CHAPTER 1

Product Overview

This chapter provides an overview of the Cisco XR 12410 and Cisco XR 12810 Routers. 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 1-33 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 1-31 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

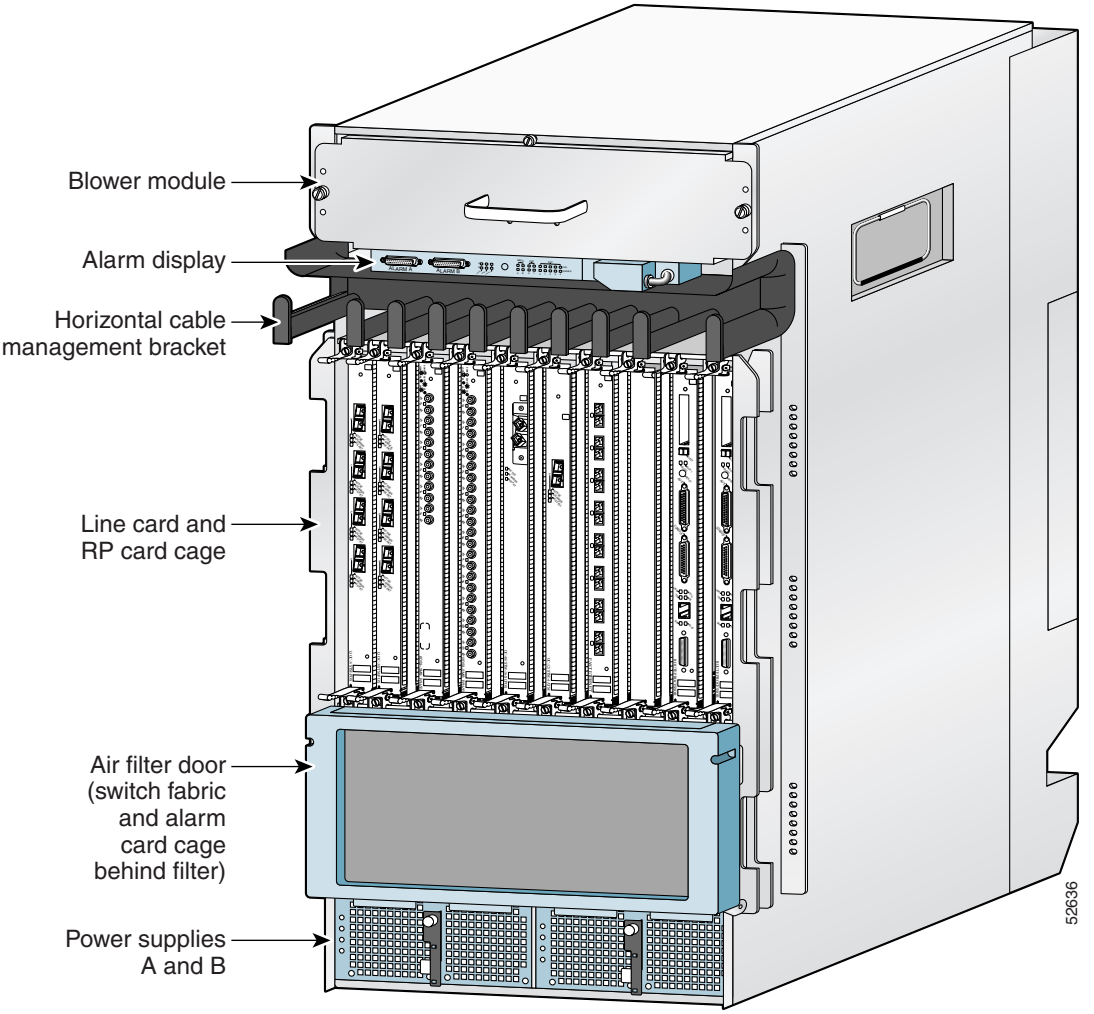
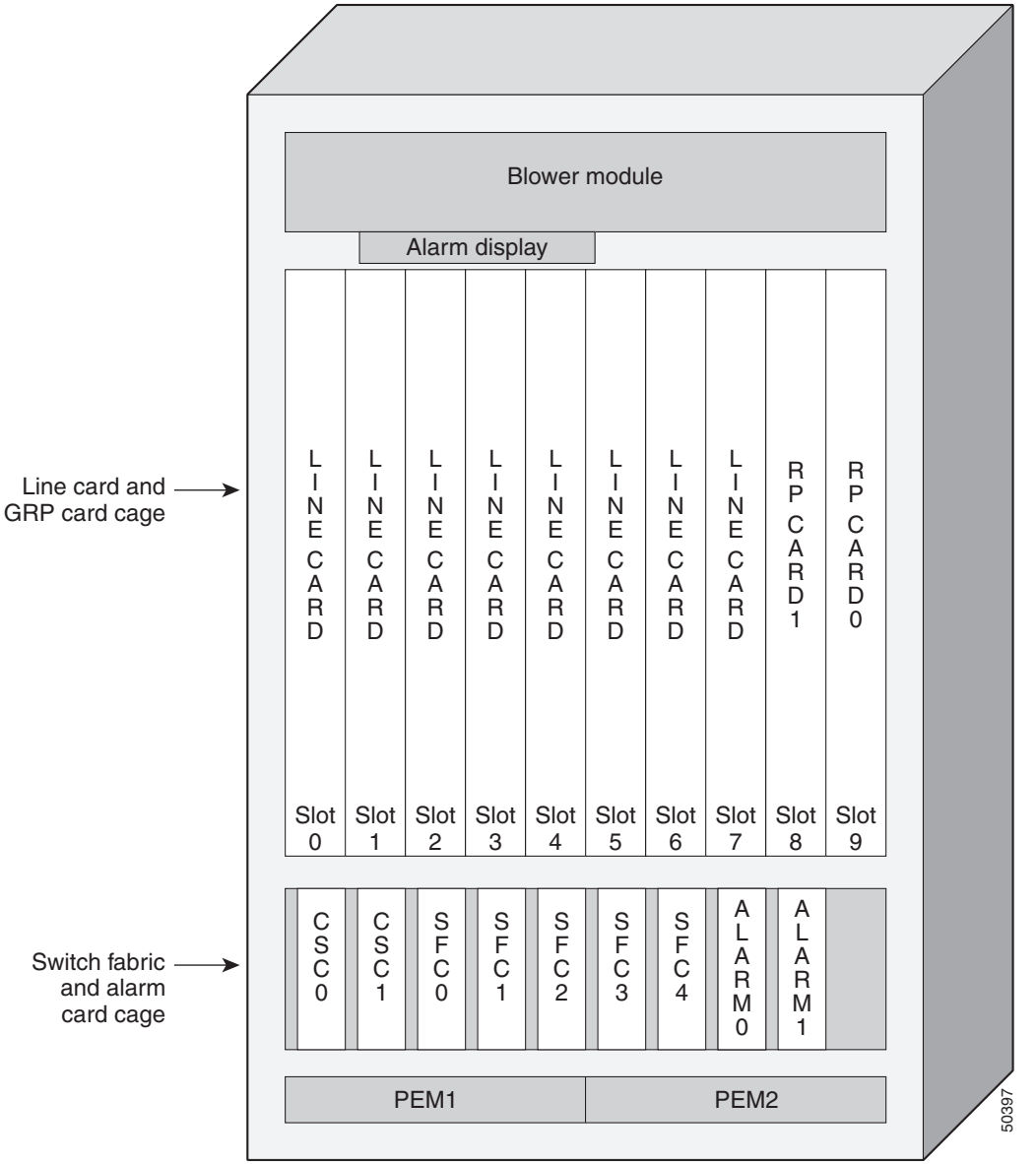


