CISCO

Cisco XR 12410 Router Installation Guide

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
 800 553-NETS (6387)
Fax: 408 527-0883

Text Part Number: OL-13832-01

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C O N T E N T S

Cisco XR 12410 Router Installation Guide

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About This Guide

Audience

The *Cisco XR 12410 Router Installation Guide* is written for hardware installers and system administrators of Cisco routers.

This publication assumes that the user has a substantial background in installing and configuring router and switch-based hardware. The reader should also be familiar with electronic circuitry and wiring practices, and have experience as an electronic or electromechanical technician.

Purpose

This installation and configuration guide contains procedures for installing the router hardware, creating a basic startup configuration file, and powering on the router for the first time.

Document Organization

This installation and configuration guide is organized into the following chapters and appendixes:

- Chapter 1, "Cisco XR 12410 Router Overview," provides an introduction to the major components of Cisco XR 12410 router.

- Chapter 2, "Preparing for Installation," describes safety considerations, required tools and equipment, an overview of the installation, and procedures to perform before the installation.

- Chapter 3, "Installing the Cisco XR 12410 Router," provides instructions for installing the hardware and connecting external network interface cables.

- Chapter 4, "Troubleshooting Overview,"provides guidelines for troubleshooting the router hardware installation.

- Chapter 5, "Maintaining the Router," provides removal and replacement procedures for primary router components or field-replaceable units (FRUs).

- Appendix A, "Technical Specifications," provides a summary of physical, electrical, and environmental specifications for the router.

- Appendix B, "Site Log,"provides a sample site log that can be used to record actions relevant to the operation and maintenance of the router.

- Index

Document Conventions

This publication uses the following conventions:

- **Ctrl** represents the key labeled *Control*. For example, the key combination **Ctrl-Z** means hold down the **Control** key while you press the **z** key.

Command descriptions use these conventions:

- Examples that contain system prompts denote interactive sessions, indicating the commands that you should enter at the prompt. The system prompt indicates the current level of the EXEC command interpreter.

  For example:

  – The `router>` prompt indicates that you should be at the *user* level.

- The router# prompt indicates that you should be at the *privileged* level.

  Access to the privileged level usually requires a password. Refer to the related software configuration and reference documentation for additional information.

- Commands and keywords are in **bold** font.

- Arguments for which you supply values are in *italic* font.

- Elements in square brackets ([ ]) are optional.

- Alternative but required keywords are grouped in braces ({ }) and separated by vertical bars (|).

Caution Means *be careful*. You are capable of doing something that might result in equipment damage or loss of data.

Note Means *take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Warning **This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.**

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Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and recommended aliases and general Cisco documents, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

Cisco XR 12410 Router Overview

This chapter provides an overview of the Cisco XR 12410 router. It contains physical descriptions of the router hardware and major components, and functional descriptions of the hardware-related features.

Physical and Functional Description of Router

The router chassis is a sheet-metal enclosure that houses router components.

All router models contain the following major components (Figure 1-1):

* Blower module—Supplies cooling air to the router so it does not overheat. See the "Blower Module" section on page 1-27 for additional information.

* Alarm display—Monitors various router functions such as power and CSC and SFC status. See the "Alarm Cards and Alarm Display" section on page 1-11 for additional information.

* Horizontal cable management bracket—Used to neatly route line card cables. See the "Horizontal Cable Management Bracket" section on page 1-25 for additional information.

* Line card and Route Processor card cage—Has 10 user-configurable slots that support a combination of line cards and either one or two route processors (RPs).

- Switch fabric and alarm card cage—Located behind the air filter door, this card cage contains 7 slots for the switch fabric card set, and two slots for alarm cards. The switch fabric card set is made up of five switch fabric cards (SFCs) and two clock scheduler cards (CSCs). See the "Switch Fabric and Alarm Card Overview" section on page 1-9 for additional information.

- Power Entry Modules—Either two AC power entry modules (PEMs) or two DC PEMs provide power to the router. See the "AC and DC Power Subsystems" section on page 1-5 for additional information.

- Chassis backplane (not shown)—Distributes power to the chassis components.

Figure 1-1 *Cisco XR 12410 Router Components—Front View*
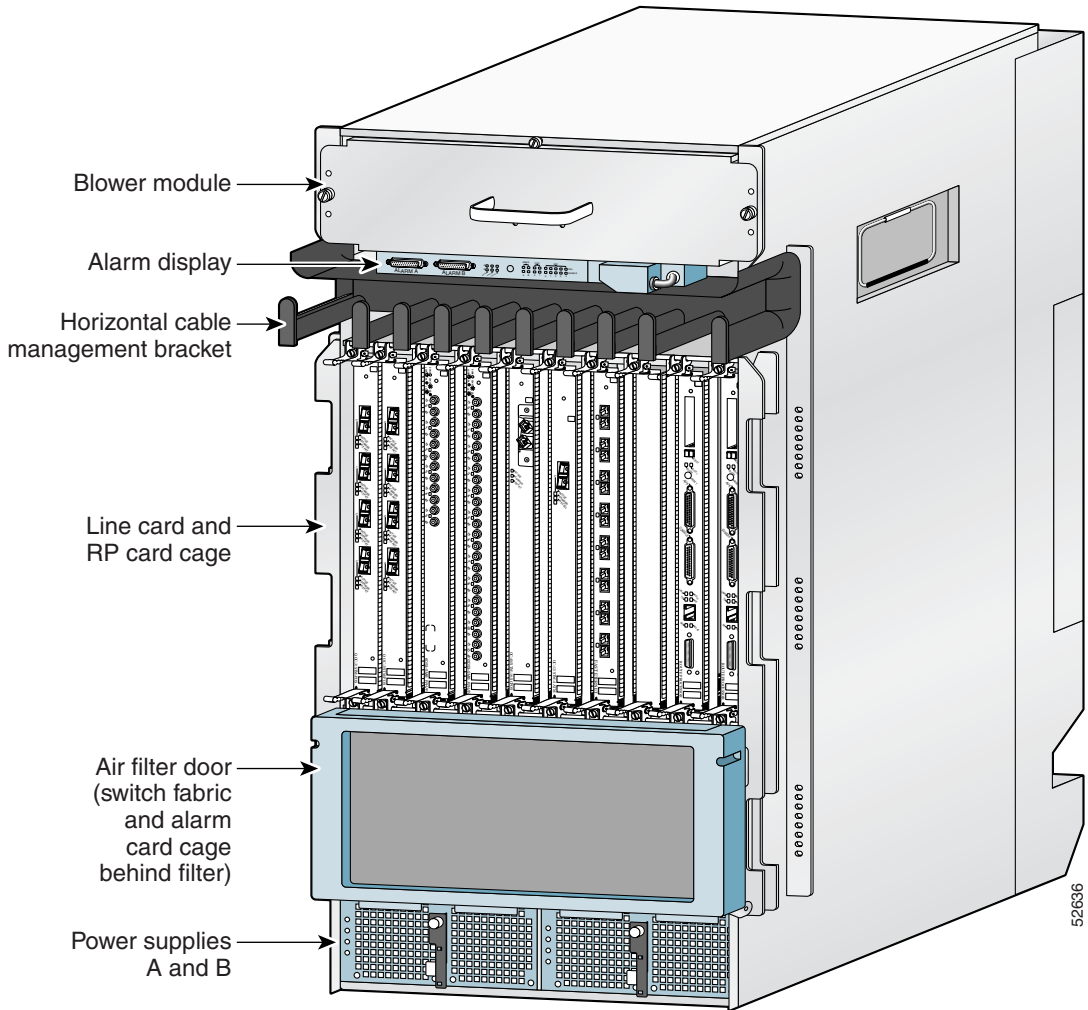
Figure 1-2 shows the slot numbering layout of the router with the location of the major components. Power is distributed to these components over the chassis backplane (not shown).

Figure 1-2   ***Router Components and Slot-Numbering***
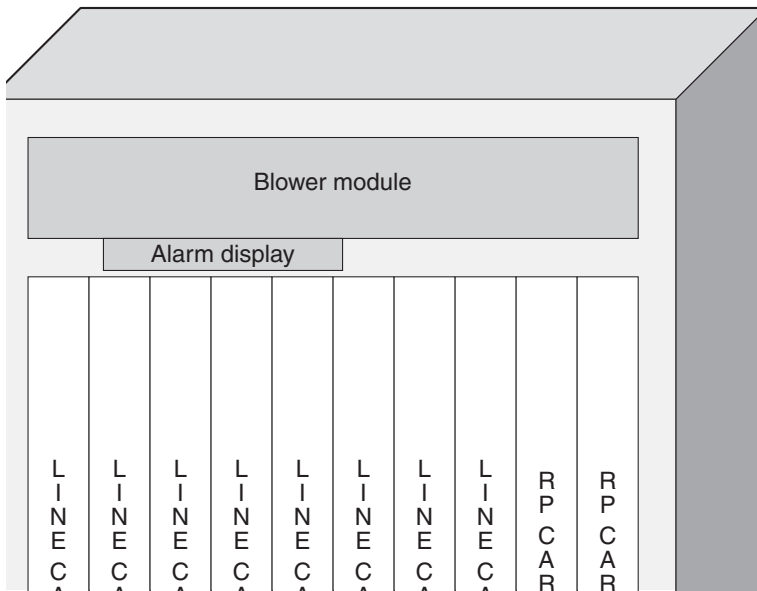
AC and DC Power Subsystems

A router ships as either an AC or DC powered system. Source power connects to power distribution units (PDUs) on the back of the chassis which route power to the power supplies, also referred to as power entry modules (PEMs).

⚠

Caution   To ensure that the chassis configuration complies with the required power budgets, use the on-line power calculator. Failure to properly verify the configuration may result in an unpredictable state if one of the power units fails. Contact your local sales representative for assistance.

AC Power Entry Modules

An AC powered router consists of two AC PDUs and AC PEMs. AC power to the router is provided through power cords connected from AC power outlets to the PDUs on the chassis rear panel as shown in Figure 1-3.

Figure 1-3   *AC PDU Connection*

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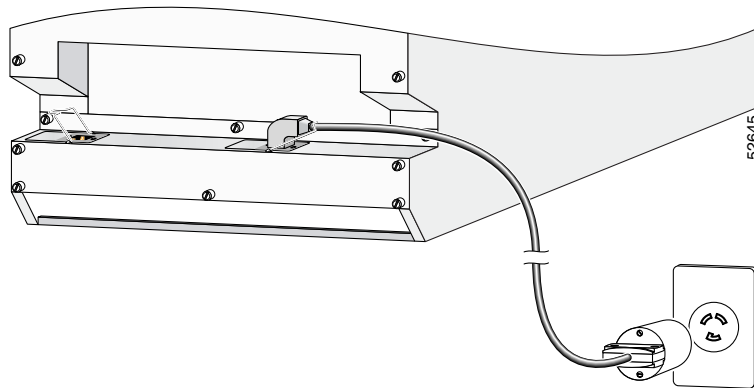
Each AC PEM converts 200 to 240 VAC into -48 VDC, which is distributed through the chassis backplane to all cards, RPs, and the blower module.

Figure 1-4 identifies the components of an AC PEM.

Figure 1-4   AC PEM Components
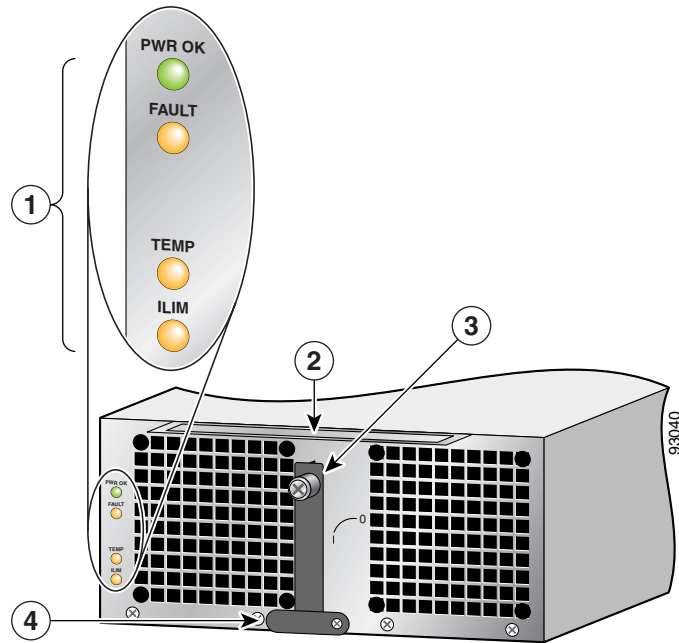
1	Status indicators	3	Ejector lever
2	Handle	4	Power On/Off switch (shown in the ON/1 position)

DC Power Supplies

A DC powered router consists of two DC PDUs and DC PEMs. DC power to the router is provided from cables from a DC power source that are connected to threaded DC-input terminal studs on the chassis rear panel as shown in Figure 1-5.

Figure 1-5   DC Power Cables—2800 W DC PDU

– 48/60V RTN (+)

– 48/60V (–)

Feed A2

– 48/60V (–)

– 48/60V RTN (+)

Feed A1

Ground

129277
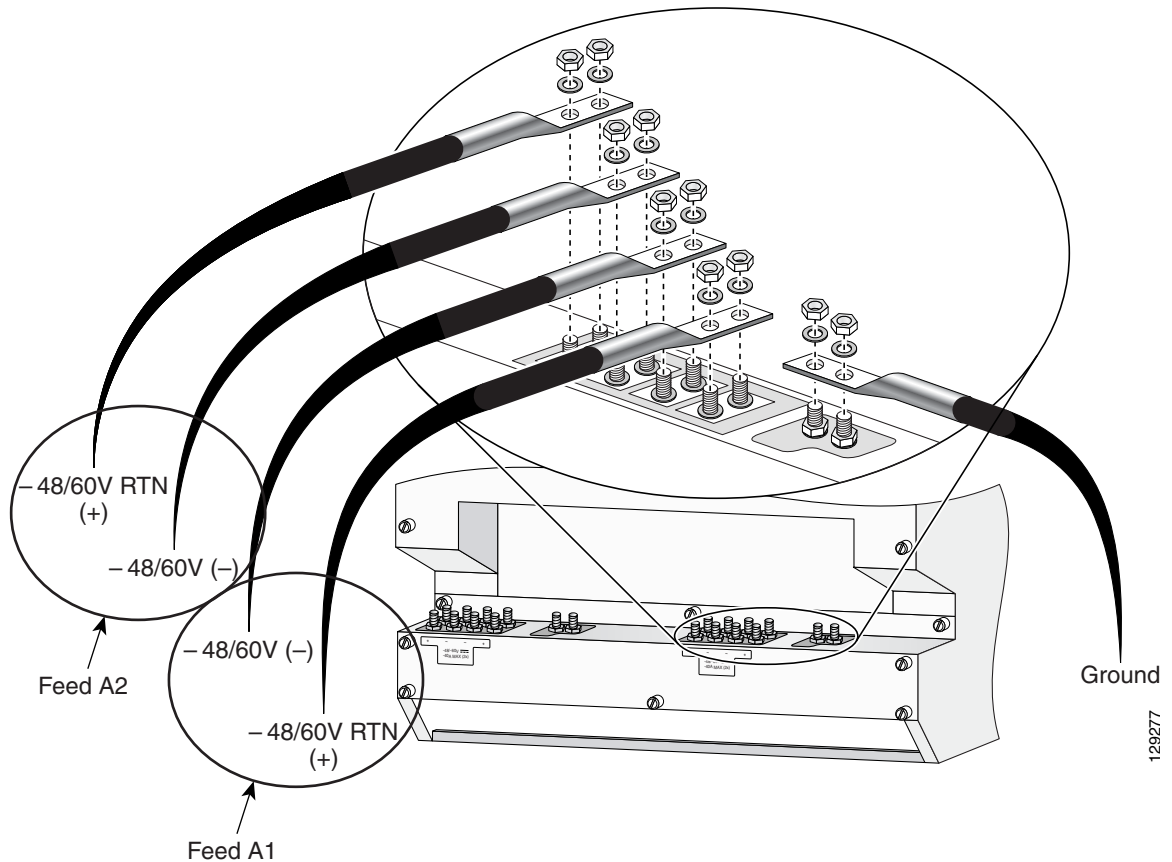
Each DC PEM operates from a nominal source DC voltage of –48 to –60 VDC and requires a dedicated 60-amp service.

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Figure 1-6 identifies the components of a DC power supply.

Figure 1-6   2800 Watt DC PEM Components
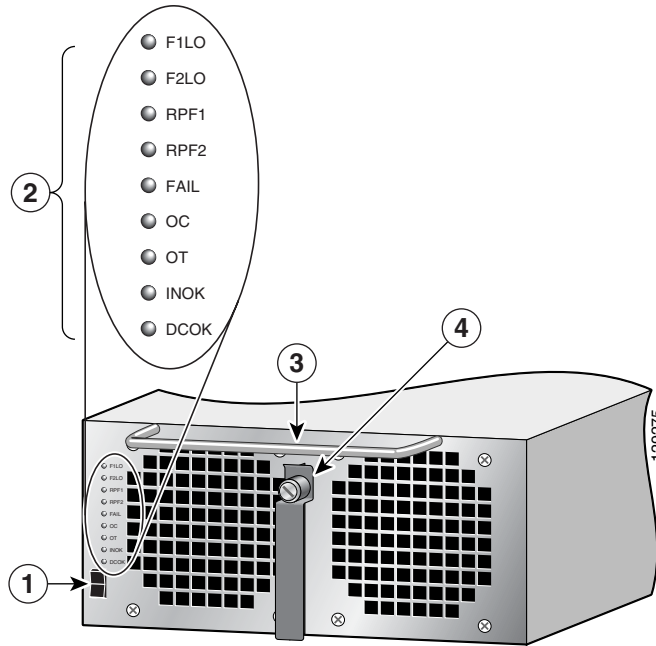
1	Power on/off switch	**3**	Handle
2	Status indicators	**4**	Ejector lever

Switch Fabric and Alarm Card Overview

The switch fabric provides synchronized gigabit-speed connections between line cards and the route processor. The 9-slot switch fabric and alarm card cage contain:

- 2 clock scheduler cards (CSCs)
- 5 switch fabric cards (SFCs)
- 2 alarm cards

Note   The two alarm cards that are located in the switch fabric and alarm card cage are not part of the switch fabric.

One CSC and four SFCs are required for an active switch fabric; the second CSC and the fifth SFC provide redundancy. The combination of CSCs and SFCs make up the 10-Gbps per-slot switch fabric.

Each SFC or CSC provides a 10-Gbps full-duplex connection to each line card in the system. For example, in a Cisco XR 12410 router with 8 line cards, each with 2 x 10 Gbps capacity (full duplex), the system switching bandwidth is 8 x 20 Gbps = 160 Gbps.

Figure 1-2 shows the slot configuration in the switch fabric and alarm card cage. The labeling identifies the type of card for each slot and can only be seen when the air filter door is opened.

Note   Cisco XR 12410 router support online insertion and removal (OIR), which allows you to remove and replace a card while the router remains powered on.

Switch Fabric Card Functionality

Routers ship from the factory with 2 CSCs and 5 SFCs installed in the 7 slots in the switch fabric and alarm card cage (see Figure 1-2).

- CSCs are installed in slot 0 (CSC0) or slot 1 (CSC1).

- SFCs are installed in slot 2 (SFC0), slot 3 (SFC1), slot 4 (SFC2), slot 5 (SFC3), and slot 6 (SFC4).

Note The enhanced version of the CSC and SFC cards is required for support of BITS, Single Router APS and Dual Priority features. The enhanced version of the cards cannot be mixed with the original version fabric cards.

Clock Scheduler Card

Clock scheduler cards provide the following functionality:

- Scheduler—Handles all scheduling requests from the line cards for access to the switch fabric.

- System clock—Supplies the synchronizing signal to all SFCs, line cards, and the RP. The system clock synchronizes data transfers between line cards or between line cards and the RP through the switch fabric.

- Switch fabric—Carries user traffic between line cards or between the RP and a line card. The switch fabric on the CSC is identical to the switch fabric on the SFC.

The second CSC provides redundancy for the data path, scheduler, and reference clock. Traffic between the line cards and the switch fabric is monitored constantly. If the system detects a loss of synchronization (LOS), it automatically activates the data paths on the redundant CSC so data flows across the redundant paths. The switch to the redundant CSC occurs within sub-seconds (the actual switch time depends on your configuration and its scale).

Switch Fabric Card

The switch fabric cards augment the traffic capacity of the router. SFCs contain switch fabric circuitry that can only carry user traffic between line cards or between the RP and the line cards. SFCs receive all scheduling information and the system clock signal from the CSCs.

Alarm Cards and Alarm Display

The two alarm cards (in the switch fabric and alarm card cage) provide several functions:

- Supply +5 VDC to the MBus modules on router components (see AC and DC Power Subsystems, page 1-5).

- Work in conjunction with the alarm display to monitor the system. The alarm display (sometimes referred to as the alarm display card) is above the horizontal cable management bracket (Figure 1-7).

Figure 1-7   Alarm Display Location
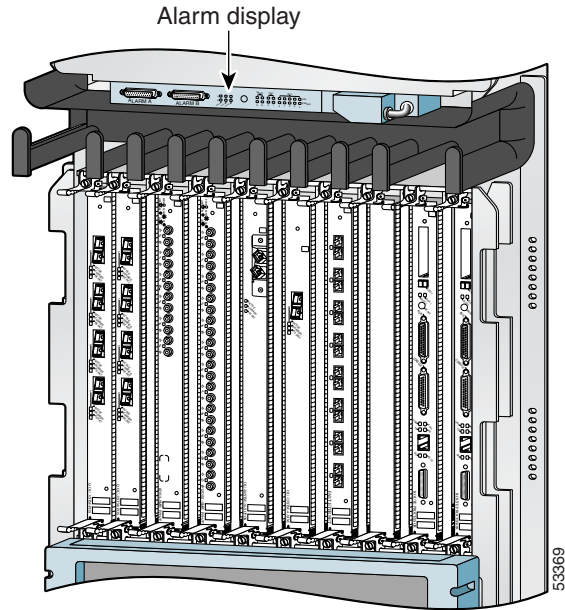
Alarm display

The following connectors and LEDs are on the front panel of the alarm display (Figure 1-8):

Figure 1-8   Alarm Display
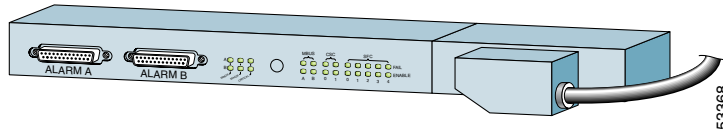
- Cable connections for the two alarm cards (labeled Alarm A and Alarm B)

- Critical, Major, and Minor LEDs that identify system level alarm conditions

- A pair of status LEDs that correspond to each of the 9 card slots in the switch fabric and alarm card cage (seven fabric cards and two alarm cards):

    - ENABLED (green)
      On—The card installed in that slot is operational and functioning properly.
      Off—Either the slot is empty or the card installed in that slot is faulty.

    - FAIL (yellow)—The card in that slot is faulty.

Line Card and Route Processor Overview

The line card and route processor (RP) card cage has 10 user-configurable slots that support a combination of line cards and either one or two RPs (see Figure 1-2). Router configurations can consist of either nine line cards and one RP, or eight line cards and two RPs (one primary and one redundant) using the following slot configurations:

- Slots 0 to 7 accommodate the newer (wider) line card designs. These wider line card slots can also accept narrower legacy line cards.

- Slots 8 and 9 only accept RPs or a narrower legacy line card.

Note   If a system uses only one RP install it in slot 9. You can use slot 8 for a legacy line card.

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Line Cards

Ports and connectors on the line card front panels provide interfaces for external connections. Line cards communicate with the RP and exchange packet data with each other through the switch fabric cards.

⚠

Caution Any unoccupied card slot in the line card and RP card cage must have a blank filler panel installed to meet electromagnetic compatibility (EMC) requirements and to ensure proper air flow through the chassis. Also, if the front panel of a line card does not completely fill the card slot opening, a narrow card filler panel must be installed to meet the EMC requirements.

A cable management bracket on the front panel of each line card helps to organize the interface cables connected to that line card.

- The Cisco XR 12410 router supports online insertion and removal (OIR), allowing you to remove and replace a card while the router remains powered on.

The following line cards, SIPs, and SPAs are supported on the Cisco XR 12410 router:

✏

Note Refer to the current s software release notes for the most up-to-date list of supported line cards (see "Obtaining Documentation, Obtaining Support, and Security Guidelines" section on page -xiv).

Route Processor

The route processor for the Cisco XR 12410 router is the Performance Route Processor (PRP-2). For detailed information about the Performance Route Processor, refer to the Cisco document, *Performance Route Processor Installation and Configuration Guide*.

The PRP-2 performs the following primary functions:

- Executes routing protocol stacks

- Performs all protocol communications with other routers

- Builds and distributes forwarding information to all line cards

- Uploads the operating system software images to all installed line cards during power-up

- Provides out-of-band system console and auxiliary ports and an Ethernet port for router configuration and maintenance

- Monitors and manages the power and temperature of system components such as line cards, power supplies, and fans

The Cisco PRP-2 delivers all these functions with enhanced performance and capabilities. It also delivers the following feature enhancements (depending on the software version running):

- Gigabit Ethernet management port

- Hard-drive support (optional part)

- BITS input ports

- 1 GB compact image Flash memory support (optional part)

- Memory scalability up to 4 GB

The PRP-2 communicates with the line cards either through the switch fabric or through the MBus. The switch fabric connection is the main data path for routing table distribution as well as for packets that are sent between the line cards and the PRP-2. The MBus connection allows the PRP-2 to download a system bootstrap image, collect or load diagnostic information, and perform general, internal system maintenance operations.

The PRP-2 can be designated as either the Designated System Controller (DSC) or the Secure Domain router (SDR).

The Designated System Controller (DSC) performs the following functions:

- Implements control plane operations for the chassis

- Monitors temperature and voltage

- Monitors line cards

- On boot up, the first card to become active is designated as the DSC.

The Secure Domain Router (SDR) controls domain security features independent of any other SDRs on the network.

Performance Route Processor Overview

The performance route processor (PRP) uses a Motorola PowerPC 7450 CPU that runs at an external bus clock speed of 133 MHz and has an internal clock speed of 667 MHz.

Figure 1-9 identifies the slots, ports, and LEDs on the PRP front panel.

Figure 1-9   Performance Route Processor Front Panel

1	PCMCIA flash disk slots (shown with cover in place) and slot LEDs	**4**	Console serial port
2	RJ-45 Ethernet ports and data status LEDs	**5**	Reset button
3	Auxiliary serial port	**6**	Alphanumeric message displays

PRP PCMCIA Card Slots and Status LEDs

Two PCMCIA card slots (slot 0 and slot 1) provide the PRP with additional flash memory capacity. All combinations of different flash devices are supported by the PRP. You can use ATA flash disks, Type 1 or Type 2 linear flash memory cards, or a combination of the two.

✎
Note   The PRP only supports +5.2 VDC flash memory devices. It does *not* support +3.3 VDC PCMCIA devices.

Status LEDs (Slot-0 / Slot-1) indicate when the flash memory card in that slot is accessed (see Figure 1-9). Each slot has an eject button (located behind the cover) to remove a flash card from the slot.

PRP Ethernet Ports and Status LEDs

The PRP has two 8-pin media-dependent interface (MDI) RJ-45 ports for either IEEE 802.3 10BASE-T (10 Mbps) or IEEE 802.3u 100BASE-TX (100 Mbps) Ethernet connections. These ports are labeled ETH 0 and ETH 1.

The transmission speed of the Ethernet port is not user-configurable. You set the speed through an autosensing scheme on the PRP which is determined by the network that the Ethernet port is connected to. However, even at an autosensed data transmission rate of 100 Mbps, the Ethernet port can only provide a usable bandwidth of substantially less than 100 Mbps. You can expect a maximum usable bandwidth of approximately 20 Mbps when using an Ethernet connection.

The following LEDs on the front panel indicate traffic status and port selection (Figure 1-10):

- LINK, EN, TX, RX—Indicate link activity (LINK), port enabled (EN), data transmission (TX), and data reception (RX).

- PRIMARY—Indicates which Ethernet port is selected (ETH 0 or ETH 1).

Note Because both ports are supported on the PRP, ETH 0 is always on. ETH 1 lights when it is selected.

Figure 1-10   Port Activity LEDs—Partial Front Panel
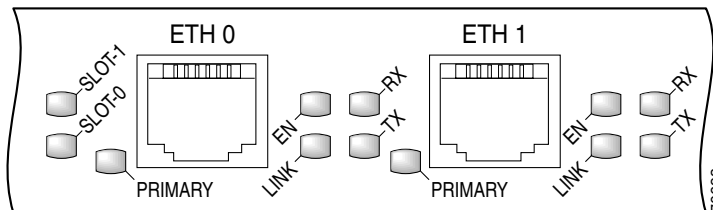
PRP Auxiliary and Console Ports

The auxiliary and console ports on the PRP are EIA/TIA-232 (also known as RS-232) asynchronous serial ports. These ports connect external devices to monitor and manage the system.

- The auxiliary port—A (male) plug that provides a data terminal equipment (DTE) interface. The auxiliary port supports flow control and is often used to connect a modem, a channel service unit (CSU), or other optional equipment for Telnet management.

- The console port—A (female) receptacle that provides a data circuit-terminating equipment (DCE) interface for connecting a console terminal.

PRP Reset Switch

Access to the (soft) reset switch is through a small opening in the PRP front panel (see Figure 1-9). To press the switch, insert a paper clip or similar small pointed object into the opening.

⚠
Caution   The reset switch is *not* a mechanism for resetting the PRP and reloading the Cisco IOS image. It is intended for software development use only. To prevent system problems or loss of data, use the reset switch only on the advice of Cisco service personnel.

Pressing the reset switch causes a nonmaskable interrupt (NMI) and places the PRP in ROM monitor mode. When the PRP enters ROM monitor mode, its behavior depends on the setting of the PRP software configuration register. For example, if the boot field of the software configuration register is set to:

- 0x0—The PRP remains at the ROM monitor prompt (rommon>) and waits for a user command to boot the system manually.

- 0x1—The system automatically boots the first Cisco IOS image found in flash memory on the PRP.

PRP Alphanumeric Message Displays

The alphanumeric message displays are organized in two rows of four LED characters each (Figure 1-11).

Figure 1-11   Alphanumeric Message Displays—Partial Front Panel
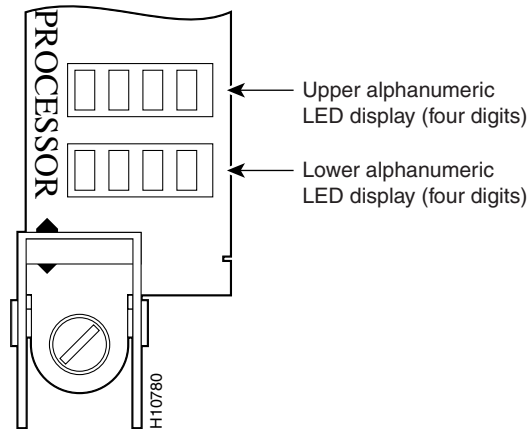
The alphanumeric message displays show router status messages during the boot process, and after the boot process is complete.

- During the boot process, the message displays are controlled directly by the MBus module.
- After the boot process, the message displays are controlled by Cisco IOS software (through the MBus).

The alphanumeric message displays also provide information about different levels of system operation, including the status of the GRP, router error messages, and user-defined status and error messages

Note   A complete, descriptive list of all system and error messages appears in the *Cisco IOS System Error Messages* publication.

PRP Memory Components

This section describes various types of memory used on the PRP to support router functions. Table 1-1 provides a quick reference of the different types of memory, and Figure 1-12 shows the location on the PRP board.

Table 1-1   **PRP Memory Components**

Type	Size	Quantity	Description	Location
SDRAM	512 MB[1], 1 GB, or 2 GB	1 or 2	Uses 512 MB or 1 GB DIMMs (based on SDRAM configuration) for main Cisco IOS XR software functions	U15 (bank 1) U18 (bank 2)
SRAM	2 MB (fixed)	—	Secondary CPU cache memory functions	—
NVRAM	2 MB (fixed)	—	System configuration files, register settings, and logs	—
Flash memory	64 MB SIMM	1	Cisco IOS XR boot image (bootflash), crash information, and other user-defined files	P3
Flash disk (PCMCIA)	64 MB[1]	1 or 2	Cisco IOS XR software images, system configuration files, and other user-defined files on one or two Flash memory cards	Flash memory card slot 0 and slot 1
Flash boot ROM	512 KB	1	Flash EPROM for the ROM monitor program boot image	—

1. Default shipping configuration.

Figure 1-12   PRP Memory Locations
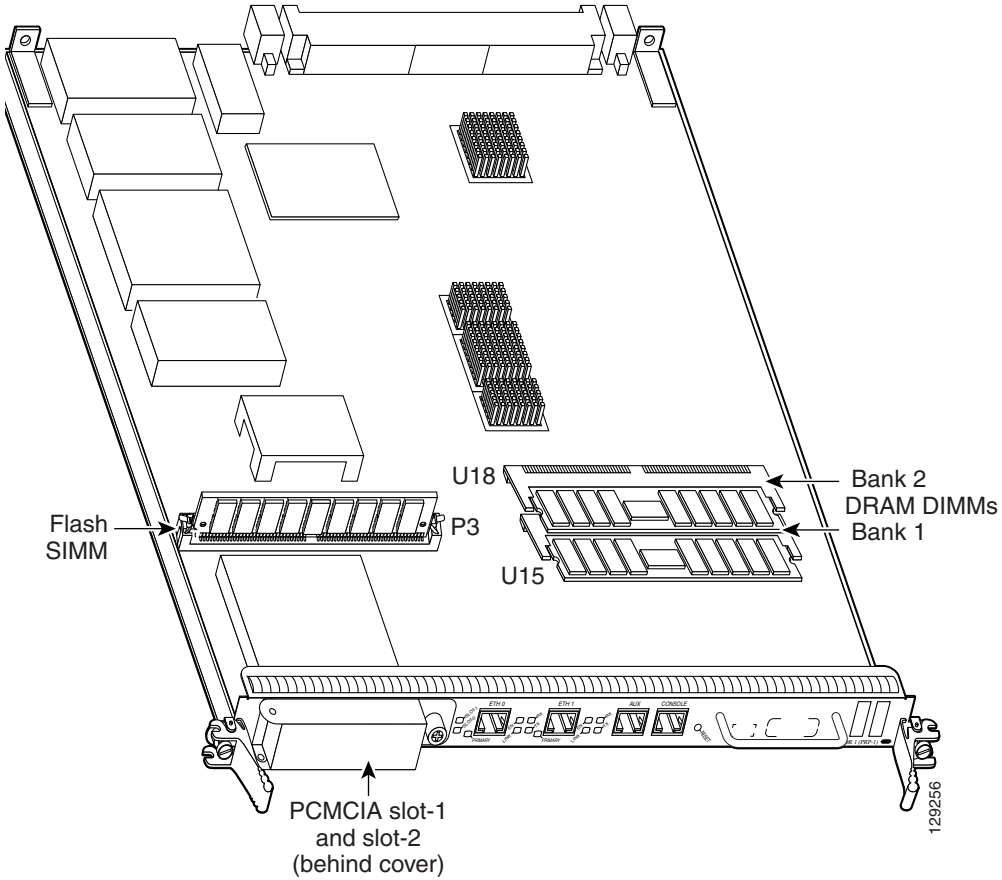
PRP SDRAM

The PRP uses Error Checking and Correction (ECC) Synchronized Dynamic Random Access Memory (SDRAM) to store routing tables, protocols, network accounting applications, and to run Cisco IOS software.

Table 1-2 lists the DRAM configurations for the PRP. If you are using:

- One DIMM—Bank 1 (U15) must be populated first.
- Two DIMMs—You cannot mix memory sizes; both banks must contain the same size DIMM.

Table 1-2   PRP DRAM Configurations

Total SDRAM	SDRAM Sockets	Number of DIMMs
512 MB[1]	U15 (bank 1) U18 (bank 2)	One 512 MB DIMM or Two 256 MB DIMMs
1 GB	U15 (bank 1) U18 (bank 2)	One 1 GB DIMM or Two 512 MB DIMMs
2 GB	U15 (bank 1) U18 (bank 2)	Two 1 GB DIMMs

1. Default shipping configuration.

⚠

Caution DRAM DIMMs must be 3.3-volt, 60-nanosecond devices only. Do not attempt to install other devices in the DIMM sockets. To prevent memory problems, use the Cisco approved memory products listed in Table 1-2.

PRP SRAM

Static Random Access Memory (SRAM) provides 2 MB of secondary CPU cache memory. Its principal function is to act as a staging area for routing table updates, and for information sent to and received from the line cards. SRAM is *not* user-configurable and cannot be upgraded in the field.

PRP NVRAM

Non-volatile Random Access Memory (NVRAM) provides 2 MB of memory for system configuration files, software register settings, and environmental monitoring logs. Built-in lithium batteries retain the contents of NVRAM for a minimum of 5 years. NVRAM is *not* user configurable and cannot be upgraded in the field.

PRP Flash Memory

Use flash memory to store multiple Cisco IOS XR software and microcode images that you can use to operate the router. You can download new images to flash memory over the network (or from a local server) to replace an existing image, or to add it as an additional image. The router can be booted (manually or automatically) from any of the stored images in flash memory.

Flash memory also functions as a Trivial File Transfer Protocol (TFTP) server to allow other servers to boot remotely from the stored images, or to copy them into their own flash memory.

