this chapter.

⚠ **Caution** To prevent damaging the MIP and port adapters, remove and install port adapters only when it is necessary. Do not attempt to isolate faults or to troubleshoot MIPs or interfaces by swapping port adapters. The surface-mount circuitry on the port adapters will not tolerate excessive handling. *Do not mix T1 and E1 port adapters on the same motherboard.*

Tools Required

You need the following tools to complete this procedure:

- Number 1 Phillips screwdriver
- 3/16-inch nut driver
- An ESD-preventive wrist strap or other grounding device to prevent ESD damage

Removing a Port Adapter

Port adapters are installed on each MIP at the factory. Each port adapter is anchored to the MIP with one plastic double-row vertical board-to-board (BTB) connector and four Phillips screws that extend through standoffs, into the mother board. (See Figure 5-21.) The port adapter is also anchored to the carrier faceplate with two jackscrews and two lock washers.

> ⚠ **Caution** The surface-mounted components on the port adapters are extremely susceptible to ESD damage. Keep each port adapter in a separate antistatic bag until you are ready to install it. Always wear an ESD-preventive ground strap and handle boards as little as possible. When you must handle the board, limit contact to the board edges only, avoiding contact between the board and clothing.

To remove an E1 port adapter from the MIP, refer to Figure 5-21 and perform the following steps:

Step 1 Ensure that the MIP is resting on an antistatic mat or on antistatic foam. You should still be wearing an ESD-preventive strap.

Step 2 Position the MIP so that it is in the same orientation shown in Figure 5-21.

Step 3 Locate the E1 port adapter to be removed and use a 3/16-inch nut driver to loosen the two jackscrews, one on either side of the cable connector. (See Figure 5-21.)

Figure 5-21 Removing an E1 Port Adapter
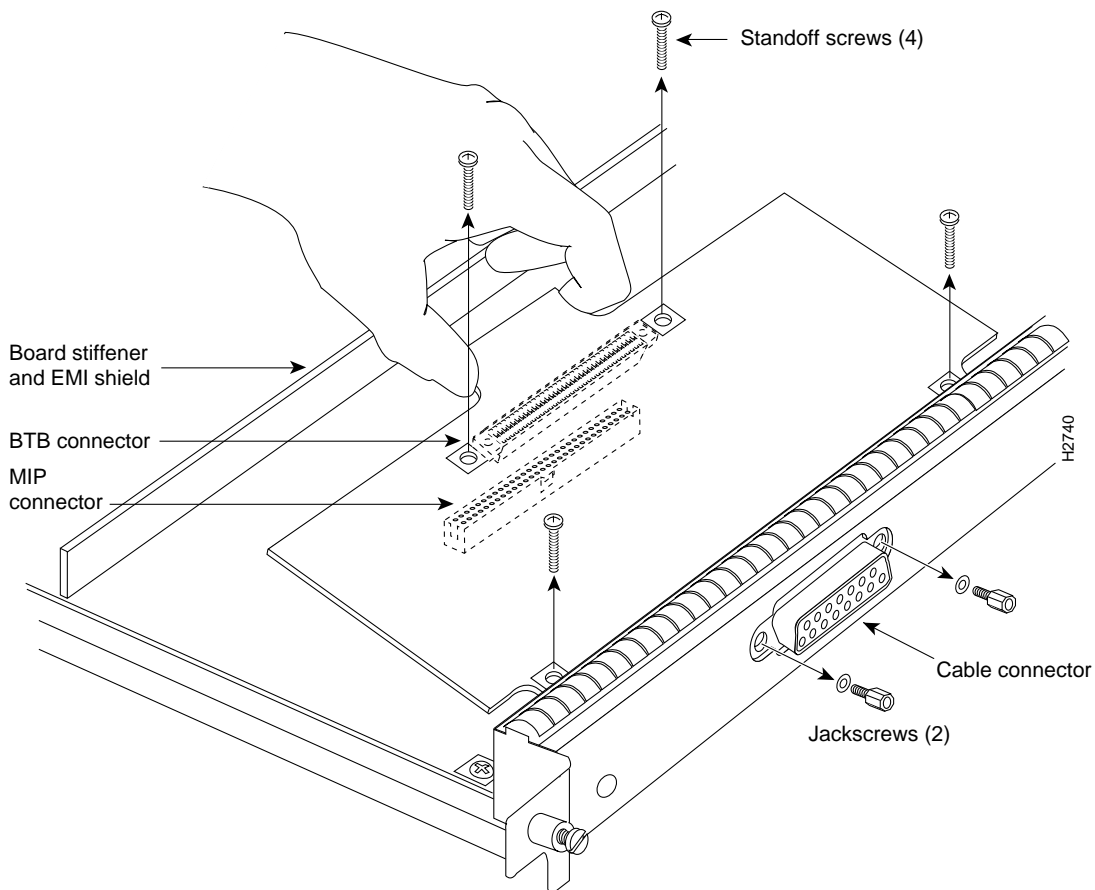
Step 4 Remove the jackscrews and washers and put them aside.

Step 5 Use a number 1 Phillips screwdriver to loosen and remove the four standoff screws. (See Figure 5-21.) The port adapter is now held in place only by the plastic BTB connector.

Step 6 While avoiding contact with any traces or components on the board, insert your thumb and forefinger under the extension behind the BTB connector and gently lift the adapter upward to dislodge it from the MIP connector. If the port adapter resists, rock it very slightly from side to side until it pulls free of the MIP connector.

Caution To prevent damage to the MIP, do not pry the port adapter out with a screwdriver or any other tool. In particular, do not use the board stiffener for leverage.

Step 7 When the port adapter is completely disconnected from the MIP connector, tilt the back of the port adapter up at about a 70-degree angle from vertical and slowly pull it up and out (using the orientation shown in Figure 5-21) and away from the faceplate. The MIP cable connector will pull out of the cutout in the faceplate.

Step 8 To reconfigure jumpers on the E1 port adapter, refer to the section "Configuring Jumper J6 on the E1 Port Adapter." After you have set the jumpers, proceed to the next section "Replacing a Port Adapter."

Caution To prevent overheating chassis components, do not reinstall the MIP in the chassis unless all port adapters are in place. The empty port will allow cooling air to escape freely through the cutouts in the faceplate, which could misdirect the airflow inside the chassis and allow components on other boards to overheat.

Replacing a Port Adapter

If necessary, refer to the previous section to remove an E1 port adapter from the MIP. Refer to Figure 5-22 while you perform the following steps:

Step 1 Ensure that the MIP is resting on an antistatic mat or on antistatic foam and position it with the same orientation as that shown in Figure 5-22. You should still be wearing an ESD-preventive ground strap.

Step 2 Handle the port adapter by the board edges only.