Figure 1-2 shows the slot numbering layout of the router with the location of the major components. Power is distributed to these components over the chassis backplane (not shown).

Figure 1-2 Router Components and Slot-Numbering



AC and DC Power Subsystems

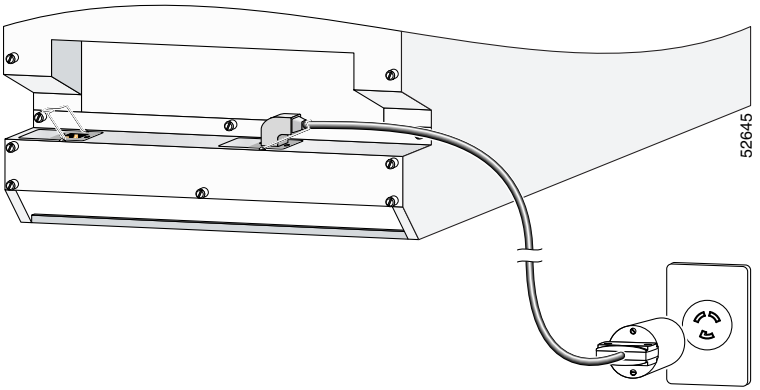
A router ships as either an AC or DC powered system. Source power connects to power distribution units (PDUs) on the back of the chassis which route power to the power supplies, also referred to as power entry modules (PEMs).

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.