The system uses two types of flash memory:

- Onboard flash memory (called *bootflash)*—Contains the Cisco IOS boot image
- Flash memory disks (or cards)—Contain the Cisco IOS software image

Table 1-3 lists supported flash disk sizes and Cisco part numbers.

Table 1-3   Supported Flash Disk Sizes

Flash Disk Size[1]	Part Number
64 MB[2]	MEM-12KRP-FD64=
128 MB	MEM-12KRP-FD128=
1 GB	MEM-12KRP-FD1G=

1. Standard Type 1 and Type 2 linear flash memory cards also are supported, although they may not have the capacity to meet the configuration requirements of your system.

2. Default shipping configuration.

Upper and Lower Cable Management Brackets

The Cisco XR 12416 router includes upper and lower cable management brackets that work together with individual line card cable management brackets to organize interface cables entering and exiting the router (see Figure 1-1).

Network interface cables to the line cards are fed across the brackets, and then through the openings to the individual line card cable management bracket. This system keeps cables out of the way and free of sharp bends.

⚠

Caution   Excessive bending of interface cables can damage the cables.

Upgrading a Cisco 12000 Series Router to a Cisco XR 12000 Series Router

A Cisco 12410 Router can be upgraded to a Cisco XR 12410 router by updating the line cards and software images. For information on this process, including supported line cards and software upgrade procedures, please refer to the Cisco document, *Upgrading a Cisco 12000 Series Router from Cisco IOS Software to Cisco IOS XR Software*.

The line card and route processor (RP) card cage has 10 user-configurable slots that support a combination of line cards and either one or two RPs (see Figure 1-2). Router configurations can consist of either nine line cards and one RP, or eight line cards and two RPs (one primary and one redundant) using the following slot configurations:

- Slots 0 to 7 accommodate the newer (wider) line card designs. These wider line card slots can also accept narrower legacy line cards.

- Slots 8 and 9 only accept RPs or a narrower legacy line card.

✎

Note   If a system uses only one RP install it in slot 9. You can use slot 8 for a legacy line card.

Ports and connectors on the line card front panels provide interfaces for external connections. Line cards communicate with the RP and exchange packet data with each other through the switch fabric cards.

⚠️

Caution Any unoccupied card slot in the line card and RP card cage must have a blank filler panel installed to meet electromagnetic compatibility (EMC) requirements and to ensure proper air flow through the chassis. Also, if the front panel of a line card does not completely fill the card slot opening, a narrow card filler panel must be installed to meet the EMC requirements.

A cable management bracket on the front panel of each line card helps to organize the interface cables connected to that line card.

✎

Note The Cisco XR 12410 router support online insertion and removal (OIR), allowing you to remove and replace a card while the router remains powered on.

Horizontal Cable Management Bracket

Cisco XR 12000 Series Routers include a horizontal cable management bracket that works with individual line card cable management brackets to organize interface cables entering and exiting the router.

The horizontal cable management bracket is directly above the line card and RP card cage (Figure 1-13). Network interface cables connecting to the line cards are fed across the bracket, and then down through the openings to the individual line card cable management bracket. This system keeps cables out of the way and free of sharp bends.

⚠️

Caution Excessive bending of interface cables can damage the cables.

Figure 1-13   Horizontal Cable Management Bracket

Horizontal cable
management bracket

52641
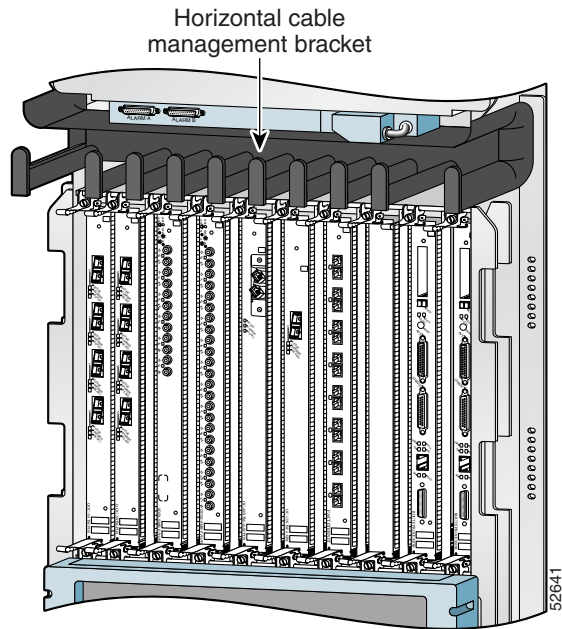
Blower Module

The blower module contains three variable speed fans and a controller card. The two front cover LEDs provide a visual indication of blower module status (Figure 1-14):

Figure 1-14   Blower Module
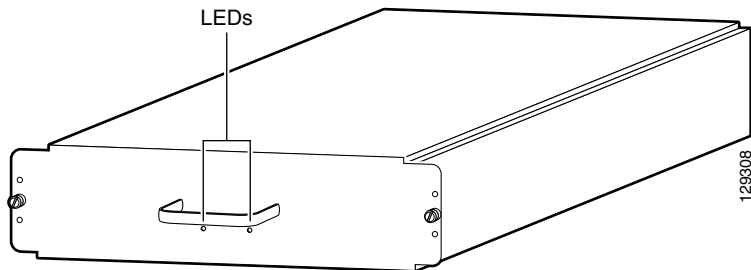
- OK (green)—All three fans are operating normally.
- FAIL (red)—The system has detected a fan failure or other fault in the blower module. The fault can be caused by any of the following:
  - One or more fans are not operating
  - One or more fans are running below speed
  - A controller card fault

The blower module maintains acceptable operating temperatures for internal components by drawing cool air through a replaceable air filter into the switch fabric and alarm card cage, and then up through the line card and RP card cage. Figure 1-15 illustrates the air flow path through the chassis.

Figure 1-15   *Cooling Air Flow*
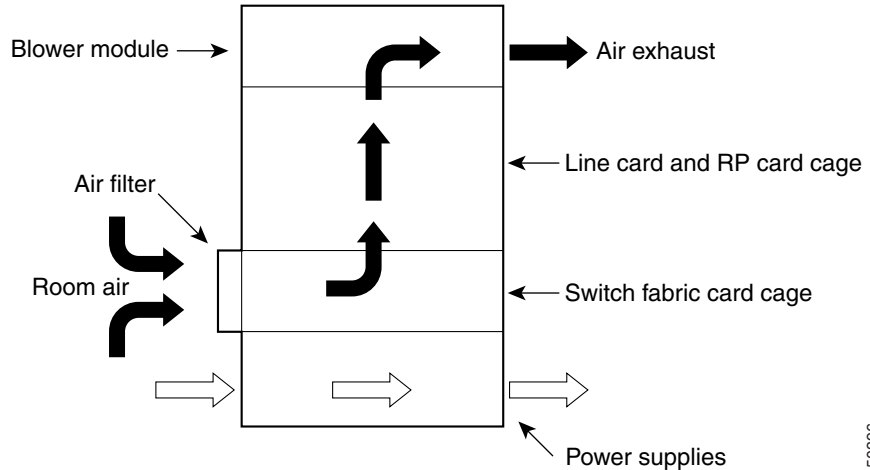
To ensure that there is adequate air flow to prevent overheating inside the card cages, keep the front and back of the router unobstructed. We recommend at least 6 inches (15.24 cm) of clearance.

⚠
Caution   You should inspect and clean the air filter one time per month (more often in dusty environments). Do not operate the router without an air filter installed.

The blower module controller card monitors and controls operation of three variable-speed fans in the blower module. The variable-speed feature allows quieter operation by running the fans at below maximum speed, while still providing adequate cooling to maintain an acceptable operating temperature inside the card cages.

Two temperature sensors on each line card monitor the internal air temperature in the card cages:

- When the ambient air temperature is within the normal operating range, the fans operate at their lowest speed, which is 55 percent of the maximum speed.

- If the air temperature rises inside the card cages the fan speed increases to provide additional cool air to the cards.

- If the air temperature continues to rise beyond the specified threshold, the system environmental monitor shuts down all internal power to prevent equipment damage due to excessive heat.

- If the system detects that one of the three fans within a blower module has failed, it displays a warning message on the console window. In addition, the two remaining fans go to full speed to compensate for the loss of the one fan. If another fan fails, the system shuts down to prevent equipment damage.

■ Horizontal Cable Management Bracket

C H A P T E R 2

Preparing for Installation

Before installing your router, you must consider power and cabling requirements that must be in place at your installation site, special equipment for installing the router, and the environmental conditions your installation site must meet to maintain normal operation. This chapter guides you through the process of preparing for router installation.

The shipping package for the router is engineered to reduce the chances of product damage associated with routine material handling experienced during shipment.

 - The router should always be transported or stored in its shipping package in the upright position.

 - Keep the router in the shipping container until you have determined the installation site.

Inspect all items for shipping damage. If an item appears damaged, contact a Cisco customer service representative immediately.

This chapter contains the following installation topics:

- Safety Guidelines, page 2-2

 - Site Requirement Guidelines, page 2-6

 - PRP Port Connection Guidelines, page 2-22

 - Alarm Display Connection Guidelines, page 2-31

Safety Guidelines

Before you perform any procedure in this publication, you must review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

Note that the information in this section are *guidelines* and do not include every potentially hazardous situation. When you install a router, always use common sense and caution.

General Safety Guidelines

- Never attempt to lift an object that might be too heavy for you to lift by yourself.
- Always disconnect the power source and unplug all power cables before lifting, moving, or working on the router.
- Keep the work area clear and dust free during and after installation.
- Keep tools and router components away from walkways and equipment rack aisles.
- Do not wear loose clothing, jewelry (including rings and chains), or other items that could get caught in the router.
- Fasten your tie or scarf and sleeves.
- Cisco equipment operates safely when it is used in accordance with its electrical ratings and product usage instructions.
- Do not work alone if potentially hazardous conditions exist.
- Always unplug the power cables when performing maintenance or working on the router, unless the replacement part is hot swappable and designed for online insertion and removal (OIR).
- The installation of the router should be in compliance with national and local electrical codes: in the United States, National Fire Protection Association (NFPA) 70, United States National Electrical Code; in Canada, Canadian Electrical Code, part I, CSA C22.1; in other countries, International Electrotechnical Commission (IEC) 364, part 1 through part 7.

Compliance and Safety Information

The Cisco XR 12410 router are designed to meet the regulatory compliance and safety approval requirements. Refer to the *Regulatory Compliance and Safety Information for Cisco 12000 Series Routers*

Laser Safety

Single-mode Cisco XR 12410 router line cards are equipped with lasers. The lasers emit invisible radiation. *Do not* stare into open line card ports. Observe the following warning to prevent eye injury:

⚠

Warning **Avoid exposure to laser radiation. Do not stare into an open aperture, because invisible laser radiation may be emitted from the aperture when a cable is not inserted in the port.**

Preventing Electrostatic Discharge Damage

Many router components can be damaged by static electricity. Not exercising the proper electrostatic discharge (ESD) precautions can result in intermittent or complete component failures. To minimize the potential for ESD damage, always use an ESD-preventive antistatic wrist strap (or ankle strap) and ensure that it makes good skin contact.

✎

Note Check the resistance value of the ESD-preventive strap periodically. The measurement should be between 1 and 10 megohms.

Before you perform any of the procedures in this guide, attach an ESD-preventive strap to your wrist and connect the leash to the chassis as shown in Figure 2-1. Note that some versions of the 10-slot chassis do not provide an ESD connection socket in the line card cage area. For those chassis, use an alligator clip to connect the leash to an open metal part of the chassis.

Figure 2-1   *Connecting an ESD-Preventive Wrist Strap to the Chassis*

ESD
connection
socket

53230
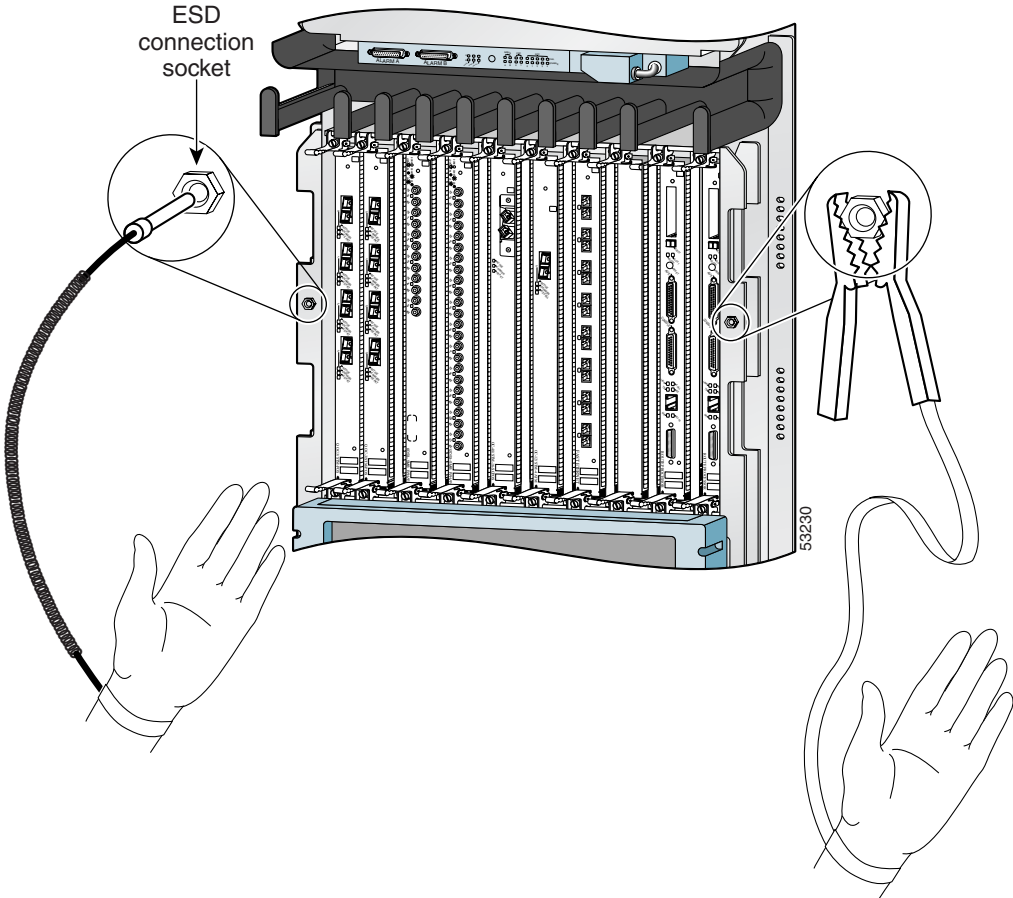
Lifting Guidelines

A fully configured router can weigh as much as 275 pounds (lb)
(124.74 kilograms (kg)), while an empty chassis weighs 125 lb (56.7 kg). These systems are not intended to be moved frequently. Before you install the router, ensure that your site is properly prepared so you can avoid having to move the router later to accommodate power sources and network connections.

Use the following lifting guidelines to avoid injury to yourself or damage to the equipment:

- Do not lift equipment alone; have another person help you to lift heavy equipment.

- Ensure that your footing is solid; balance the weight of the object between your feet.

- Lift the equipment slowly; never move suddenly or twist your body as you lift.

- Keep your back straight and lift with your legs, not your back. When bending down to lift equipment, bend at the knees (not at the waist), to reduce the strain on your lower back muscles.

⚠️

Caution   To prevent equipment damage, never attempt to lift or tilt the router chassis using the handles on the blower module or on line cards. These handles do not support the weight of the chassis.

Laser Safety

Some line cards are equipped with ports that can emit hazardous laser radiation from the aperture when there is no cable connected to the port. This invisible radiation can cause eye injury if you stare into the port.

⚠️

Warning   **To avoid eye injury, never stare into open line card ports.**

Cisco XR 12410 Router Installation Guide

Site Requirement Guidelines

The following sections contain the site requirement guidelines that you should be familiar with before installing the router:

Rack-Mounting Guidelines

The router can be mounted in most 2-post, 4-post, or telco-type 19-inch equipment racks that comply with the Electronics Industries Association (EIA) standard for equipment racks (EIA-310-D). The rack must have at least two posts with mounting flanges to mount the router chassis. The distance between the center lines of the mounting holes on the two mounting posts must be 18.31 inches ± 0.06 inch (46.50 cm ± 0.15 cm). The rack-mounting hardware included with the router is suitable for most 19-inch equipment racks or telco-style frames.

Figure 2-2 shows examples of typical 2-post, 4-post, and telco-type equipment racks.

Figure 2-2   *Equipment Rack Types*
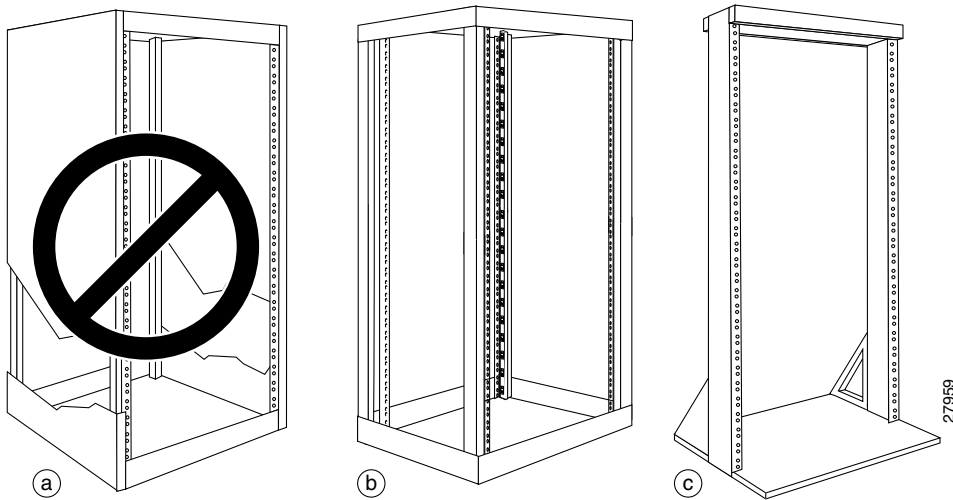
Enclosed Rack

Figure 2-2**a** shows a free-standing, enclosed rack with two mounting posts in the front. The router should *not* be installed in this type of enclosed rack, because the router requires an unobstructed flow of cooling air to maintain acceptable operating temperatures for its internal components. Installing the router in any type of enclosed rack—*even with the front and back doors removed*—could disrupt the air flow, trap heat next to the chassis, and cause an overtemperature condition inside the router.

Open Rack

Figure 2-2**b** shows a free-standing, 4-post open rack with two mounting posts in the front and two mounting posts in the back. The mounting posts in this type of rack are often adjustable so that you can position the rack-mounted unit within the depth of the rack rather than flush-mount it with the front of the rack.

Cisco XR 12410 Router Installation Guide

Telco Rack

Figure 2-2**c** shows a telco-type rack. The telco-type rack is an open frame consisting of two posts tied together by a cross-bar at the top and a floor stand at the bottom.

This type of rack is usually secured to the floor and sometimes to an overhead structure or wall for additional stability. The router chassis can be installed in the telco-type rack either in a front-mounted position or a center-mounted position.

In the front-mounted position, you secure the chassis rack-mounting brackets directly to the rack posts (Figure 2-3).

Figure 2-3   Front-Mounted Router—Telco Rack
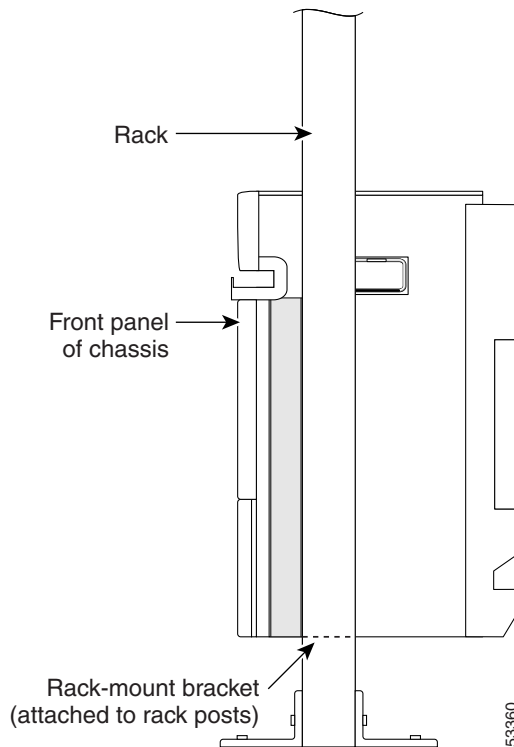
In the center-mounted position, you secure a set of optional center-mount brackets to the rack posts. The chassis rack-mounting flanges are then secured to the center-mount brackets (Figure 2-4). The center-mounted position moves the center of gravity of the chassis closer to the vertical axis of the rack posts, which adds to the stability of the rack installation.

Figure 2-4   Center-Mounted Router—Telco Rack
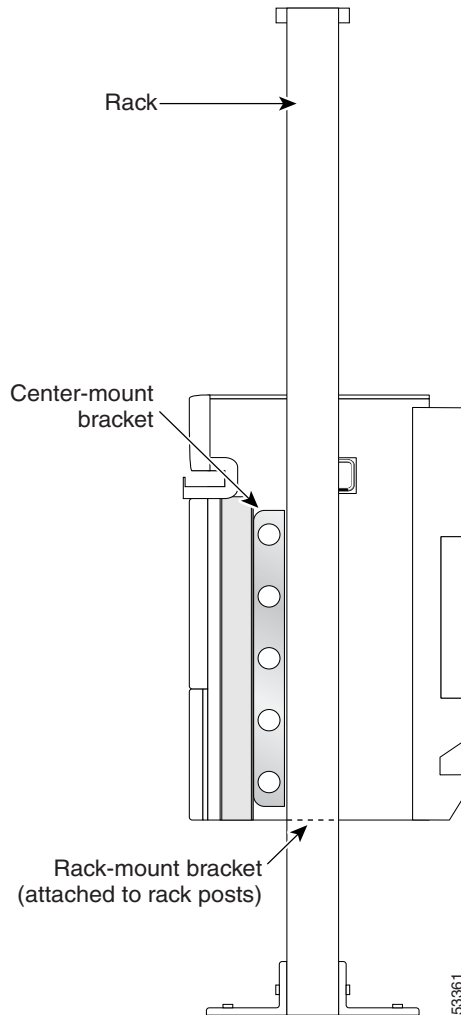
Site Layout and Equipment Dimensions

To help maintain trouble-free operation, adhere to the following precautions when planning your rack installation:

- Ensure the site of the rack includes provisions for source AC or DC power, grounding, and network interface cables.

- Allow sufficient space to work around the rack during the installation. You need:

  - At least 3 feet adjacent to the rack to move, align, and insert the chassis.

  - At least 2 feet in front of the power shelf to insert power entry modules.

- Maintain at least 24 inches (61 cm) of clearance in front of and behind the chassis for maintenance after installation.

- To mount the router between two posts or rails, the usable aperture (the width between the *inner* edges of the two mounting flanges) must be at least 17.7 inches (45.0 cm).

- The height of the router is 37.0 inches (93.98 cm). Most racks accommodate two routers.

- When fully populated with cards, the router can weigh as much as 275 lb (124.74 kg). To maintain equipment rack stability and to ensure your safety, the rack is provided with stabilizing devices. Make sure you install the stabilizers before installing the router.

- If you use a telco-style rack, the weight of the chassis is cantilevered off of the two rack posts. Make sure that:

  - The weight of the router does not make the frame unstable.

  - The frame is bolted to the floor and is secured to the building structure using either wall brackets or overhead brackets.

- When mounting the router in a telco-type rack or 4-post rack, be sure to use all of the screws provided to secure the chassis to the rack posts.

- Install the cable-management brackets included with the router to keep cables organized. Be sure to:

  - Use appropriate strain-relief methods to protect cables and equipment connections.

  - Make sure that cables from other equipment installed in the rack do not restrict access to the card cages.

- To avoid noise interference in network interface cables, do not route them directly across or along power cables.

Figure 2-5 shows the footprint and outer dimensions of the of the router chassis.

Figure 2-5   Router Chassis Footprint and Dimensions—Top View
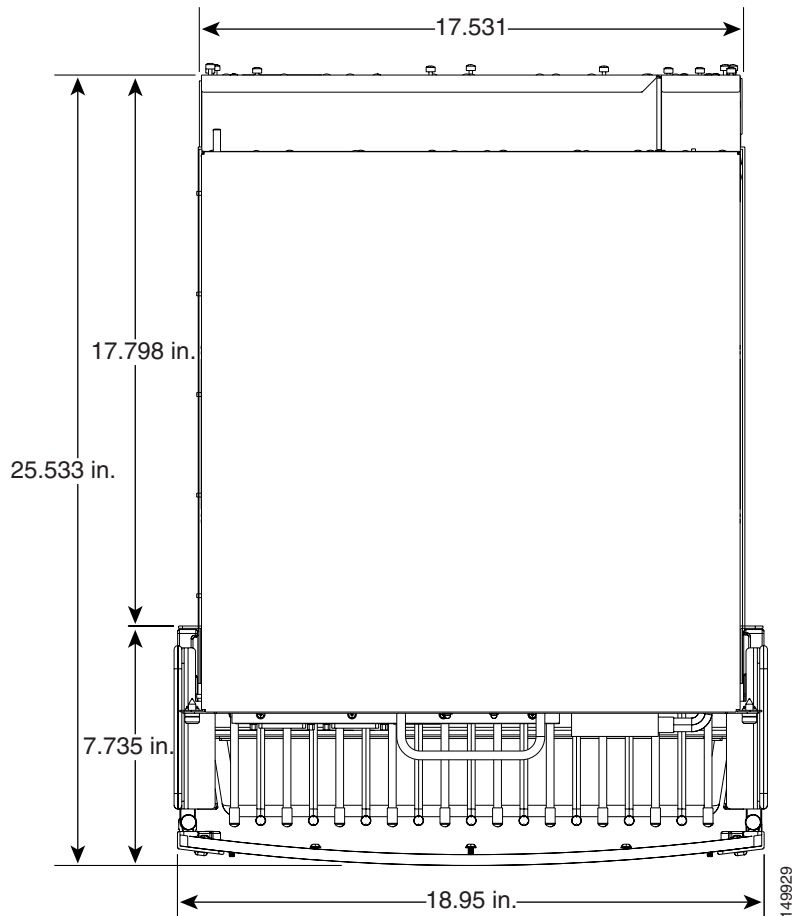
Air Flow Guidelines

Cool air is circulated through the router by the blower module located at the top of the chassis. The blower module maintains acceptable operating temperatures for the internal components by drawing in cool air through the air filter in front of the switch fabric and alarm card cage, and circulating the air through both card cages (Figure 2-6). Each power supply is also equipped with a fan that draws cooler air into the front of the power supply and forces warmer air out of the back of the chassis.

Figure 2-6   Air Flow Path through the Router—Side View
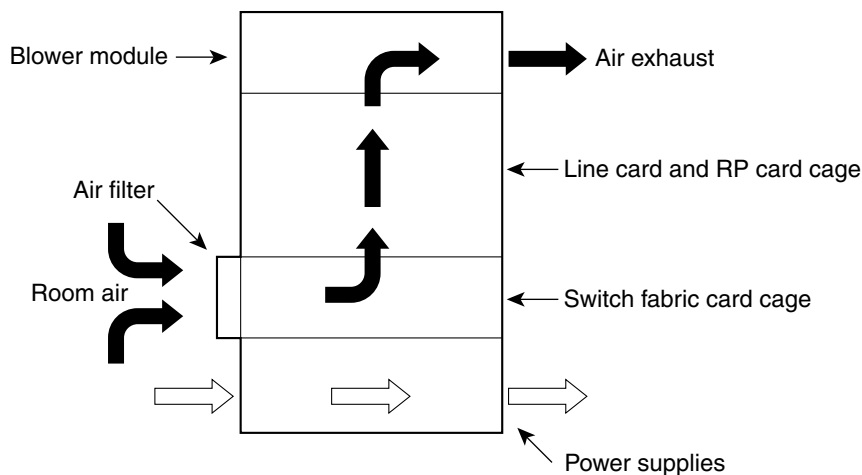
When selecting a site to install the router, observe the following guidelines:

- Dust free area—The site should be as dust free as possible. Dusty environments can clog the air filter or power supply intake vents, reducing the cooling air flow through the router. Clogged filters and vents can cause an overtemperature condition in the router.

- Unrestricted air flow—Allow sufficient air flow by maintaining a minimum of 6 inches (15.24 cm) of clearance at both the inlet and exhaust openings on the chassis and the power modules. If the air flow is blocked or restricted, or if the inlet air is too warm, an overtemperature condition can occur within the router. Under extreme conditions, the environmental monitoring system powers off the router to protect the components.

Temperature and Humidity Guidelines

The operating and nonoperating environmental site requirements are listed in Table A-4 on page A-5. The router normally operates within the ranges listed in Table A-4, however, if a temperature measurement is approaching a minimum or maximum parameter it indicates a potential problem. Maintain normal operation by anticipating and correcting environmental anomalies before they approach critical values by properly planning and preparing your site before you install the router.

Power Connection Guidelines

You can configure the router with either an AC-input or DC-input power subsystem, so the site power source requirements differ depending on the power subsystem in your router. Ensure all power connection wiring conforms to the rules and regulations in the National Electrical Code (NEC), as well as local codes.

⚠

Caution   Proper grounding is necessary to avoid damage from lightning and power surges. See the "NEBS Supplemental Unit Bonding and Grounding Guidelines" section on page 2-18 for grounding requirements.

AC-Powered Routers

AC PEMs operate in the nominal range of 200 VAC to 240 VAC and require a minimum service of:

- 20 A for operation in North America

- 16 A for international operation

- 13 A for operation in the UK

Each of the AC power inputs requires separate dedicated branch circuit. For a list of the nominal and acceptable value ranges for source AC power, refer to Table A-2 on page A-3.

Figure 2-7 shows the different styles of AC power cords used to connect to the local AC power source that are available for North America and various locales.

Figure 2-7   *AC Power Cord Plugs and Appliance Coupler*
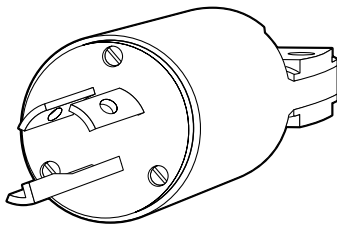
North America
Rewirable twist-lock plug
NEMA L6-20P (20A)
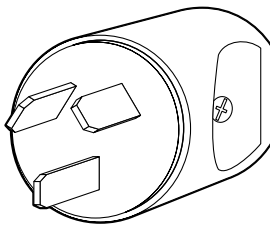
Australia, New Zealand
SAA/3 plug
AS/NZZS 3112-1993 (15A)
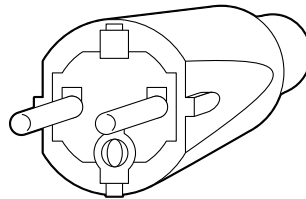
Europe, Argentine, Brazil
VIIG plug
CEE (7) VII (16A)
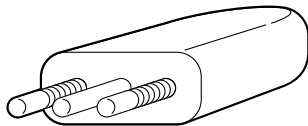
Italy
1/3/16 plug
CEI 23-16 (16A)
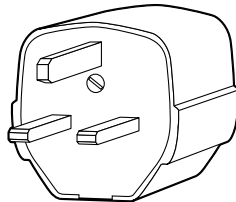
United Kingdom
BS89/13
BS 1363/A
(13A; replaceable fuse)
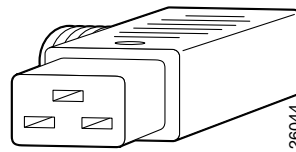
Appliance coupler
C19W coupler
Hot EN60320/C19 (20A)

26044

Table 2-1 lists power cord options. All AC-input power supply power cords measure 14 feet (4.3 m).

Table 2-1   AC Power Cord International Options

Label	Description	Part Number
North America	20 A, 250 VAC	CAB-GSR16-US=
Australia, New Zealand	15 A, 250 VAC	CAB-GSR16-AU=
Europe, Argentina, Brazil	16 A, 250 VAC	CAB-GSR16-EU=
Italy	16 A, 250 VAC	CAB-GSR16-IT=
United Kingdom	13 A, 250 VAC (13 A replaceable fuse)	CAB-GSR16-UK=

DC-Powered Routers

Connections to DC PEMs are rated at 60 A maximum. A dedicated, commensurately rated DC power source is required for each PEM connection.

For DC power cables, we recommend that you use a commensurately rated, high-strand-count copper wire cable. Connection to the DC power distribution unit (PDU) requires one earth ground cable and two cable leads; a source DC (–) and source DC return (+) for each PDU (2 PDUs x 3 = 6 cables).

The length of the cables depends on your router location from the source power.

Note   DC power cables are not available from Cisco, but are available from any commercial cable vendor.

You must terminate DC power cables using cable lugs at the power shelf end.Ensure the lugs are dual-hole and that they fit over M6 terminal studs at 0.625-inch (15.88-mm) centers (for example, Panduit Part Number LCD8-14A-L or equivalent).

Figure 2-8 shows the type of lug required for DC-input cable connections.

Figure 2-8   *DC Power Cable Lug*

All measurements in inches

End View

0.48

Ø 0.267
2 holes

2.24

Crimp area

0.08

0.25   0.63   0.37

25527
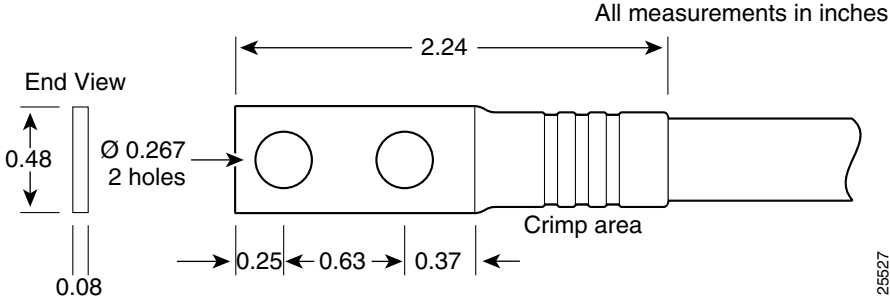
Figure 2-9 shows a typical source DC power distribution scheme for a 2800 W DC PDU.

Figure 2-9   ***Typical Source DC Power Cabling Scheme—2800W PDU***
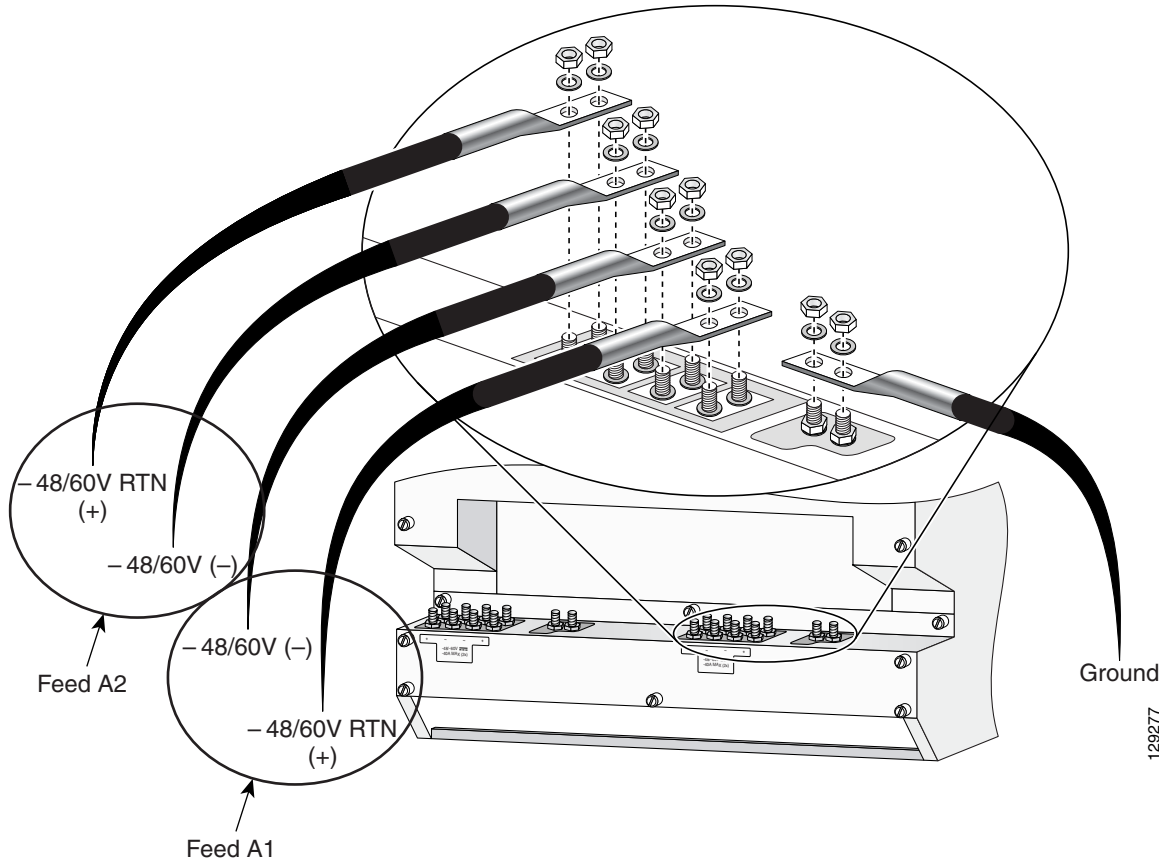
The color coding of source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, be sure that power source cables are connected to the PDU using the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads*. Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the PDU when making the measurement.