Step 3 Position the port adapter so that it is in the orientation shown in Figure 5-22: at about a 70-degree angle from vertical, component-side down, standoffs on the underside, and the external interface cable connector facing the inside of the carrier faceplate.

Step 4 As shown in Figure 5-22, *partially* insert the cable connector through the back of the cutout in the carrier faceplate. Do not force the cable connector through the cutout until the standoffs and BTB connector is aligned.

Step 5 With the cable connector partially inserted into the faceplate cutout, slowly lower the back (opposite) side of the port adapter. Continue to ease the cable connector through the cutout until the BTB connector and the MIP and port adapter meet and the standoffs on the MIP are aligned with the standoff holes in the port adapter. Shift the port adapter until the cable connector is fully inserted through the cutouts and the standoffs are aligned with the standoff holes. (See Figure 5-22.)

Figure 5-22   Installing an E1 Port Adapter
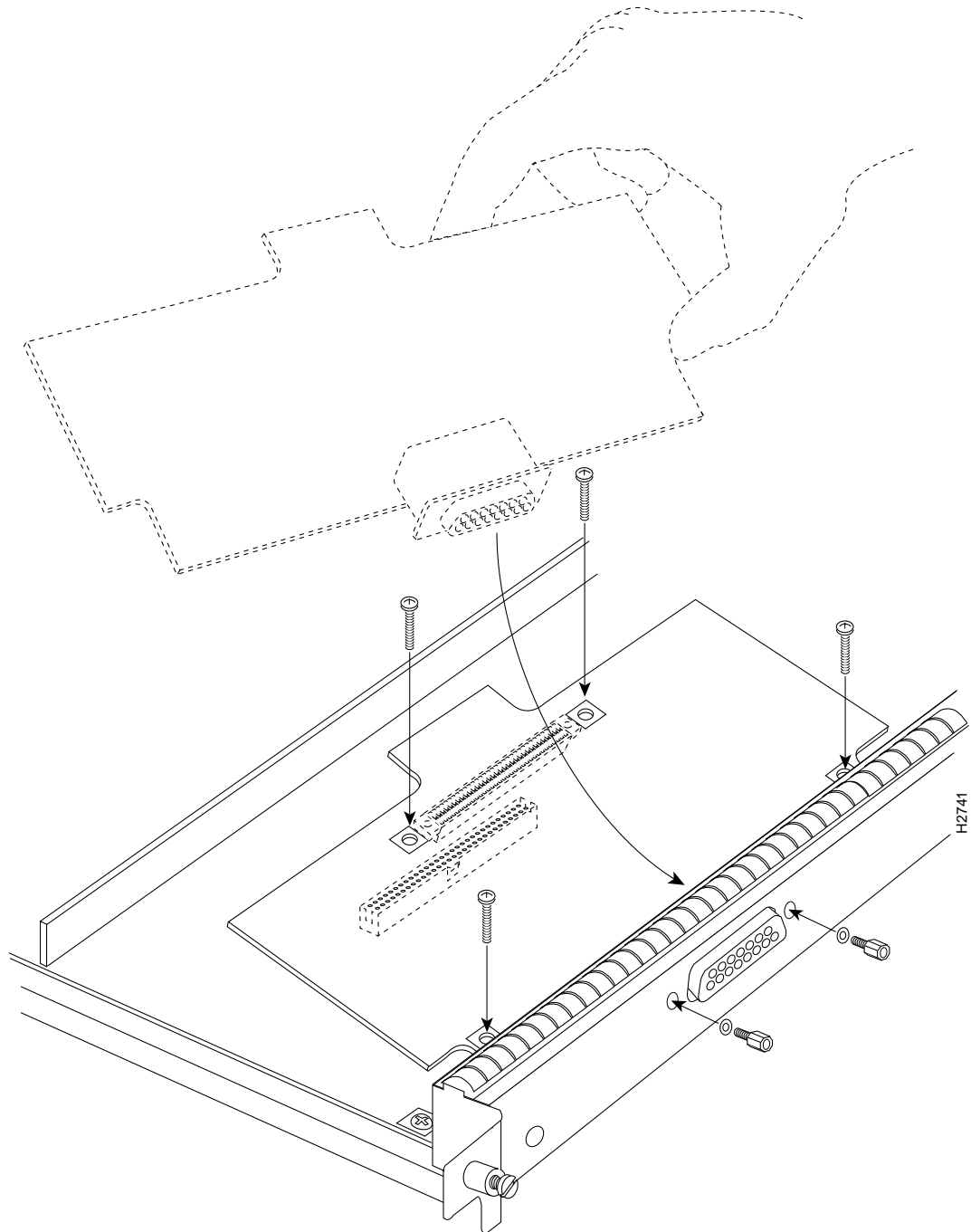
Step 6 Place your fingers over the BTB connector and firmly (but gently) press down until the BTB connector mates with the MIP connector. If the connector resists, do not force it. Shift the port adapter around until the connectors mate properly.

Step 7 Insert the four long Phillips screws through the four port adapter holes and finger-tighten them. These screws extend through the standoffs and the MIP board and thread into the metal carrier.

Step 8 Install a lockwasher on each of the two jackscrews.

Step 9 Insert the two jackscrews through the front of the carrier faceplate and into the holes on either side of the cable connector.

Step 10 When all screws and connectors are aligned properly, use a Phillips screwdriver to tighten the four standoff screws and a 3/16-inch nut driver to tighten the two jackscrews. *Do not overtighten any of these screws.*

Step 11 Follow the steps in the section "Installing CxBus IPs" to reinstall the MIP in the chassis.

Step 12 Reconnect the network interface cables or other connection equipment to the MIP interface ports.

⚠ **Caution**   To prevent potential EMI and overheating problems, do not replace the MIP in the chassis unless all port adapters are installed. An empty port violates the EMI integrity of the system, and also allows cooling air to escape freely through the cutouts in the carrier faceplate, which could misdirect the airflow inside the chassis and allow components on other boards to overheat.

When you insert the new MIP, the console terminal will display several lines of status information about OIR as it reinitializes the interfaces. Change the state of the interfaces to up and verify that the configuration matches that of the interfaces you replaced.

Use the **configure** command or the **setup** command facility to configure the new interfaces. You do not have to do this immediately, but the interfaces will not be available until you configure them and bring them up.

After you configure the interfaces, use the **show controller cbus**, **show controller T1** and the **show controller E1** commands to display the status of the new interface. For brief descriptions of commands, refer to the section "Using Show Commands to Verify the MIP Status" in this chapter

For complete command descriptions and instructions refer to the appropriate software publications, which are available on UniverCD.

This completes the port adapter replacement procedure.