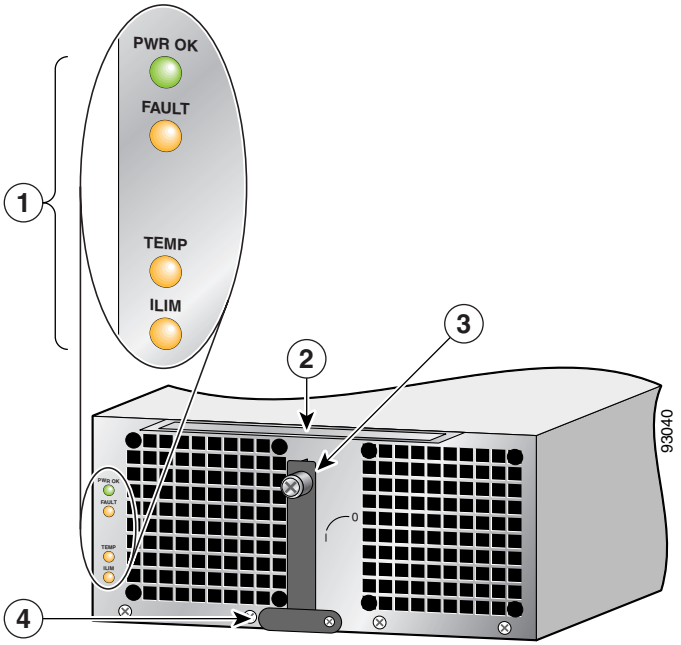
Figure 1-3 AC PDU Connection



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

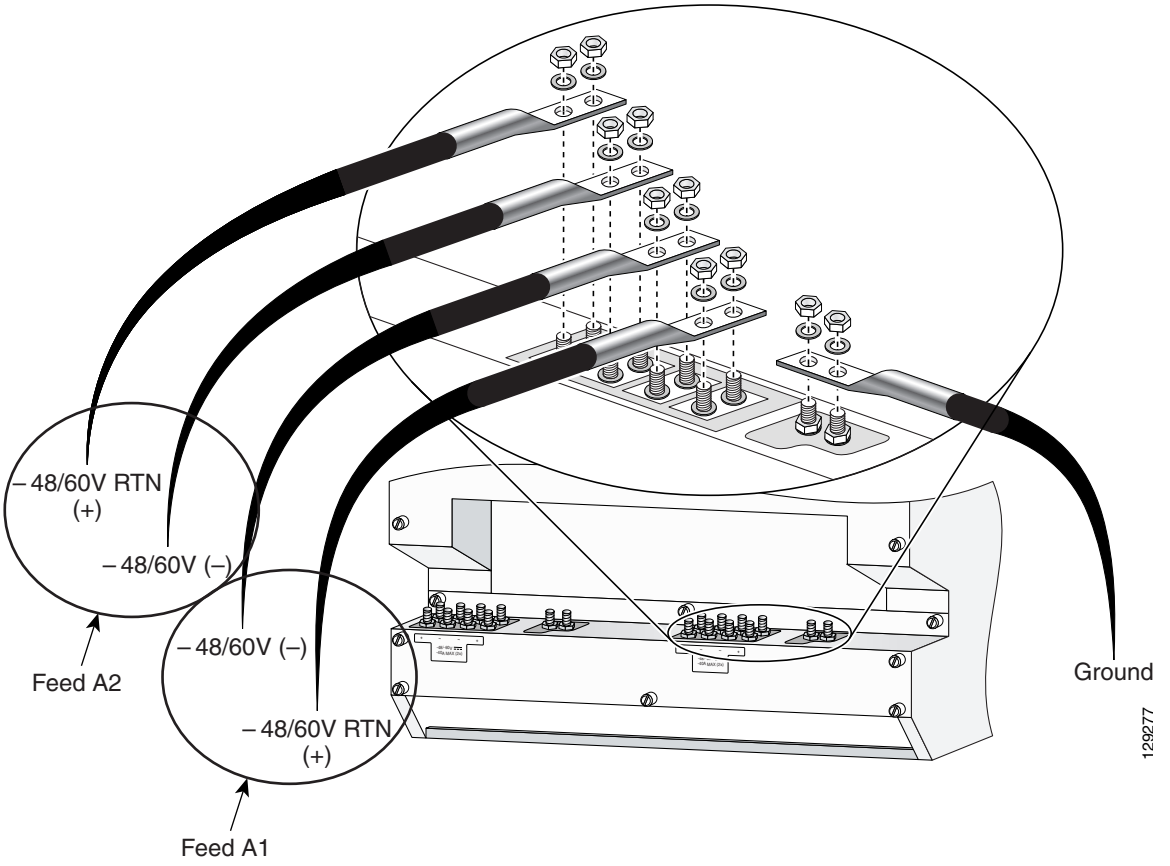


1	Status indicators	**3**	Ejector lever
2	Handle	**4**	Power On/Off switch (shown in the ON/1 position)

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.

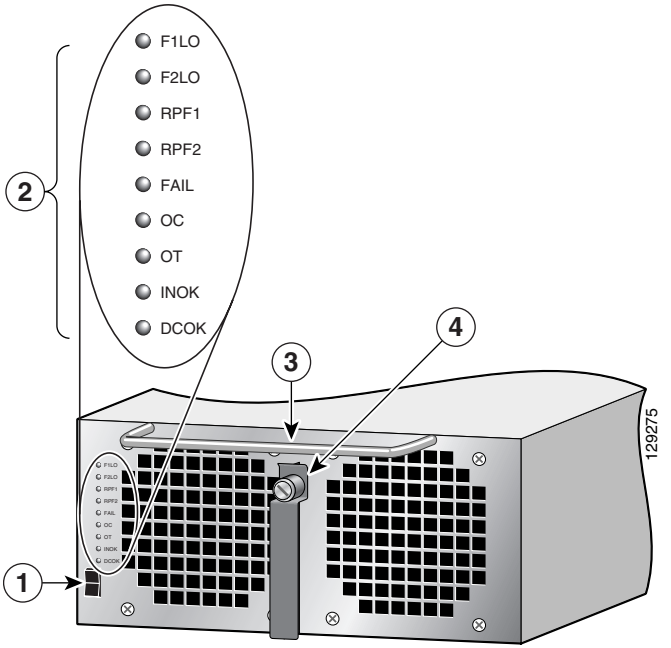
Figure 1-5 DC Power Cables—2800 W DC PDU