- A green (or green and yellow) cable typically indicate that it is a ground cable.

⚠
Caution   DC PEMs contains circuitry to trip the breaker on the PEM if the PEM detects a reverse polarity condition. No damage should occur from reverse polarity, but you should correct a reverse polarity condition immediately.

For a list of the nominal and acceptable value ranges for source DC power, refer to Table A-3 on page A-3.

NEBS Supplemental Unit Bonding and Grounding Guidelines

Although the router chassis requires a safety earth ground connection as part of the power cabling to PDUs, we also recommend that you connect the central office ground system or interior equipment grounding system to the supplemental bonding and grounding connections on the back of the router chassis (Figure 2-10). This grounding point is also referred to as the network equipment building system (NEBS) bonding and grounding studs.

✎
Note   These bonding and grounding connections satisfy the Telcordia NEBS requirements for supplemental bonding and grounding connections. If you are not installing the router in a NEBS environment, you can choose to bypass these guidelines and rely on the safety earth ground connections to the AC and DC PDUs.

Figure 2-10   NEBS Bonding and Grounding Studs

NEBS bonding
and grounding
studs

Agency
compliance
label

53287
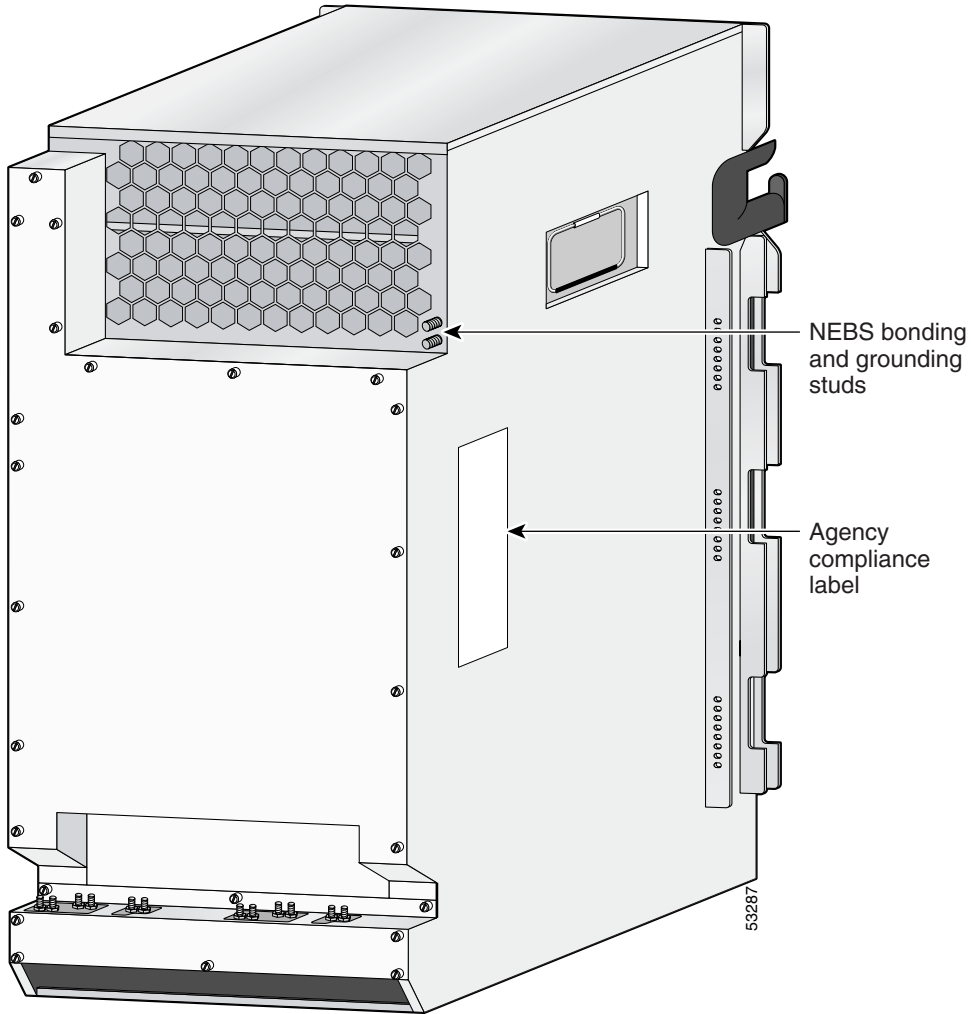
To ensure a satisfactory supplemental ground connection to the router, use the following parts:

> **Note** These parts are not available from Cisco, but are available from commercial vendors.

- One grounding lug, which have two M6 bolt holes with 0.625 to 0.75-inch (15.86 to 19.05-mm) spacing between them, and a wire receptacle large enough to accept a 6-AWG or larger, multistrand copper wire. This lug is similar to those used for the DC-input power supply leads (see Figure 2-8).
- Two M6 hex-head nuts and locking washers (nickel-plated brass is ideal).
- One grounding wires. Although we recommends at least 6-AWG multistrand copper wire, the wire diameter and length depend on your router location and site environment.

Site Wiring Guidelines

When planning the location of the router, consider distance limitations for signaling, electromagnetic interference (EMI), and connector compatibility. If the wiring is run for any significant distance in an electromagnetic field, interference can occur between the field and the signals on the wires. Poor wiring can cause:

- Radio interference emanating from the wires.
- Strong EMI, especially when caused by lightning or radio transmitters. EMI can destroy the signal drivers and receivers in the router, and can even create an electrical hazard by conducting power surges through lines and into equipment.

> **Note** To predict and remedy strong EMI, you may need to consult with experts in radio frequency interference (RFI).

Site wiring is unlikely to emit radio interference if you use twisted-pair cable with a good distribution of grounding conductors. Use a high-quality twisted-pair cable with one ground conductor for each data signal, when applicable.

Give special consideration to the effect of a lightning strike in your vicinity, especially if the wiring exceeds the recommended distances, or if it passes between buildings. The electromagnetic pulse (EMP) caused by lightning or other high-energy phenomena can easily induce enough energy into unshielded conductors to destroy electronic devices. If you have experienced EMP problems in the past, you may want to consult experts in electrical surge suppression and shielding.

Most data centers cannot resolve infrequent but potentially catastrophic problems without pulse meters and other special equipment. In addition, these problems can take a great deal of time to identify and resolve. We recommend that you take the necessary precautions to avoid these problems by providing a properly grounded and shielded environment, with special attention to issues of electrical surge suppression.

PRP Port Connection Guidelines

This section contains detailed cabling and signal information for all interface and port connections to the PRP. It also provides information for Ethernet routing and equipment.

> ⚠️
>
> **Caution**   Ports labeled Ethernet, 10BASE-T, Token Ring, Console, and AUX are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits.

PRP Auxiliary and Console Port Connections

The PRP has two RJ-45 connection ports:

- Auxiliary port— DTE RJ-45 interface for connecting a modem or other DCE device (such as a CSU/DSU or another router) to the PRP.

- Console port—DCE RJ-45 interface for connecting a data terminal device to the router, which you need to perform the initial configuration of the router.

> ✎
>
> **Note**   The auxiliary and console ports are asynchronous serial ports. Ensure that devices connected to these ports are capable of asynchronous transmission.

Figure 2-11 shows the auxiliary and console port connections from the PRP to the associated devices.

Figure 2-11　　　**PRP Auxiliary and Console Port Connections**
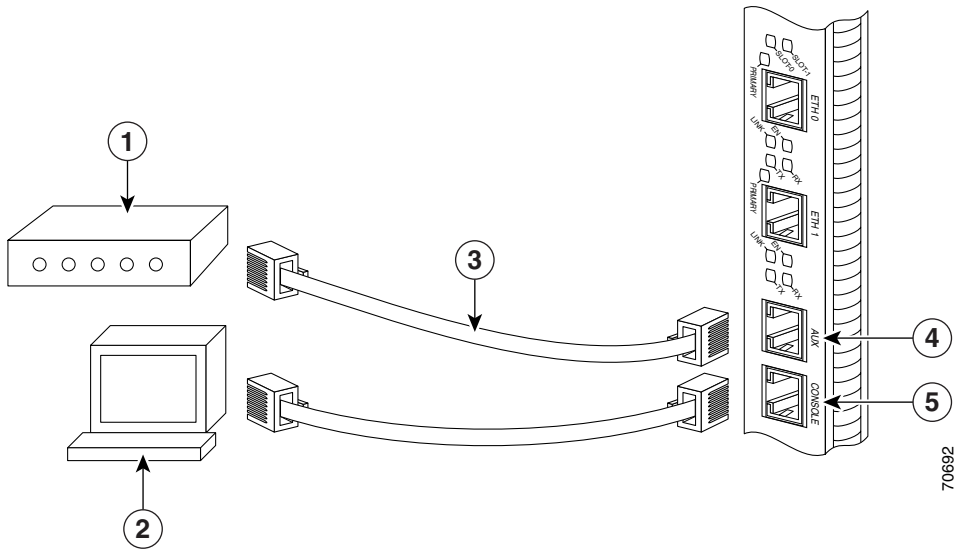
1	Modem	**4**	Auxiliary port
2	Console terminal	**5**	Console port
3	RJ-45 cables		

PRP Auxiliary Port Signals

The PRP auxiliary port is a DTE, RJ-45 interface for connecting a modem or other DCE device (such as a CSU/DSU or another router) to the PRP. The auxiliary port supports hardware flow control and modem control.

Table 2-2 lists the signals used on the auxiliary port.

Table 2-2   PRP Auxiliary Port Signals

Auxiliary Port Pin	Signal	Input/Output	Description
1	RTS	Output	Request to send
2	DTR	Output	Data terminal ready
3	TxD	Output	Transmit data
4	GND	—	Signal ground
5	GND	—	Signal ground
6	RxD	Input	Receive data
7	DSR	Input	Data set ready
8	CTS	Input	Clear to send

PRP Console Port Signals

The PRP console port is a DCE RJ-45 interface for connecting a terminal to the router. The console port does not support modem control or hardware flow control and requires a straight-through RJ-45 cable.

Before connecting a terminal to the console port, check the terminal setting for the data transmission rate, in bits per second (bps). The terminal transmission rate setting must match the default rate of the PRP console port, which is 9600 bps. Set the terminal to these operational values: 9600 bps, 8 data bits, no parity, 2 stop bits (9600 8N2).

Table 2-3 lists the signals used on the console port.

Table 2-3   PRP Console Port Signals

Console Port Pin	Signal	Input/Output	Description
1[1]	—	—	—
2	DTR	Output	Data terminal ready
3	TxD	Output	Transmit data
4	GND	—	Signal ground
5	GND	—	Signal ground
6	RxD	Input	Receive data
7	DSR	Input	Data set ready
8[1]	—	—	—

1.   These pins are not connected.

PRP Ethernet Connections

The PRP has two RJ-45 MDI Ethernet ports; ETH0 and ETH1 (Figure 2-12).

Figure 2-12   PRP Ethernet Connections
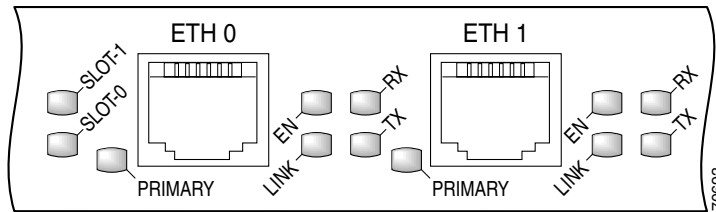
These connections support IEEE 802.3 and IEEE 802.3u interfaces compliant with 10BASE-T and 100BASE-TX standards. The transmission speed of the Ethernet ports is "autosensing" by default and is user configurable.

The PRP Ethernet port does not provide external routing functions. Its primary roles are to act as a Telnet port into the router, and to boot or access Cisco software images over a network to which the PRP Ethernet port is directly connected.

⚠
Caution   Cisco Express Forwarding (CEF) functions on these ports are switched off by default for security reasons. We strongly caution you to consider the security implications of switching on CEF routing functions on these ports.

Figure 2-13 shows:

- You cannot access Network 2.0.0.0 from Ethernet port (E0) on the PRP in Router A. You can only access Host A, Host B, and Router C, which are in Network 1.0.0.0 (see dotted-line arrows).

- To access Network 2.0.0.0 from Router A, you must use an interface port on one of the line cards (a POS line card in this example) in Router A. Data from Router A is routed through Router B and Router C, to reach Network 2.0.0.0 (see solid-line arrows).

Figure 2-13   Using the Ethernet Port on the PRP
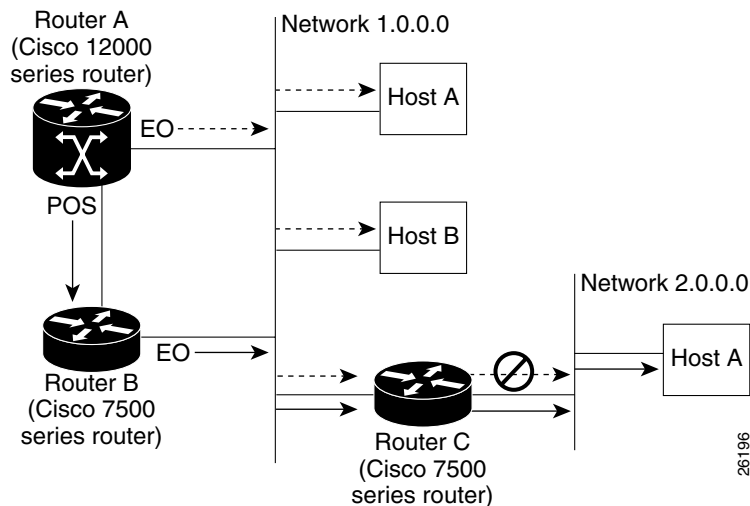
PRP RJ-45 Ethernet Connections

The RJ-45 Ethernet connection does not require an external transceiver. Figure 2-14 shows the pin orientation of the RJ-45 Ethernet port and the modular cable plug it accepts.

Figure 2-14   RJ-45 Receptacle and Plug

87654321

RJ-45 connector

H2936
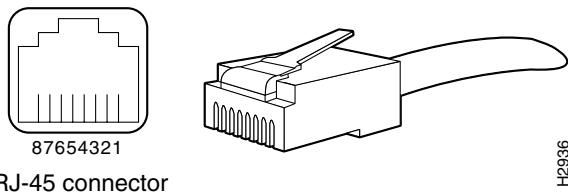
Table 2-4 lists the RJ-45 pin signals used on the connector.

Table 2-4   PRP RJ-45 Ethernet Receptacle Pinout

Ethernet Port Pin	Signal	Description
1	TxD+	Transmit data +
2	TxD–	Transmit data –
3	RxD+	Receive data +
4	Termination network	No connection
5	Termination network	No connection
6	RxD–	Receive data –
7	Termination network	No connection
8	Termination network	No connection

When connecting the RJ-45 port to a hub or repeater, use the straight-through cable pinout shown in Figure 2-15.

Figure 2-15   ***Straight-Through Cable Pinout to Hub or Repeater***

MDI wiring   MDI-X wiring

1 TxD+ ——————— 1 RxD+
2 TxD– ——————— 2 RxD–

3 RxD+ ——————— 3 TxD+
6 RxD– ——————— 6 TxD–
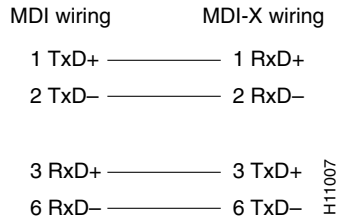
When connecting two PRPs back-to-back, use the crossover cable pinout shown in Figure 2-16.

Figure 2-16   ***Crossover Cable Pinout Between PRPs***

PRP   PRP

1 TxD+   1 TxD+
2 TxD–   2 TxD–

3 RxD+   3 RxD+
6 RxD–   6 RxD–
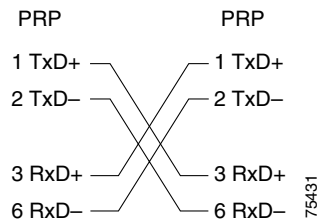
Table 2-5 lists the cabling specifications for 100-Mbps transmission over unshielded twisted-pair (UTP) cables.

> **Note** The transmission speed of the Ethernet ports is autosensing by default and is user-configurable.

Table 2-5   ***Specifications and Connection Limits for 100-Mbps Transmission***

Parameter	RJ-45
Cable specification	Category 5[1] UTP, 22 to 24 AWG[2]
Cable length (max)	—
Segment length (max)	328 feet (100 m) for 100BASE-TX
Network length (max)	656 feet (200 m)[3] with 1 repeater

1. EIA/TIA-568 or EIA-TIA-568 TSB-36 compliant. Not supplied by Cisco.

2. AWG = American Wire Gauge. This gauge is specified by the EIA/TIA-568 standard.

3. Specifically the length between any two stations on a repeated segment.

Table 2-6 lists IEEE 802.3u physical characteristics for 100BASE-TX.

Table 2-6   ***IEEE 802.3u Physical Characteristics***

Parameter	100BASE-TX
Data rate (Mbps)	100
Signaling method	Baseband
Maximum segment length	100 m between DTE and repeaters
Media	Category 5 UTP
Topology	Star/Hub

Alarm Display Connection Guidelines

The router alarm system consists of the following cards:

- Two alarm cards—Installed in the switch fabric and alarm card cage. They do not have any indicators, connectors, or switches.

- One alarm display card—Mounted on the front of the router chassis, just above the horizontal cable management tray.

    The alarm display card has two 25-pin D-subconnectors (ALARM A and ALARM B) on the front panel that connect the router to an external site alarm maintenance system (Figure 2-17). When a critical, major, or minor alarm is generated, it energizes the alarm relays on the alarm card to activate the external site alarm.

Figure 2-17   Alarm Display Card Front Panel
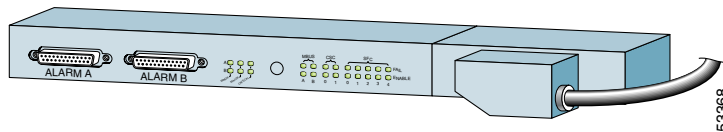
The alarm relay contacts on the alarm card consist of standard *common*, *normally open*, and *normally closed* relay contacts that are wired to the pins on the connectors.

⚠️

Caution   Only safety extra-low voltage (SELV) circuits can be connected to the alarm connector. Maximum rating for the alarm circuit is 2 A, 50 VA.

✎

Note   To comply with the intrabuilding lightning surge requirements of GR-1089-CORE, Issue II, Revision 01, February 1999, you must use a shielded cable when connecting to the external alarm ports on the alarm card. The shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Table 2-7 lists the pin-to-signal correspondence between the cable connector pins and the alarm card relay contacts.

Table 2-7   *Alarm Connector Pinout*

Pin Group	Common	Normally Open	Normally Closed
Critical audible alarm	2	1	14
Major audible alarm	16	3	15
Minor audible alarm	5	4	17
Critical visual alarm	19	6	18
Major visual alarm	8	7	20
Minor visual alarm	22	9	21
Alarm input	13	25	—

C H A P T E R **3**

Installing the Cisco XR 12410 Router

This chapter contains the procedures to install the router in a rack. The installation is presented in the following sections:

Pre-Installation Considerations and Requirements

Before you perform any procedures in this chapter, review the following sections in Chapter 2, "Preparing for Installation."

- Safety Guidelines, page 2-2
- Site Requirement Guidelines, page 2-6

In particular, observe the guidelines for preventing electrostatic discharge (ESD) damage described in the "Compliance and Safety Information" section on page 2-3 and use Figure 2-1 on page 2-4 as a reference in locating and using the ESD sockets on the front of the router chassis.

For additional safety and compliance information, refer to the *Regulatory Compliance and Safety Information for Cisco 12000 Series Routers* publication that accompanied your router.

Warning **This router is not designed to be installed as a shelf-mounted or a free-standing router. The router must be installed in a rack that is secured to the building structure. You must install the router in either a telco-style frame or a four-post equipment rack.**

Installation Overview

The router is shipped strapped to a shipping pallet as shown in Figure 3-1.

Figure 3-1   Router Packaged on Shipping Pallet
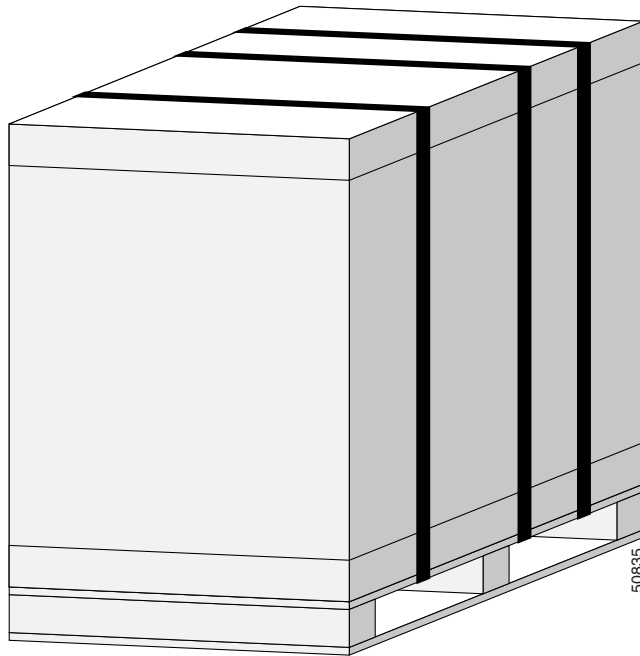
A fully equipped router with two power supplies can weigh as much as
275 pounds (124.74 kg); an empty chassis weighs 125 pounds (56.7 kg). The
chassis is designed to be lifted by two persons *after* you remove some of the
components, such as line cards, power supplies, and the blower module, to reduce
the weight before lifting the chassis. See the "Removing Components Before
Installing the Chassis" section on page 3-4 for procedures to remove these
components.

Required Tools and Equipment

Before you begin the rack-mount installation, you must read and understand the information in the "Rack-Mounting Guidelines" section on page 2-6 and have the following tools and equipment:

- ESD-preventive wrist strap

- Number 1 and number 2 Phillips screwdrivers

- 1/4-inch (6.35-mm) and 3/16-inch (4.5-mm) flat-blade screwdrivers

- Tape measure

- Level (optional)

- A minimum of 10 slotted binderhead screws (usually provided with the rack) to secure the chassis to the mounting flanges (also called *rails*) in the rack. Five screws should be installed on each side of the chassis.

- 3/8-inch (10-mm) nutdriver (for systems equipped with the DC-input power shelf)

- 9/16-inch (14-mm) wrench (for chassis hold-down bolts and pallet hold-down bracket bolts)

- 3/4-inch (19-mm) socket and ratchet wrench

Unpacking and Positioning the Router

Follow the unpacking instructions shipped with the router and use a safety hand truck to move the router to the location where it is being installed in a rack.

Save the packaging materials in case the router needs repackaging or shipping.

Removing Components Before Installing the Chassis

The router is designed to be lifted by two persons into a rack. To reduce the weight of the system, you can remove some of the components before attempting to lift it into the rack.

Use the following procedure to remove the front cover from the router.

Step 1   Open the front door by pressing the right latch button (Figure 3-2).

Figure 3-2   Opening the Front Door
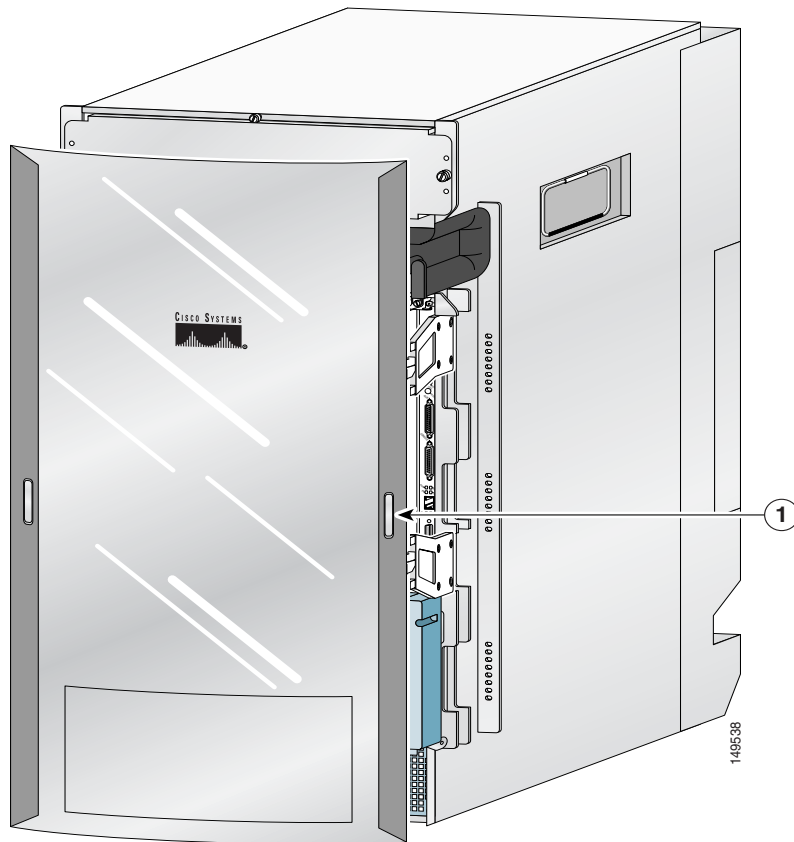
1	Front Door Latch

Step 2   Remove the front door by lifting the (top and bottom) hinge pins to free the door from the chassis (Figure 3-3).

⚠

Caution   Make sure you are holding the front door securely so it does not drop when you release it from the chassis.

Step 3   Reinstall the hinge pins into the chassis hinge brackets.

Figure 3-3   Removing or Installing Hinge Pins
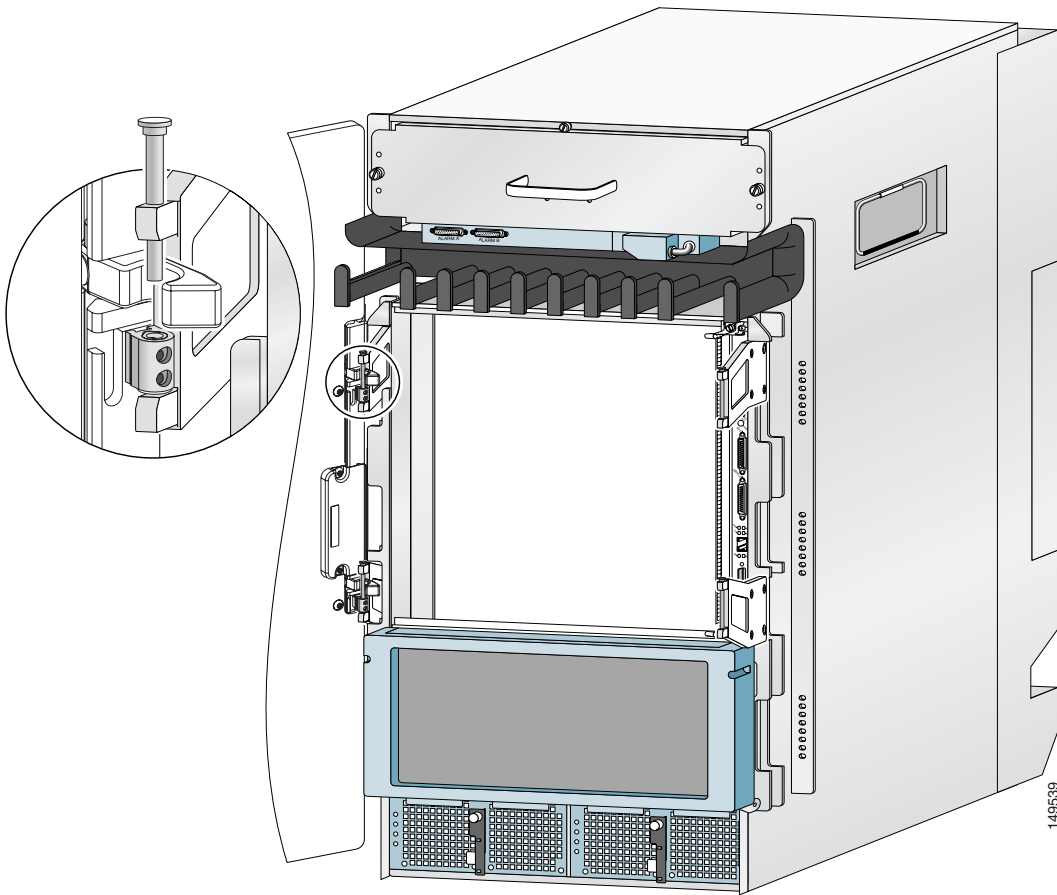
Removing Power Supplies

Remove both power supplies to reduce the top-end weight of the router by approximately 28 pounds (12.70 kg) to 40 pounds (18.14 kg).

Removing AC PEMs

Use the following procedure to remove the AC PEMs from the chassis.

Step 1   Remove the PEM from the chassis (Figure 3-4):

   a. Loosen the captive screw on the ejector lever.

   b. Pivot the lever down to eject the PEM from its bay.

   c. Slide the power supply out of its bay while supporting it with your other hand.

⚠️

Warning   **The power supply weighs approximately 20 pounds (9 kg). Use two hands to remove the power supply.**

Figure 3-4   Removing an AC Power Supply
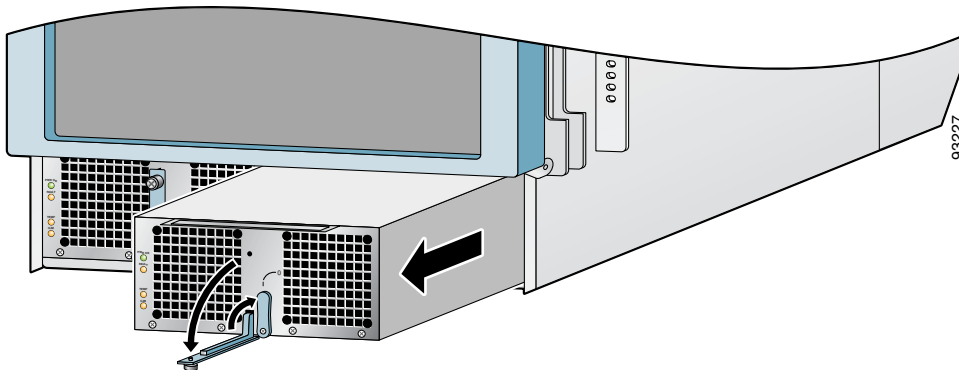
Step 2   Repeat Step 1 for the other PEM.

Removing DC PEMs

Use the following procedure to remove the DC PEMs from the chassis.

Step 1   Remove the PEM from the chassis (Figure 3-5):

   a.   Loosen the captive screw on the ejector lever.

   b.   Pivot the lever down to eject the PEM from its bay.

   c.   Slide the PEM out of its bay while supporting it with your other hand.

⚠️

Warning   **The DC PEM weighs approximately 14 pounds (6.35 kg). Use two hands to remove the power supply.**

Figure 3-5   Removing a DC PEM
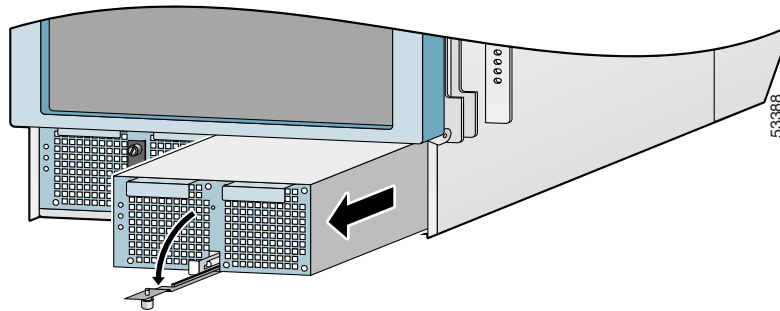
Step 2   Repeat Step 1 for the other PEM.

Removing the Blower Module

By removing the blower module from the chassis, you can reduce the top-end weight of the chassis by approximately 20.5 pounds (9.3 kg).

Use the following procedure to remove the blower module from the chassis (Figure 3-6).

Step 1   Loosen the captive screw on each side of the blower module.

Step 2   Pull the blower module halfway out of the module bay.

Step 3   Slide out the blower module completely from the module bay while supporting it with your other hand.

Warning   **The blower module weighs approximately 20 pounds (9 kg). Use two hands when handling the blower module.**

Cisco XR 12410 Router Installation Guide

Figure 3-6   Removing the Blower Module
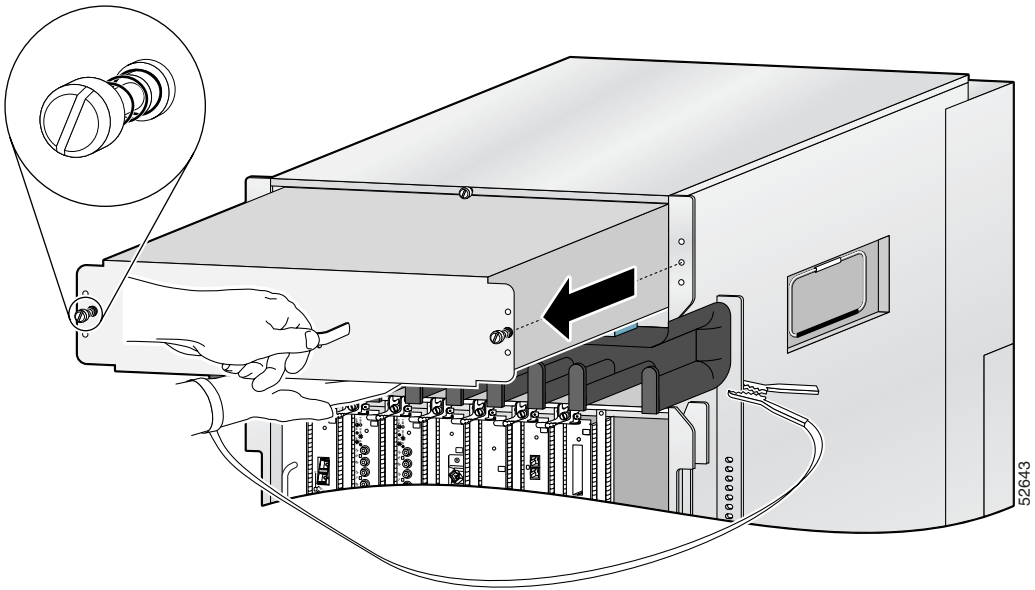
Removing Cards from the Chassis

To reduce additional weight from the chassis, you can remove all line cards, RPs, switch fabrics, and alarm cards. This section describes how to remove the various types of cards.

Removing Cards from the Line Card and RP Card Cage

The line card and RP card cage contains 10 slots (numbered 0 through 9, from left to right). Line cards are installed in slots 0 through 7; RPs are installed in slots 8 and 9.

⚠

Caution   Handle all cards by the metal card carrier edges only; avoid touching the board or any connector pins. After removing a card, carefully place it in an antistatic bag or similar environment to protect it from ESD and dust in the optic ports (fiber-optic line cards).

Use the following procedure to remove line cards and RPs from of the chassis.

Step 1   Proceeding from left to right, identify each card and write down the card type and slot number on a piece of paper (Figure 3-7).

✎

Note   You will need this information when you reinstall the cards in the chassis to be sure you install them in the same card slots.

Figure 3-7   Cisco XR 12410 router Components and Slot-Numbering

Step 2   Starting at slot 0:

   a.   Loosen the captive screws at the top and bottom of the front panel
            (Figure 3-8a).

   b.   Pivot the ejector levers to unseat the card from the backplane connector
            (Figure 3-8b.)

   c.   Slide the card out of the slot (Figure 3-8c) and place it directly into an
            antistatic bag or other ESD-preventive container.

Figure 3-8   *Removing a Line Card from the Line Card and RP Card Cage*

(a) Loosen captive screws

(b) Pivot ejector levers away from card to unseat card

(c) Grasp card carrier to slide card out of slot

52644

Step 3   Repeat Step 2 for each line card.

Step 2 Starting at slot CSC0:

   a. Pivot the ejector levers to unseat the card from the backplane connector (Figure 3-10).

   b. Slide the card out of the slot and place it directly into an antistatic bag or other ESD-preventive container.

Figure 3-10   *Removing a Card from the Switch Fabric and Alarm Card Cage*
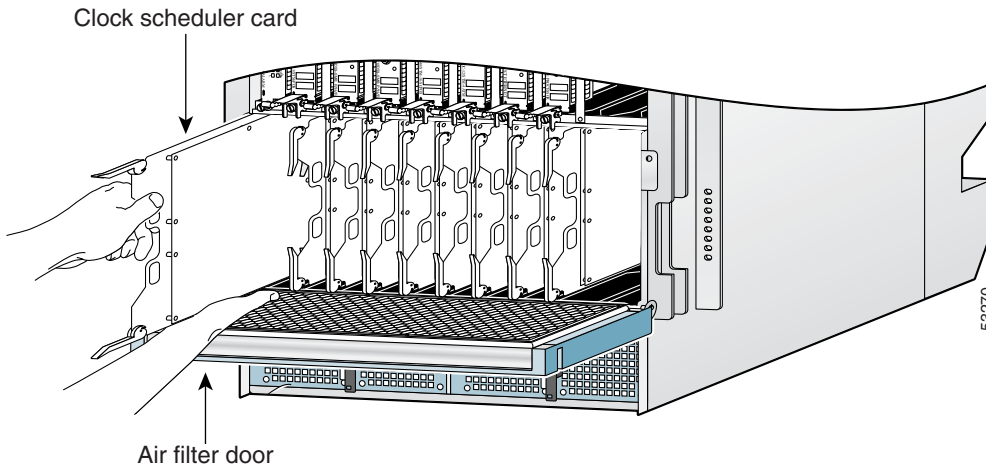
Clock scheduler card

Air filter door

Step 3 Repeat Step 2 for each card.