Replacing Internal Components

Internal components fall into two categories: those that support online insertion and removal (OIR) and those that require you to shutdown the system power before replacement. Because interface processors support OIR, you can remove and replace them while the system is operating. However, you must shutdown the system power before removing the RP, the SP (or SSP), or any of the internal components (the fan tray, power supply, and arbiter). (See Figure 5-23.)

This section contains replacement procedures for the following components:

• Fan tray (MAS-7010FAN=), the 6-fan array and fan control board on a removable tray that draws cooling air through the chassis interior. Replace this unit if a fan or the control board fails.

• Arbiter (MAS-7KARB=), a printed circuit board that mounts directly to the backplane. It is sandwiched between the backplane and the backplane cover.

- Power supply (PWR-7010AC*), the 600-watt power supply for the Cisco 7010. Depending upon the type of power cord required, the order number is as follows:

  — PWR-7010AC=, with U.S. cord

  — PWR-7010ACU=, with U.K. cord

  — PWR-7010ACA=, with Australian cord

  — PWR-7010ACE=, with European cord

  — PWR-7010ACI=, with Italian cord
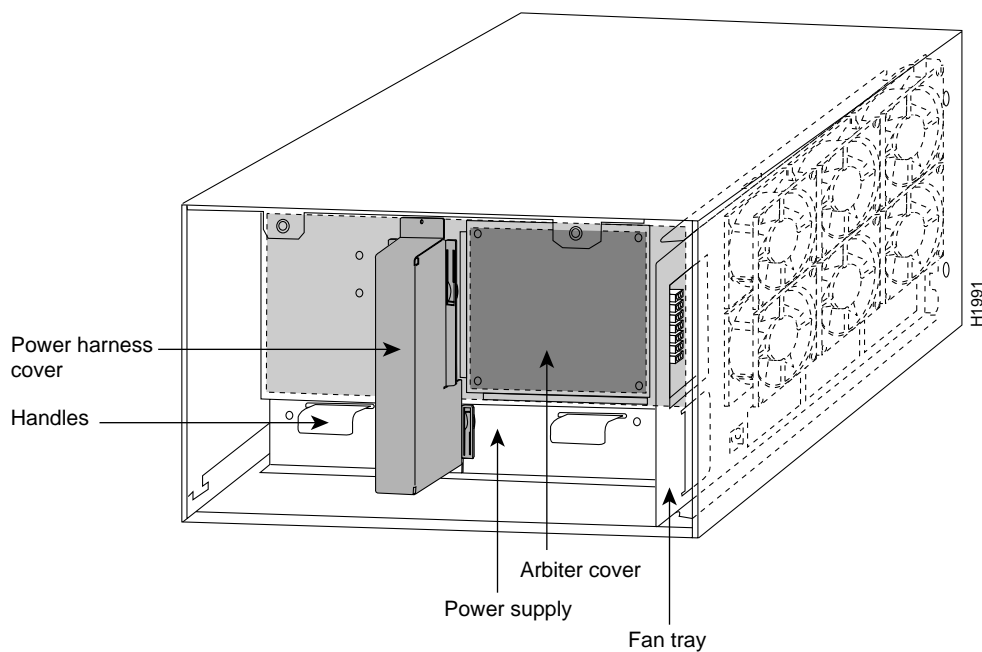
Figure 5-23   Internal Chassis Components

Power harness cover

Handles

Arbiter cover

Power supply

Fan tray

Figure 5-23 shows the locations of each of the internal components inside the service (noninterface processor) end of the chassis. In addition to the internal components, the following assemblies are also available as spares. This document does not include replacement instructions for chassis spares or packing materials. However, specific replacement instructions, called *configuration notes*, accompany all field-replaceable components.

- Chassis without a power supply (MAS-7010=)

- Chassis with power supply (CHAS-7010=)

- Cable management kit (ACS-7010CBLM=); refer to the chapter "Installing the Router" for installation instructions

- Rack-mount kit (ACS-7010RMK=); refer to the chapter "Installing the Router" for installation instructions

- RP, SP (or SSP), and interface processors (various product numbers); refer to "Installing and Configuring Processor Modules" in this chapter for replacement instructions

- Repackaging container and materials (PKG-7010=) for moving or shipping the router safely

Warning   Before replacing any internal components, review "Safety Recommendations" in the chapter "Preparing for Installation."

To replace internal components, all of which are inside the service (noninterface processor) end of the router, you must remove the chassis cover panel and expose the chassis interior. To replace some components, you must also remove the power harness cover and the backplane cover, which exposes the backplane power connection. If the power is not shutdown before removing the chassis cover panel, the high current on the fan tray and fan control board becomes a hazard. When the power harness and backplane covers are removed, the high current present in the wiring and on the backplane also becomes a hazard. Removing the cover panel when the system is operating also compromises the EMI integrity of the system. Therefore, always turn off the system power before removing the cover panel, and remove the cover panel only when it is necessary to replace internal components.

The fan tray comprises six individual fans (the fan array) and a fan control printed circuit board mounted on a metal tray; the entire assembly is called the *fan tray*. The fans draw cooling air through the inlet vents on the left side of the chassis (when viewing the chassis from the nonintegrated processor end) and force the air out through the exhaust vents on the right side of the chassis. The fan control board distributes power to the fans, controls the fan speed, and monitors and reports fan failures to the system through the backplane. To remove the fan tray, you need only remove a single pan-head screw that anchors the tray to the interior chassis frame; an edge connector on the fan control board also snaps into a socket connector on the backplane cover. The fan tray slides into the right side of the chassis (when viewing the chassis from the noninterface processor end).

The power harness cover shields the wiring harness that delivers DC power from the power supply to the backplane. A tab at the bottom of the cover fits into a slot in the chassis floor; a single Phillips screw secures the top of the harness cover to the backplane cover. Because the harness cover straddles both the power supply and backplane cover, you must remove it to access the power supply or the arbiter.

An external modular power cord delivers source power to the external AC receptacle on the interface processor end of the power supply. The power harness, which is part of the power supply, carries DC voltages from the power supply to a polarized connector on the backplane. The backplane distributes the operating voltages to all of the internal chassis components. The power supply rests on the floor of the chassis, under the card cage and backplane. Two Phillips-head screws secure the power supply to the interior chassis frame. To remove the power supply, you need to disconnect the modular AC power cord, remove the power harness cover, disconnect the power harness from the backplane, and remove the two Phillips screws. The noninterface processor end of the power supply has handles for pulling the supply out of the chassis. Before inserting a power supply, remove the cable retention clip (or secure it with tape); otherwise, it will catch on the chassis floor and prevent the chassis from sliding into the power supply bay.

The backplane cover shields the noninterface processor side of the backplane and the arbiter (the arbiter cover is integrated with the backplane cover). Fourteen Phillips screws secure the four flanged sides of the cover to the interior chassis frame and, near the center of the cover, two additional screws secure the cover to two standoffs mounted to the backplane (behind the cover). The arbiter standoff screws secure the backplane cover and the arbiter to the four arbiter standoffs mounted to the backplane.