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

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 and Cisco XR 12810 Routers 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 and Cisco XR 12810 Routers 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

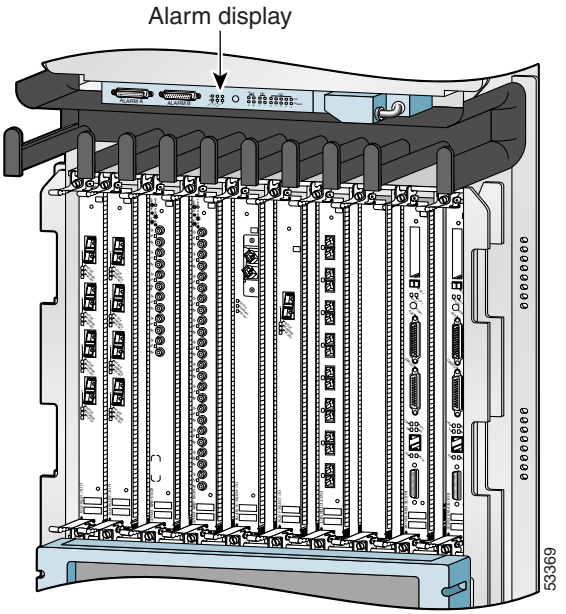
The switch fabric cards augment the traffic capacity of the router. SFCs contain switch fabric circuitry that can only carry user traffic between line cards or between the RP and the line cards. SFCs receive all scheduling information and the system clock signal from the CSCs.

Alarm Cards and Alarm Display

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

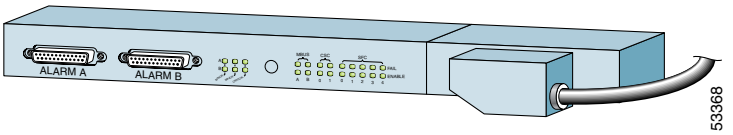
- Supply +5 VDC to the MBus modules on router components (see AC and DC Power Subsystems, page 1-5).
- Work in conjunction with the alarm display to monitor the system. The alarm display (sometimes referred to as the alarm display card) is above the horizontal cable management bracket (Figure 1-7).

Figure 1-7 Alarm Display Location



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.

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 and Cisco XR 12810 Routers 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 and Cisco XR 12810 Routers:

Note Refer to the current s software release notes for the most up-to-date list of supported line cards (see "Obtaining Documentation and Submitting a Service Request" section on page -xiv).

Route Processor

The route processor for the Cisco XR 12410 and Cisco XR 12810 Routers is the Performance Route Processor-2 (PRP-2) and the Performance Route Processor-3 (PRP-3). For detailed information about the Performance Route Processor, refer to the Cisco document, *Performance Route Processor Installation and Configuration Guide*.

The PRP-2 and PRP-3 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-on
- 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 and PRP-3 delivers all these functions with enhanced performance and capabilities. It also delivers the following feature enhancements (depending on the software version running):

- 2 Ethernet management ports
- Hard-drive support (optional part)
- BITS input ports
- 1 GB compact image Flash memory support (optional part)
- Memory scalability up to 4 GB with PRP-2 and up to 8 GB with PRP-3.

The PRP-2 and PRP-3 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. The MBus connection allows the PRP-2 and PRP-3 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.

In addition to the functionality listed for the PRP-2, PRP-3 provides the following specific functions:

- Reduced boot time.
- Increased overall scalability.
- Improved memory access rates and scale.
- Improved CPU performance through dual 1.3-GHz PPC processor cores.
- Improved packet processing using hardware-based acceleration.
- 10-G bandwidth backplane connectivity.
- Support for all 124*xx* and 128*xx* chassis, except low–speed fabric (2.5 G).
- New ROMMON that supports IPv4 network configuration directly.

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-2 (PRP-2) Front Panel

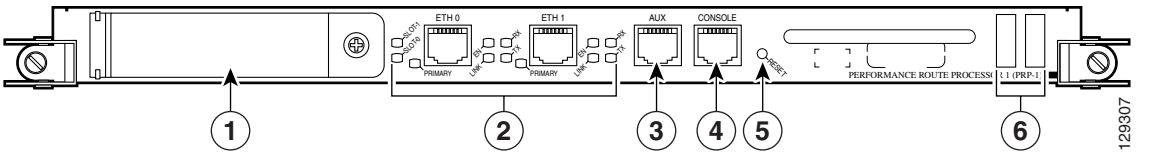


Table 1-1 Performance Route Processor-2 (PRP-2) Front Panel Hardware Components

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 messages

Figure 1-10 Performance Route Processor 3 (PRP-3) Front Panel

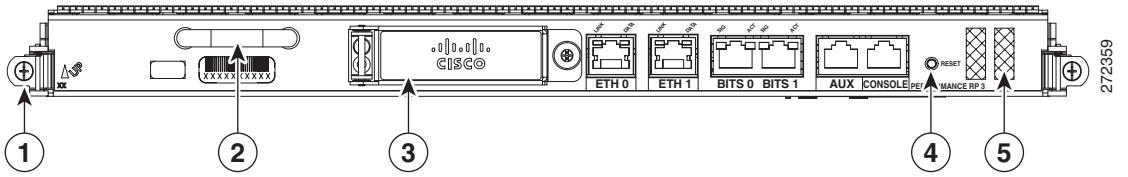


Table 1-2 PRP-3 Front Panel Hardware Components Detail

Numeric Callout	Hardware Components
1	Ejecter Lever
2	Handle
3	External Compact Flash
4	Reset button
5	Alphanumeric LEDs