Step 4 Close the air filter door and tighten the captive screws to prevent the door from opening during the chassis installation.

Rack-Mounting the Router Chassis

The router chassis can be installed in either a front-mounted position or a center-mounted position as shown in Figure 3-11.

Figure 3-11   ***Front-Mount and Center-Mount Rack Positions***
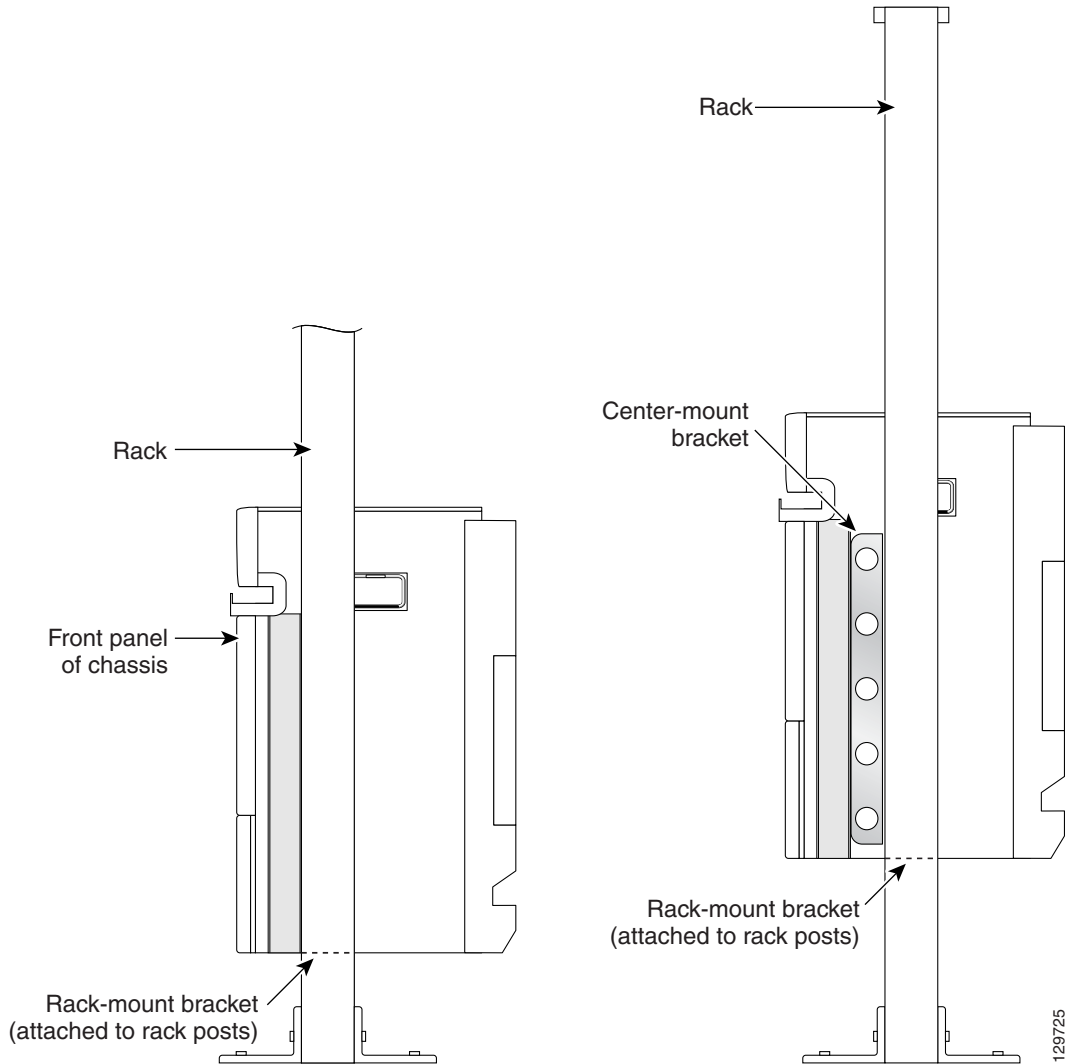
In a front-mounted position, the chassis rack-mounting flanges are secured directly to the rack posts.

In a center-mounted position, an optional set of center-mount brackets are secured to the rack posts and the chassis rack-mounting flanges are then secured to the center-mount brackets. The center-mounted position moves the center of gravity of the chassis closer to the vertical axis of the rack posts, which adds to the security and stability of the rack installation.

Verifying Rack Dimensions

Before you install the chassis, measure the space between the vertical mounting flanges (rails) on your equipment rack to verify that the rack conforms to the measurements shown in Figure 3-12.

Step 1   Mark and measure the distance between two holes on the left and right mounting rails.

The distance should measure 18.31 inches ± 0.06 inches (46.5 cm ± 0.15 cm).

> **Note**   Measure for pairs of holes near the bottom, middle and top of the equipment rack to ensure that the rack posts are parallel.

Step 2   Measure the space between the inner edges of the left front and right front mounting flanges on the equipment rack.

The space must be at least 17.7 inches (45 cm) to accommodate the chassis which is 17.25 inches (43.8 cm) wide and fits between the mounting posts on the rack.

Figure 3-12   Verifying Equipment Rack Dimensions
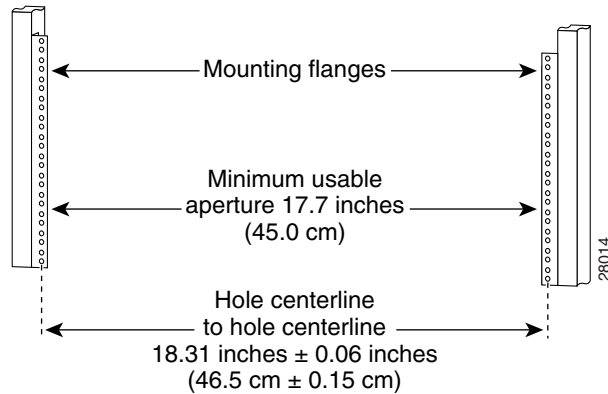
Installing Rack-Mount Brackets—Optional

The router accessory kit ships with a pair of rack-mount brackets that can be used as a temporary aid to bear the weight of the chassis while it is being positioned and secured in the equipment rack. Using these mounting brackets is optional, but highly recommended to make installation easier. The rack-mount brackets can be left in place after the chassis is installed.

Note   Before installing the rack-mount brackets, make sure you have performed the measurements described in "Verifying Rack Dimensions" section on page 3-17.

Use the following procedure to install the rack-mount brackets.

Step 1   Determine the location in which you want to position the chassis in the rack, and mark holes at the same height on both the left and right rack rails.

Step 2   Install the right rack-mount bracket (Figure 3-13).

    a.   Align the bottom screw hole of the bracket with the marked screw hole at the bottom of the rack and finger tighten a screw in that hole.

    b.   Finger-tighten a second screw in the top hole of the bracket.

    c.   Use a screwdriver to tighten both screws securely.

Step 3   Repeat Step 2 for the left rack-mount bracket.

Step 4   Use a level to verify that the tops of the two brackets are level, or use a measuring tape to verify that both brackets are the same distance from the top of the rack rails.

Figure 3-13   *Installing the Left and Right Rack-Mount Brackets*
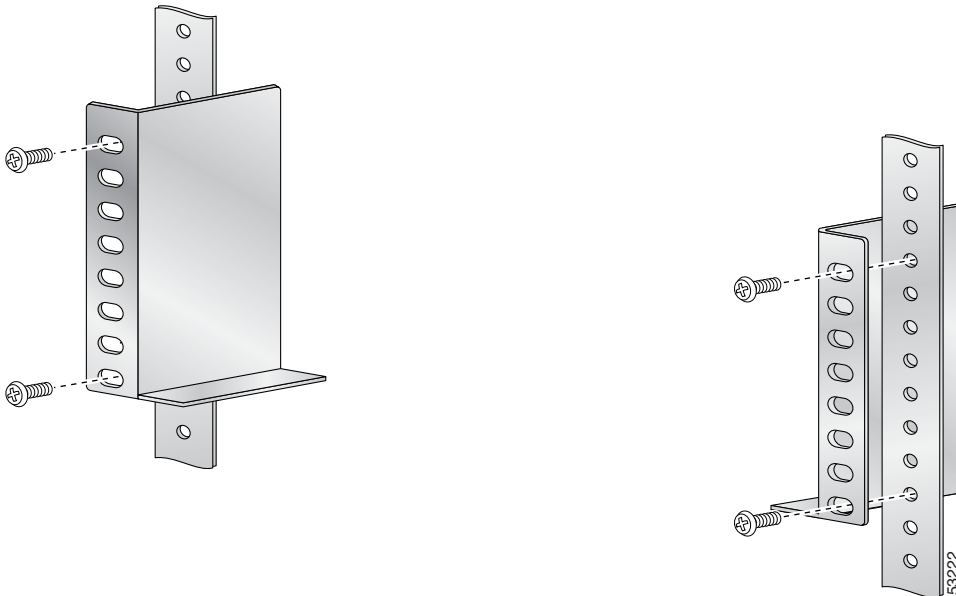
Installing Center-Mount Brackets—Optional

If you plan to install the router in the center-mount position, you must install the center-mount brackets to the rack rails first. If you do not plan to use the optional center-mount brackets, proceed directly to the "Installing the Chassis in the Rack" section on page 3-23.

The optional center-mount bracket installation kit ships in the accessories box included with the router and contains the following:

- Two center-mount brackets.
- 10 (minimum) Phillips binderhead screws (usually provided with the bracket kit) to secure the brackets to the mounting flanges (also called *rails*) in the rack. Five screws should be installed on each bracket.

Contact a Cisco service representative for assistance if any parts are missing.

Note Before installing the center-mount brackets, make sure you have performed the measurements described in "Verifying Rack Dimensions" section on page 3-17.

Use the following procedure to install the center-mount brackets to the rack rails.

Step 1 Determine the location in which you want to position the bottom of the router chassis in the rack, and mark holes at the same height on both the left and right rack rails.

Step 2   Identify the orientation of the left and right center-mount brackets (Figure 3-14).

Figure 3-14   Center-Mount Brackets
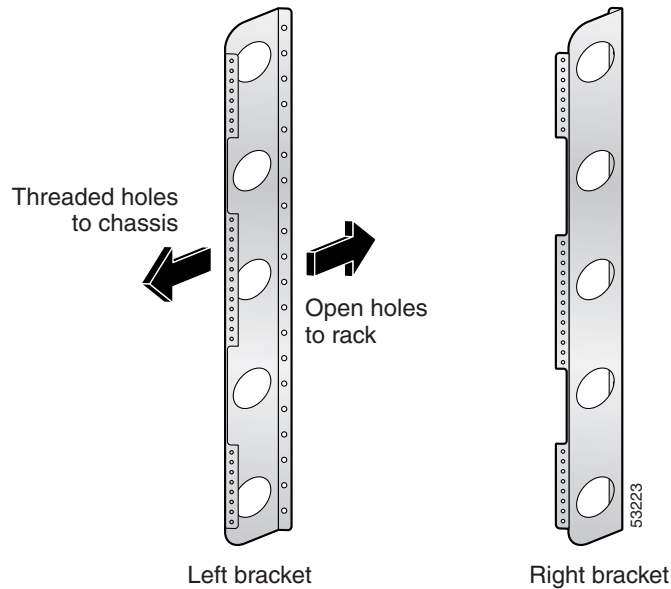
Step 3   Install the right center-mount bracket (Figure 3-15).

    a. Align the bottom screw hole of the bracket with the marked screw hole at the bottom of the rack and finger tighten a screw in that hole.

    b. Finger-tighten a second screw in the top hole of the bracket.

    c. Finger- tighten three more screws in the middle of in the bracket.

    d. Use a screwdriver to tighten all five screws securely.

Step 4   Repeat Step 3 for the left center-mount bracket.

Step 5   Use a level to verify that the tops of the two brackets are level, or use a measuring tape to verify that both brackets are the same distance from the top of the rack rails.

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Figure 3-15   *Installing a Center-Mount Rack-Mounting Bracket*
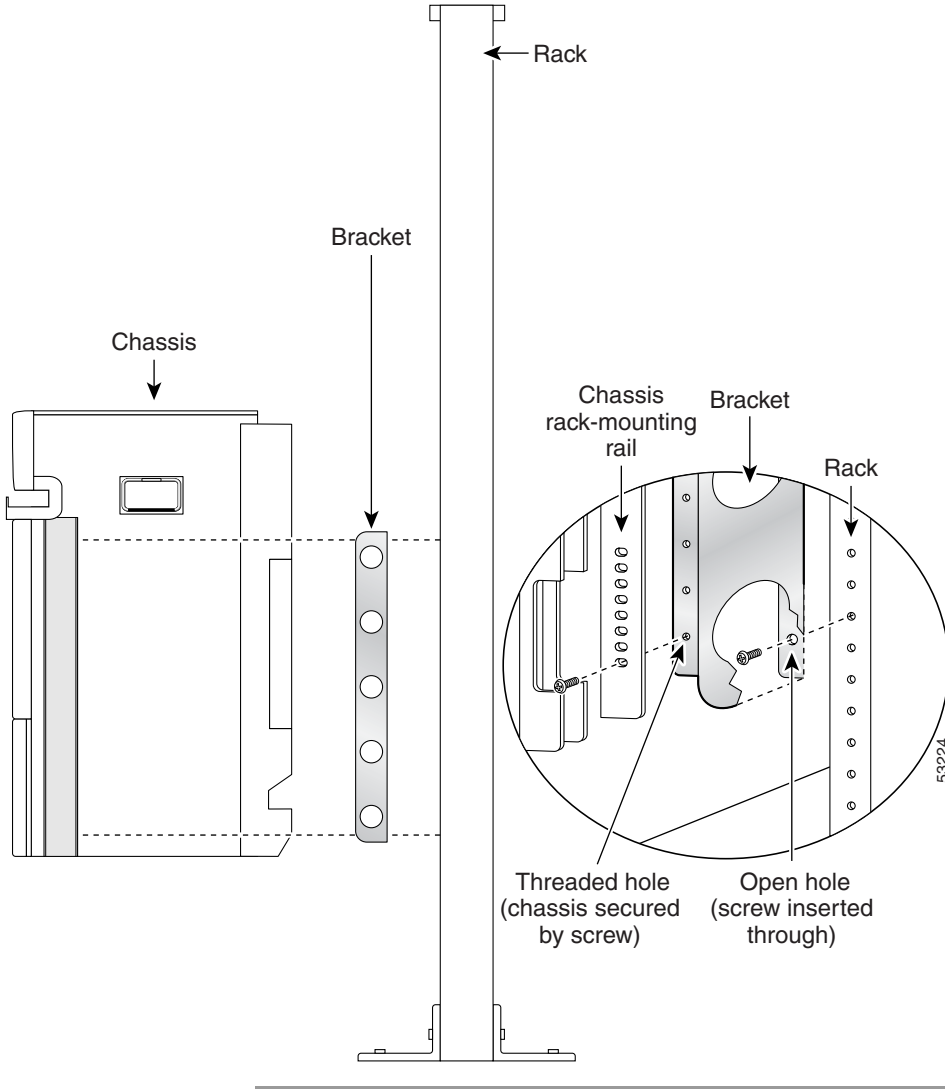
Installing the Chassis in the Rack

Two people can lift an empty router chassis using the handles on the sides. To accommodate racks with different hole patterns in their mounting flanges, the chassis rack-mounting flanges have three groups of eight oblong screw holes on each side.

This section describes how to install the chassis in a telco rack.

Figure 3-16 shows the orientation of the chassis to the rack posts.

Figure 3-16   Router and Rack Posts

Front panel of chassis

Rear panel of chassis

Rack

Rack-mount bracket (attached to rack posts)

53229
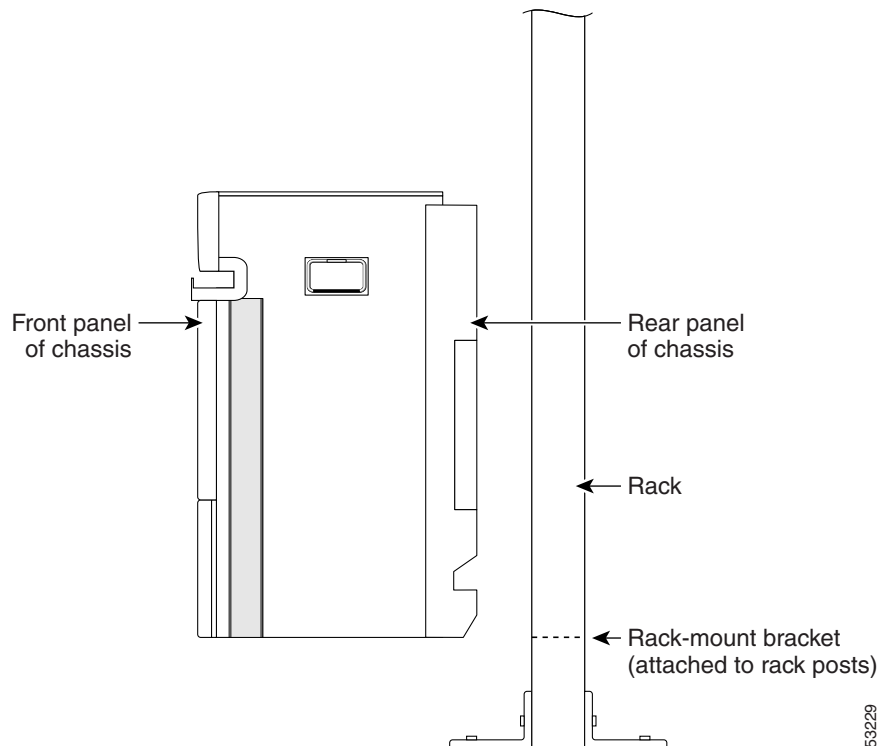
Use the following procedure to install the chassis in the equipment rack:

Step 1 Using two people, lift the chassis into the rack using the side handles and grasping underneath the power supply bays (Figure 3-17).

⚠

Warning **An empty chassis weighs approximately 125 pounds (56.7 kg). You need two people to slide the chassis into the equipment rack safely.**

 • If you are using the rack-mount brackets, raise the chassis to the level of the brackets. Let the bottom of the chassis rest on the brackets, but continue to support the chassis.

Figure 3-17 *Correct Lifting Positions*

⚠
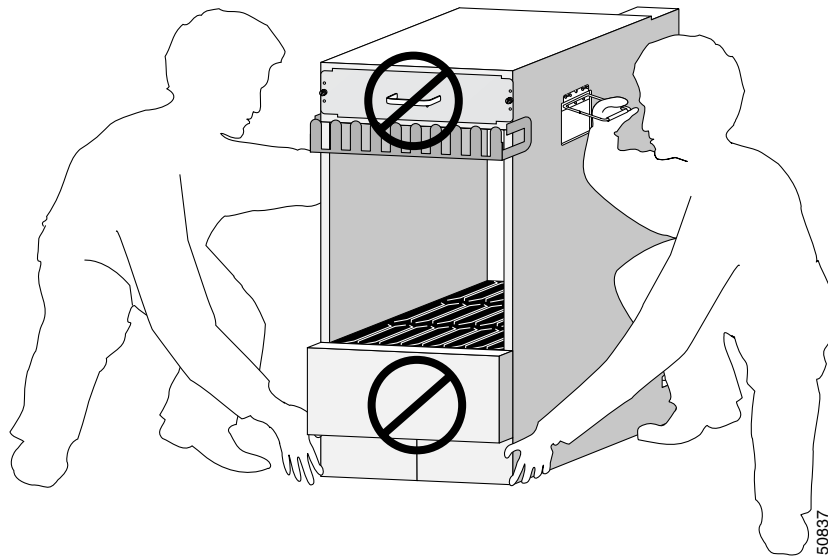
Caution Do not grasp the card cage or the air filter door when lifting the router chassis. (Figure 3-18.)

Figure 3-18   *Incorrect Lifting Handholds*
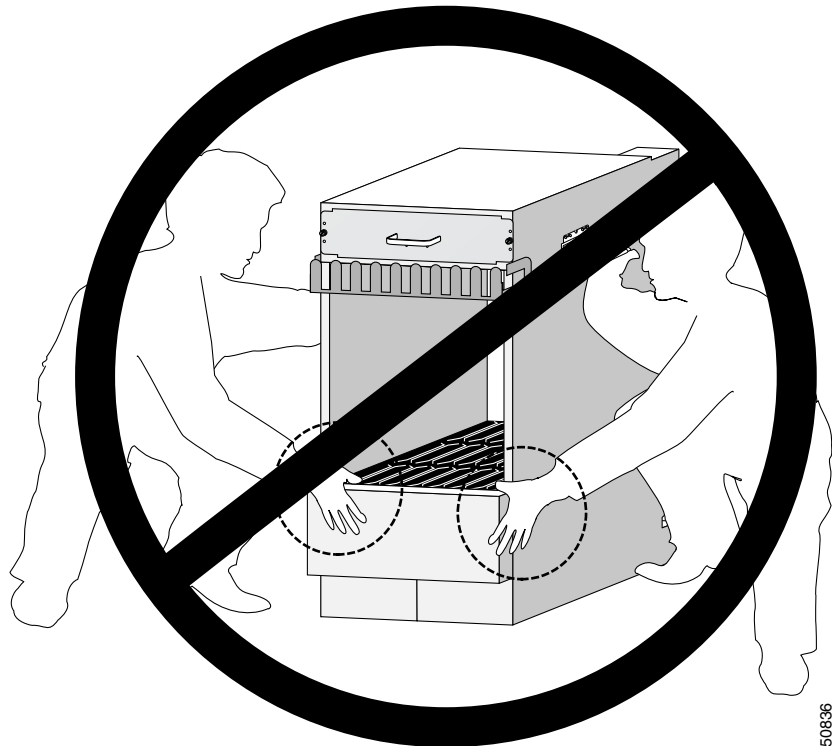
Step 2   Position the chassis until the rack-mounting flanges are flush against the mounting rails on the rack (or the optional center-mount brackets, if installed).

Step 3   Hold the chassis in position against the mounting rails while the second person finger-tightens a screw to the rack rails on each side of the chassis.

Step 4   Finger-tighten 4 more screws to the rack rails on each side of the chassis.

• Space the screws evenly between the top and bottom of the chassis.

Step 5   Tighten all 5 screws on each side to secure the chassis to the equipment rack.

Supplemental Bonding and Grounding Connections

Before you connect power to the router, or power on the router for the first time, We recommend that you connect the central office ground system or new equipment building system (NEBS) to the supplemental bonding and grounding points on the router. For more information on supplemental bonding and grounding cable requirements, see the "NEBS Supplemental Unit Bonding and Grounding Guidelines" section on page 2-18.

Use the following procedure to attach a grounding cable lug to the router:

Step 1   Install the locking washers and nuts over the bonding and grounding cable studs and tighten securely (Figure 3-19).

Figure 3-19   Router Rear NEBS Bonding and Grounding Studs
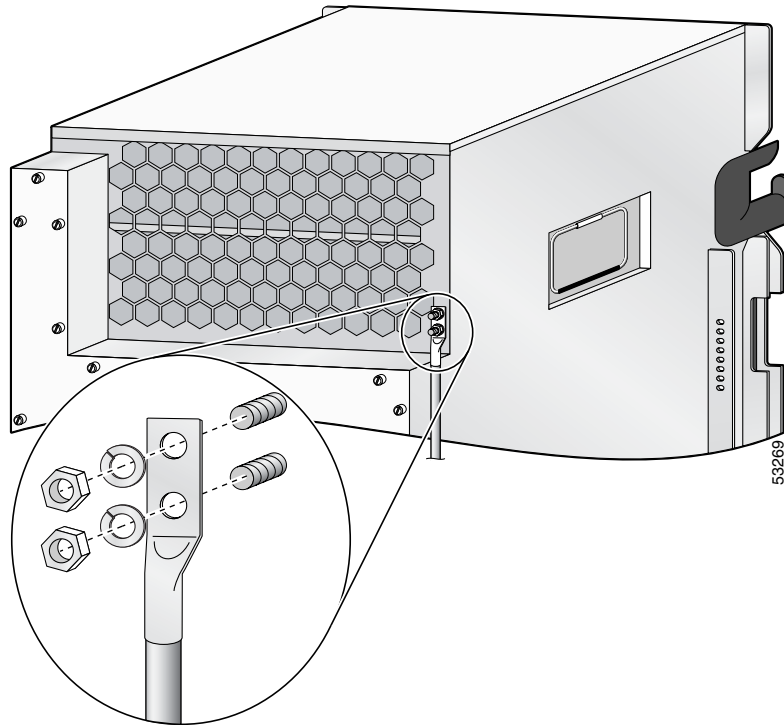
Step 2   Prepare the other end of the grounding wire and connect it to the appropriate grounding point at your site to ensure an adequate earth ground.

Reinstalling Components After Installing the Chassis

This section describes how to reinstall the components that you removed before installing the chassis in the rack. It also describes how to reconnect cables to line cards, the RP, and alarm cards.

Reinstalling Power Supplies

Use the following procedures to reinstall the AC or DC power supplies.

- To reinstall AC PEMs, go to Reinstalling AC PEMs, page 3-28
- To reinstall DC PEMs, go to Reinstalling DC PEMs, page 3-29

Reinstalling AC PEMs

Use the following procedure to reinstall the AC PEMs back into the chassis.

Step 1   Install the AC PEMs (Figure 3-20):

   a.   Slide the power supply into the bay until it mates with its backplane connector.

   b.   Lift the ejector lever into place and tighten the captive screw to securely seat the power supply to the backplane connector.

⚠️

Caution   To prevent damage to the power shelf backplane connector, do not use excessive force when inserting the power supply into the chassis.

Figure 3-20   Installing an AC PEM
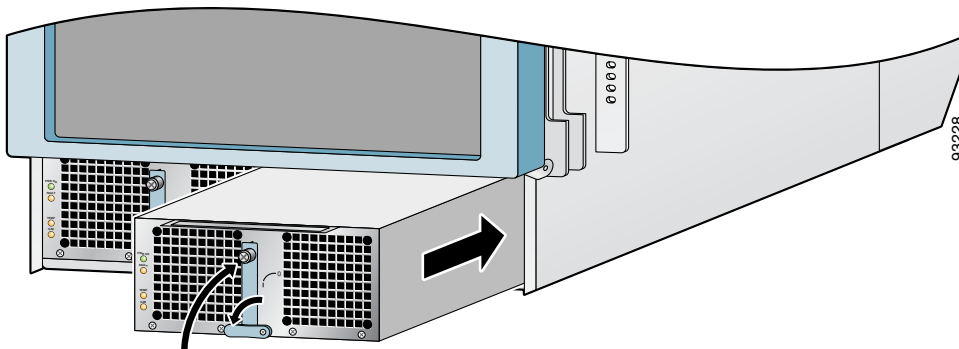
Step 2   Repeat Step 1 for the other power supply.

Step 3   Go to the "Reinstalling the Blower Module" section on page 3-30 to install the blower module.

Reinstalling DC PEMs

Use the following procedure to reinstall the DC PEMs back into the chassis.

Step 1   Install the DC PEM (Figure 3-21):

 a.   Slowly push the power supply into the chassis until it mates with the backplane connector at the back of the bay.

⚠

Caution   To prevent damage to the power shelf backplane connector, do not use excessive force when inserting a power supply into the chassis.

 b.   Lift the ejector lever into place and tighten the captive screw to securely seat the power supply to the backplane connector.

Figure 3-21   Installing a DC PEM
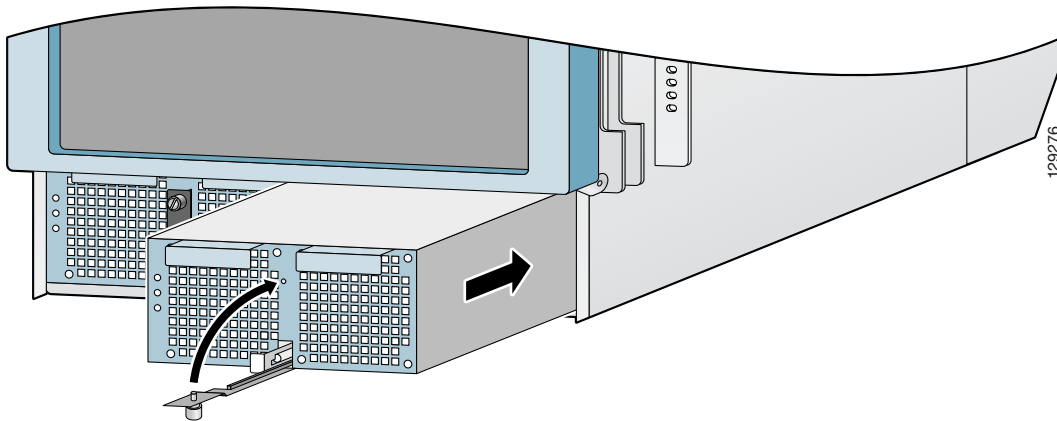
Step 2   Repeat Step 1 for the other power supply.

Step 3   Go to the "Reinstalling the Blower Module" section on page 3-30 to install the blower module.

Reinstalling the Blower Module

Use the following procedure to reinstall the blower module in the chassis.

Step 1 Install the blower module into the chassis (Figure 3-22):

    a. Lift the blower module (with two hands) and slide it halfway into the module bay.

    b. Slowly push the blower module into the chassis until it mates with the backplane connector at the back of the module bay.

⚠

Caution To prevent damage to the connectors, do not use excessive force when inserting the blower module into the chassis.

    c. Tighten the captive screws on the blower module to secure it to the chassis.

Figure 3-22   Installing the Blower Module
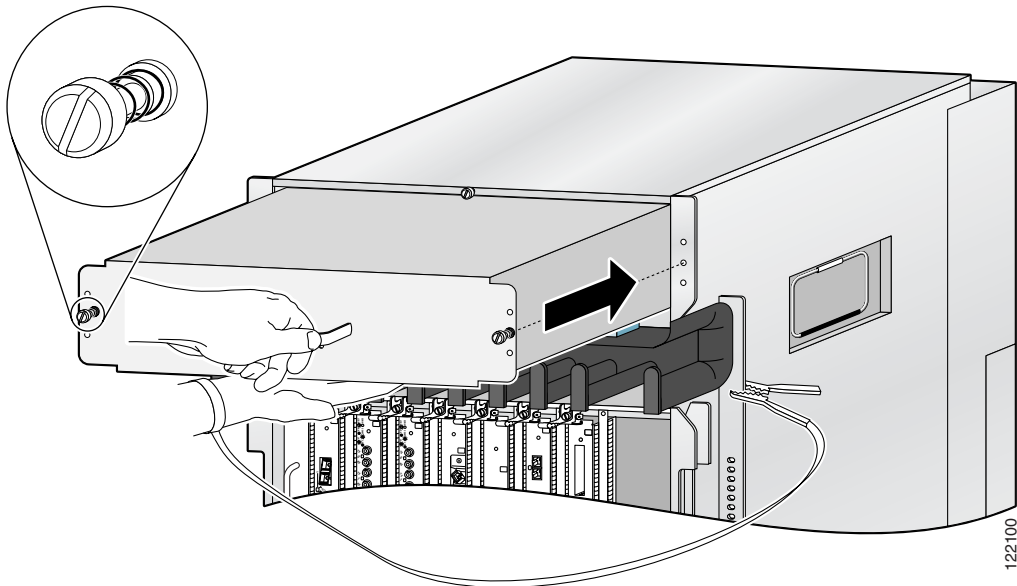
Step 2   Go to the "Reinstalling Cards in the Switch Fabric and Alarm Card Cage" section on page 3-31 to reinstall SFCS cards.

Reinstalling Cards in the Chassis

This section describes how to reinstall various line cards back into the chassis.

Reinstalling Cards in the Switch Fabric and Alarm Card Cage

Use the following procedure to reinstall cards into the switch fabric and alarm card cage (refer to Figure 3-7 for slot numbering).

Step 1   Loosen the two captive screws on each side of the air filter door and swing the door away from the switch fabric and alarm card cage (Figure 3-7).

Figure 3-23   Opening the Air Filter Door

Cisco XR 12410 Router Installation Guide
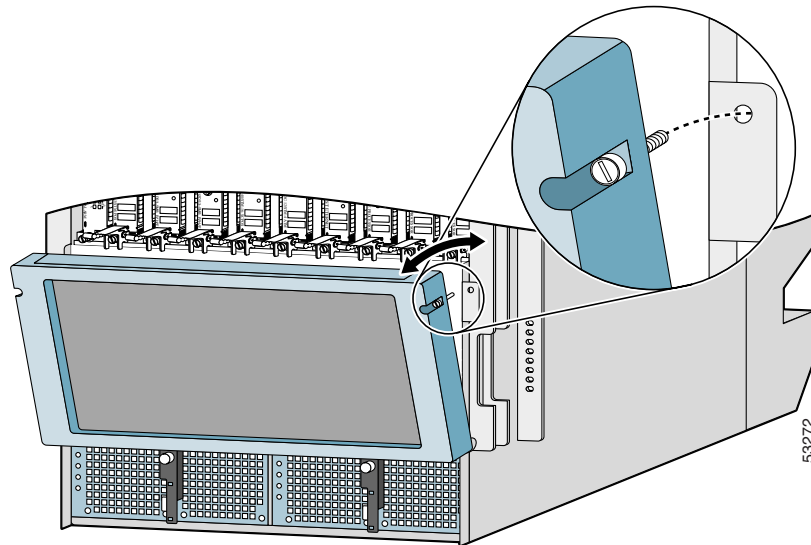
Step 2   Starting at slot CSC0:

    d. Slide the card into the slot (Figure 3-24).

    a. Pivot the ejector levers to seat the card to the backplane connector.

Figure 3-24   ***Reinstalling a Clock Scheduler Card into the Switch Fabric and Alarm Card Cage***
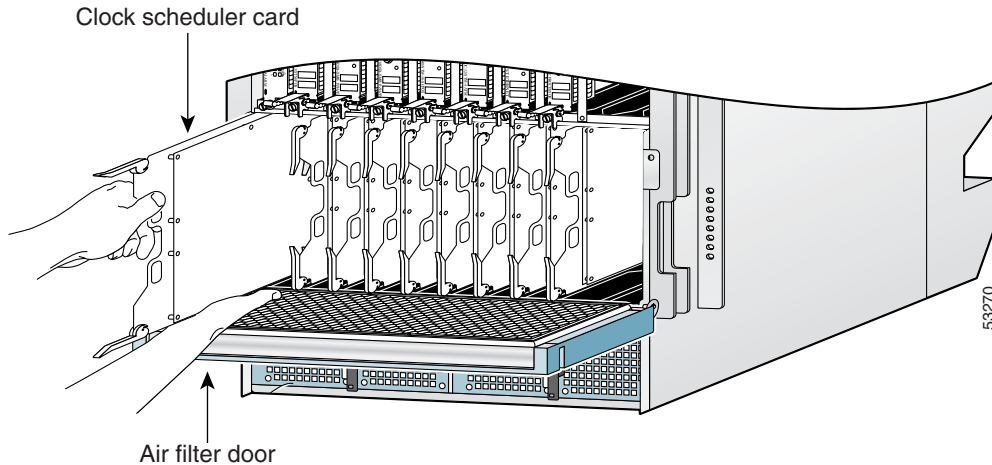
Clock scheduler card

Air filter door

Step 3   Repeat Step 2 for each card.

Step 4   Close the air filter door and tighten the captive screws to prevent the door from opening during chassis installation.

⚠

Caution   The air filter door must be closed and secured at all times to maintain correct EMI performance.

Step 5   Go to the "Reinstalling Cards in the Line Card and RP Card Cage" section on page 3-33 to reinstall the line cards and RP.

Reinstalling Cards in the Line Card and RP Card Cage

Before you begin reinstalling cards in the card cage, identify slot assignments by referring to the written list you prepared when you removed the cards (refer to Figure 3-7 for slot-numbering).

Use the following procedure to reinstall cards in the line card and RP card cage.

Step 1   Starting at slot 0 (Figure 3-25):

b.   Slide the card into the slot until it mates with the backplane connector.

a.   Tighten the captive screws at the top and bottom of the front panel.

Figure 3-25   *Installing a Line Card into the Line Card and RP Card Cage*

Cisco XR 12410 Router Installation Guide
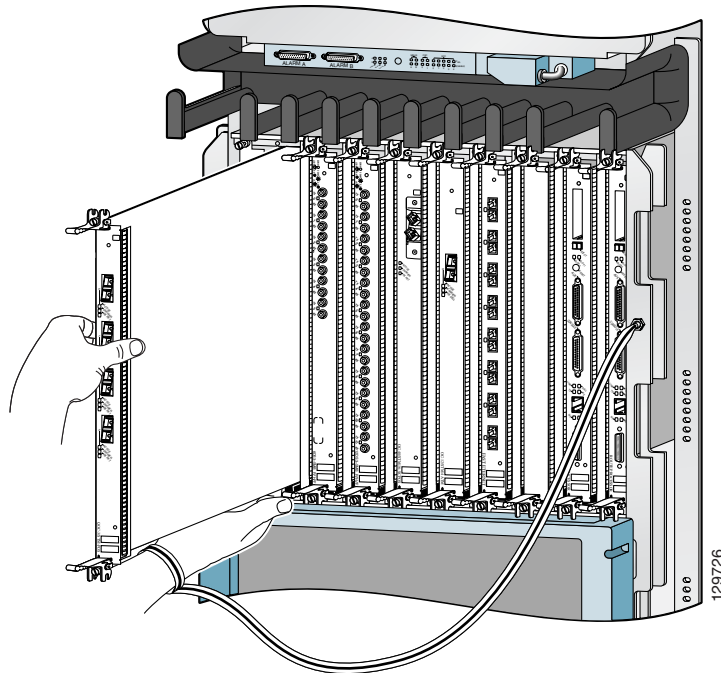
⚠
Caution   Unoccupied card slots in the line card and RP card cage must have a blank filler panel installed for electromagnetic compatibility (EMC) and to ensure proper air flow through the chassis.