The arbiter mounts directly to the noninterface processor side of the backplane, behind the backplane cover. A bus connector on the arbiter mates with the backplane, and the corners of the arbiter board butt up against four standoffs. When the backplane cover is in place, four long Phillips screws extend through the cover, arbiter, and standoffs to secure the cover and the arbiter to the backplane. To replace the arbiter, you must remove the fan tray, power harness cover, and backplane cover.

Tools Required

You need the following tools to replace any one of the internal components:

- 3/16-inch flat-blade screwdriver to loosen the captive screws on the chassis cover panel

- Number 1 Phillips screwdriver to remove the M-3 Phillips screws on the power harness cover, backplane cover, and arbiter

- Number 2 Phillips screwdriver for the M-4 Phillips screws on the power supply and the fan tray

Removing and Replacing the Chassis Cover Panel

The two captive slotted screws are the only fasteners on the cover panel. Five shallow tabs at the bottom edge of the panel fit into slots at the base of the chassis opening. The tabs act as a pivot point for pulling the top of the panel away from the chassis opening, and as guides to align the panel when replacing it.

Warning Before accessing the chassis interior, turn OFF the system power and unplug the power cord. When the power is ON, high current is exposed on the fan tray and backplane.

Follow these steps to remove and replace the chassis cover panel:

Step 1 On the front of the cover panel, use a 3/16-inch flat-blade screwdriver to loosen the two captive screws. (See Figure 5-24.)

Step 2 Pull the top of the panel out about three inches, then grasp the sides of the panel and pull it upward and away from the chassis.

Step 3 To replace the cover panel, hold the sides of the panel with both hands and tilt the top of the panel back slightly (toward you).

Step 4 Slide the guide tabs into the slots in the bottom edge of the chassis. (See Figure 5-24.)

Figure 5-24   Removing and Replacing the Chassis Cover Panel
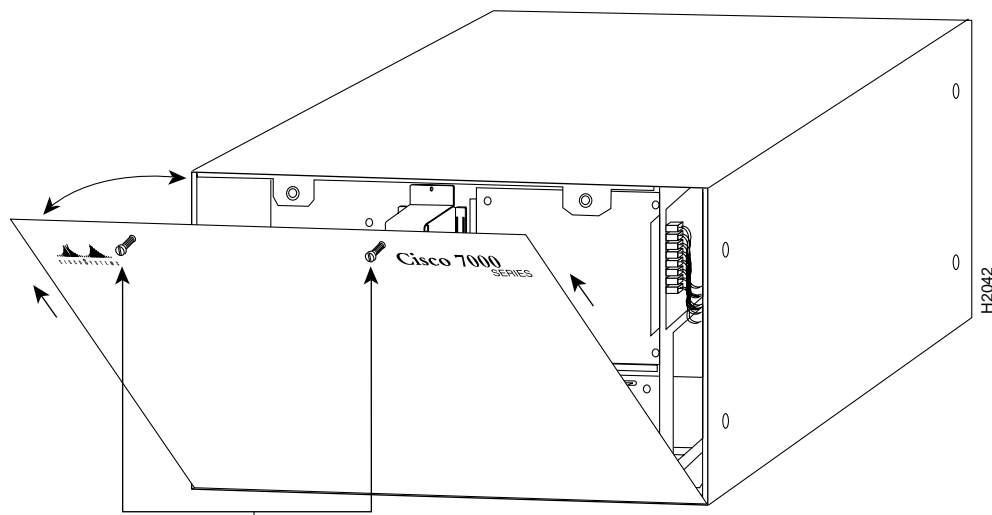
Step 5 Using the guides as a pivot point, push the top half of the panel back toward the chassis opening until the panel is flush with the edges of the chassis.

Step 6 Hold the top front of the panel in place, if necessary, while you tighten the two captive slotted screws with a 3/16-inch flatblade screwdriver.

This completes the chassis cover panel removal and replacement procedure.

Replacing the Fan Tray

The fan tray provides cooling air to the internal system components. If the system detects that a fan has failed, it will display a 2-minute warning, then shutdown the system until all of the fans are operational. You cannot replace individual fans; if a fan fails, you must replace the whole fan tray assembly.

When viewing the chassis from the noninterface processor end, the fan tray is on the far right. (See Figure 5-23.) A cutout in the front of the tray provides a handle for pulling the tray out of the chassis. An M-4 Phillips-head screw anchors a tab on the lower left side of the tray to the interior chassis frame, just below the right power supply ear. When the fan tray is fully inserted in the chassis, an edge connector on the fan control board snaps into the backplane electrical connector. The bottom of the tray is a metal runner that guides the tray along a metal track on the chassis floor. Also, a bracket on the chassis ceiling helps guide the tray into the chassis.

Warning Before accessing the chassis interior, turn OFF the system power and unplug the power cord. When the power is ON, high current is exposed on the fan tray and backplane.

Follow these steps to replace the fan tray.

Step 1 Turn OFF the system power switch and disconnect the power cable from the power source.

Step 2 Follow Steps 1 and 2 in the section "Removing and Replacing the Chassis Cover Panel."

Step 3 Put on an antistatic strap (your own or the one supplied with the spare fan tray) and connect the equipment end to a power supply handle or any unpainted surface on the chassis body.

Step 4 Locate the fan tray, which is in the far right of the noninterface processor end of the chassis. (See Figure 5-23.) On the lower left side of the fan tray, locate the tab that is anchored to the chassis frame with an M-4 Phillips screw.

Step 5 Use a number 2 Phillips screwdriver to remove the M-4 Phillips screw from the tab on the lower left side of the fan tray.

Step 6 Grasp the cutout handle in the front of the tray and pull the fan tray straight out of the chassis.(See Figure 5-25, top view.) After the fan control board connector frees the backplane socket, the fan tray will slide easily along the track and out of the chassis.

Step 7 Place the removed fan tray in an antistatic bag for storage or return to the factory.

Step 8 Hold the assembly in the position shown in Figure 5-25, lower view. You can hold the handle with either your right or left hand as long as you use both hands to handle the tray. However, when inserting the tray, there is little room between the tray and the right side of the chassis. Keep the tray as straight as possible, or you may have trouble inserting it into the chassis.

Note   Before inserting the fan tray, compare the hardware inside the chassis to Figure 5-26. The runner on the bottom of the fan tray has to slide along in the track on the floor. At the same time, the runner on the top of the tray has to slide through the notch at the top of the chassis opening, then over the top of the card cage while staying to the left of the L-bracket on the chassis ceiling.