PRP-3 is the route processor for the Cisco XR 12404 and 12804 Router chassis running Cisco IOS XR Software Release 3.8.0 or a later release. The PRP-3 is available as product number PRP-3 or PRP-3= for a primary route processor and is available as PRP-3/R for a redundant route processor. PRP-3 has significant improvements over PRP-2. These improvements include increased speed, improved scalability, higher system memory, faster packet processing. Because PRP-3 does not support Cisco IOS, the bootflash memory no longer exists in PRP-3. PRP-3 ROMMON has software intelligence to download a Cisco IOS XR image without the support of bootflash memory.

Note PRP-3 supports Cisco XR 12410 (10 G per slot fabric) and Cisco XR 12810 (40 G per slot fabric) Router chassis only. PRP-3 does not support Cisco XR 12004, 12006, 12010, and 12016 Router chassis (2.5 G low-speed fabric).

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.

Note PRP-3 does not have PCMCIA slots (slot 0 and slot 1). PRP-3 has an external CompactFlash (disk0:) that replaces the PCMCIA slots.

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 1-11):

- 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 1-11 PRP-2 Port Activity LEDs—Partial Front Panel

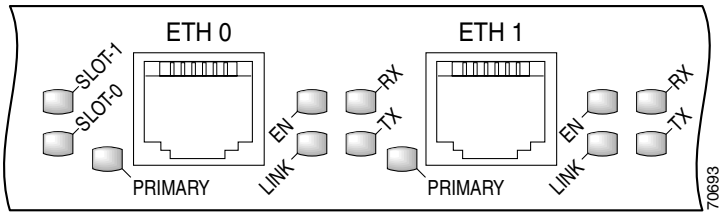
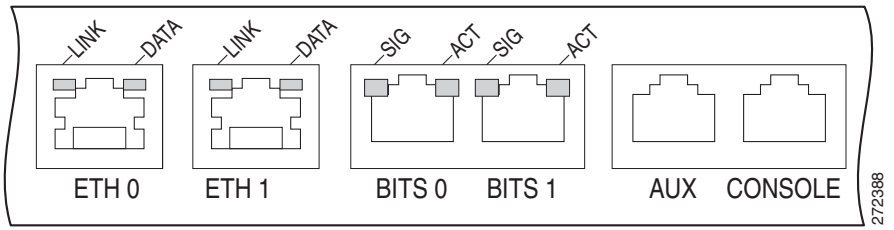


Figure 1-12 PRP-3 Port Activity LEDs—Partial Front Panel



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-3 LEDs

The PRP-3 has the following LED indicators:

- Two Ethernet port LEDs used in conjunction with each of the three RJ-45 Ethernet connectors:
  - LINK—Indicates link activity
  - DATA—Indicates data transmission or reception
- Two BITS port LEDs used in conjunction with each of the two BITS ports:
  - SIG—Indicates carrier signal available
  - ACT—Indicates that the interface is active

Note BITS feature is not supported in Release 3.8.0.

- One auxiliary port (AUX) and one console port (CONSOLE) LED:
  - AUX—Used as a backup for the command outputs on the Console.
  - CONSOLE—Used for configuring the router by connecting an RJ-45 cable to the console terminal. The router can be configured through the 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.

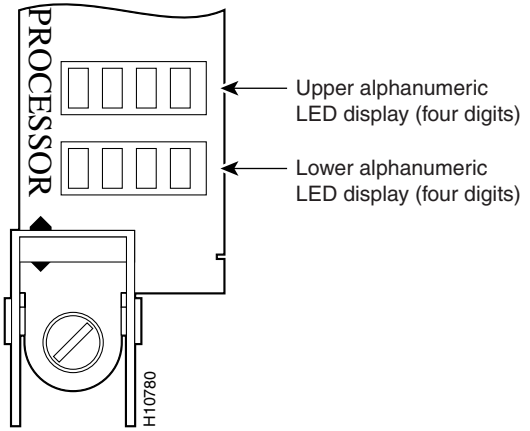
Pressing the reset switch causes a nonmaskable interrupt (NMI) and places the PRP in ROM monitor mode. When the PRP enters ROM monitor mode, its behavior depends on the setting of the PRP software configuration register. For example, if the boot field of the software configuration register is set to:

- 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 1-13).

Figure 1-13 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 1-3 provides a quick reference of the different types of memory, and Figure 1-14 shows the location on the PRP board.