Step 2   Repeat Step 2 for each line card.

⚠
Caution   Unoccupied card slots must have a blank filler panel installed for electromagnetic compatibility (EMC) and to ensure proper air flow through the chassis. If the faceplate of a line card does not completely fill the card slot opening, a narrow card filler panel must be installed for electromagnetic compatibility (EMC) and to ensure proper air flow through the chassis.

Step 3   Go to the "Connecting Line Card Network Interface Cables" section on page 3-34 to connect the network interface cables.

Connecting Line Card Network Interface Cables

This section describes how to route the network interface cables through the router cable-management system and attach the network interface cables to the line card ports.

This procedure uses an 8-port fiber-optic Fast Ethernet card as an *example* to describe how to attach a network interface cable to a line card port and route the cable through the cable-management system. Depending on which line cards are installed in your system, your cable connection procedure might differ slightly from this example. For cable connection information for your specific line card, refer to the installation and configuration note for that line card.

✎
Note   You can access the most current Cisco line card documentation on the World Wide Web at: http://www.cisco.com.

Use the following procedure as an example to route the network interface cables through the cable-management system and connect them to the line card.

Step 1   Route an interface cable across the horizontal cable-management tray, through the cable tray opening to connect it to the line card:

- For legacy fiber-optic line cards, go to Step 2.
- For current fiber-optic line cards, go to Step 6.

Step 2   Install a plastic bend-radius clip on the strain-relief ferrule on the connector (see blow-out in Figure 3-26).

✎
Note   The bag of bend-radius clips (Part Number 800-06119-01) in the accessories box that shipped with your router contains two sizes of bend-radius clips. The clip size is determined by the diameter of the strain-relief ferrule on the cable connectors. Use the size that provides the most secure fit on the strain-relief ferrule on the cable connectors in use at your site.

Step 3   Insert the cable connector into its assigned port.

Step 4   Route the cable up the cable-management bracket and carefully press the cable into the channel so it is held in place by the cable clips (Figure 3-26b).

Step 5   Repeat Steps 3 through 5 for each additional cable connection to that line card.

Figure 3-26   Connecting a Network Interface Cable to a Legacy Line Card

Line card
cable-management
bracket

Network
interface
cable

Cable clips

FAST ETHERNET

FAST ETHERNET

28350
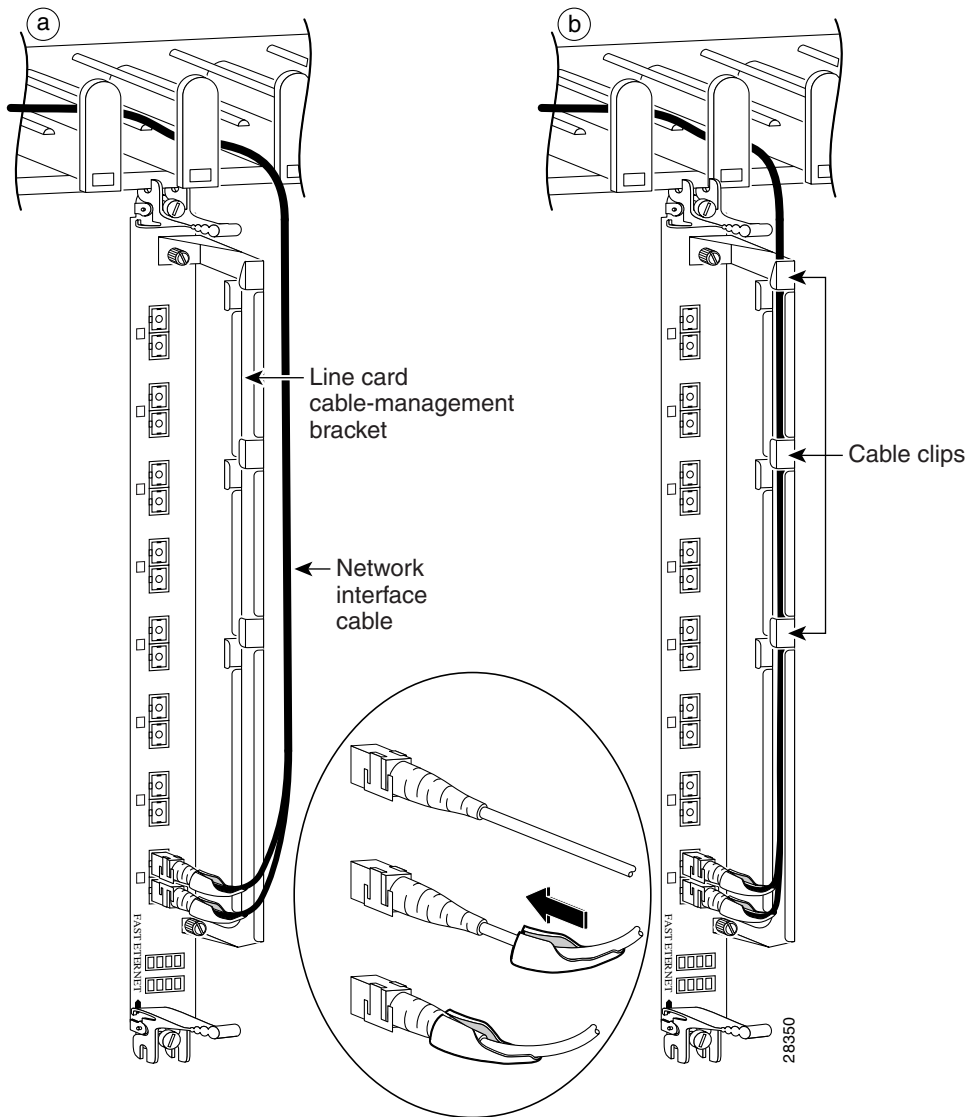
Step 6   Insert all cables into their assigned ports.

Step 7   Place several evenly spaced velcro straps through slots on the cable-management bracket (Figure 3-27a).

Step 8   Route the cables alongside the cable-management bracket and secure them with the velcro straps as appropriate (Figure 3-27b).

⚠

Caution   Make sure the interface cables do not have any kinks or sharp bends which can destroy or degrade the ability of the optical fiber to propagate the signal-encoded beam of light accurately from one end of the cable to the other. Always allow adequate strain relief in the interface cable.

Figure 3-27   Current Style Cable Management Bracket

Line card
cable-management
bracket

Network
interface
cable

Velcro
strap
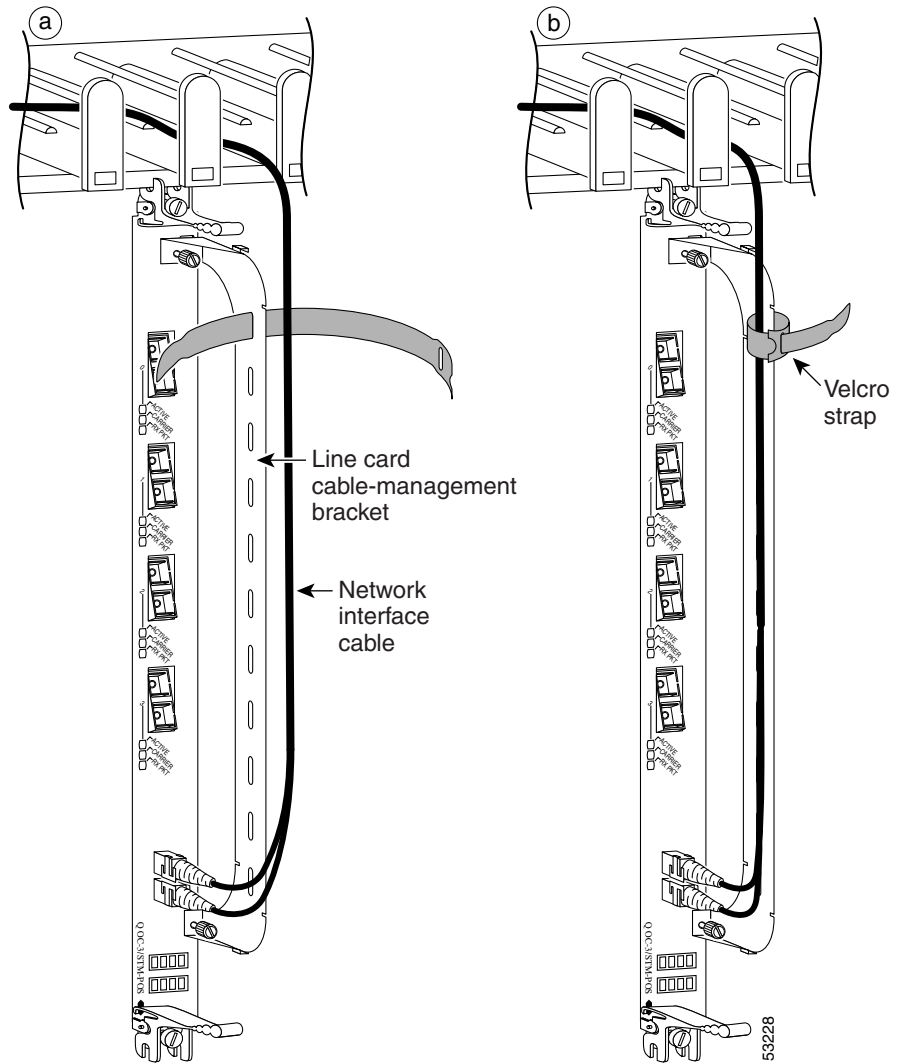
Connecting PRP Route Processor Cables

This section describes how to connect cables to the console, auxiliary, and Ethernet ports on the PRP. The console and auxiliary ports are both asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. For example, most modems are asynchronous devices.

Figure 3-28 shows an example of a data terminal and modem connections.

Figure 3-28   PRP Console and Auxiliary Port Connections
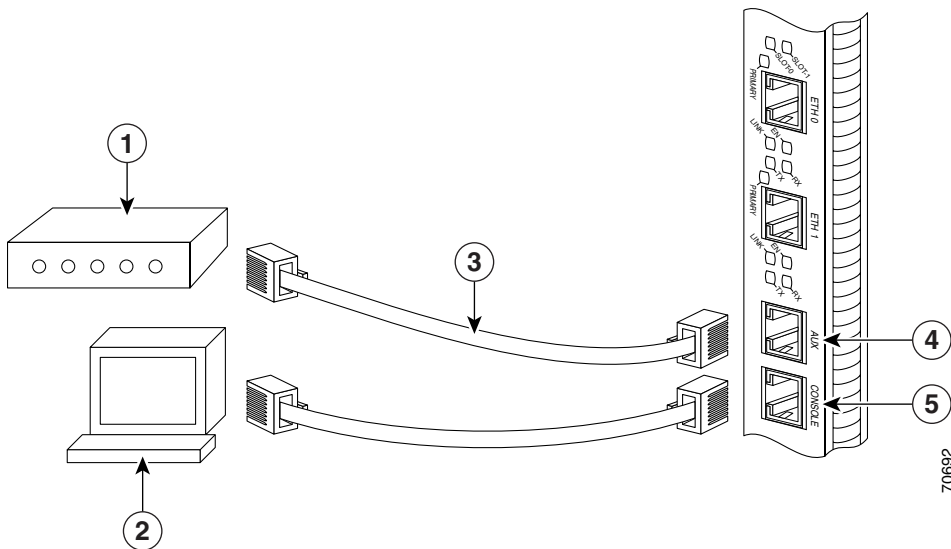
1	Modem	**4**	Auxiliary port
2	Console terminal	**5**	Console port
3	RJ-45 Ethernet cables		—

⚠️

Caution   The ports labeled Ethernet, 10BASE-T, Token Ring, Console, and AUX are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits.

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■ **Connecting PRP Route Processor Cables**

> **Note** RP cables are not available from Cisco, but are available from any commercial cable vendor.

> **Note** To comply with the intra-building lightning surge requirements of GR-1089-CORE, Issue II, Revision 01, February 1999, you must use a shielded cable when connecting to the console, auxiliary, and Ethernet ports. The shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Connecting to the PRP Console Port

The system console port on the PRP is a DCE RJ-45 receptacle for connecting a data terminal to perform the initial configuration of the router. The console port requires a straight-through RJ-45 cable.

See the "PRP Auxiliary and Console Port Connections" section on page 2-22 for additional information about the console port.

Refer to Figure 3-28 and use the following procedure to connect a data terminal to the PRP console port.

Step 1 Set your terminal to these operational values: 9600 bps, 8 data bits, no parity, 2 stop bits (9600 8N2).

Step 2 Power off the data terminal.

Step 3 Attach the terminal end of the cable to the interface port on the data terminal.

Step 4 Attach the other end of the cable to the PRP console port.

Step 5 Power on the data terminal.

Connecting to the PRP Auxiliary Port

The auxiliary port on the PRP is a DTE, RJ-45 receptacle for connecting a modem or other DCE device (such as a CSU/DSU or another router) to the router. The asynchronous auxiliary port supports hardware flow control and modem control.

See the "PRP Auxiliary and Console Port Connections" section on page 2-22 for additional information about the auxiliary port.

Refer to Figure 3-28 and use the following procedure to connect an asynchronous serial device to the PRP auxiliary port.

Step 1   Power off the asynchronous serial device.

Step 2   Attach the device end of the cable to the interface port on the asynchronous serial device.

Step 3   Attach the other end of the cable to the PRP auxiliary port.

Step 4   Power on the asynchronous serial device.

Connecting to the PRP Ethernet Ports

Two RJ-45 Ethernet interface receptacles on the PRP provide media-dependent interface (MDI) Ethernet ports. These connections support IEEE 802.3 and IEEE 802.3u interfaces compliant with 10BASE-T and 100BASE-TX standards. The transmission speed of the Ethernet ports is autosensing by default and is user-configurable.

The RJ-45 receptacles on the PRP provide two physical connection options for Ethernet interfaces. To connect cables to the PRP Ethernet interfaces (ports labeled ETH0 and ETH1), attach the Category 5 UTP cable directly to a RJ-45 receptacle on the PRP.

See the "PRP Ethernet Connections" section on page 2-26 for additional information about the Ethernet ports.

Note   RJ-45 cables are not available from Cisco Systems; they are available from outside commercial cable vendors. Use cables that comply with EIA/TIA-568 standards.

Caution   Ethernet ports are primarily used as a Telnet port into the Cisco XR 12410 router, and for booting or accessing Cisco software images over a network to which an Ethernet port is directly connected. Cisco Express Forwarding (CEF) functions are switched off by default for security reasons. We strongly caution you to consider the security implications of switching on CEF routing functions on these ports.

Use the following procedure to connect an Ethernet cable to the PRP RJ-45 Ethernet receptacle:

Step 1   Plug the cable directly into the RJ-45 receptacle.

Step 2   Connect the network end of your RJ-45 cable to a switch, hub, repeater, DTE, or other external equipment.

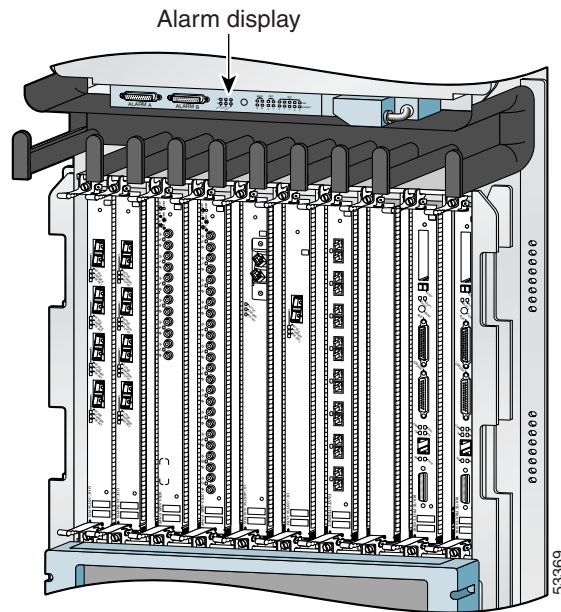Note   The Ethernet interfaces on the PRP are endstation devices only, not repeaters.

Connecting Alarm Display Card Cables

The router alarm display card, which is located above the horizontal cable management tray, has two 25-pin D-subconnectors, labeled Alarm A and Alarm B (Figure 3-29).

Figure 3-29   Alarm Display Card Cable Connection

The alarm subconnectors can be used to connect the router to an external site alarm maintenance system. Any critical, major, and minor alarms generated by the router also energize alarm relays on the alarm card and activate the external site alarm. The alarm relay contacts on the alarm card consist of standard *common*, *normally open*, and *normally closed* relay contacts that are wired to Alarm A and Alarm B connector pins.

Table 2-7 on page 2-32 lists the pin-to-signal correspondence between the connector pins and the alarm card relay contacts. Because alarm contact cables are entirely dependent on installation site circumstances, alarm connector cables are not available from Cisco. For information about alarm connector wiring requirements and the pinouts for the alarm connector interface, see the "Alarm Display Connection Guidelines" section on page 2-31.

⚠

Caution   Only safety extra-low voltage (SELV) circuits can be connected to the alarm connector. Maximum rating for the alarm circuit is 2 A, 50 VA.

✎

Note   To comply with the intra-building lightning surge requirements of GR-1089-CORE, Issue II, Revision 01, February 1999, you must use a shielded cable when connecting to the external alarm ports on the alarm card. The shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Connecting Power to the Router

Use the one of the following procedures to connect power to your router.

- Connecting Power to an AC-Powered Router, page 3-45
- Connecting Power to a DC-Powered Router, page 3-46

⚠

Caution   A router must be operated with both of its power modules installed at all times for electromagnetic compatibility (EMC).

Connecting Power to an AC-Powered Router

Use the following procedure to connect the AC power cords to the router.

✎

Note   Connect each AC power supply to a dedicated power source (branch circuit). Each AC-input power supply operates between 200 and 240 VAC and requires at least a 20 A service for North American use, or a 13 A service for international use. For more information on AC power cords, see the "Power Connection Guidelines" section on page 2-13.

Step 1   Connect each power cable to the AC power connector on the horizontal trough and secure them with their retention clips (Figure 3-30).

Step 2   Plug each power supply cable into its AC outlet.

Figure 3-30   Connecting Source AC to the AC-Input Power Connector

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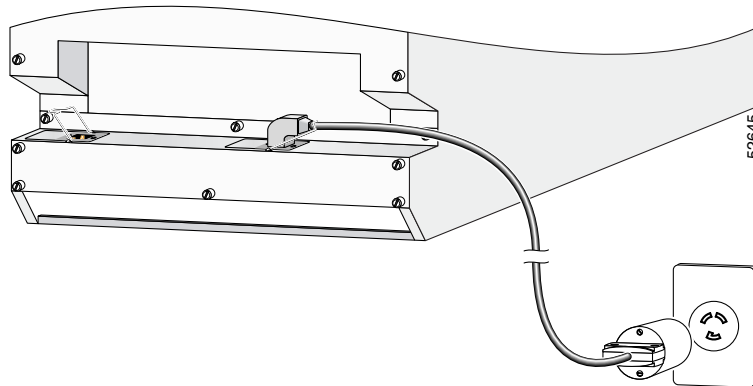
Connecting Power to a DC-Powered Router

This section contains the procedures to connect the DC source power cables to a DC-powered router.

The color coding of source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, you must be sure that power source cables are connected to the PDU with the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads*. Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the PDU when making the measurement.

- A green (or green and yellow) cable typically indicate that it is a ground cable.

⚠

Caution   DC PEMs contains circuitry to trip the breaker on the PEM if the PEM detects a reverse polarity condition. No damage should occur from reverse polarity, but you should correct a reverse-polarity condition immediately.

✎

Note   The length of the cables depends on the location of your router in relation to the source of DC power. These cables and the cable lugs used to attach the cables to the router chassis are not available from Cisco Systems. They are available from any commercial cable vendor. For more information on site power and source DC cable requirements, see the "Power Connection Guidelines" section on page 2-13.

⚠

Warning   **To ensure that power remains off while you are performing this procedure, tape the DC circuit breaker switch in the off (0) position.**

Use the following procedure to connect the DC source power cables to a 2800 W
DC powered router.

Step 1   Remove the clear plastic safety cover that fits over the DC power connection
terminal studs.

> ✎
> **Note**   Safety covers for 2800 W PDUs use an upper and lower, 2-piece design.

Step 2   Connect the 2800 W DC power cables in the following order (Figure 3-31):

   a.   Ground cables first.

   b.   Positive cables next.

   c.   Negative cable last.

   d.   Repeat steps a, b, and c for the other PDU.

> ⚠
> **Warning**   **To prevent injury and damage to the equipment, always attach the ground and
> source DC power cable lugs to power shelf terminals in the following order:
> (1) ground to ground, (2) positive (+) to positive (+), (3) negative (−) to
> negative (−).**

Figure 3-31   Connecting the DC Power Cables—2800 W PDU

- 48/60V RTN
(+)

- 48/60V (−)

- 48/60V (−)

Feed A2

- 48/60V RTN
(+)

Feed A1

Ground
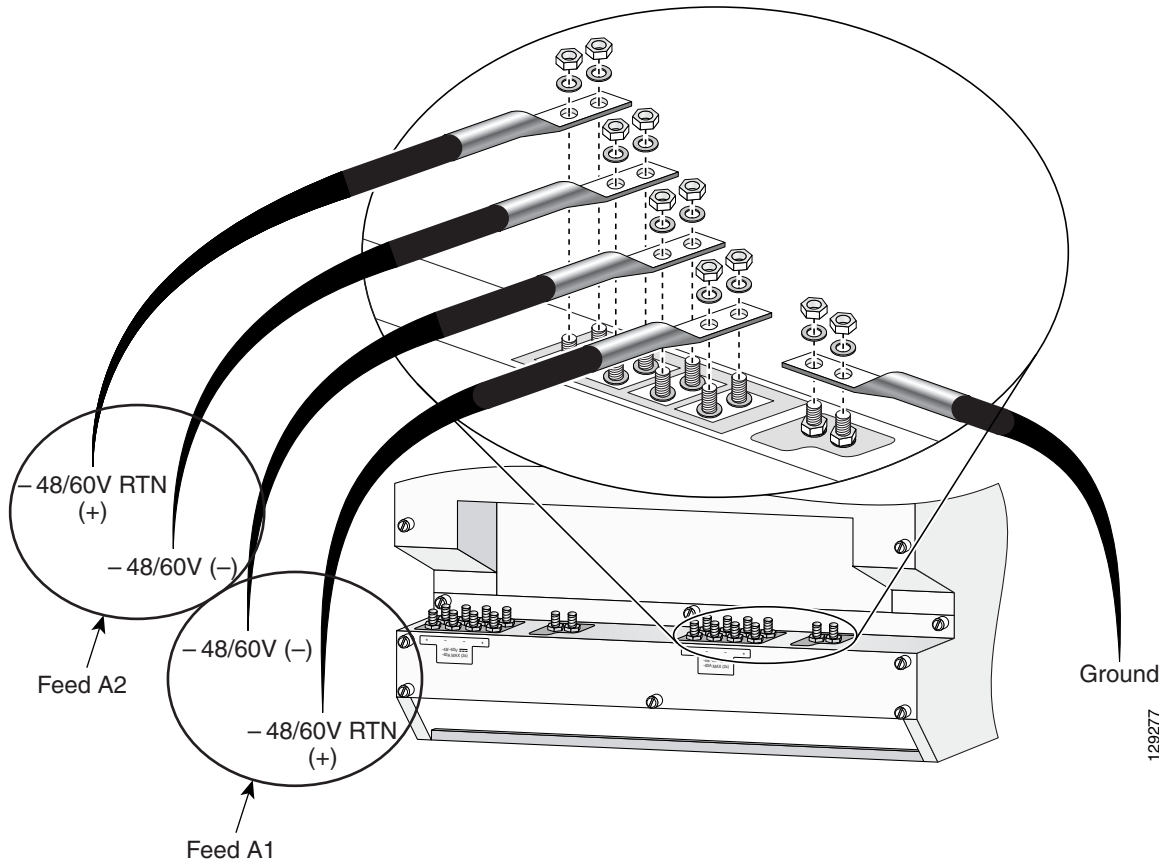
129277

Step 3   Replace the clear plastic safety covers over the PDUs.

Step 4   Power on the circuit breaker.

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Troubleshooting the Installation

This chapter contains general troubleshooting information to help isolate the cause of any difficulties you might encounter during the installation and initial startup of the system.

Although an overtemperature condition is unlikely at initial startup, environmental monitoring functions are included in this chapter because they also monitor internal voltages.

Troubleshooting the installation is presented in the following sections:

Troubleshooting Overview

This section describes the methods used in troubleshooting the router. The troubleshooting methods are organized according to the major subsystems in the router.

If you are unable to solve a problem on your own, you can contact a Cisco customer service representative for assistance. When you call, have the following information ready:

- Date you received the router and the chassis serial number (located on a label on the back of the chassis).
- Installed line cards.
  - Use the **show hardware** command to determine which line cards are installed if possible.
- Cisco software release number.
  - Use the **show version** command to determine this information if possible.
- Brief description of the symptoms and steps you have taken to isolate and solve the issue.
- Maintenance agreement or warranty information.

Troubleshooting Using a Subsystem Approach

To solve a system problem, try to isolate the problem to a specific subsystem. Compare current router behavior with expected router behavior. Because a startup issue is usually attributable to one component, it is most efficient to examine each subsystem, rather than trying to troubleshoot each router component.

For troubleshooting purposes in this chapter, the router consists of the following subsystems:

- Power subsystem—Includes the following components:
  - AC-input or DC-input power supplies, also called power entry modules (PEMs). The router chassis is shipped with fully-redundant PEMs installed in the chassis.

- Chassis backplane power distribution. –48 VDC power from the power supplies is transferred to the chassis backplane and is distributed to all of the cards through the backplane connectors. The blower module receives power from the chassis backplane through a wiring harness and passes MBus data back to the chassis backplane.

- Processor subsystem—Includes the RP, up to nine line cards (when no optional, redundant RP is installed), and two alarm cards. The RP and line cards are equipped with onboard processors. The RP downloads a copy of the Cisco software image to each line card processor. The system uses an alphanumeric display (on each line card and RP) t o display status and error messages, which can help in troubleshooting.

- Cooling subsystem—Consists of a blower module, which circulates air through the card cages to cool the cards, and a fan in each of the power modules, which circulates cooling air through the power module.

Normal Router Startup Sequence

You can generally determine when and where the router failed during the startup sequence by checking the status LEDs on the power modules, and the alphanumeric displays on the RP and line cards.

In a normal router startup sequence, the following sequence of events and conditions occur:

1. The fans in the blower module receive power and begin drawing air through the chassis.

The blower module OK indicator is on.

2. The fan in each PEM receives power and begins drawing air through the power supply.

The power supply Pwr OK indicator is on.

3. As the power on and boot process progresses for the RP and each installed line card, the status of each card appears on the alphanumeric display on the front panel of the card:

   – The upper row of the display is powered by the DC-to-DC converter on the card.

   – The lower row of the display is powered by the +5 VDC provided through the backplane.

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Identifying Startup Issues

Table 4-1 shows the contents of the alphanumeric displays on the RP and the line cards, as well as the normal LED states on the alarm card, the power entry modules (AC or DC), and the blower module after a successful system startup.

Table 4-1   *Alphanumeric Displays and LEDs at System Startup*

Component	Type of Indicator	Display Contents/LED Status and Meaning
RP	Alphanumeric display	Top row: MSTR Bottom row: PRP The RP is enabled and recognized by the system; a valid Cisco software image is running.
Line Cards	Alphanumeric display	Top row: IOS XR Bottom row: RUN The line card is enabled and ready for use.
Alarm Display	Detected alarm severity	Critical: Off Major: Off Minor: Off
	MBUS (Alarm A and Alarm B cards)	Enabled: On Fail: Off
	CSC 0 and 1	Enabled: On Fail: Off
	SFC 0, 1, 2, 3, and 4	Enabled: On Fail: Off
AC Power Supplies	Power status	Pwr OK: On Fault: Off Temp: Off Ilim: Off The correct power module voltages are present and no faults have been detected.

Table 4-1   *Alphanumeric Displays and LEDs at System Startup (continued)*

Component	Type of Indicator	Display Contents/LED Status and Meaning
DC Power Supplies	Power status	F1LO: Off F2LO: Off RPF1: Off RPF2: Off OC: Off OT: Off INOK: On DCOK: On The correct power module voltages are present and no faults have been detected.
Blower Module	Blower status	OK: On FAIL: Off The blower module fans are operating correctly.

Troubleshooting the Power Subsystem

This section contains information to troubleshoot the power subsystems:

- Troubleshooting the AC-Input Power Subsystem, page 4-5
- Troubleshooting the DC-Input Power Subsystem, page 4-8
- Troubleshooting the Power Distribution System, page 4-14

Troubleshooting the AC-Input Power Subsystem

AC-input power supplies are monitored for internal temperature, voltage, and current load by the MBus module on the alarm cards, and by the master MBus module on the RP. If the router detects an extreme condition, it generates an alarm on the alarm card and logs the appropriate warning messages on the console.

Figure 4-1 identifies the components of an AC PEM.

Figure 4-1   *AC PEM Components*
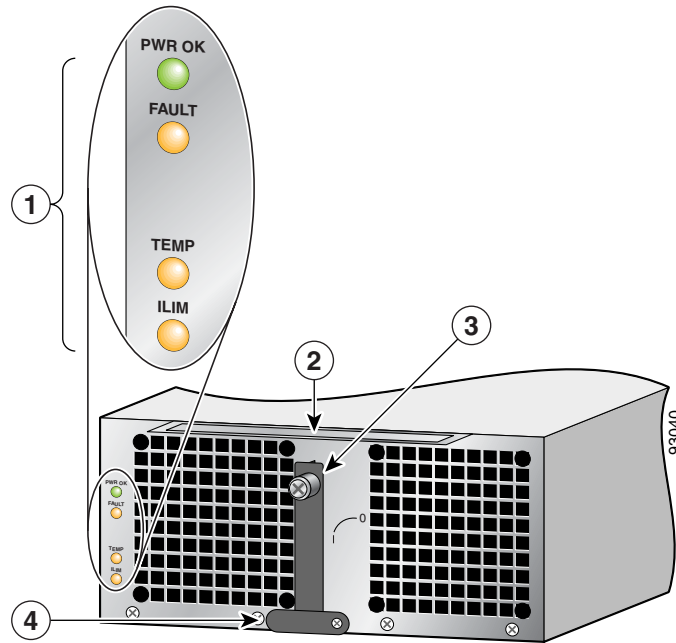
1	Status indicators	**3**	Ejector lever
2	Handle	**4**	Power On/Off switch (shown in the ON/1 position)

Use the following procedure to troubleshoot the AC power supply if it is not operating properly.

Step 1   Make sure the power supply is seated properly.

- Eject and reseat the PEM. Check that:

  – The captive screw on the ejector lever is tightened securely.

  – The power switch is set to the on (1) position.

Step 2   Make sure the router is powered on and that all power cords are connected properly. Check that the:

- Power cords on the horizontal trough on the back of the chassis are secured in place with their retention clips.

- Power cords at the power source end are securely plugged into their own AC power outlet.

- Source AC circuit breaker is switched on.

Step 3   Check the power supply status LED indicators.

- Pwr OK (green)—Indicates that the power supply is operating normally, and both the source AC input voltage of 200 VAC to 240 VAC, and the –48 VDC output voltage to the backplane are within the nominal operating range. This indicator lights when the power switch is set to the on (1) position.

    - If the Pwr OK indicator remains off after checking all of the power sources, replace the power supply with a spare.

    - If the spare power supply does not work, replace its power distribution unit (PDU).

- Fault (yellow)—Indicates that the system has detected a fault within the power supply. This indicator remains off during normal operation.

    If the indicator is on:

    - Toggle the power switch off and then on. If the indicator remains on after several attempts to power it on, replace the power supply with a spare.

    - If the spare power supply also fails, the problem could be a faulty power shelf backplane connector. Power off the router and contact a Cisco service representative for assistance.

- Temp (yellow)—Indicates that the power supply is in an overtemperature condition, causing a shut-down to occur.

Note   If the temp indicator is on, the fault indicator is also on.

    - Verify that the power supply fans are operating properly.

    - Verify that the blower module is operating properly.

    If the power supply fans and the blower module are operating properly, replace the existing power supply with a spare.

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- Ilim—Indicates the power supply is operating in a current-limiting condition.

    – Make sure that each power cord is connected to a dedicated AC power
      source.

    – Each AC power supply operating in the nominal range of 200 to 240 VAC
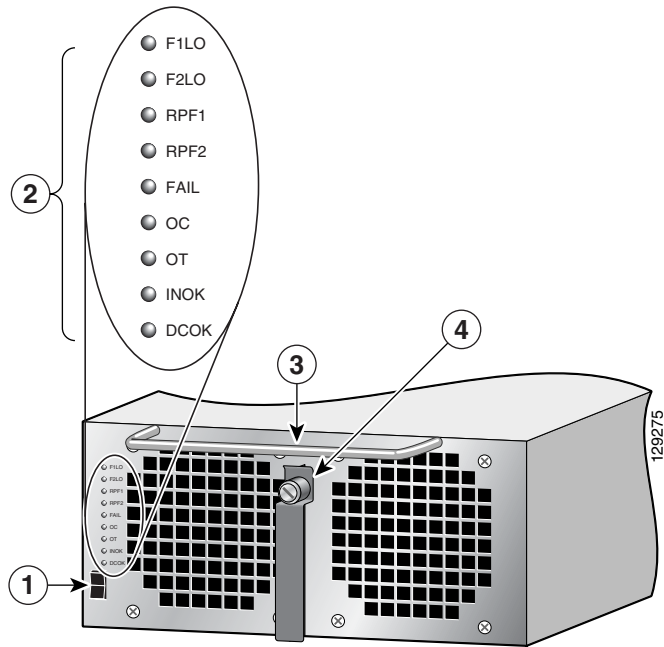   requires a minimum service of 20 A, North America (or 13 A,
      international).

Because the AC-input power subsystems use redundant power supplies, a problem
with the DC output voltage to the backplane from only one power supply should
not affect router operation. When the router is equipped with two AC power
supplies, it powers on and operates even if one power supply fails.

Troubleshooting the DC-Input Power Subsystem

DC-input power supplies are monitored for internal temperature, voltage, and
current load by the MBus module on the alarm cards, and by the master MBus
module on the RP. If the router detects an extreme condition, it generates an alarm
on the alarm card and logs the appropriate warning messages on the console.

Figure 4-2 identifies the components of a DC PEM.

Figure 4-2   *2800 Watt DC PEM Components*

1	Power on/off switch	3	Handle
2	Status indicators	4	Ejector lever

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Troubleshooting a DC PEM

Use the following procedure to troubleshoot a 2800 W DC PEM if it is not operating properly.

Step 1   Make sure the PEM is seated properly:

- Eject and reseat the PEM. Make sure:
    - The captive screw on the ejector lever is tightened securely.
    - The power switch is set to the on (1) position.

Step 2   Check the PEM status indicators:

- F1LO (feeder 1 low) (flashing yellow)—Indicates that input connections to the PDU (feeder 1) are loose or not connected, or the input voltage is below the minimum. This indicator remains off during normal operation. Make sure that:
    - Power cords are securely attached to their PDU terminal studs.
    - Power cords are securely attached at the DC source end.
    - The source DC circuit breaker is switched on.

    If the indicator is still flashing after you perform the above checks, replace the power supply.

- F2LO (feeder2 low) (flashing yellow)—Indicates that input connections to the PDU (feeder 2) are loose or not connected, or the input voltage is below the minimum. This indicator remains off during normal operation. Make sure that:
    - Power cords are securely attached to their PDU terminal studs.
    - Power cords are securely attached at the DC source end.
    - The source DC circuit breaker is switched on.

    If the indicator is still flashing after you perform the above checks, replace the power supply.

- RPF1 (reverse polarity feeder 1) (flashing yellow)—The (feeder 1) PDU is miswired. For wiring instructions see the "Connecting Power to a DC-Powered Router" section on page 3-46. This indicator remains off during normal operation.

- RPF2 (reverse polarity feeder 2) (flashing yellow)—The (feeder 2) PDU is mis-wired For wiring instructions see the "Connecting Power to a DC-Powered Router" section on page 3-46. This indicator remains off during normal operation.

- FAIL (red)—Lights in conjunction with the following indicators (which flash) to show the type of power supply failure:

    - F1LO (Feeder 1 Low)

    - F2LO (Feeder 2 Low)

    - OC (Over Current)

    - OT (Over Temperature)

- OC (over current) (flashing red)—Indicates the input or output current has exceeded its limit and that an overload or short has occurred.

    - Set the power supply switch to off (0) and then back to the on (1) position.

    - If the indicator is still flashing, eject and reseat the power supply.

    - If the indicator is still flashing, replace the power supply.

- OT (over temperature) (steady or flashing red)—Indicates that the power supply is in an overtemperature condition, causing a shut-down to occur.

    - Flashing red indicates a locked power supply fan. Replace the power supply.