Figure 5-25   Replacing the Fan Tray

Removing/replacing
fan tray
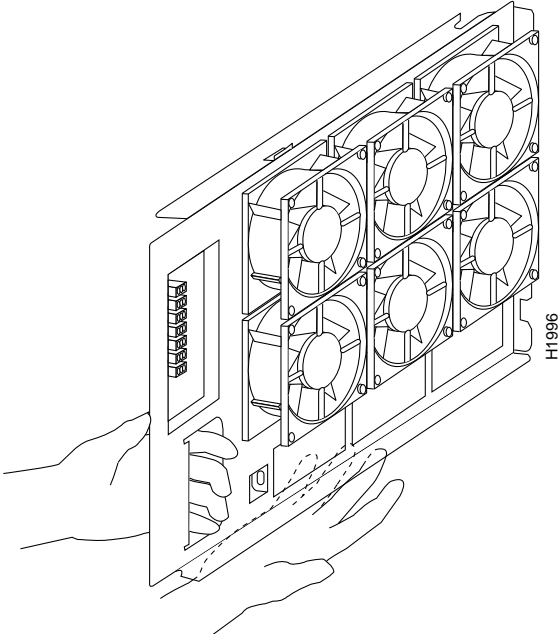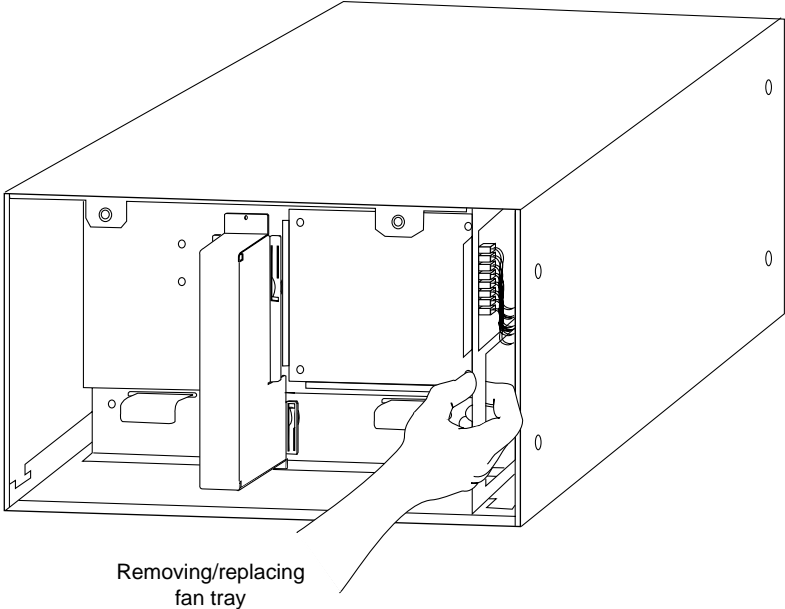
Step 9 Insert the top runner of the fan tray through the notch in the top of the chassis. Continue pushing the tray into the chassis, and ensure that the bottom runner slides into the track on the floor of the chassis. If the tray hangs up, pull it back out a few inches and try pushing it back in again. If the runners seem to be catching on the brackets, push the tray slightly toward the left when inserting it again.

Step 10 Slide the tray back into the chassis, pushing it all the way in until the circuit board snaps into the backplane socket.

Step 11 Replace the M-4 screw in the tab and tighten it with a number 2 Phillips screwdriver.

Step 12 Follow the steps in the section "Removing and Replacing the Chassis Cover Panel" to replace the cover panel.

This completes the fan tray replacement.

Figure 5-26   Fan Tray Tracks and Guides
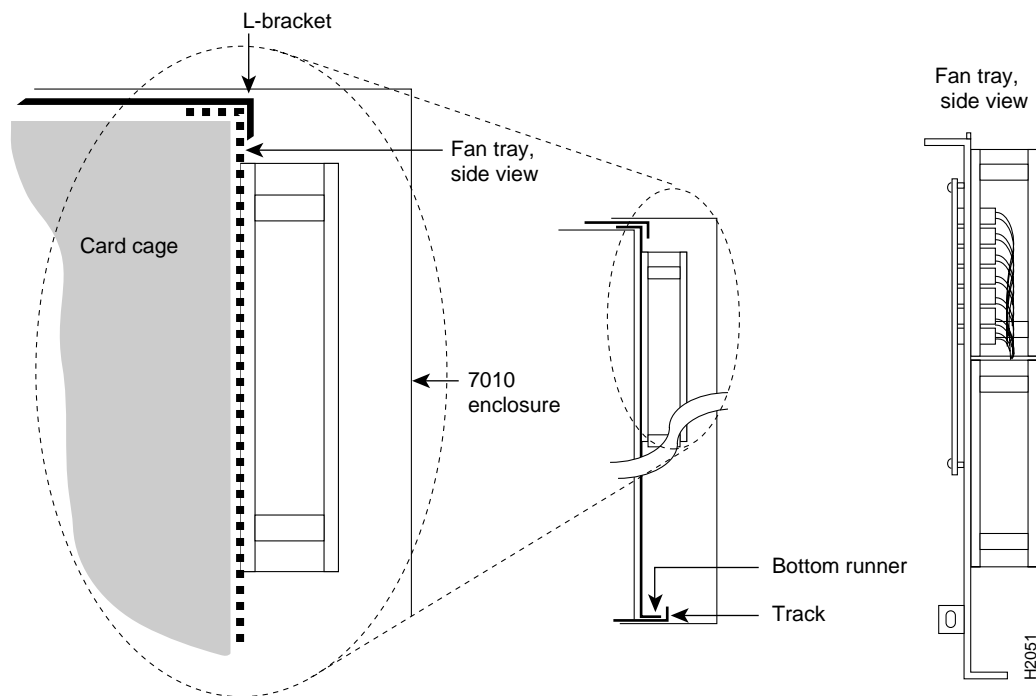
Removing and Replacing the Power Harness Cover

You must remove the power harness cover to access either the power supply or the arbiter. A single M-3 Phillips screw secures the power harness cover to the backplane cover.

Warning   Before accessing the chassis interior, turn OFF the system power and unplug the power cord. When the power is ON, high current is exposed on the fan tray and backplane.

Follow these steps to remove and replace the power harness cover:

Step 1   Turn OFF the system power switch and unplug the power cord from the AC source.

Step 2   Follow Steps 1 and 2 in the section "Removing and Replacing the Chassis Cover Panel" to open the chassis.

Step 3   Use a number 1 Phillips screwdriver to remove the M-3 screw that secures the harness cover to the backplane. (See Figure 5-28.)

Step 4   Holding the cover with one hand, tilt the top of the cover back toward you, then pull it upward slightly so that the tab clears the slot in the chassis floor.

Step 5   When the tab clears the slot, pull the cover straight back off the harness and out of the chassis.