Table 1-3 PRP Memory Components

Type	Size	Quantity	Description	Location
SDRAM[1]	2 GB (default) or 4 GB (optional)	1 or 2	2-GB or 4-GB DIMMs (based on desired SDRAM configuration) for main Cisco IOS XR software functions	U15 (bank 1)[2] U18 (bank 2)
SRAM[3]	2 MB (fixed)	—	Secondary CPU cache memory functions	—
NVRAM[4]	2 MB (fixed)	1	System configuration files, register settings, and logs	—
HDD	40 GB	1	Contains log and crash information for specific Cisco IOS XR versions.	—
Flash memory	2 GB or 4 GB (optional) Compact Flash	1	Contains Cisco IOS XR boot image (bootflash), crash information, and other user-defined files	P3
	4 MB Boot ROM	1	Stores the ROMMON minimum boot image (MBI).	—
	Flash disks[5] 2 GB (default) or 4 GB (optional)	1 or 2	Contains Cisco IOS XR software images, system configuration files, and other user-defined files on up to two flash disks	Flash disk slot 0 and slot 1
	1 GB CF[6]	1	Contains large Cisco IOS XR software images	—

1. Default SDRAM configuration is 2-GB for PRP-2. Bank 1 (U15) must be populated first. You can use one or both banks to configure SDRAM combinations of 2 GB and 4 GB for the PRP-2. 1.5-GB configurations.and DIMM devices that are not from Cisco are not supported.
2. If both banks of the PRP-2 are populated, bank 1 and bank 2 must contain the same size DIMM.
3. SRAM is not user configurable or field replaceable.
4. NVRAM is not user configurable or field replaceable.
5. ATA Flash disks are supported in the PRP-2.
6. Optional PRP-2 hardware. Compact disks that are not from Cisco are not supported.

Figure 1-14 PRP-2 Memory Locations

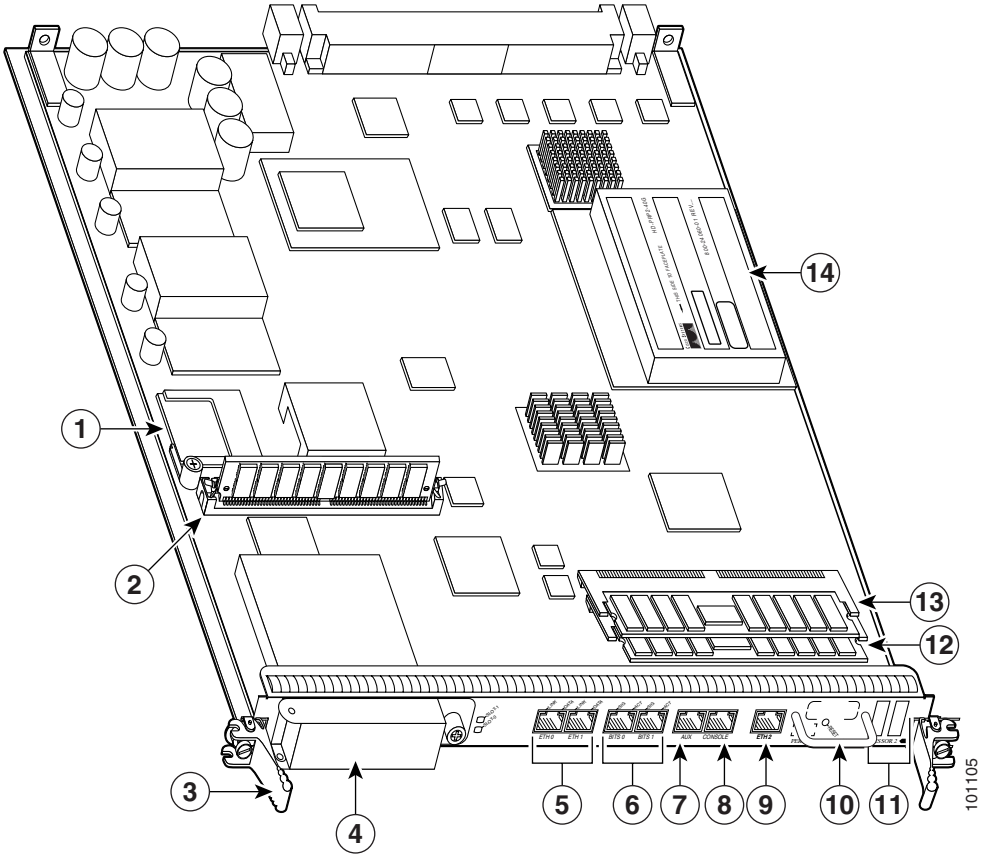
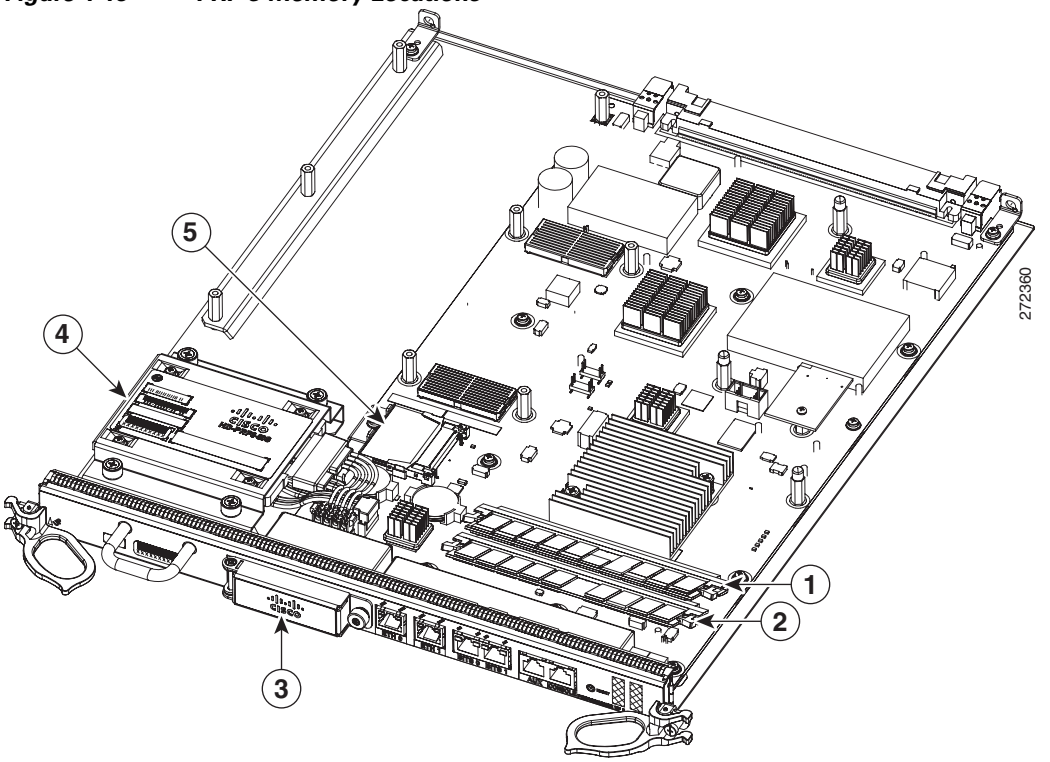