    - Steady red indicates a true overtemperature condition. Make sure that all blower module fans are operating properly.

      Replace the power supply if the blower module is operating properly.

      Replace the blower module if one or more of the blower module fans are not working.

- INOK (green)—Indicates that the power supply is operating normally, and the source DC voltage is within the nominal operating range of –48 to –60 VDC. This indicator lights when the power switch is set to the on (1) position.

    - If the INOK indicator is off, replace the power supply.

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- DCOK (green)—Indicates that the power supply is operating normally, and is within the nominal operating range. This indicator lights a few seconds after the INOK indicator lights.
  - If the DCOK indicator is off, replace the power supply.

Because there are redundant power supplies, a problem with the DC output voltage to the backplane from only one PEM should not affect router operation. When the router is equipped with two DC power supplies, it powers on and operates even if one power supply fails.

Additional Power Subsystem Troubleshooting Information

This section contains additional troubleshooting information to help you isolate the cause of a power problem.

The MBus modules powering the alphanumeric displays on the RP and line cards are powered by +5 VDC from the backplane. The blower modules use –48 VDC from the backplane. If both the RP and the blower modules are operating, all internal correct DC voltages are present.

Enter the **show environment** command at the user EXEC mode prompt to display temperature and voltage information for each installed card, blower module, and PEM as shown in this example:

```
router#show environment
Slot #  Hot Sensor      Inlet Sensor
        (deg C)         (deg C)

1        38.0            32.5
3        36.5            39.0
5        37.0            37.0
7        36.0            32.0
16       26.0            26.0
17       27.5            27.5
18       27.0            27.5
19       0.0      0.0
20       27.0            27.5
21       28.0            28.0
22       28.0            28.0
24       47.0            NA
29       NA              22.0

Slot #  PEM Over Temperature Sensors
```

```
24      PEM1    OK
        PEM2    OK
Slot #  Hot Sensor      Inlet Sensor
         (deg C)          (deg C)

29        NA             22.0

Slot #  3V      5V      MBUS 5V
        (mv)    (mv)    (mv)

1       3296    5016    5048
3       3284    4976    5000
5       3308    5008    5048
7       3296    5016    5000
16      3300    NA      5064
17      3308    NA      5064
18      3292    NA      5056
19      3300    NA      5072
20      3288    NA      5056
21      3296    NA      5072
22      3292    NA      5064
24      NA      NA      5096
29      NA      NA      4920

Slot #          48V     AMP_48
                (Volt)  (Amp)

24      PEM1    56      2
        PEM2    55      2
Slot #  Fan 0   Fan 1   Fan 2
        (RPM)   (RPM)   (RPM)

29      3021    3090    2997
```

Troubleshooting the Power Distribution System

The power distribution system consists of:

- AC or DC PEMs which supply –48 VDC to the backplane,

- The chassis backplane which carries voltage to chassis components.

- DC-to-DC converters which convert –48 VDC from the backplane to the correct voltages required by the line cards.

Use the following procedure to troubleshoot the power distribution system.

Step 1 Check each power supply to make sure that:

- The ejector lever is fully closed and properly secured by the its captive screw.

- The Pwr OK indicator is on.

- The Fault and Temp indicators are both off.

If the power supplies meet the above criteria, then the correct source power is present and within tolerance. The power supplies are functioning properly.

Step 2 Make sure the blower module is operating.

- If the blower module is functioning, then the –48 VDC from the chassis backplane and the cables from the backplane to the blower module are functioning properly.

- If the blower module is not functioning, there may be a problem with either the blower module itself, or the –48 VDC power supplied to the blower module. Eject and reseat the blower module.

- If the blower module is still not operating there could be a problem with the blower module controller card or cable. Replace the blower module.

- Contact your Cisco representative if replacing the blower module does not fix the problem.

Troubleshooting the Processor Subsystem

The router processor subsystem consists of the route processor, line cards, and alarm cards. The RP and the line cards have two onboard processors; one serves as the main (or master) processor, and the other serves as the MBus module processor. The MBus module processor monitors the environment and controls the onboard DC-to-DC converters.

Note   A minimally configured router must have an RP installed in slot 9 of the card cage to operate. If the router is equipped with a redundant RP, the redundant RP must be installed in slot 8 of the card cage.

This section contains information to troubleshoot the processor subsystem, including:

- Performance Route Processor Overview, page 4-16
- Troubleshooting the Route Processor, page 4-24
- Troubleshooting Line Cards, page 4-27
- Troubleshooting Using the Alarm Display, page 4-33

Performance Route Processor Overview

The performance route processor (PRP) uses a Motorola PowerPC 7450 CPU that runs at an external bus clock speed of 133 MHz and has an internal clock speed of 667 MHz.

Figure 4-3 identifies the slots, ports, and LEDs on the PRP front panel.

Figure 4-3   Performance Route Processor Front Panel

1	PCMCIA flash disk slots (shown with cover in place) and slot LEDs	**4**	Console serial port
2	RJ-45 Ethernet ports and data status LEDs	**5**	Reset button
3	Auxiliary serial port	**6**	Alphanumeric message displays

PRP PCMCIA Card Slots and Status LEDs

Two PCMCIA card slots (slot 0 and slot 1) provide the PRP with additional flash memory capacity. All combinations of different flash devices are supported by the PRP. You can use ATA flash disks, Type 1 or Type 2 linear flash memory cards, or a combination of the two.

Note   The PRP only supports +5.2 VDC flash memory devices. It does *not* support +3.3 VDC PCMCIA devices.

Status LEDs (Slot-0/Slot-1) indicate when the flash memory card in that slot is accessed (see Figure 4-3). Each slot has an eject button (located behind the cover) to remove a flash card from the slot.

PRP Ethernet Ports and Status LEDs

The PRP has two 8-pin media-dependent interface (MDI) RJ-45 ports for either IEEE 802.3 10BASE-T (10 Mbps) or IEEE 802.3u 100BASE-TX (100 Mbps) Ethernet connections. These ports are labeled ETH 0 and ETH 1.

The transmission speed of the Ethernet port is not user-configurable. You set the speed through an autosensing scheme on the PRP which is determined by the network that the Ethernet port is connected to. However, even at an autosensed data transmission rate of 100 Mbps, the Ethernet port can only provide a usable bandwidth of substantially less than 100 Mbps. You can expect a maximum usable bandwidth of approximately 20 Mbps when using an Ethernet connection.

The following LEDs on the front panel indicate traffic status and port selection (Figure 4-4):

- LINK, EN, TX, RX—Indicate link activity (LINK), port enabled (EN), data transmission (TX), and data reception (RX).

- PRIMARY—Indicates which Ethernet port is selected (ETH 0 or ETH 1).

Note   Because both ports are supported on the PRP, ETH 0 is always on. ETH 1 lights when it is selected.

Figure 4-4   Port Activity LEDs—Partial Front Panel
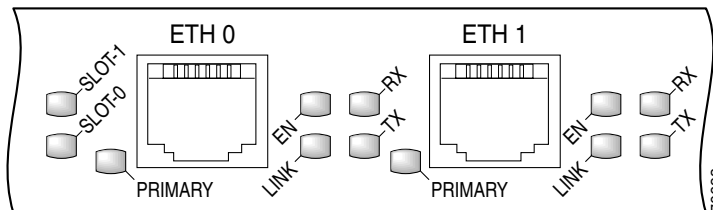
PRP Auxiliary and Console Ports

The auxiliary and console ports on the PRP are EIA/TIA-232 (also known as RS-232) asynchronous serial ports connect external devices to monitor and manage the system.

- Auxiliary port—A (male) plug that provides a data terminal equipment (DTE) interface. The auxiliary port supports flow control and is often used to connect a modem, a channel service unit (CSU), or other optional equipment for Telnet management.

- Console port—A (female) receptacle that provides a data circuit-terminating equipment (DCE) interface for connecting a console terminal.

PRP Reset Switch

Access to the (soft) reset switch is through a small opening in the PRP front panel (see Figure 4-3). To press the switch, insert a paper clip or similar small pointed object into the opening.

⚠️

Caution   The reset switch is *not* a mechanism for resetting the PRP and reloading the Cisco IOS XR image. It is intended for software development use only. To prevent system problems or loss of data, use the reset switch only on the advice of Cisco service personnel.

Pressing the reset switch causes a non-maskable interrupt (NMI) and places the PRP in ROM monitor mode. When the PRP enters ROM monitor mode, its behavior depends on the setting of the PRP software configuration register. For example, if the boot field of the software configuration register is set to:

- 0x0—The PRP remains at the ROM monitor prompt (rommon>) and waits for a user command to boot the system manually.

- 0x1—The system automatically boots the first Cisco IOS XR image found in flash memory on the PRP.

PRP Alphanumeric Message Displays

The alphanumeric message displays are organized in two rows of four LED characters each (Figure 4-5).

Figure 4-5   Alphanumeric Message Displays—Partial Front Panel
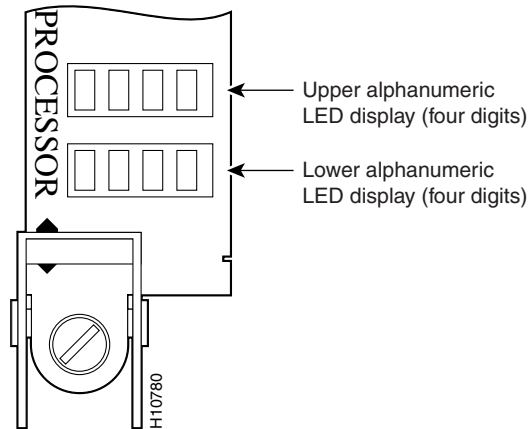
Upper alphanumeric
LED display (four digits)

Lower alphanumeric
LED display (four digits)

The alphanumeric message displays show router status messages during the boot process, and after the boot process is complete.

- During the boot process, the message displays are controlled directly by the MBus module.

- After the boot process, the message displays are controlled by Cisco IOS XR software (through the MBus).

The alphanumeric message displays also provide information about different levels of system operation, including the status of the PRP, router error messages, and user-defined status and error messages

Note   A list of all system and error messages appears in the *Cisco IOS XR System Error Messages* publication.

PRP Memory Components

This section describes types of memory used on the PRP to support router functions. Table 4-2 provides a quick reference of the different types of memory, and Figure 4-6 shows the location on the PRP board.

Table 4-2   PRP Memory Components

Type	Size	Quantity	Description	Location
SDRAM	512 MB[1], 1 GB, or 2 GB	1 or 2	Uses 512 MB or 1 GB DIMMs (based on SDRAM configuration) for main Cisco IOS XR software functions	U15 (bank 1) U18 (bank 2)
SRAM	2 MB (fixed)	—	Secondary CPU cache memory functions	—
NVRAM	2 MB (fixed)	—	System configuration files, register settings, and logs	—
Flash memory	64 MB SIMM	1	Cisco IOS XR boot image (bootflash), crash information, and other user-defined files	P3
Flash disk (PCMCIA)	64 MB[1]	1 or 2	Cisco IOS XR software images, system configuration files, and other user-defined files on one or two flash memory cards	Flash memory card slot 0 and slot 1
Flash boot ROM	512 KB	1	Flash EPROM for the ROM monitor program boot image	—

1. Default shipping configuration.

Figure 4-6   PRP Memory Locations
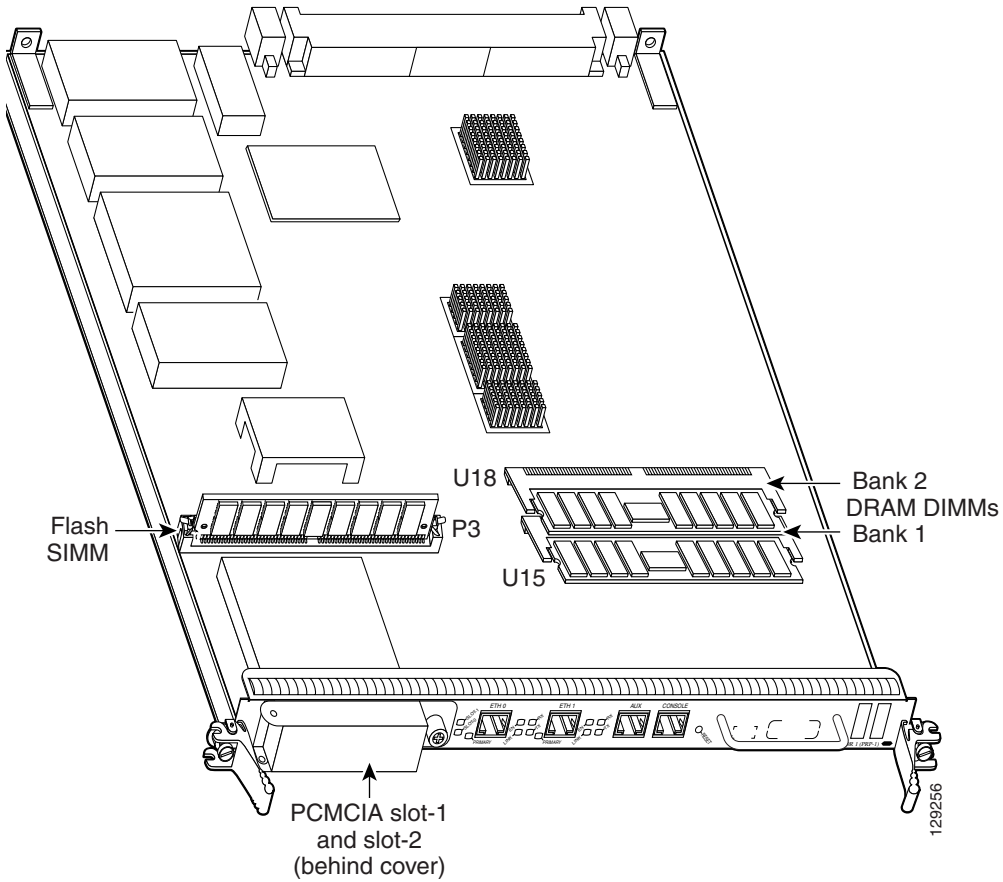
PRP SDRAM

The PRP uses Error Checking and Correction (ECC) Synchronized Dynamic Random Access Memory (SDRAM) to store routing tables, protocols, network accounting applications, and to run Cisco IOS XR software.

Table 4-3 lists the DRAM configurations for the PRP. If you are using:

- One DIMM—Bank 1 (U15) must be populated first.
- Two DIMMs—You cannot mix memory sizes; both banks must contain the same size DIMM.

Table 4-3   PRP DRAM Configurations

Total SDRAM	SDRAM Sockets	Number of DIMMs
512 MB[1]	U15 (bank 1) U18 (bank 2)	One 512 MB DIMM or Two 256 MB DIMMs
1 GB	U15 (bank 1) U18 (bank 2)	One 1 GB DIMM or Two 512 MB DIMMs
2 GB	U15 (bank 1) U18 (bank 2)	Two 1 GB DIMMs

1. Default shipping configuration.

⚠ **Caution**   DRAM DIMMs must be 3.3-volt, 60-nanosecond devices only. Do not attempt to install other devices in the DIMM sockets. To prevent memory problems, use the Cisco approved memory products listed in Table 4-3.

PRP SRAM

Static Random Access Memory (SRAM) provides 2 MB of secondary CPU cache memory. Its principal function is to act as a staging area for routing table updates, and for information sent to and received from the line cards. SRAM is *not* user-configurable and cannot be upgraded in the field.

PRP NVRAM

Non-volatile Random Access Memory (NVRAM) provides 2 MB of memory for system configuration files, software register settings, and environmental monitoring logs. Built-in lithium batteries retain the contents of NVRAM for a minimum of 5 years. NVRAM is *not* user configurable and cannot be upgraded in the field.

PRP Flash Memory

Use flash memory to store multiple Cisco IOS XR software and microcode images that you can use to operate the router. You can download new images to flash memory over the network (or from a local server) to replace an existing image, or to add it as an additional image. The router can be booted (manually or automatically) from any of the stored images in flash memory.

Flash memory also functions as a Trivial File Transfer Protocol (TFTP) server to allow other servers to boot remotely from the stored images, or to copy them into their own flash memory.

The system uses two types of flash memory:

- Onboard flash memory (*bootflash)*—Contains the Cisco IOS XR boot image
- Flash memory disks (or cards)—Contain the Cisco IOS XR software images

Table 4-4 lists supported flash disk sizes and Cisco part numbers.

Table 4-4   Supported Flash Disk Sizes

Flash Disk Size[1]	Part Number
64 MB[2]	MEM-12KRP-FD64=
128 MB	MEM-12KRP-FD128=
1 GB	MEM-12KRP-FD1G=

1. Standard Type 1 and Type 2 linear flash memory cards also are supported, although they may not have the capacity to meet the configuration requirements of your system.

2. Default shipping configuration.

Troubleshooting the Route Processor

When the router is powered on, the alphanumeric display on the RP indicate the following (Figure 4-7):

- Upper row—Indicates which RP software component is running. At the end of a successful boot process, this display reads MSTR.

- Lower row—Indicates the current phase of the boot process. At the end of a successful boot process, this display reads PRP.

Figure 4-7   RP Alphanumeric Display

Upper alphanumeric
LED display (four digits)

Lower alphanumeric
LED display (four digits)
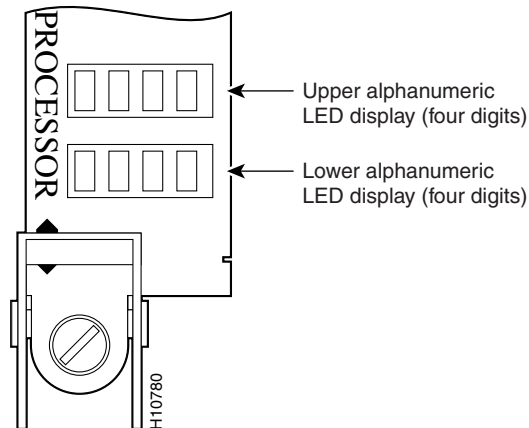
Troubleshooting Using the RP Alphanumeric Display

You can use the alphanumeric display to isolate a problem with the RP. The two rows on the alphanumeric display are powered separately:

- The upper row receives power from the DC-to-DC converters on the RP.

- The lower row is powered directly from the MBus on the RP through the chassis backplane.

  - If the lower row is not operating, the MBus module may be malfunctioning.

  - If the MBus module is operating, the lower row could be on even if the RP failed to powered on.

- If neither the upper nor the lower row is on, but the power modules and the blower modules are operational, the RP may not be installed properly, or the +5 VDC output from the chassis backplane is faulty.

  - Make sure that the system is powered on.

  - Initialize the RP by ejecting it from the chassis backplane and then reseating it.

⚠

Caution   The soft reset (NMI) switch is *not* a mechanism for resetting the RP and reloading the Cisco software image. It is intended for software development use. To prevent system problems or loss of data, use the soft reset switch *only* when instructed by a Cisco certified service representative.

- If both the upper and the lower displays are operating, check the meaning of the messages (see Table 4-5).

  When the DC-to-DC converters are powered-on by the MBus module, the RP processor begins the boot process and displays various status messages. Some messages appear briefly; while others appear for several seconds. If the messages appear to stop at a particular point, the boot process may be halted.

  - Make a note of the message.

  - Turn off power to the router, then turn on the power again to reset the router and start the boot process. If the router halts again, replace the RP (see "Removing and Replacing Cards from the Line Card and RP Card Cage" section on page 5-38).

Table 4-5   *Troubleshooting Using the RP Alphanumeric Display Messages*

Message	Description
LMEM TEST	Running low memory test
LCAH TEST	Initializing lower 15K cache
BSS INIT	Initializing main memory for ROM
NVRAM INIT	Initializing NVRAM
EXPT INIT	Initializing interrupt handlers
TLB INIT	Initializing TLB
CACH INIT	Initializing CPU data and instruction cache
CACH PARY	Enabling CPU cache parity
MEM INIT	Initializing main memory
NVRAM SIZE	Detecting the NVRAM size
PCMC INIT	Initializing the PCMCIA
EXIT INIT	Exiting the initialization sequence
IOS XR UP	Running Cisco IOS XR software

Troubleshooting Line Cards

When the line card is powered on, the display on the line card indicates the following (Figure 4-8):

- Upper row—Indicates which software component is running. At the end of a successful boot process, this display reads IOS XR.

- Lower row—Indicates the current phase of the boot process. At the end of a successful boot process, this display reads RUN.

Figure 4-8   Line Card Alphanumeric Display

Upper alphanumeric
LED display (four digits)

Lower alphanumeric
LED display (four digits)

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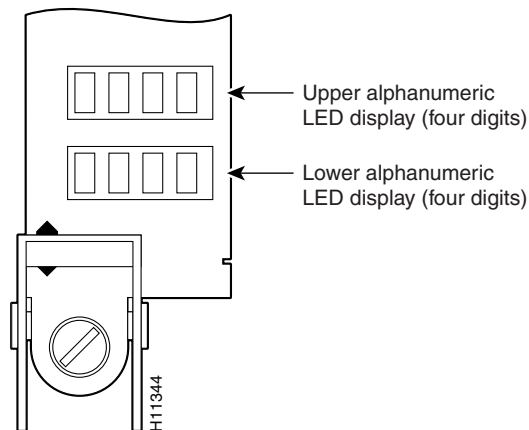
Troubleshooting Using the Line Card Alphanumeric Display

You can analyze the alphanumeric displays to isolate a problem with the line card. The two rows of the alphanumeric display are powered separately:

- The upper row receives power from the DC-to-DC converters on the line card.

- The lower row is powered directly from the MBus on the line card through the chassis backplane.

    - If the lower row is not operating the MBus module may be malfunctioning.

    - If the MBus module is operating, the lower row could be on even if the RP failed to powered on.

- If neither the upper or lower row is on, but the power modules and the blower modules are operational, the line card may not be installed properly, or the +5 VDC output from the chassis backplane is faulty.

    - Make sure that the system is powered on.

    - Initialize the line card by ejecting it from the chassis backplane and then reseating it.

- If both the upper and lower rows are operating, check the status messages (see Table 4-6).

When the DC-to-DC converters are powered-on by the MBus module, the line card processor begins the boot process and displays various status messages. Some messages appear briefly; while others appear for several seconds.

Table 4-6   Troubleshooting Using Alphanumeric Display Messages

Display[1]	Meaning	Source
MROM *nnnn*	MBus microcode executing; where *nnnn* is the microcode version number.	MBus controller
LMEM TEST	Low memory on the line card is being tested.	Line card ROM monitor
LROM RUN	Low memory test is complete.	Line card ROM monitor
BSS INIT	Main memory is being initialized.	Line card ROM monitor

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Table 4-6   Troubleshooting Using Alphanumeric Display Messages (continued)

Display[1]	Meaning	Source
RST SAVE	Contents of the reset reason register are being saved.	Line card ROM monitor
IO RST	Reset I/O register is being accessed.	Line card ROM monitor
EXPT INIT	Interrupt handlers are being initialized.	Line card ROM monitor
TLB INIT	TLB is being initialized.	Line card ROM monitor
CACH INIT	CPU data and instruction cache is being initialized.	Line card ROM monitor
MEM INIT	Size of the main memory on the line card is being discovered.	Line card ROM monitor
LROM RDY	ROM is ready for a software download attempt.	Line card ROM monitor
ROMI GET	ROM image is being loaded into line card memory.	RP IOS XR software
ROM VGET[3]	ROM image is receiving a response.	RP IOS XR software
FABI WAIT	Line card is waiting for the fabric downloader.[2]	RP IOS XR software
FABM WAIT[3]	Line card is waiting for the Fabric Manager to report that the fabric is usable.	RP IOS XR software
FABL DNLD	Fabric downloader is being loaded into line card memory.	RP IOS XR software
FABL STRT	Fabric downloader is being launched.	RP IOS XR software
FABL RUN	Fabric downloader is launched and running.	RP IOS XR software
IOS XR DNLD	Cisco IOS XR software is being downloaded into line card memory.	RP IOS XR software

Table 4-6   Troubleshooting Using Alphanumeric Display Messages (continued)

Display[1]	Meaning	Source
IOS XR FABW[3]	Cisco IOS XR software is waiting for the fabric to be ready.	RP IOS XR software
IOS XR VGET[3]	Line card is obtaining the Cisco IOS XR release.	RP IOS XR software
IOS XR RUN	Line card is enabled and ready for use.	RP IOS XR software
IOS XR STRT	Cisco IOS XR software is being launched.	RP IOS XR software
IOS XR TRAN	Cisco IOS XR software is transitioning to active.	RP IOS XR software
IOS XR UP	Cisco IOS XR software is running.	RP IOS XR software

1. The LED initialization sequence shown in Table 4-6 may occur too quickly for you to read; therefore, the sequence is provided in this tabular form as a baseline for how a line card should function at startup.

2. The fabric downloader loads the Cisco IOS XR software image onto the line card.

3. This LED sequence only appears in Cisco IOS XR OL-13832-01 or later.

Table 4-7   Troubleshooting Using Other Alphanumeric Display Messages

Display	Meaning	Source
MAL FUNC	Line card malfunction reported by field diagnostics.	RP
MISM ATCH[1]	Line card type mismatch in paired slots.	RP
PWR STRT[1]	Line card is newly powered on.	RP
PWR ON	Line card is powered on.	RP
IN RSET	System is resetting.	RP

Table 4-7   Troubleshooting Using Other Alphanumeric Display Messages (continued)

Display	Meaning	Source
RSET DONE	System reset complete.	RP
MBUS DNLD	MBus agent is downloading.	RP
MBUS DONE	MBus agent download complete.	RP
ROMI DONE	Acquisition of ROM image complete.	RP
MSTR WAIT	Waiting for mastership determination.	RP
CLOK WAIT	Waiting for slot clock configuration.	RP
CLOK DONE	Slot clock configuration complete.	RP
FABL LOAD	Load of fabric downloader[2] complete.	RP
IOS XR LOAD	Downloading of Cisco IOS XR software is complete.	RP
BMA ERR	Cisco IOS XR software BMA error.	RP
FIA ERR	Cisco IOS XR fabric interface ASIC configuration error.	RP
CARV ERR	Buffer carving failure.	RP
DUMP REQ	Line card requesting a core dump.	RP
DUMP RUN	Line card dumping core.	RP
DUMP DONE	Line card core dump complete.	RP

Table 4-7   *Troubleshooting Using Other Alphanumeric Display Messages (continued)*

Display	Meaning	Source
DIAG MODE	Diagnostic mode.	RP
DIAG LOAD	Downloading field diagnostics over the MBus.	RP
DIAG F_LD	Downloading field diagnostics over the fabric.	RP
DIAG STRT	Launching field diagnostics.	RP
DIAG HALT	Cancel field diagnostics.	RP
DIAG TEST	Running field diagnostics tests.	RP
DIAG PASS[1]	Field diagnostics completed successfully.	RP
POST STRT	Launching power-on self-test (POST).	RP
UNKN STAT	Unknown state.	RP
ADMN DOWN	Line card is administratively down.	RP
SCFG PRES[1]	Incorrect **hw-module slot srp** command entered.	RP
SCFG[1] REDQ	Required **hw-module slot srp** command not entered.	RP

1. This LED sequence only appears in Cisco IOS XR OL-13832-01 or later.

2. The fabric downloader loads the Cisco IOS XR software image onto the line card.

Troubleshooting Using the Alarm Display

If you experience critical, major, or minor alarms you can use the alarm display to troubleshoot those conditions. The following connectors and indicators are on the front panel of the alarm display (Figure 4-9):

- Cable connections for the two alarm cards (labeled Alarm A and Alarm B).

- Critical (red), Major (red), and Minor (yellow) indicators that identify system level alarm conditions detected by the system through the MBus. These indicators are normally off.

- Alarm card indicators (labeled MBus) that correspond to alarm cards connected to Alarm A and Alarm B:

    1. ENABLED (green)—Alarm card is operational and functioning properly.

    2. FAIL (yellow)—Alarm card in that slot is faulty.

- Two status LEDs that correspond to each of the CFC and SFC card slots in the switch fabric and alarm card cage:

    – ENABLED (green)
      On—The card installed in that slot is operational and functioning properly.
      Off—Either the slot is empty or the card installed in that slot is faulty.

    – FAIL (yellow)—The card in that slot is faulty.

Figure 4-9   Status LEDs on the Alarm Display
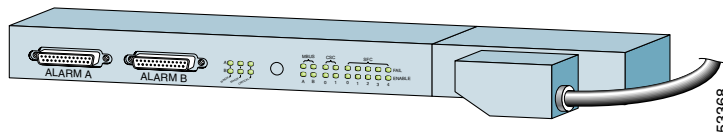
Monitoring Critical, Major, and Minor Alarm Status

The alarms can warn of an overtemperature condition:

- On a component in the card cage
- A fan failure in a blower module
- An overcurrent condition in a power supply
- An out-of-tolerance voltage on one of the cards

The alarm LEDs are controlled by MBus software, which sets the threshold levels for triggering the different stages of alarms.

The RP continuously polls the system for temperature, voltage, current, and fan speed values. If a threshold value is exceeded, the RP sets the appropriate alarm severity level on the alarm card which lights the corresponding LED, and energizes the appropriate alarm display relays to activate any external audible or visual alarms wired to the alarm display. The RP also logs a message about the threshold violation on the system console.

Note   If one or more of the alarm LEDs is on, check the system console for messages describing the alarm.

Troubleshooting the Cooling Subsystem

You may need to troubleshoot the cooling subsystem if an overtemperature condition occurs. The cooling subsystem of the router consists of a blower module in the chassis and a fan in each of the power supplies. The blower module and the power supply fans circulate air to maintain acceptable operating temperatures within the router (Figure 4-10).

This section contains information to troubleshooting the cooling subsystem and includes:

- Blower Module Operation, page 4-36
- Power Supply Operation, page 4-36
- Overtemperature Conditions, page 4-37
- Isolating Cooling Subsystem Problems, page 4-38

Figure 4-10   Cooling Air Flow
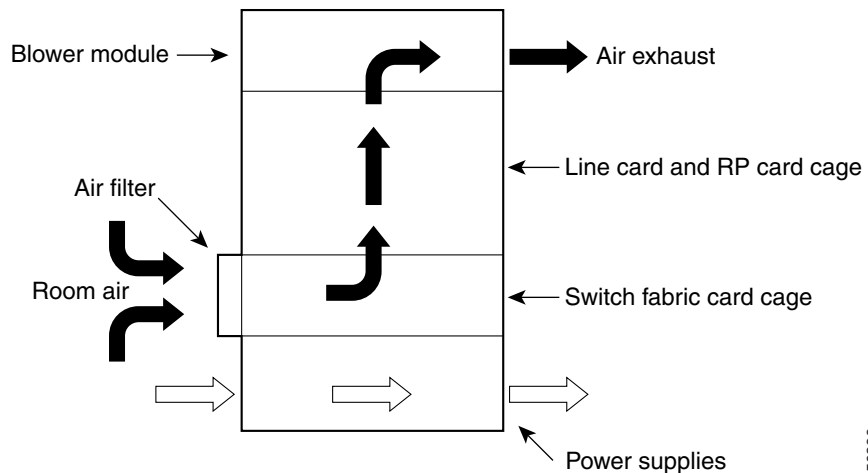
Blower Module Operation

The blower module maintains acceptable operating temperatures for the internal components by drawing cooling air through a replaceable air filter into the switch fabric and alarm card cage, and then through the line card and RP card cage (see Figure 4-10). The blower module occupies a bay at the top of the router and receives power from the chassis backplane through a wiring harness.

The blower module contains three fans, a controller card, and two front panel status LEDs. A snap-on plastic front cover fits over the front panel, but the LEDs are visible through the front covers.

- Green—The blower module is functioning properly.

- Red—There is a fault detected in the blower module.

• If the air temperature inside the chassis rises, blower speed increases to provide additional cooling air to the internal components.

• If the internal air temperature continues to rise beyond the specified threshold, the system environmental monitor shuts down all internal power to prevent equipment damage due to excessive heat.

• If the system detects that one or more of the fans in the blower module has failed, it displays a warning message on the system console and displays a blower failure message on the RP alphanumeric display. In addition, the remaining fans go to full speed to compensate for the loss of the failed fan.

Power Supply Operation

Each AC or DC power supply is equipped with a fan that draws cooler air in through the front of the power module and forces warmer out the back of the power shelf.

• If the power source is within the required range, the power supply fan remains on.

• If the fan fails:

- Power supply detects an internal overtemperature condition

- Fault and Temp indicators light

- Power supply sends an overtemperature warning to the system and then shuts down the system.

For additional power supply troubleshooting information, see the

Overtemperature Conditions

The following console error message indicates that the system has detected an
overtemperature condition or out-of-tolerance power value inside the system:

```
Queued messages:
%ENVM-1-SHUTDOWN: Environmental Monitor initiated shutdown
```

The preceding message could also indicate a faulty component or temperature
sensor. Enter the **show environment** command or the **show environment all**
command at the user EXEC prompt to display information about the internal
system environment. The information generated by these commands include:

- Voltage measurements on each card from the DC-to-DC converter

- The +5 VDC for the MBus module

- The operating voltage for the blower module.

- Temperature measurements received by two sensors on each card (one for
  inlet air temperature and one for the card's hot-spot temperature), as well as
  temperature measurements from sensors located in each power supply.

If an environmental shutdown results from an overtemperature or out-of-tolerance
condition, the Fault indicator on the power supply lights before the system shuts
down.

Although an overtemperature condition is unlikely at initial system startup, make
sure that:

- Heated exhaust air from other equipment in the immediate environment is not
  entering the chassis card cage vents.

- You allow sufficient air flow by maintaining a minimum of 6 inches
  (15.24 cm) of clearance at both the inlet and exhaust openings on the chassis
  and the power modules to allow cool air to enter freely and hot air to be
  expelled from the chassis.

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Isolating Cooling Subsystem Problems

Use the following procedure to isolate a problem with the chassis cooling system if you have an overtemperature condition.

Step 1 Make sure the blower module is operating properly when you power on the system.

- To determine if a blower module is operating, check the two LED indicators on the blower module front panel:
    - OK (green)—The blower module is functioning properly and receiving –48 VDC power, indicating that the cables from the chassis backplane to the blower module are good.
    - Fail (red)—A fault is detected in the blower module. Replace the blower module.
    - If neither indicator is on and the blower is not operating, there may be a problem with either the blower module or the –48 VDC power supplied to the blower module. Go to Step 2.

Step 2 Eject and reseat the blower module making sure the captive screws are securely tightened.

If the blower module still does not function, go to Step 3.

Step 3 Check for –48 VDC power by looking at the LED indicators on each power supply:

- If the Pwr OK indicator is on and the Fault indicator is off on each power supply, it indicates that the blower is receiving –48 VDC.
    - If the blower module is still not functioning, there could be a problem with the blower module controller card or an undetected problem in the blower module cable. Replace the blower module.
    - If the new blower module does not function, contact a Cisco customer service representative for assistance.
- If the Fault indicator is on, the power supply is faulty. Replace the power supply.

- If the Temp and Fault indicators are on, an overtemperature condition exists.

    - Verify that the power supply fan is operating properly.

    - If the fan is not operating, replace the power supply.

        Contact your Cisco representative if replacing the power supply does not fix the problem.

Maintaining the Router

The router is equipped as ordered and is ready for installation and startup when it is shipped. As network requirements change, you may need to upgrade the system by adding or changing components. This chapter describes how to maintain router components.

Procedures for maintaining the router are described in the following sections:

- Powering Off the Router, page 5-2
- Cleaning or Replacing the Chassis Air Filter, page 5-5
- Cleaning or Replacing the Chassis Air Filter, page 5-5
- Removing and Replacing the Blower Module, page 5-9
- Removing and Replacing AC and DC Power Subsystem Components, page 5-12
- Removing and Replacing Cards from the Chassis, page 5-36
- Removing and Installing a Chassis, page 5-41

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Prerequisites and Preparation

Before you perform any of the procedures in this chapter, be sure that you:

- Review the "Safety Guidelines" section on page 2-2.
- Read the safety and ESD-prevention guidelines described in the "Compliance and Safety Information" section on page 2-3.
- Ensure that you have all of the necessary tools and equipment before beginning the procedure.
- Have access to the following documents during the installation:
  - *Regulatory Compliance and Safety Information for Cisco 12000 Series Routers* publication that shipped with the router.

Powering Off the Router

Most Cisco XR 12410 router field-replaceable units (FRUs) can be removed and replaced with the power on and the system operating. This is known as online insertion and removal (OIR). Power supplies, line cards, the RP, CSCs, SFCs, and alarm cards all support OIR. Unless otherwise noted, the maintenance tasks described in this chapter can be performed while the router remains powered on.

In some cases it may be necessary to power off the router, for example, to upgrade both power supplies and PDUs. Use the following procedure to power off the router.

Step 1   Set the power switch on each power supply to the off (0) position.

Step 2   Power off all circuit breakers for the source power lines connected to the power supplies.

Step 3   Verify that the Pwr OK indicator on each power supply is off.

Step 4   Verify that the OK indicator on the blower module is off.

Removing and Replacing the Air Filter Door Front Cover

Use the following procedure to remove and replace the air filter door front cover.

Step 1 Loosen the captive screws on each side of the air filter door and swing the door away from the switch fabric and alarm card cage.