Step 6   To replace the power harness cover, hold the cover with one hand, with the tab on the bottom and the open side facing away from you. Tilt the top of the panel back slightly (toward you).

Step 7   Insert the tab on the bottom of the cover into the slot in the chassis floor. (See Figure 5-27.)

Step 8   While pushing the cover downward slightly to keep the bottom tab in the slot, push the top of the cover back over the harness wires until the sides are flush against the backplane cover. Ensure that all of the harness wires are under the cover.

Step 9   Insert the M-3 screw through the top of the harness cover, and use a number 1 Phillips screwdriver to tighten it.

Step 10   Follow Steps 3 through 6 in the section "Removing and Replacing the Chassis Cover Panel" to replace the chassis cover panel.

This completes the power harness cover removal and replacement procedures.

Figure 5-27   Removing the Power Harness Cover

Removing power harness cover

Power harness cover

Arbiter cover

Power supply

Fan tray
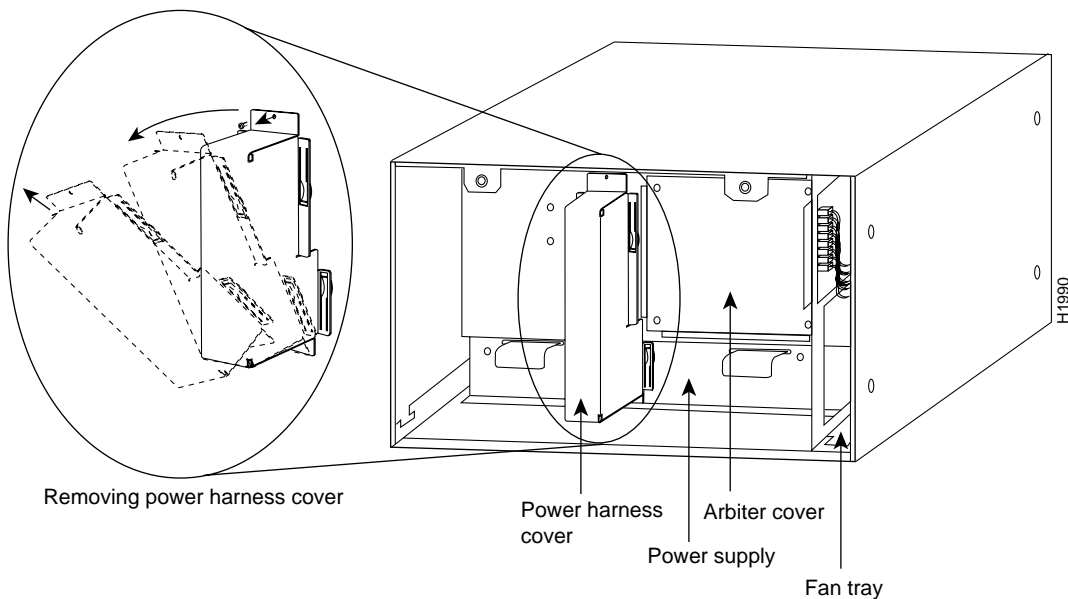
Removing and Replacing the Power Supply

The power supply rests on the floor of the chassis under the card cage and backplane. To remove the power supply, you must remove the chassis access cover at the noninterface processor end of the router, remove the power harness cover, and disconnect the harness from the backplane receptacle. Always pull the harness out by the connector, not by the wires. Before removing the power harness cover, ensure that the system power is turned off; otherwise, the backplane voltages become a hazard.

On the AC receptacle on the interface processor end of the 550W power supply, a cable-retention clip snaps up and around the modular AC power cable connector to prevent the cable from accidentally being pulled out or from falling out. (See Figure 5-28.) When inserting the power supply, this clip can get snagged on the chassis floor. Before inserting the supply, remove the clip or tape it up out of the way.

For the DC-input power cable, for the 600W DC-input power supply, strain relief is provided by a nylon cable tie that fastens the power cable to the terminal block cover. You provide this cable tie.

Caution To prevent damage, always pull the connector, not the harness wires, to disconnect the power harness.

Figure 5-28 **AC Power Supply, Interface Processor End**
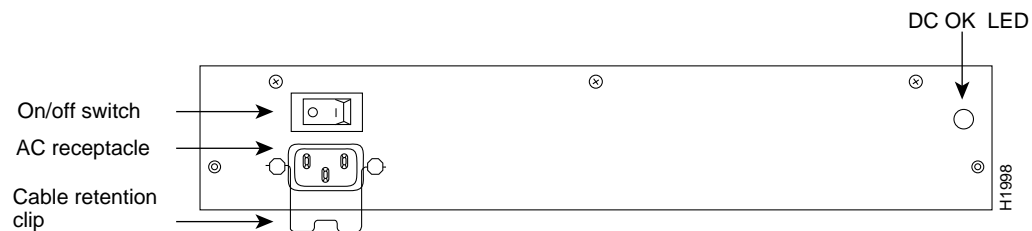
Warning Before accessing the chassis interior, turn OFF the system power and unplug the power cable. When the power is ON, high current is exposed on the fan tray and backplane.
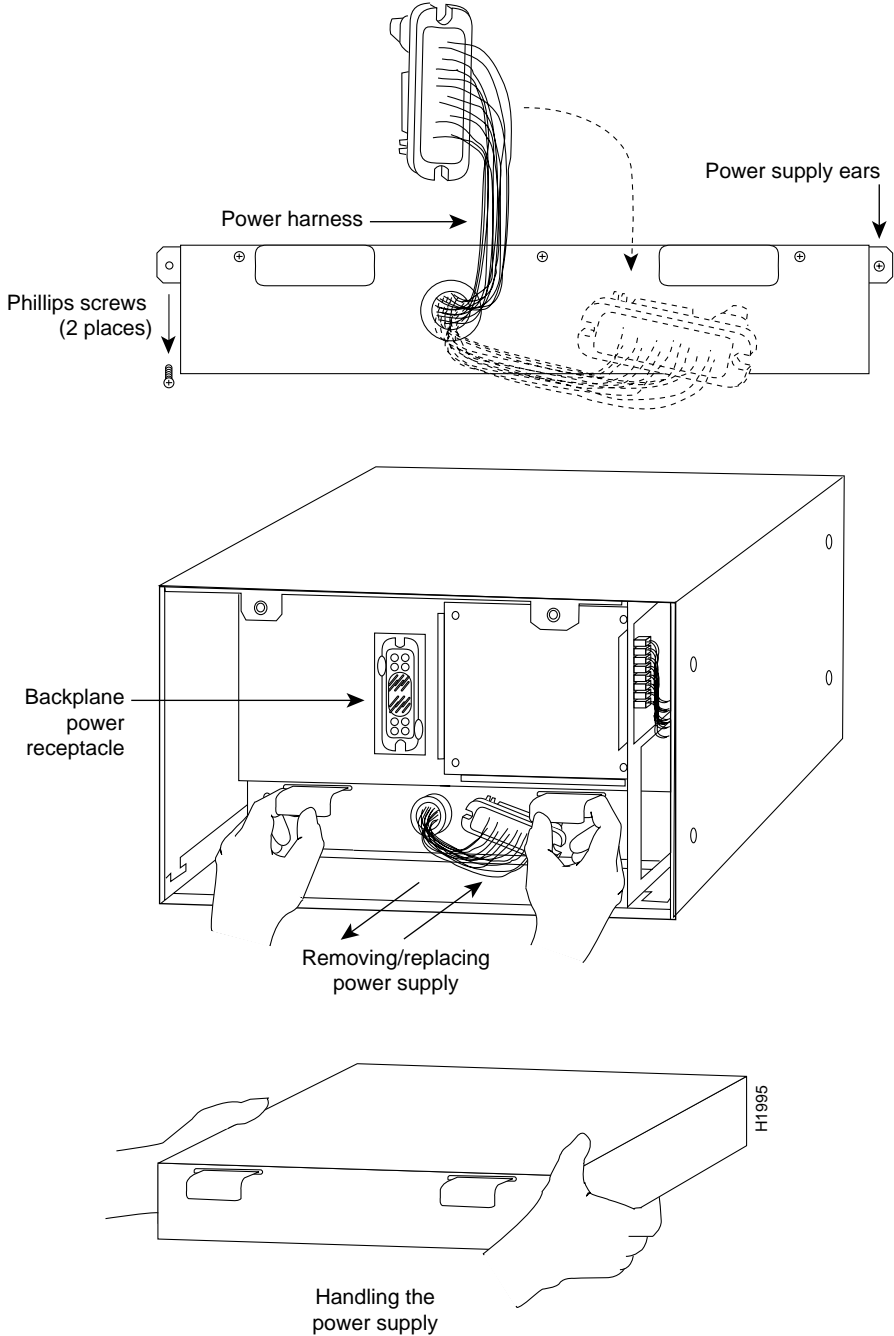
Removing the Power Supply