Figure 1-15 PRP-3 Memory Locations



1	SDRAM DIMM: Bank 1 - Socket number U8
2	SDRAM DIMM: Bank 2 - Socket number U10
3	External CompactFlash
4	Hard disk (80 GB)
5	Internal CompactFlash

Table 1-4 PRP-3 Memory Components

Type	Size	Quantity	Description	Location
SDRAM[1]	2 GB (Default) for each DDR2 DRAM for a total system memory of 4 GB, option for upgrade to total system memory of 8 GB (4 GB each).	2	Two 2-GB default DDR2 DRAM for main CiscoIOSXR software functions. Provision for optional upgrade to 4 GB also possible to provide total system memory of 8 GB.	U8 (bank 1)[2] U10 (bank 2)
NVRAM[3]	2 MB (fixed)	1	System configuration files, register settings, and logs	—
Flash memory	2 GB (default) or 4 GB (optional) Flash disks[4]	2 (Internal and External Compact Flash)	Contains Cisco IOS XR software images, system configuration files, and other user-defined files on two CompactFlash.	Internal and External Compact Flash[5]
Flash boot ROM	8 MB	1	Flash EPROM for the ROM monitor program boot image	—
HDD[6]	80 GB SATA	1	Contains log and crash information for specific Cisco IOS XR versions	—

1. Default SDRAM configuration is a total of 4 GB (2 x 2GB) system memory for PRP-3. Bank 1 (U15) must be populated first. You can use one or both banks to configure DDR2 DRAM combinations of 2 GB or 4 GB for the PRP-3. DIMM devices that are not from Cisco are not supported.
2. If both banks of the PRP-3 are populated, bank 1 and bank 2 must contain the same size DIMM.
3. NVRAM is not user configurable or field replaceable.
4. ATA Flash disks are supported in the PRP-3.
5. PRP-3 provides an onboard internal CompactFlash and also an external CompactFlash. The external CompactFlash in PRP-3 replaces the two PCMCIA slots (slot0 and slot1) of PRP-2.
6. Hard disk drives that are not from Cisco are not supported.

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 1-5 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 1-5 PRP-2 DRAM Configurations

Total SDRAM	SDRAM Sockets	Number of DIMMs
2 GB[1]	U15 (bank 1) U18 (bank 2)	One 2 GB DIMM or Two 2 GB DIMMs
4 GB	U15 (bank 1) U18 (bank 2)	One 4 GB DIMM or Two 4 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 1-5.

PRP-3 provides more system memory than PRP-2. PRP-3 is shipped with 2 GB of system memory in each DDR2 DRAMs, for a total of 4 GB and provides an upgrade option for a total of 8 GB (4 GB x 2 DRAM).

Note The two DIMMs must be of the same sizes. Do not use two different DIMM sizes together.

Table 1-6 PRP-3 DDR2 DRAM Configuration

Total SDRAM	SDRAM Sockets	Number of DIMMs
4 GB	U8 (bank 1) U10 (bank 2)	Two 2 GB DIMMs
8 GB	U8 (bank 1) U10 (bank 2)	Two 4 GB DIMMs

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 on PRP-2:

- Onboard flash memory (called *bootflash)*—Contains the Cisco IOS boot image

- Flash memory disks (or cards)—Contain the Cisco IOS software image

Table 1-7 lists supported flash disk sizes and Cisco part numbers.