Figure 5-1   Opening the Air Filter Door

⚠
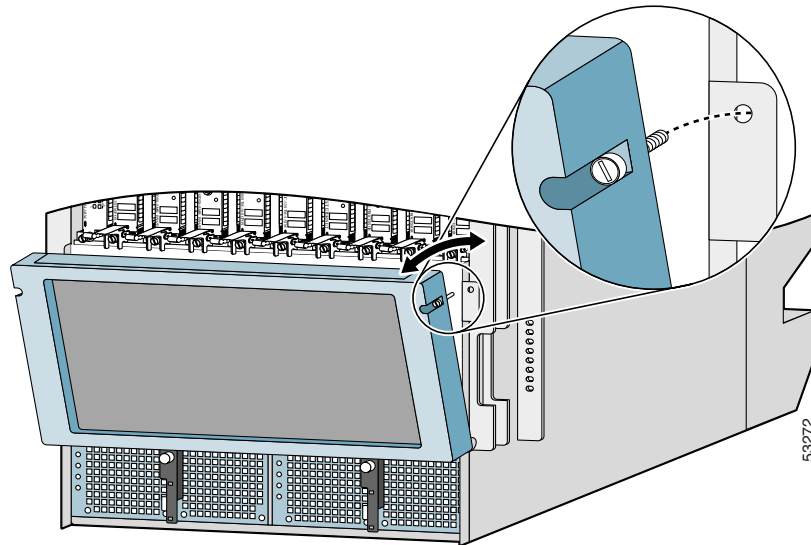
Caution Be especially careful not to damage the honeycomb screen on the back of the air filter door and on the inside of the switch fabric and alarm card cage. Damaging the honeycomb screen can restrict the air flow and cause overheating and diminish EMI protection.

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Step 2 Remove the (4) screws from each corner that fasten the partial front cover to the air filter door (Figure 5-2).

- Set aside the screws; you will need them to install the replacement front cover.

Figure 5-2   ***Removing the Air Filter Door Front Cover***
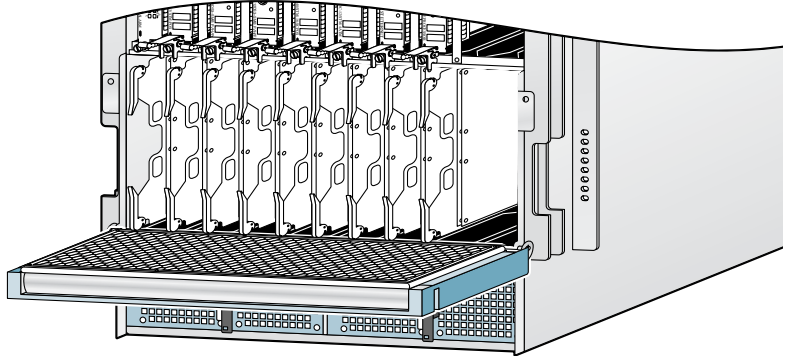
Step 3 Hold the replacement front cover by its outside edges and align the screw holes in the front cover with the holes on the air filter door.

Step 4 Secure the front cover to the air filter door using the (4) screws that you removed in Step 2.

⚠

Caution Do not overtighten the screws. Overtightening the screws can damage the threaded holes in the air filter door.

Step 5 Close the air filter door and tighten the captive screws.

⚠

Caution Align and seat the door carefully to avoid damaging the EMI-preventive gaskets on the door. The air filter door must be closed and secured at all times to maintain correct EMI performance.

Cleaning or Replacing the Chassis Air Filter

The Cisco XR 12410 router is equipped with a user-serviceable air filter that prevents dust from being drawn into the router. One time per month (or more often in dusty environments), examine the air filter for damage and cleanliness.

⚠

Caution   Damage to the air filter can restrict the airflow, cause overheating in the router, and degrade EMI performance. Be careful when cleaning and replacing the filter.

Cleaning or Replacing a Chassis Air Filter

Use the following procedure to clean or replace the air filter.

Step 1   Loosen the captive screw on each side of the air filter door and pivot the door open (Figure 5-3).

Figure 5-3   ***Opening the Chassis Air Filter Door***

138151
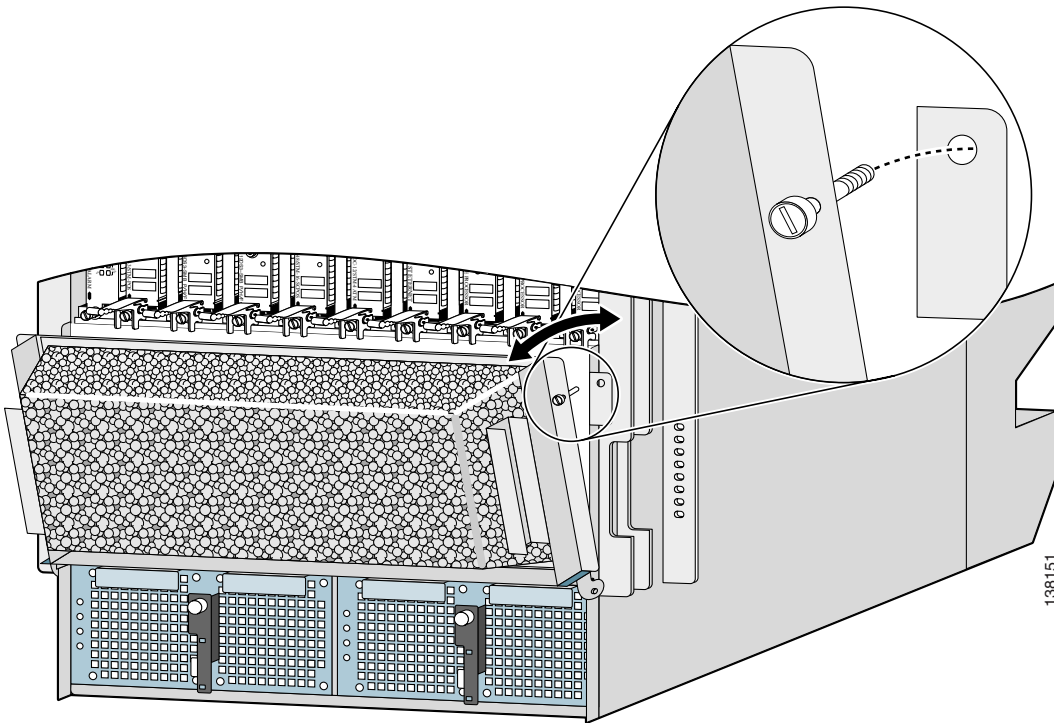
Step 2   Remove the air filter by sliding it out of the door (Figure 5-4).

Figure 5-4   *Removing the Chassis Air Filter*
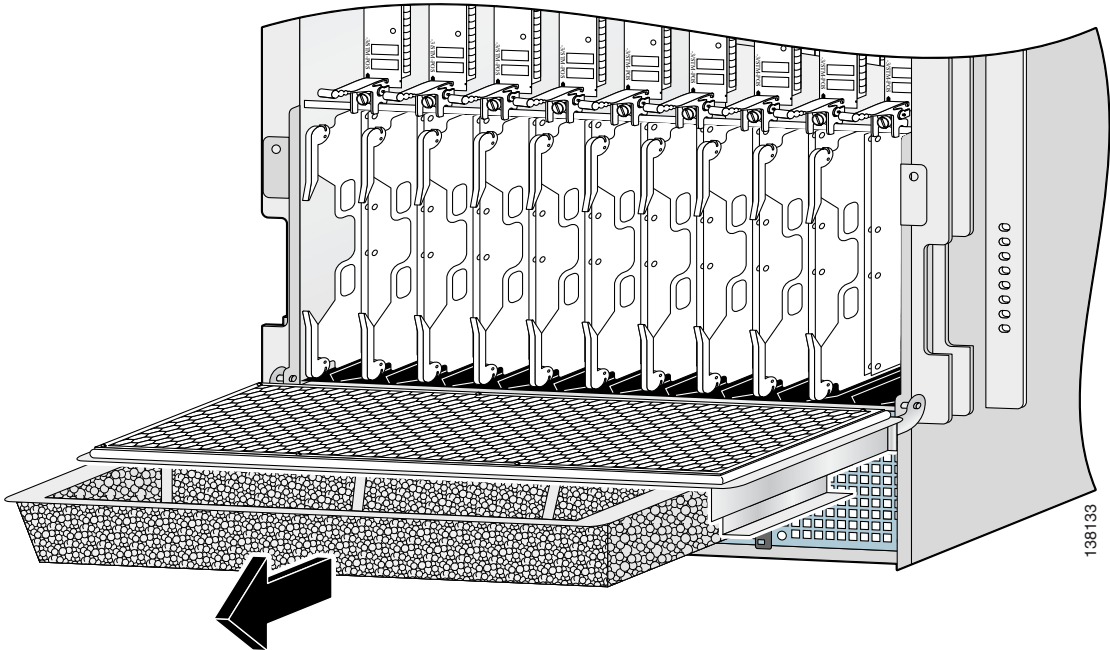
Step 3   Visually check the condition of the air filter to determine whether to clean it or install a new replacement filter:

- Dirty—You can either vacuum or replace the filter.

⚠

Caution   Do not vacuum the air filter while it is installed in the chassis. Before you clean it, you must remove the air filter completely to prevent contaminants from being drawn into the router.

- Worn or torn—If the filter appears worn or torn, dispose of it in a responsible manner and install a new replacement (12000/10-FILTER=).

Step 4   Slide the new or cleaned air filter into the air filter door (honey comb side down).

Step 5   Close the air filter door and tighten the captive screws (see Figure 5-3).

⚠

Caution   Align and seat the door carefully to avoid damaging the EMI-preventive gaskets on the door. The air filter door must be closed and secured at all times to maintain correct EMI performance.

Removing and Replacing the Blower Module

Use the following procedure to remove and replace the blower module.

Step 1 Remove the blower module from the chassis (Figure 5-5):

 a. Loosen the captive screw on each side of the blower module.

 b. Pull the blower module halfway out of the module bay.

 c. Slide out the blower module completely from the module bay while supporting it with your other hand.

Warning **The blower module weighs approximately 20 pounds (9 kg). Use two hands when handling the blower module.**

Figure 5-5 *Removing the Blower Module*
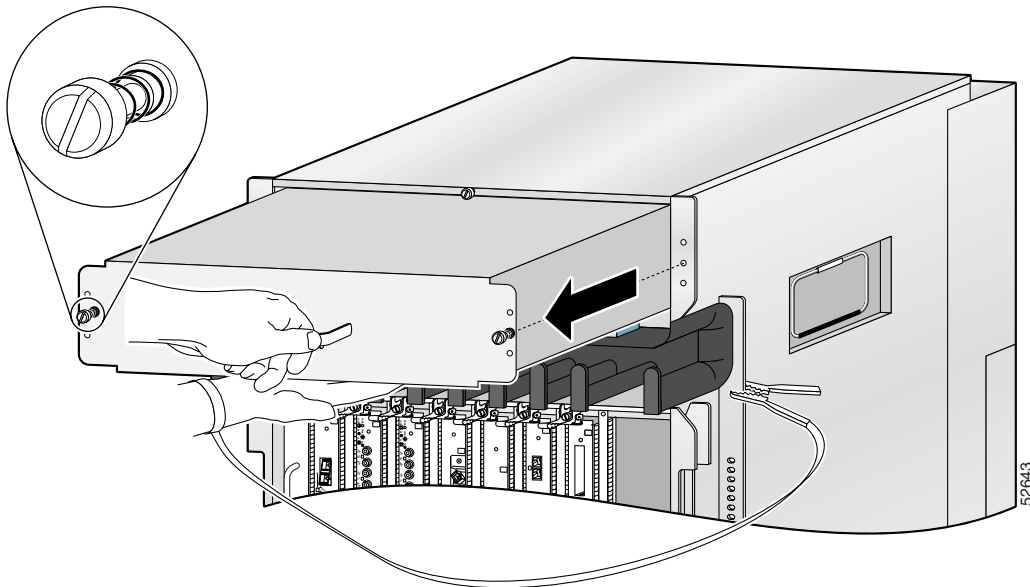
Step 2   Install the new blower module into the chassis (Figure 5-6):

    a.   Lift the blower module (with two hands) and slide it halfway into the module bay.

    b.   Slowly push the blower module into the chassis until it mates with the backplane connector at the back of the module bay.

⚠

Caution   To prevent damage to the connectors, do not use excessive force when inserting the blower module into the chassis.

    c.   Tighten the captive screws on the blower module to secure it to the chassis.

    •   The (green) OK status indicator on the front of the blower module goes on. If the OK indicator does not light, see the "Troubleshooting the Blower Module Installation" section on page 5-11.

Figure 5-6   *Installing the Blower Module*

122100
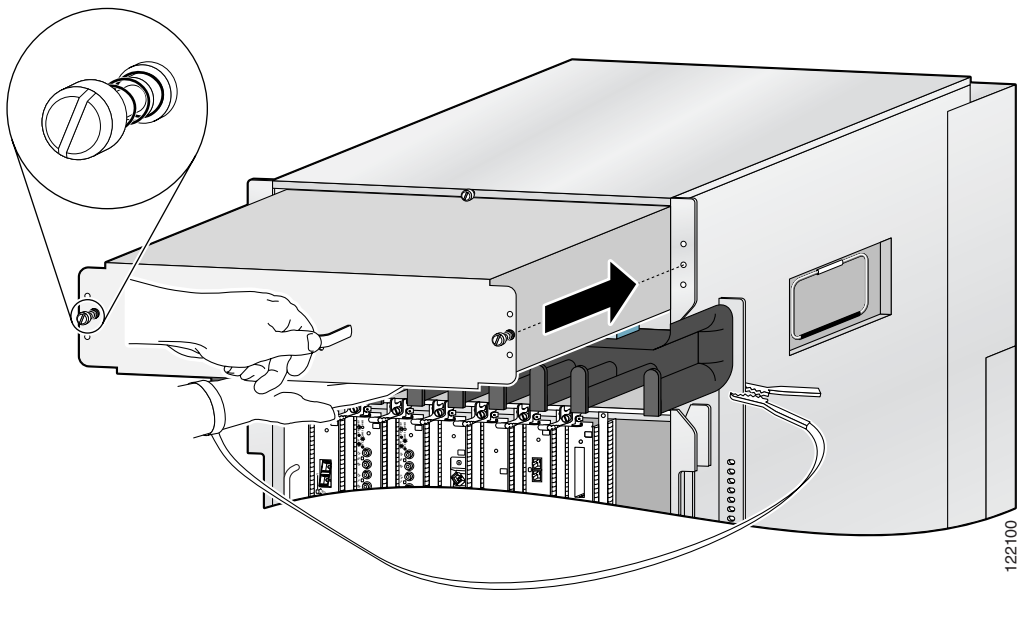
Troubleshooting the Blower Module Installation

Use the following procedure to troubleshoot the blower module if it is not operating properly after installation.

Step 1   Be sure the router is powered on and that all power cords are connected properly.

Step 2   Loosen the captive screws and reseat the blower module to the chassis.

- Retighten the captive screws to ensure the blower module is properly seated to the backplane connector.

Step 3   Check the blower module status indicators:

- OK (green)—Indicates that the blower module is operating normally. This indicator should light as soon as the blower module is installed and receives power from the backplane connector.

  - If this indicator remains on, and the blower module fans fail to operate after several attempts to reseat the blower module, replace it with a spare.

  - If the spare blower module also fails, power off the router and contact a Cisco service representative for assistance.

- Fail (red)—This indicator remains off during normal operation. If this indicator is on, the system has detected a fan failure or other fault in the blower module.

  - If this indicator remains on, and the blower module fans fail to operate after several attempts to reseat the blower module, replace it with a spare.

  - If the spare blower module also fails, power off the router and contact a Cisco service representative for assistance.

Removing and Replacing AC and DC Power Subsystem Components

This section contains removal and replacement procedures for the AC and DC power systems used with the Cisco XR 12410 router.The following tools and equipment are required to remove and install power equipment:

- Number 1 Phillips screwdriver
- 3/16-inch flat-blade screwdriver
- An ESD-preventive wrist strap

Installation Guidelines

The Cisco XR 12410 router supports online insertion and removal (OIR). If you are replacing a redundant power supply, you can remove and install the power supply while the system remains powered on without causing an electrical hazard or damage to the system. This feature enables you replace a power supply while the system maintains all routing information and ensures session preservation.

However, to maintain operational redundancy, proper cooling, and meet EMI compliance standards, you must have both working power supplies installed. When you remove a failed power supply with the router in operation, perform the replacement as quickly as possible. Before you begin the removal and installation procedure, make sure you have the tools and the replacement power supply ready.

⚠️

Caution   You cannot mix power supply types within the chassis. If you are replacing a 2400 W power supply from an older system with a newer 2800 W power supply, you must replace both power supplies and the PDUs. You must shut down the router to perform the upgrade. Be sure to notify the appropriate personnel that all routing traffic stops while the upgrade takes place.

⚠️

Caution   Cisco XR 12410 router configured with non-enhanced fabric and a single power supply and with more than five Engine5 line-cards may fail to boot during the start-up procedures. To safeguard against this possibility ensure that the chassis is configured with two power supplies or configured with the enhanced fabric.

Removing and Replacing an AC PEM

This section contains the procedure to remove and replace an AC PEM from the chassis.

Figure 5-7 identifies the components of an AC PEM.

Figure 5-7   AC PEM Components
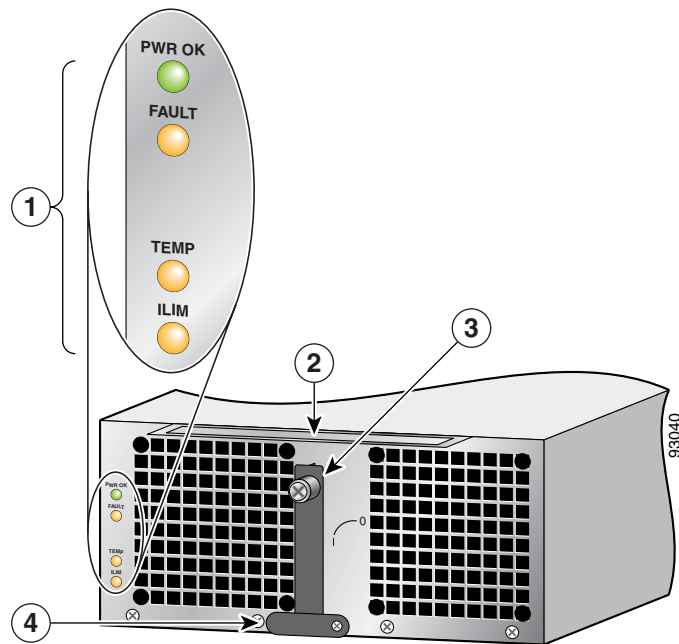
1	Status indicators	3	Ejector lever
2	Handle	4	Power ON/OFF switch (shown in the ON/1 position)

Use the following procedure to remove and replace an AC PEM.

Step 1   Set the power switch to the off (0) position.

Step 2   Unplug the power supply cord from its AC outlet.

Step 3   Power off the circuit breaker assigned to that AC outlet.

Step 4   Remove the PEM from the chassis (Figure 5-8):

    d.   Loosen the captive screw on the ejector lever.

    e.   Pivot the lever down to eject the PEM from its bay.

    f.   Slide the power supply out of its bay while supporting it with your other hand.

⚠️

Warning   **The power supply weighs approximately 20 pounds (9 kg). Use two hands to remove the power supply.**

Figure 5-8   Removing an AC Power Supply
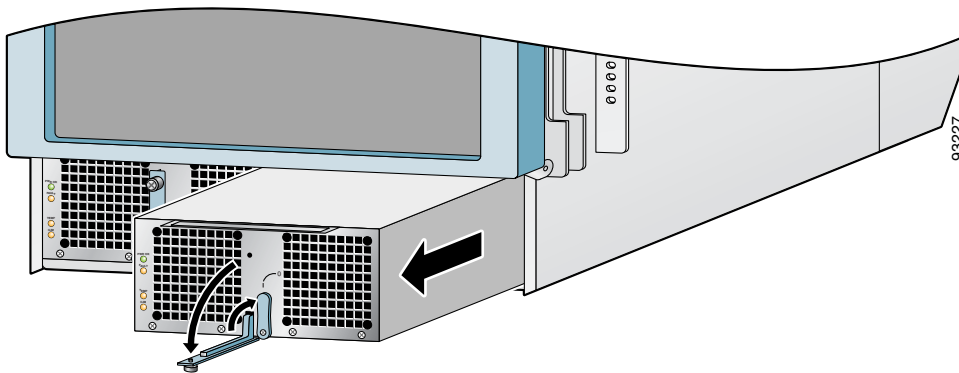
Step 5 Install the new power supply (Figure 5-9):

    a. Slide the power supply into the bay until it mates with its backplane connector.

    b. Lift the ejector lever into place and tighten the captive screw to securely seat the power supply to the backplane connector.

⚠

Caution To prevent damage to the power shelf backplane connector, do not use excessive force when inserting the power supply into the chassis.

Figure 5-9   *Installing an AC Power Supply*
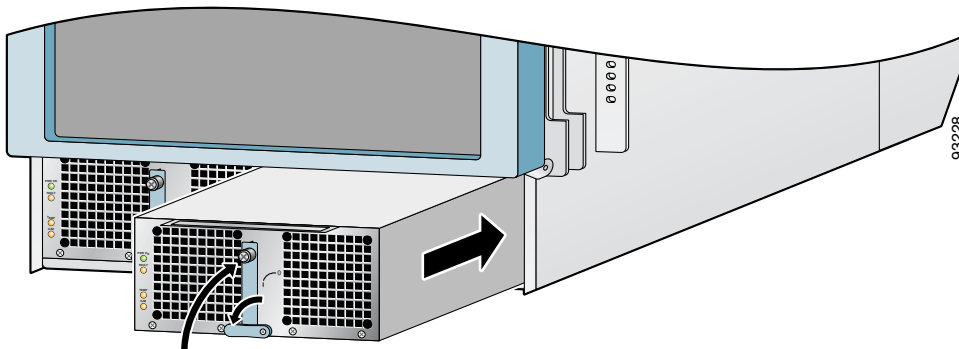
Step 6 Power on the circuit breaker to that AC outlet.

Step 7 Plug the power supply cable into its AC outlet.

Step 8 Set the power switch to the on (1) position.

    The (green) Pwr OK indicator on the front of the power supply should light. If the indicator does not light, see the "Troubleshooting the AC Power Supply Installation" section on page 5-16.

Troubleshooting the AC Power Supply Installation

Use the following procedure to troubleshoot the AC power supply if it is not operating properly after installation.

Step 1   Make sure the power supply is seated properly:

- Eject and reseat the PEM. Make sure:

    – The captive screw on the ejector lever is tightened securely.

    – The power switch is set to the on (1) position.

Step 2   Make sure the router is powered on and that all power cords are connected properly:

- Power cords on the horizontal trough are secured in place with their retention clips.

- Power cords at the power source end are securely plugged into their own AC power outlet.

    Each AC power supply operating in the nominal range of 200 to 240 VAC requires a minimum service of 20 A, North America (or 13 A, international).

- Source AC circuit breaker is switched on.

Step 3   Check the power supply status indicators:

- Pwr OK (green)—Indicates that the power supply is operating normally, and the source AC voltage is within the nominal operating range of 200 VAC to 240 VAC. This indicator lights when the power supply switch is set to the on (1) position.

    – If the Pwr OK indicator remains off after checking all of the power sources, replace the power supply with a spare.

    – If the spare power supply does not work, replace its PDU.

- Fault (yellow)—Indicates that the system has detected a fault within the power supply. This indicator remains off during normal operation.

  If the indicator is on:

  - Toggle the power switch off and then on. If the indicator remains on after several attempts to power it on, replace the power supply with a spare.

  - If the spare power supply also fails, the problem could be a faulty power shelf backplane connector. Power off the router and contact a Cisco service representative for assistance.

- Temp (yellow)—Indicates that the power supply is in an over-temperature condition, causing a shut-down to occur.

  - Verify that the power supply fans are operating properly.

  - Verify that the blower module is operating properly.

  - If the power supply fans and the blower module are operating properly, replace the existing power supply with a spare.

- Ilim—Indicates the power supply is operating in a current-limiting condition.

  - Each power cord should be connected to a dedicated AC power source. Each AC power supply operating in the nominal range of 200 to 240 VAC requires a minimum service of 20 A, North America (or 13 A, international).

Removing and Replacing an AC PDU

Use the following procedure to remove and replace an AC PDU.

Step 1 Set the power switch to the off (0) position.

Step 2 Unplug the power supply cord from its AC outlet.

Step 3 Power off the circuit breaker assigned to the PDU you are removing.

⚠️

Warning **To ensure that power remains off while you are performing this procedure, tape the circuit breaker switch in the off (0) position.**

Step 4 Eject the PEM from the chassis (Figure 5-10):

   a. Loosen the captive screw on the ejector lever and pivot the lever down to eject the PEM from its bay.

   b. Pull out the power supply halfway from its bay.

✎

Note It is not necessary to completely remove the power supply. You can leave the power supply in its bay while you replace the AC PDU.

Figure 5-10 Ejecting an AC Power Supply

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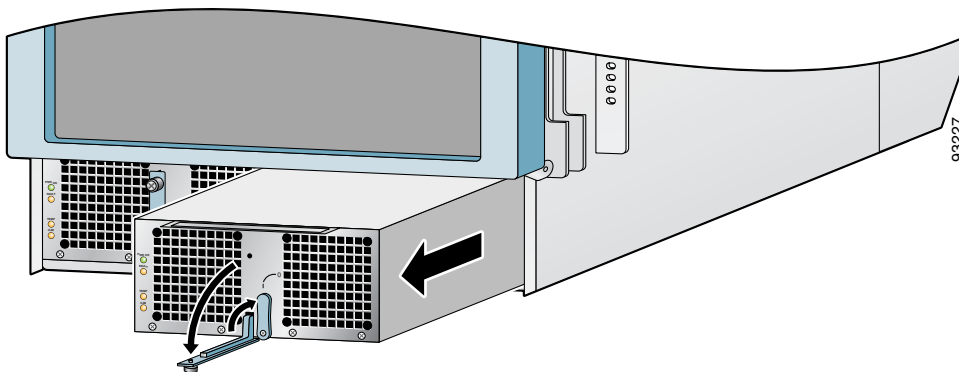
Step 5   Release the retention clip and disconnect the power cable from the AC power
connector on the horizontal trough (Figure 5-11).

Figure 5-11   Disconnecting an AC Power Cord
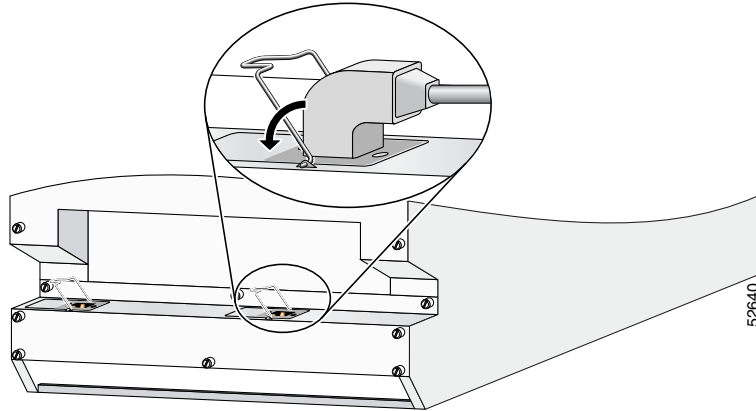
Step 6   Remove the rear chassis components (Figure 5-12):

    a. Loosen the (6) captive screws on the AC horizontal trough and remove it.

    b. Loosen the (16) captive screws that secure the rear panel to the chassis and remove it.

    c. Remove the (4) screws securing the AC PDU to the chassis and remove the PDU.

Figure 5-12   ***Removing Rear AC Chassis Components***

Rear panel

AC PDUs

AC horizontal trough

53363
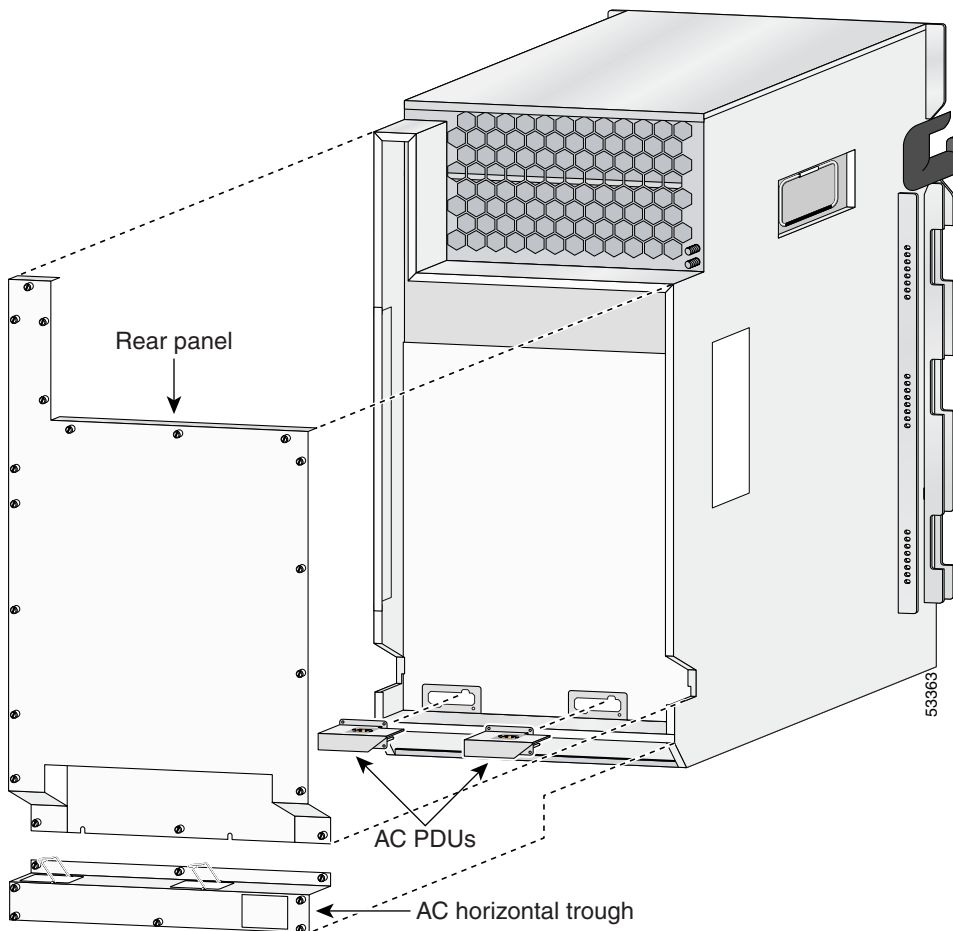
Step 7   Install the rear chassis components (see Figure 5-12):

    a.   Install the new AC PDU and tighten the (4) screws to secure it to the chassis.

    b.   Replace the rear panel and tighten the (16) captive screws.

> ✎
>
> **Note**   The rear panel has a lip that fits over the top of the chassis. Be sure to fit the bottom of the rear panel above the AC horizontal trough.

    c.   Replace the AC horizontal trough and tighten the (6) captive screws.

Step 8   Reconnect the power cable to the AC power connector on the horizontal trough and secure the cable with the retention clip (see Figure 5-11).

Step 9   Reinstall the power supply (Figure 5-13):

    a.   Slowly push the power supply into the chassis until it mates with the backplane connector at the back of the bay.

> ⚠
>
> **Caution**   To prevent damage to the power shelf backplane connector, do not use excessive force when inserting the power supply into the chassis.

    b.   Lift the ejector lever into place and tighten the captive screw to securely seat the power supply to the backplane connector.

Figure 5-13   Installing an AC Power Supply
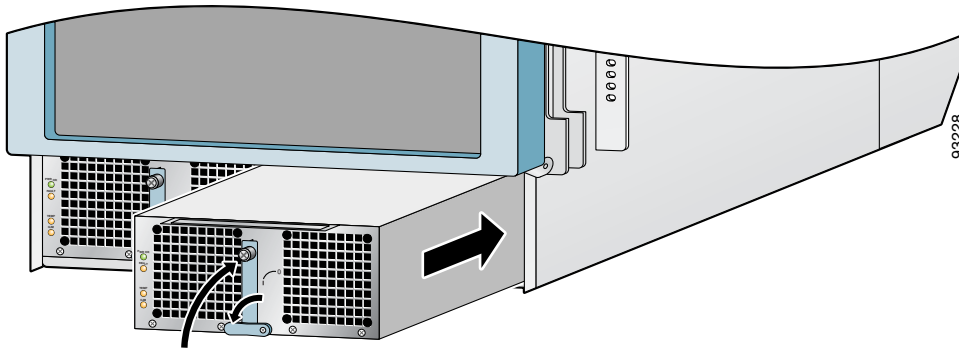
Step 10   Power on the circuit breaker.

Step 11   Plug the power supply cable into its AC outlet.

Step 12   Set the power switch to the on (1) position.

The (green) Pwr OK indicator on the front of the power supply should light. If the indicator does not light, see the "Troubleshooting the AC Power Supply Installation" section on page 5-16.

Removing and Replacing a DC PEM

This section contains the procedure to remove and replace a DC power entry module (PEM) from the chassis. Figure 5-14 shows the DC PEM components.

Figure 5-14   DC PEM Components—2800 Watt
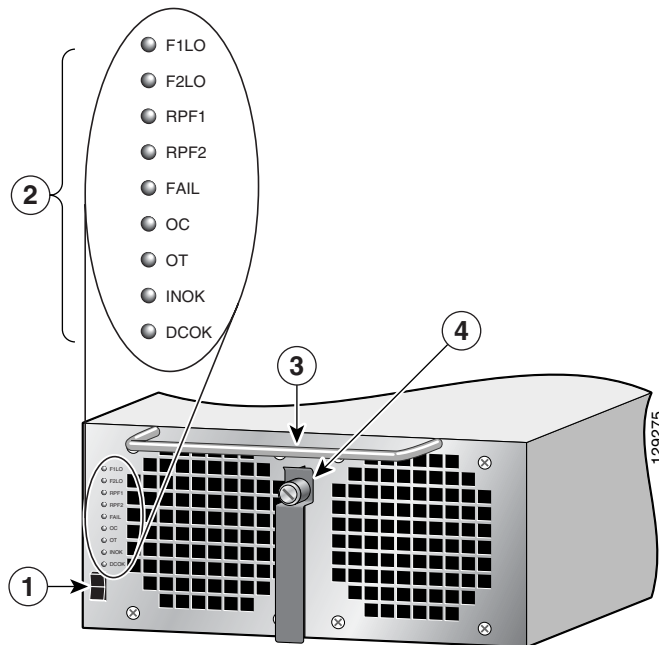
| **1** | Power on/off switch | **3** | Handle |
| **2** | Status indicators | **4** | Ejector lever |

Use the following procedure to remove and replace a DC PEM.

Step 1   Set the power switch to the off (0) position.

Step 2   Power off the circuit breaker assigned to the PEM you are removing.

⚠

Warning   **To ensure that power remains off while you are performing this procedure, tape the circuit breaker switch in the off (0) position.**

Step 3   Remove the PEM from the chassis (Figure 5-15):

   a.   Loosen the captive screw on the ejector lever.

   b.   Pivot the lever down to eject the PEM from its bay.

   c.   Slide the PEM out of its bay while supporting it with your other hand.

⚠

Warning   **The DC PEM weighs approximately 14 pounds (6.35 kg). Use two hands to remove the power supply.**

*Figure 5-15*   *Removing a DC PEM*
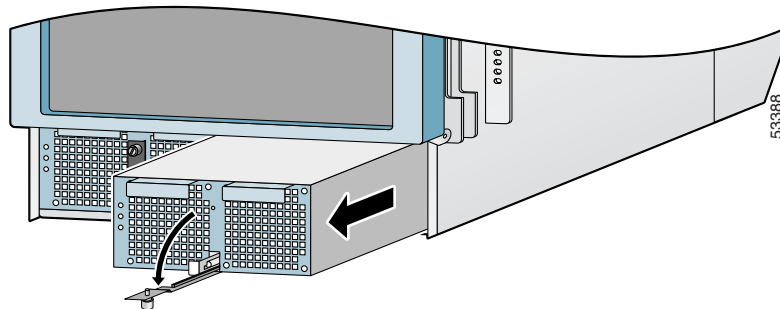
Step 4   Install the new DC PEM into the chassis (Figure 5-16):

    a.   Slowly push the power supply into the chassis until it mates with the backplane connector at the back of the bay.

⚠

Caution   To prevent damage to the power shelf backplane connector, do not use excessive force when inserting a power supply into the chassis.

    b.   Lift the ejector lever into place and tighten the captive screw to securely seat the power supply to the backplane connector.

Figure 5-16   *Installing a DC PEM*
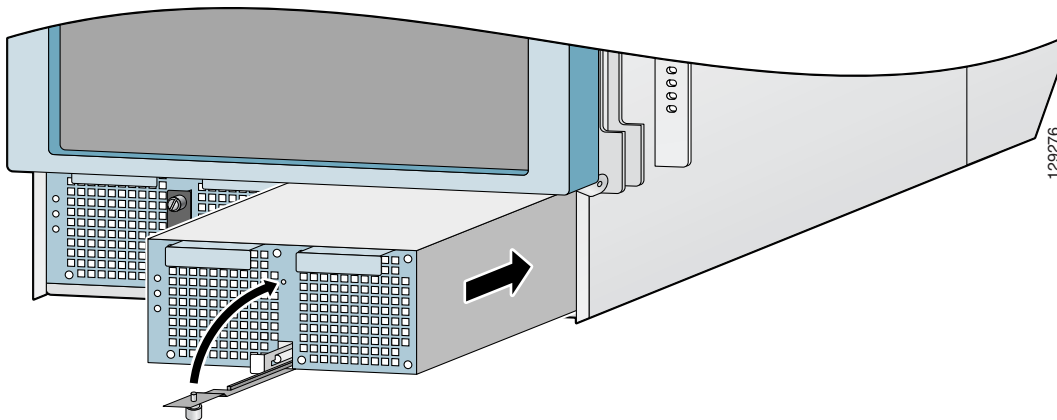
Step 5   Power on the circuit breaker.