Follow these steps to remove the power supply:

Step 1 Turn OFF the system power switch and disconnect the power cable from the power source.

Step 2 Follow Steps 1 and 2 in the section "Removing and Replacing the Chassis Cover Panel."

Step 3 Follow Steps 1 through 5 of the section "Removing and Replacing the Power Harness Cover" to remove the power harness cover.

Step 4 Put on an antistatic strap (your own or the one supplied with the spare fan tray) and connect the equipment end to any unpainted surface on the chassis body.

Step 5 Disconnect the power harness plug from the backplane receptacle by pulling the polarized plug out of the receptacle; do not pull on the wires. (Figure 5-29 top view.)

Step 6 Use a number 2 Phillips screwdriver to remove the two M-4 Phillips pan-head screws that secure the power supply ears (one on each side of the power supply) to the chassis frame. (Figure 5-29 middle view.)

Step 7 Using both hands, grasp both of the power supply handles and pull the power supply about halfway out of the bay (Figure 5-29 middle view), then grab the sides of the supply and pull it out of the chassis. (Figure 5-29 lower view.)

This completes the power supply removal procedure.

Figure 5-29   Removing and Replacing the Power Supply

Power supply ears

Power harness

Phillips screws
(2 places)

Backplane
power
receptacle

Removing/replacing
power supply

H1995

Handling the
power supply

⚠️ **Warning** Before accessing the chassis interior, turn OFF the system power and unplug the power cord. When the power is ON, high current is exposed on the fan tray and backplane.

Replacing the Power Supply

Follow these steps to replace the power supply:

Step 1 Before inserting a power supply, remove the cable retention clip from the AC input port (on the interface processor end); otherwise it can catch on the floor of the chassis during the installation. Pinch the sides together until they clear the jackscrews. (See Figure 5-28.)

Step 2 To replace a power supply, hold the supply as shown in Figure 5-29c and slide it into the bottom of the chassis. Use the handles to push the supply all the way into the chassis until the ears on both sides are flush against the chassis frame. (See Figure 5-29b.)

Step 3 Use a number 2 Phillips screwdriver to replace the two M-4 Phillips pan-head screws to secure the two power supply ears to the chassis frame.

Step 4 Reconnect the power harness plug to the backplane receptacle. The harness plug and backplane receptacle are polarized with notches at the top of both guide tabs (top and bottom) on the plug. Ensure that the plug is fully seated in the receptacle.

Step 5 Follow Steps 6 through 10 in the section "Removing and Replacing the Power Harness Cover" to replace the power harness cover.

Step 6 Follow Steps 3 through 6 in the section "Removing and Replacing the Chassis Cover Panel" to replace the chassis cover panel.

Step 7 On the interface processor side of the AC-input power supply, replace the cable retention clip on the AC-input port by pinching the sides together and letting the ends snap out into holes in the jackscrews. (See Figure 5-28.)

For the DC-input power supply, refer to the section "Connecting Power" in the chapter "Installation" and follow the steps for connecting the DC-input power cable leads.

This completes the power supply replacement procedure.

Replacing the Arbiter

The arbiter provides switching and traffic control assistance to the SP (or SSP). Replace the arbiter board only if it fails.

The arbiter is a printed circuit board mounted to the noninterface processor side of the backplane, behind the backplane cover. (See Figure 5-23.) On the back (backplane side) of the arbiter are four standoffs and a 96-pin connector that plugs directly into the backplane. When the backplane cover is in place, four standoff screws extend through the backplane cover, through each corner of the arbiter, and into the standoffs to keep both the arbiter and cover in place.

You must remove the backplane cover to access the arbiter, and you must remove the power harness cover and the fan tray before you can remove the backplane cover.

Figure 5-30   Arbiter
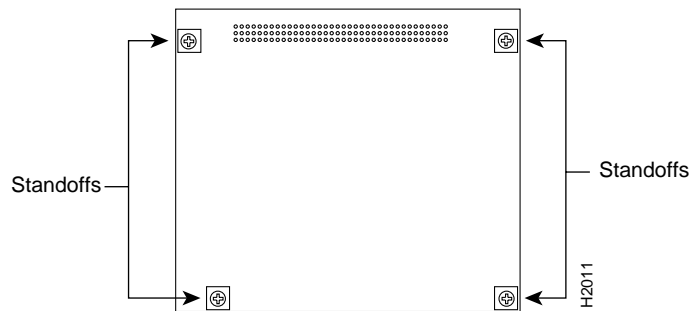
The backplane cover is held in place with the following screws:

- Sixteen 10-mm M3 pan-head screws (two on each flanged side of the cover, five along the top and five along the bottom flanges)

- Two standoff screws near the center to the left of the backplane power connection

- Four 20-mm M3 pan-head standoff screws at each corner of the arbiter cover that extend through the cover, arbiter, and into the backplane to anchor the arbiter

Be careful not to disconnect any backplane screws that are near the cover flanges.