Table 1-7 Supported Flash Disk Sizes

Flash Disk Size[1]	Part Number
2 GB[2]	MEM-FD2G=
4 GB	MEM-FD4G=

1. 4 GB is supported with 2 GB mode prior to Release 3.8.0.
2. Default shipping configuration.

PRP-3 Compact Flash

PRP-3 provides more flash memory than PRP-2. PRP-3 uses flash memory to store Cisco IOS XR software images. PRP-3 includes a default internal flash memory of 2 GB and also has an external flash memory of 2 GB. A flash memory upgrade option is also available for a total of 8 GB (2 x 4 GB).

PRP-2 and PRP-3 compactflashes are not compatible with each other and hence PRP-2 compactflash cannot be used in PRP-3 and vice versa. PRP-3 uses Multiword DMA to access the compactflash device, a PRP-2 compactflash does not support this access type.

Note The PRP-3 external CompactFlash disk replaces the two PCMCIA slots of PRP-2. The external CompactFlash disk can be installed or removed from the PRP-3 front panel. The internal CompactFlash disk memory is denoted as compactflash, while the external CompactFlash disk is denoted as disk0:.

Table 1-8 PRP-3 CompactFlash Disk Sizes

Flash Disk Size	Part Numbers
2 GB	FLASH-PRP3-2G(=)
4 GB	FLASH-PRP3-4G(=)

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 and Cisco XR 12810 Routers 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 and Cisco XR 12810 Routers support online insertion and removal (OIR), allowing you to remove and replace a card while the router remains powered on.

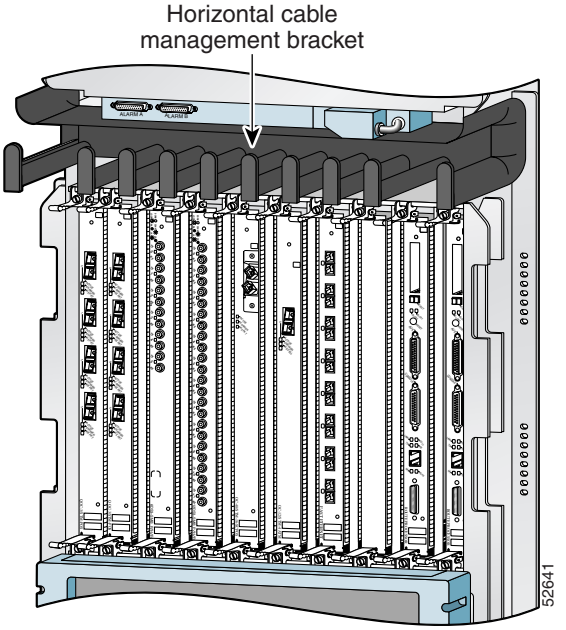
Horizontal Cable Management Bracket

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 1-16). 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.

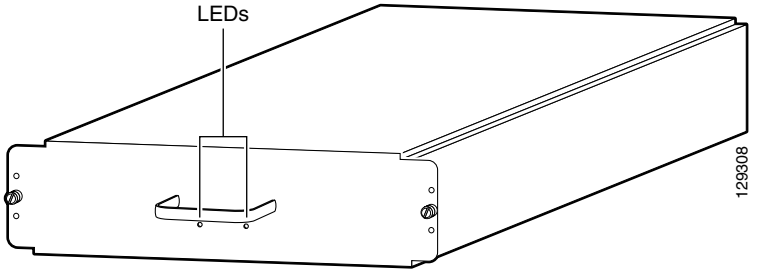
Figure 1-16 Horizontal Cable Management Bracket



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 1-17):

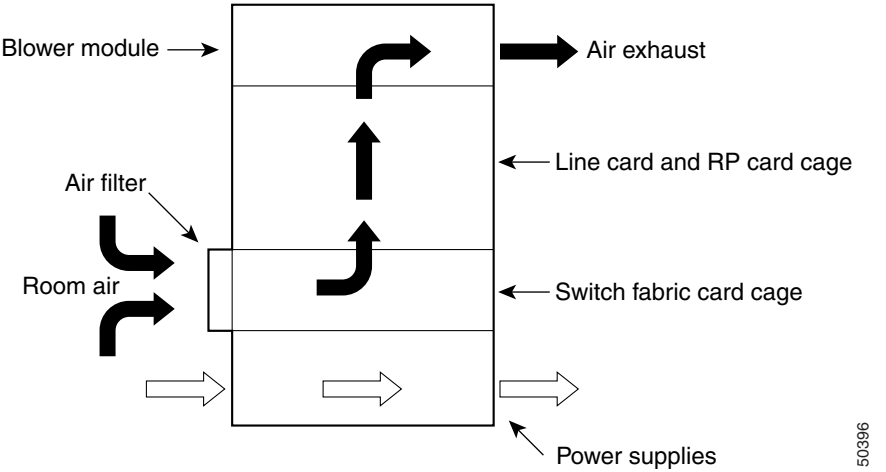
Figure 1-17 Blower Module



- 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 1-18 illustrates the air flow path through the chassis.

Figure 1-18 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.