**Step 6**   Set the power switch to the on (1) position.

The (green) Pwr OK indicator on the front of the power supply should light. If the indicator does not light, see the "Troubleshooting a 2800 W DC PEM Installation" section on page 5-25.

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Troubleshooting a 2800 W DC PEM Installation

Use the following procedure to troubleshoot the DC PEM if it is not operating properly after installation.

Step 1   Make sure the PEM is seated properly:

- Eject and reseat the PEM. Make sure:

  – The captive screw on the ejector lever is tightened securely.

  – The power switch is set to the on (1) position.

Step 2   Make sure the router is powered on and that all power cords are connected properly.

Step 3   Check the PEM status indicators:

- F1LO (Feeder 1 Low) (flashing yellow)—Indicates that input connections to the PDU (Feeder 1) were removed, or the input voltage is below the minimum. Make sure that:

  – Power cords are securely attached to their PDU terminal studs.

  – Power cords are securely attached at the DC source end.

  – The source DC circuit breaker is switched on.

  If the indicator is still flashing after you perform the above checks, replace the power supply.

  During normal operation, this indicator remains off.

- F2LO (Feeder2 Low) (flashing yellow)—Indicates that input connections to the PDU (Feeder 2) are removed or the input voltage is below the minimum. Make sure that:

  – Power cords are securely attached to their PDU terminal studs.

  – Power cords are securely attached at the DC source end.

  – The source DC circuit breaker is switched on.

  If the indicator is still flashing after you perform the above checks, replace the power supply.

  During normal operation, this indicator remains off.

- RPF1 (Reverse Polarity Feeder 1) (flashing yellow)—The PDU (Feeder 1) is miswired. See Step 8 of the "Removing and Replacing a DC PDU" procedure on page 5-27. During normal operation, this indicator remains off.

- RP21(Reverse Polarity Feeder 2) (flashing yellow)—The PDU (Feeder 2) is mis-wired. See Step 8 of the "Removing and Replacing a DC PDU" procedure on page 5-27. During normal operation, this indicator remains off.

- Fail (red)—Lights in conjunction with the following indicators (which flash) to show the type of power supply failure:

  - F1LO

  - F2LO

  - OC

  - OT

- OC (Over Current) (flashing red)—Indicates the input or output current has exceeded its limit and that an overload or short circuit has occurred:

  - Set the power supply switch to off (0) and then back to the on (1) position.

  - If the indicator is still flashing, eject and reseat the power supply.

  - If the indicator is still flashing, replace the power supply.

- OT (Over Temperature) (steady or flashing red)—Indicates that the power supply is in an overtemperature condition, causing a shut-down to occur.

  - Flashing red—Indicates a locked power supply fan. Replace the power supply.

  - Steady red—Indicates an overtemperature condition. Verify that all fans in the blower module are operating properly.

  - If all the blower module fans function, replace the power supply.

- INOK (green)—Indicates that the power supply is operating normally, and the source DC voltage is within the nominal operating range of –48 to –60 VDC. This indicator lights when the power switch is set to the on (1) position. If there is a power supply failure, the INOK indicator shuts off.

- DCOK (green)—Indicates that the power supply is operating normally, and is within the nominal operating range. This indicator lights a few seconds after the DCOK indicator lights. If there is a power supply failure, the INOK indicator shuts off.

Removing and Replacing a DC PDU

Use the following procedure to remove and replace a DC PDU.

Note This procedure describes how to replace a single PDU. The procedure is the same if you are replacing both PDUs.

Step 1 Set the power switch to the off (0) position.

Step 2 Power off the circuit breaker assigned to the PDU you are removing.

Warning **To ensure that power remains off while you are performing this procedure, tape the circuit breaker switch in the off (0) position.**

Step 3   Eject the PEM from the chassis (Figure 5-17):

a. Loosen the captive screw on the ejector lever and pivot the lever down to eject the PEM from its bay.

b. Pull out the PEM halfway from its bay.

Note   It is not necessary to completely remove the power supply. You can leave the power supply in its bay while you replace the DC PDU.

Figure 5-17   Ejecting a DC PEM
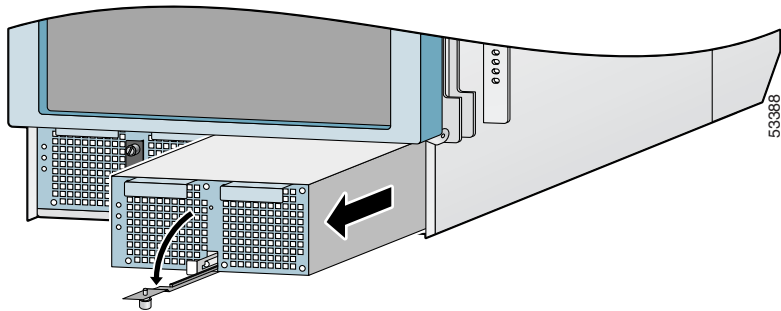
Step 4   Remove the clear plastic safety covers over the PDUs (see Figure 5-19).

Step 5   Disconnect the DC power cables from their terminals in the following order and note the color of each cable (Figure 5-18):

a. Negative cables first.

b. Positive cables next.

c. Ground cable last.

d. Repeat steps a, b, and c for the other PDU.

e. Go to Step 6.

Warning   **To prevent injury and damage to the equipment, always remove the source DC power cables and ground from the power shelf terminals *in the following order*: (1) negative (–), (2) positive (+), (3) ground.**

Figure 5-18   Disconnecting the DC Power Cables—2800 W DC PDU

— 48/60V RTN
(+)

— 48/60V (−)

Feed A2

— 48/60V (−)

— 48/60V RTN
(+)

Feed A1

Ground

129277
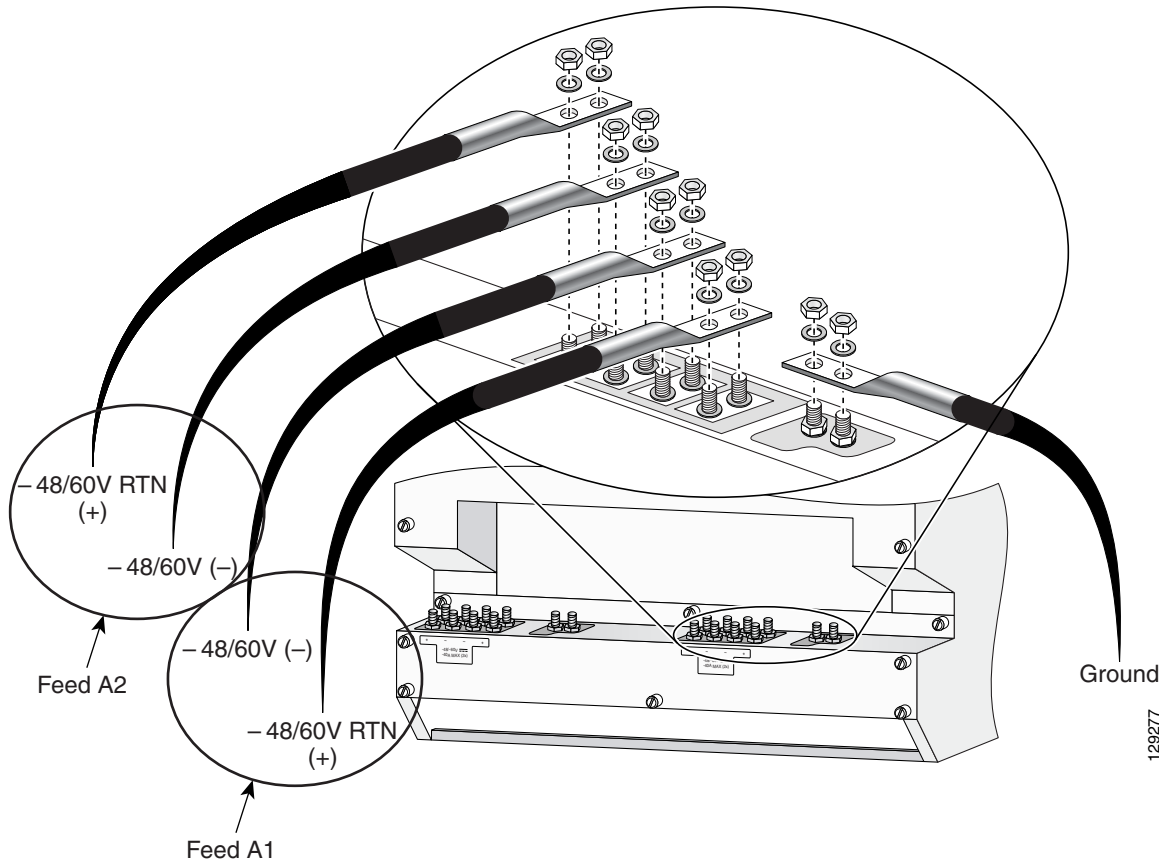
Step 6   Remove the rear chassis components (Figure 5-19):

    a. Loosen the (6) captive screws on the DC horizontal trough and remove it.

    b. Loosen the (16) captive screws that secure the rear panel to the chassis and remove it.

    c. Remove the (4) screws securing the DC PDU to the chassis and remove the PDU.

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Figure 5-19   Rear DC Chassis Components

Rear panel

DC PDUs

DC horizontal trough

Clear plastic covers

53365
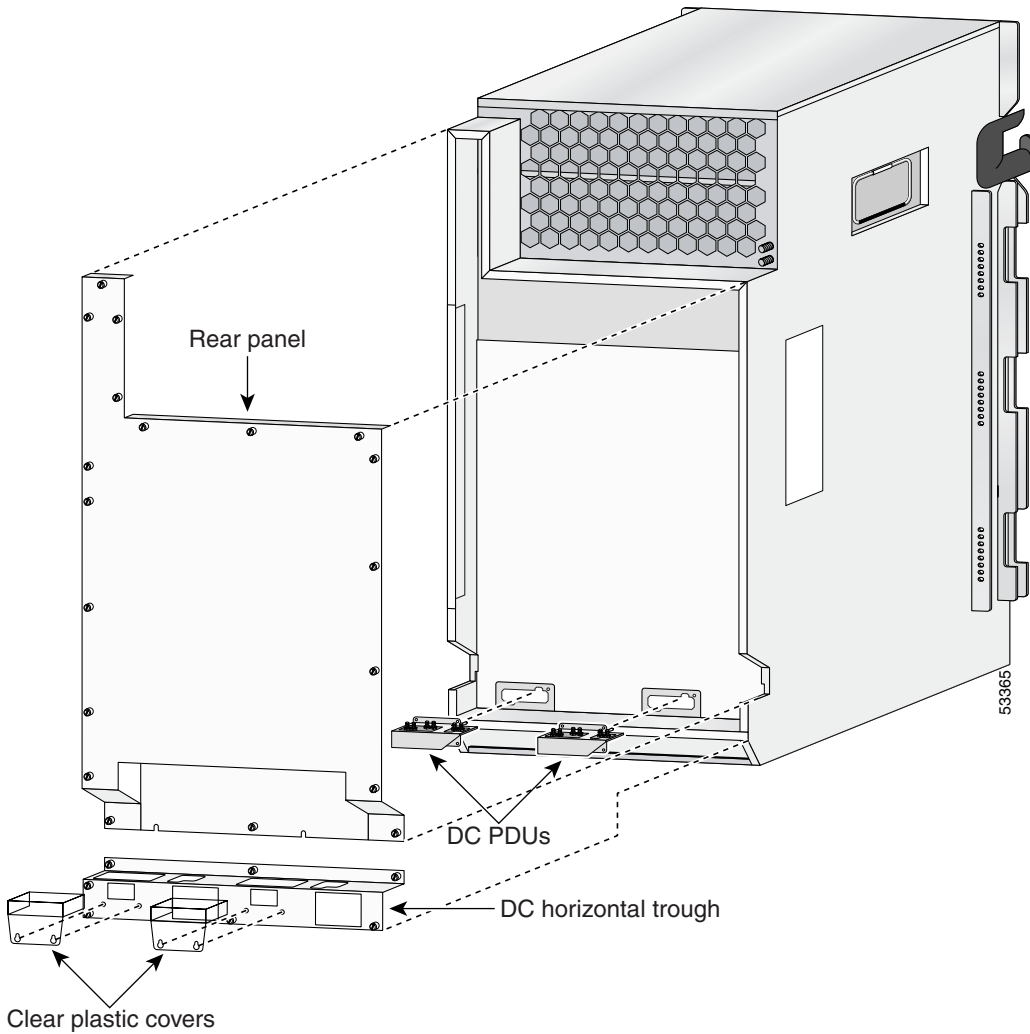
Step 7   Install the rear chassis components (Figure 5-19):

    a.   Install the new DC PDU and tighten the (4) screws to secure it to the chassis.

    b.   Replace the rear panel and tighten the (16) captive screws.

> **Note**   The rear panel has a lip that fits over the top of the chassis. Be sure to fit the bottom of the rear panel above the DC horizontal trough.

    c.   Replace the DC horizontal trough and tighten the (6) captive screws.

> **Caution**   If you have installed an upgraded PDU to accommodate 2800 W PEM, do not use the old DC horizontal trough. Be sure to install the replacement DC horizontal trough which has the correct voltage and warning labels attached to it.

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Step 8   Reconnect the W DC power cables in the following order (Figure 5-20):

    a.   Ground cables first.

    b.   Positive cables next.

    c.   Negative cable last.

    d.   Repeat steps a, b, and c for the other PDU.

    e.   Go to Step 9.

Warning   **To prevent injury and damage to the equipment, always attach the ground and source DC power cable lugs to the power shelf terminals in the following order: (1) ground to ground, (2) positive (+) to positive (+), (3) negative (−) to negative (−).**

Figure 5-20   *Connecting the DC Power Cables—2800 W PDU*
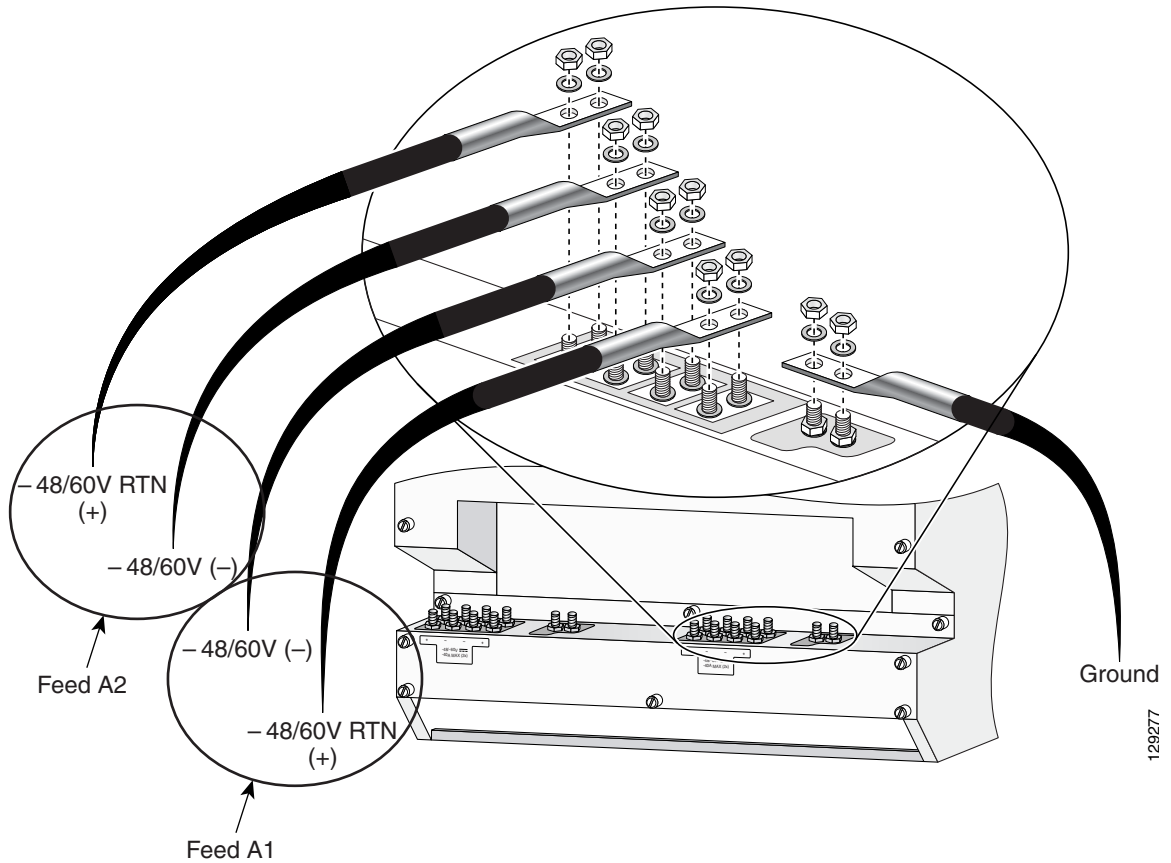
Step 9   Replace the clear plastic safety covers over the PDUs and tighten the screws (see Figure 5-19).

Step 10   Reinstall the DC PEM into the chassis (Figure 5-21):

   a.   Slowly push the power supply into the chassis until it mates with the backplane connector at the back of the bay.

⚠

Caution   To prevent damage to the power shelf backplane connector, do not use excessive force when inserting a power supply into the chassis.

   b.   Lift the ejector lever into place and tighten the captive screw to securely seat the power supply to the backplane connector.

Figure 5-21   *Installing a DC PEM*
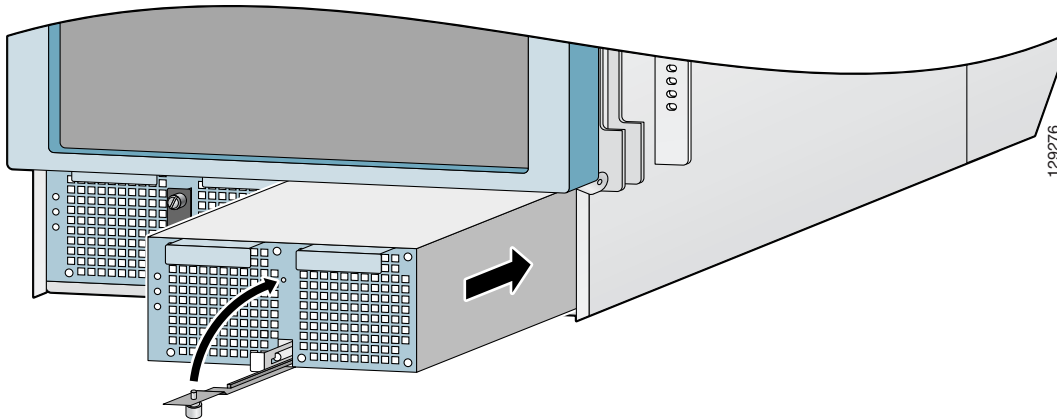
Step 11   Power on the circuit breaker.

Step 12   Set the power switch to the on (1) position.

The (green) Pwr OK indicator on the front of the power supply should light. If the indicator does not light, see the "Troubleshooting a 2800 W DC PEM Installation" section on page 5-25.

Removing and Replacing Cards from the Chassis

This section contains the procedures to remove cards from the chassis.
Figure 5-22 shows the slot locations of the various cards.

■ **Removing and Replacing Cards from the Chassis**

Figure 5-22   ***Router Components and Slot-Numbering***
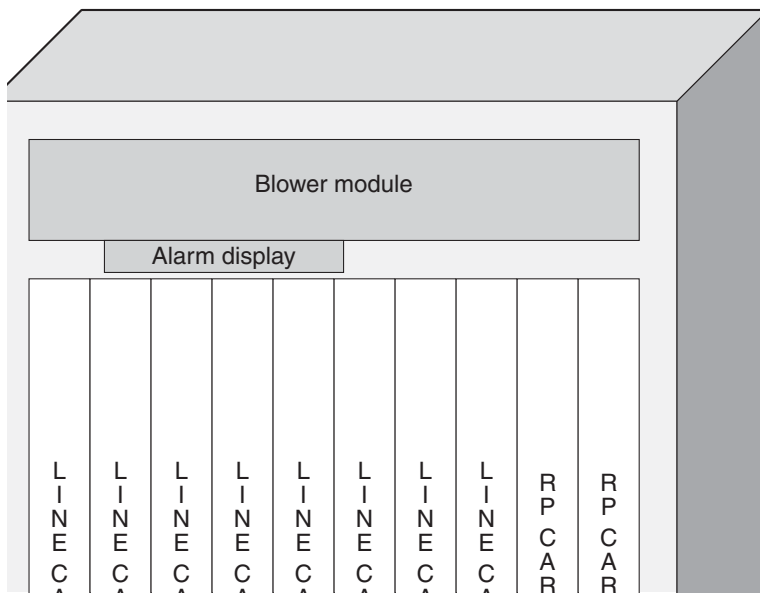
Removing and Replacing Cards from the Line Card and RP Card Cage

This section describes the procedures for removing and installing a router processor (RP) card or a line card. The line card and RP card cage has 10 slots (numbered 0 through 9, from left to right). Line cards are installed in slots 0 through 7; RPs are installed in slots 8 and 9 (see Figure 5-22).

⚠️

Caution   Handle all cards by the metal card carrier edges only; avoid touching the board or any connector pins. After removing a card, carefully place it in an antistatic bag or similar environment to protect it from ESD and dust in the optic ports (fiber-optic line cards).

Use the following procedure to remove and replace a line card or RP from the card cage:

Step 1   Disconnect any cables from the card.

Step 2   Remove the card:

    a.   Loosen the captive screws at the top and bottom of the front panel (Figure 5-23a).

    b.   Pivot the ejector levers to unseat the card from the backplane connector (Figure 5-23b.)

    c.   Slide the card out of the slot (Figure 5-23c) and place it directly into an antistatic bag or other ESD-preventive container.

Step 3   Replace the card by reversing the procedures in Steps 1 and 2.

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Figure 5-23   Removing a Line Card from the Line Card and RP Card Cage

(a) Loosen captive screws

(b) Pivot ejector levers away from card to unseat card

(c) Grasp card carrier to slide card out of slot

52644
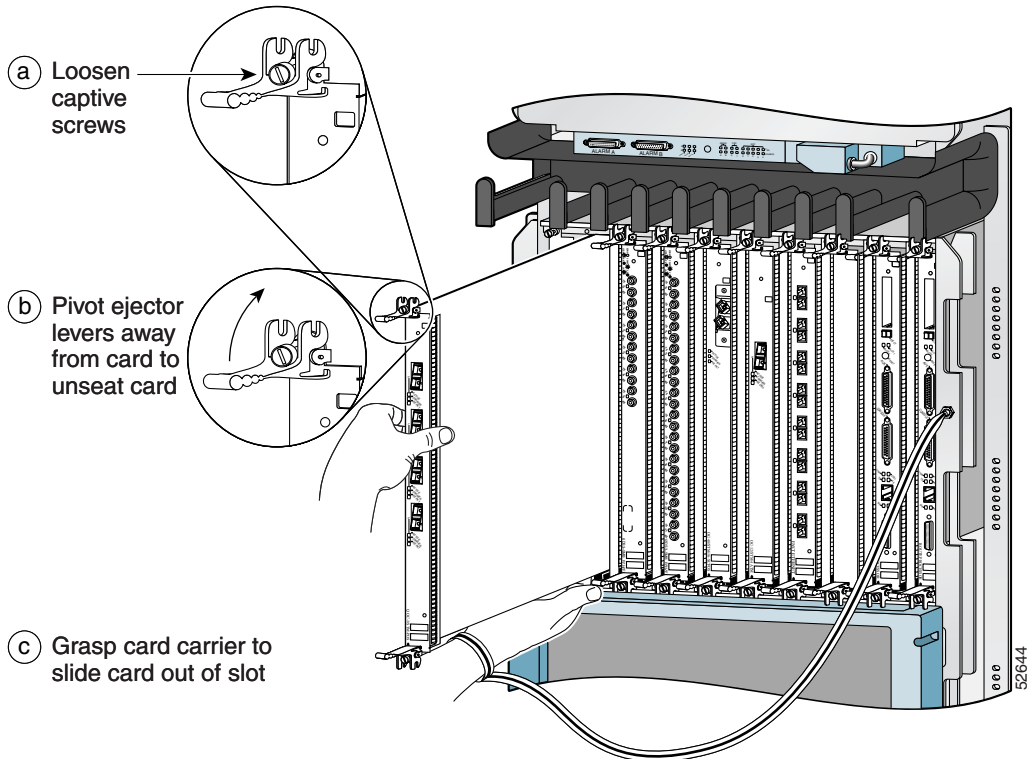
Removing and Replacing Cards from the Switch Fabric and Alarm Card Cage

The switch fabric and alarm card cage is located behind the air filter door on the front of the chassis. The card cage has 9 keyed, vertical card slots for the clock scheduler cards, switch fabric cards, and alarm cards (see Figure 5-22):

Use the following procedure to remove and replace cards from the switch fabric and alarm card cage.

Step 1   Loosen the captive screws on each side of the air filter door and swing the door away from the switch fabric and alarm card cage (Figure 5-24).

Figure 5-24   Opening the Air Filter Door

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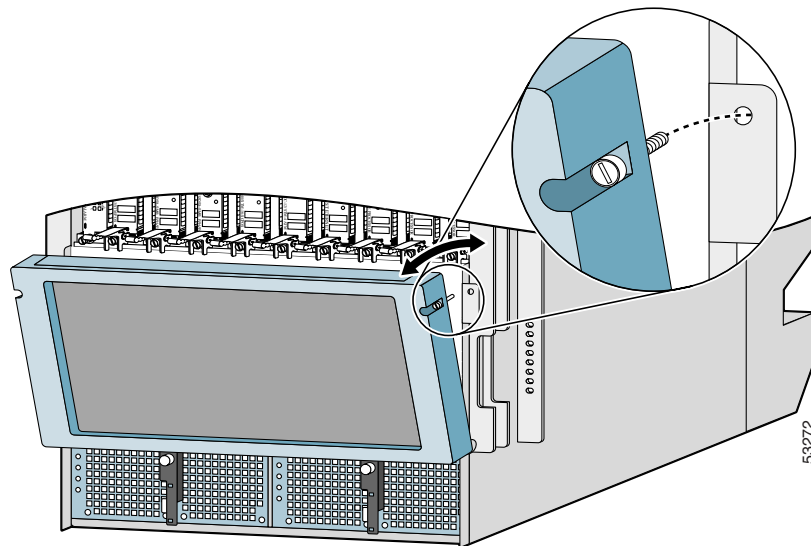
Step 2   Remove the card (a CSC in this example):

a. Pivot the ejector levers to unseat the card from the backplane connector.

b. Grasp the card by its metal card carrier and slide the card out of the slot (Figure 5-25).

– Place the card directly into an antistatic bag or other ESD-preventive container.

Figure 5-25   Removing a Card from the Switch Fabric and Alarm Card Cage

Clock scheduler card
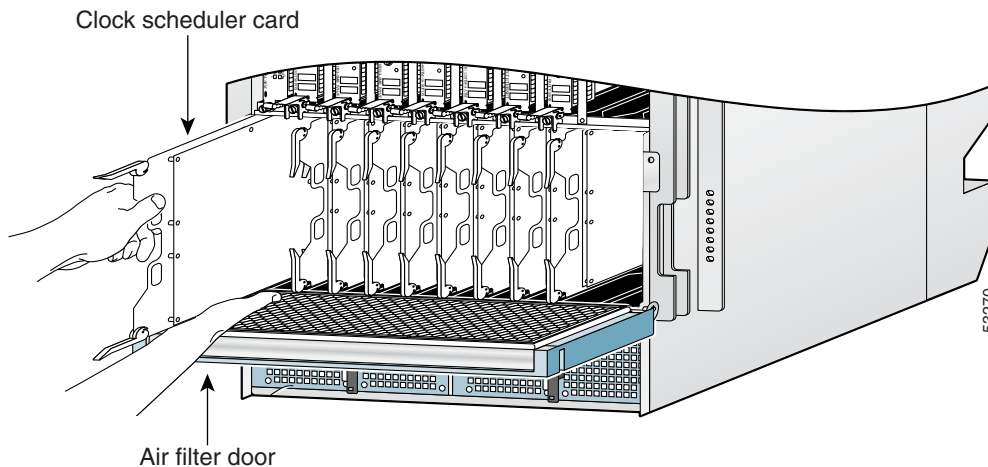
Air filter door

Step 3   To install the card, reverse the procedure in Step 2.

Step 4   Close the air filter door and tighten the captive screws.

Removing and Installing a Chassis

This section provides the procedures to remove and replace a chassis. You may need to perform this procedure to replace a defective chassis or move it to another location. These instructions include the steps directing you to removal and replacement instructions for individual components such as power supplies and line cards.

Removing a Chassis from the Equipment Rack

Use the following procedure to remove the chassis and its components from the equipment rack.

Step 1 Power off the router (see Powering Off the Router, page 5-2).

Step 2 Power off the circuit breakers to the power supplies.

Step 3 Disconnect the power cords from the PDUs on the rear of the chassis.

- For AC PDUs, see Step 5 of Removing and Replacing an AC PDU, page 5-18.

- For 2800 W DC PDUs, see Step 5 of Removing and Replacing a DC PDU, page 5-27.

Step 4 Disconnect the supplemental bonding and grounding connection (if there is one) from the chassis (see Supplemental Bonding and Grounding Connections, page 3-26).

Step 5 Remove the power supplies (see Removing and Replacing an AC PEM, page 5-13, or Removing and Replacing a DC PEM, page 5-22).

Step 6 Remove the blower module (see Removing and Replacing the Blower Module, page 5-9).

Step 7 Disconnect RP cables connected to the console port, auxiliary port, or either of the Ethernet ports, RJ-45 or MII.

Label each of the RP cables before you disconnect the cables.

Step 8   Disconnect any cables connected to the external alarm port on the alarm display.

Label each of the alarm display cables before you disconnect the cables.

Step 9   Disconnect the line card interface cables:

a. Identify the type of line card and its slot number. Write this information on a piece of paper before you disconnect the cables. You'll need this information when you reinstall the line cards.

b. Identify the line card cable and its port connection. Label the cable with this information.

c. Starting with the bottom port of the line card (on line cards with multiple ports), disconnect the interface cable connectors from each of the line card ports.

d. Loosen the captive screw at each end of the line card cable-management bracket and pull the cable-management bracket away from the line card.

e. Carefully remove the cables from the horizontal cable tray and carefully place the cable bundle out of the way.

f. Repeat steps **a** through **e** for each line card.

Step 10   Remove cards from the line card and RP card cage (see Removing and Replacing Cards from the Line Card and RP Card Cage, page 5-38).

Step 11   Remove cards from the switch fabric and alarm card cage (see Removing and Replacing Cards from the Switch Fabric and Alarm Card Cage, page 5-40).

Step 12   Remove the chassis air filter (see Cleaning or Replacing the Chassis Air Filter, page 5-5).

Step 13   Remove the chassis from the rack.

⚠
Warning   **An empty chassis weighs approximately 125 pounds (56.7 kg). You need two people to remove the chassis from the equipment rack safely.**

    a.   Using the side handles to support the weight of the chassis, remove the screws that attach the chassis rack mount flanges to the rack posts.

⚠
Warning   **There is nothing to support the chassis in the rack when you remove the screws if the optional rack-mount support brackets are not installed.**

    b.   Carefully lift the chassis out of the rack and set it aside.

Installing a Replacement Chassis in the Equipment Rack

Use the following procedure to install the replacement chassis and components in the equipment rack.

Step 1   Install the new chassis in the rack (see Rack-Mounting the Router Chassis, page 3-15).

Step 2   Install the power supplies (see Removing and Replacing an AC PEM, page 5-13, or Removing and Replacing a DC PEM, page 5-22).

Step 3   Install the blower module (see Removing and Replacing the Blower Module, page 5-9).

Step 4   Install cards in the line card and RP card cage (see Removing and Replacing Cards from the Line Card and RP Card Cage, page 5-38).

Step 5   Install cards in the switch fabric and alarm card cage (see Removing and Replacing Cards from the Switch Fabric and Alarm Card Cage, page 5-40).

Step 6   Install the chassis air filter (see Cleaning or Replacing the Chassis Air Filter, page 5-5).

Step 7   Connect all line card and interface cables (see Connecting Line Card Network Interface Cables, page 3-34).

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Step 8   Connect the supplemental bonding and grounding connection (if there is one) to the chassis (see Supplemental Bonding and Grounding Connections, page 3-26).

Step 9   Connect the power cords to the PDUs on the rear of the chassis.

- For AC PDUs, see Step 8 of Removing and Replacing an AC PDU, page 5-18.
- For 2800 W DC PDUs, see Step 8 of Removing and Replacing a DC PDU, page 5-27.

Step 10   Power on the circuit breakers to the power supplies.

Step 11   Power on the router.

Packing a Defective Chassis for Shipment

Use the packaging that came with the replacement chassis to repack and ship the defective chassis.

Technical Specifications

This appendix lists the Cisco XR 12410 router specifications.

Router Specifications

The Cisco XR 12410 router specifications are presented in four tables:

- Table A-1, "Physical Specifications"
- Table A-2, "AC Electrical Specifications"
- Table A-3, "DC Electrical Specifications"
- Table A-4, "Environmental Specifications"

Table A-1   Physical Specifications

Description	Value
Chassis height	37.5 in. (95.2 cm)
Chassis width	17.25 in. (43.8 cm) 19.0 in. (48.3 cm) including chassis rack-mount flanges and front door width
Chassis depth	22.0 in. (55.9 cm) 26.5 in (67.3 cm) including cable management system and front cover

Weight
 	
• chassis only
 	
• chassis: fully configured
  using all card slots and 2 AC
  input power supplies
	
	125 lb (56.7 kg)
	
	287 lb (130.2 kg)

Table A-2   AC Electrical Specifications

Description	Value
Total AC Input Power	3000 VA (volt-amps) per AC power supply (2 AC power supplies per system)
Rated input voltage[1]	200–240 VAC nominal (range: 180 to 264 VAC) 220–240 VAC (UK)
Rated input line frequency[1]	50/60 Hz nominal (range: 47 to 63 Hz) 50/60 Hz UK
Input current rating[1]	15 A maximum @ 200 VAC 13 A maximum @220 to 240 VRMS (UK)
Source AC service requirement[1]	20 A North America; 16 A international; 13 A UK
Heat dissipation (total maximum)	2800 W @9,544 BTU/hour
Redundancy	2 AC power supply modules required for 2N redundancy

1.   For each AC power supply module.

⚠️

Caution   To ensure that the chassis configuration complies with the required power budgets, use the on-line power calculator. Failure to properly verify the configuration may result in an unpredictable state if one of the power units fails. Contact your local sales representative for assistance.

Table A-3   DC Electrical Specifications

Description	Value
Total DC Input Power	2800 W per DC power entry module
Rated input voltage[1]	–48 VDC nominal in North America –60 VDC nominal in the European Community (range: –40.5 to –72 VDC (–75 VDC FOR 5mS))
Input current rating[1]	40 A maximum (2x)

Table A-3   DC Electrical Specifications

Description	Value
Source DC service requirement[1]	Sufficient to supply the rated input current. Local codes apply.
Redundancy	2 DC power entry modules required for 2N redundancy

1. For each DC power entry module.

⚠
Caution   To ensure that the chassis configuration complies with the required power budgets, use the on-line power calculator. Failure to properly verify the configuration may result in an unpredictable state if one of the power units fails. Contact your local sales representative for assistance.

Table A-4   ***Environmental Specifications***

Description	Value
Temperature	Operating: 32° to 104°F (0° to 40°C)
	Nonoperating: −4° to 149°F (−20° to 65°C)
Humidity	Operating: 10 to 85% noncondensing
	Nonoperating: 5 to 95% noncondensing
Altitude	Operating: 0 to 10,000 ft (0 to 3,000 m)
	Nonoperating: 0 to 15,000 ft (0 to 4,570 m)
Heat dissipation	9,554 BTU/hr maximum
Acoustic noise	70 dBa maximum
Shock	Operating (halfsine): 21 in/sec (0.53 m/sec)
	Nonoperating (trapezoidal pulse): 20 G[1], 52 in/sec (1.32 m/sec)
Vibration	Operating: 0.35 Grms[2] from 3 to 500 Hz
	Nonoperating: 1.0 Grms from3 to 500 Hz

1. G is a value of acceleration, where 1G equals 32.17 ft/sec^2 (9.81 m/sec^2).

2. Grms is the root mean square value of acceleration.

APPENDIX **B**

Site Log

The site log provides a historical record of all actions relevant to the operation and maintenance of the router. Keep your site log in a convenient place near the router where anyone who performs the maintenance has access to it.

Site log entries might include the following:

- Installation progress—Make entries in the site log to record installation progress. Note any difficulties and remedies during the installation process.

- Upgrades or removal and replacement procedures—Use the site log as a record of router maintenance and expansion history.

  Each time a procedure is performed on the router, update the site log to show the following:

  - Any FRU that is installed, removed, or replaced
  - Any router configuration changes
  - Software upgrades
  - Corrective or preventive maintenance procedures performed
  - Intermittent problems
  - Related comments

The following page shows a sample site log page. You can make copies of the sample or design your own site log page to meet the needs of your site and equipment.

■

Date	Description of Action Performed or Symptoms Observed	Initials

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I N D E X

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