Removing the Arbiter

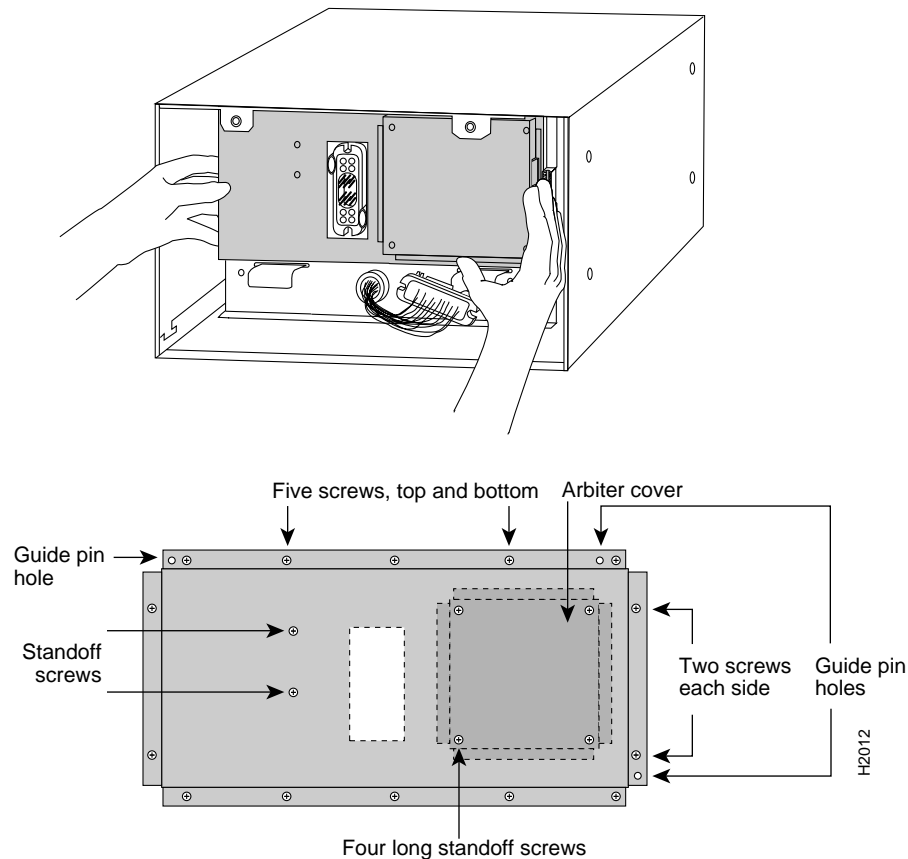Follow these steps to remove the arbiter:

Step 1   Turn OFF the system power switch and disconnect the power cable from the power source.

Step 2   Follow Steps 1 and 2 in the section "Removing and Replacing the Chassis Cover Panel" to open the chassis.

Step 3   Follow Steps 1 through 7 in the section "Replacing the Fan Tray" to remove the fan tray.

Step 4   Follow Steps 1 through 5 in the section "Removing and Replacing the Power Harness Cover" to remove the power harness cover.

Step 5   Put on an antistatic strap (your own or the one supplied with the spare fan tray) and connect the equipment end to a power supply handle or any unpainted surface on the chassis body.

Step 6   Disconnect the power harness from the backplane. (See Figure 5-29.)

Step 7   Use a number 1 Phillips screwdriver to remove the sixteen 10-mm M-3 Phillips pan-head screws that secure the backplane cover (2 on each side, 5 along the top, 5 along the bottom, and 2 standoff screws near the center to the left of the backplane power connection). Be careful not to disconnect any backplane screws. (The corners of the backplane extend just beyond the corners of the backplane cover.) Remove only the screws from the aluminum cover. (See Figure 5-31.)

Step 8   Use a number 1 Phillips screwdriver to remove the four longer (20-mm) M-3 standoff screws from the arbiter cover. (See Figure 5-31.) Keep these four longer standoff screws separate so that you can replace all the screws in the proper place.

Step 9   Holding the cover at the edge of each side with your fingertips, pull the cover straight out, away from the backplane (toward you) until it clears the three guide pins at the top and lower right corners. Put the cover aside.

Step 10 Because you already had to remove the four long standoff screws to remove the cover, the arbiter is held in place only by the 96-pin connector that is connected to the backplane. Grasp the edges of the board and pull the board straight out at a 90-degree orientation to the backplane to disconnect the board connector from the backplane socket. If necessary, rock it from side to side very slightly to dislodge the pins from the backplane connector.

Step 11 Place the arbiter in an antistatic bag.

This completes the arbiter removal procedure.

Figure 5-31   Removing the Backplane Cover

Five screws, top and bottom   Arbiter cover

Guide pin hole

Standoff screws

Two screws each side   Guide pin holes

Four long standoff screws

H2012

Replacing the Arbiter

Follow these steps to replace the arbiter:

Step 1 When replacing the arbiter, hold the board in the orientation shown in Figure 5-30, with the connector along the top and facing the backplane. Position the board over the backplane connector and align the four holes in the corners of the board with the four standoffs.

Step 2 Place your fingers around the top and side edges of the board and push the board straight in toward the backplane until the 96-pin connector is fully seated in the backplane socket.

Step 3 To replace the backplane cover, hold the side edges of the cover with your fingertips and slide the cover over the guide pins. (The guide pins are at the top left, top right, and lower right corners of the cover. See Figure 5-31.)

Step 4 Replace the four longer standoff screws at each corner of the arbiter cover, but do not tighten them until you align the cover and replace the other screws.

Step 5 Replace the sixteen M-3 screws along the cover edges and in the two standoffs. When all screws are in place, tighten them all.

Step 6 Reconnect the power harness plug to the backplane receptacle; the plug and receptacle are polarized with notches on the guide tabs. If you have trouble making the connection, ensure that the notch is at the top on both guide tabs (top and bottom) on the plug.

Step 7 Follow Steps 6 through 10 in the section "Removing and Replacing the Power Harness Cover" to replace the power harness cover.

Step 8 Follow Steps 8 through 11 in the section "Replacing the Fan Tray" to replace the fan tray.

Step 9 Follow Steps 3 through 6 in the section "Removing and Replacing the Chassis Cover Panel" to replace the chassis cover panel.

This completes the arbiter replacement procedure.

Note All components are shipped with detailed, up-to-date instructions (called *configuration notes*) for installing and, if applicable, configuring the spare.