

# Product Overview

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This chapter provides physical and functional overviews of the Cisco 7204 router. It contains physical descriptions of the router hardware and major components, and functional descriptions of hardware-related features. Descriptions and examples of software commands are included only when they are necessary for replacing, installing, configuring, or maintaining the router hardware.

The Cisco 7204 is part of the Cisco 7200 series routers, which consists of the Cisco 7204 and the Cisco 7206. The four-slot Cisco 7204 supports multiprotocol, multimedia routing and bridging with a wide variety of protocols and any combination of Ethernet, Fast Ethernet, Token Ring, Fiber Distributed Data Interface (FDDI), and serial media.

Network interfaces reside on port adapters that provide the connection between the router's three Peripheral Component Interconnect (PCI) buses and external networks. The Cisco 7204 has four slots (slot 1 through slot 4) for the port adapters, one slot for an Input/Output (I/O) controller, and one slot for a network processing engine. You can place the port adapters in any of the four available slots.

There are bays for up to two AC-input or DC-input power supplies. The Cisco 7204 will operate with one power supply. While a second power supply is not required, it allows load sharing and increased system availability. The Cisco 7204 does not support a mixture of AC- and DC-input power.

## Physical Description

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The Cisco 7204 provides the following features:

- Online insertion and removal (OIR)—allows you to add, replace, or remove port adapters without interrupting the system or entering any console commands.
- Dual hot-swappable, load-sharing power supplies—provide system power redundancy; if one power supply or power source fails, the other power supply maintains system power without interruption. Also, when one power supply is powered off and removed from the router, the second power supply immediately takes over the router's power requirements without interrupting normal operation of the router.
- Environmental monitoring and reporting functions—allow you to maintain normal system operation by resolving adverse environmental conditions prior to loss of operation.
- Downloadable software—allows you to load new images into Flash memory remotely, without having to physically access the Cisco 7204 router, for fast, reliable upgrades.

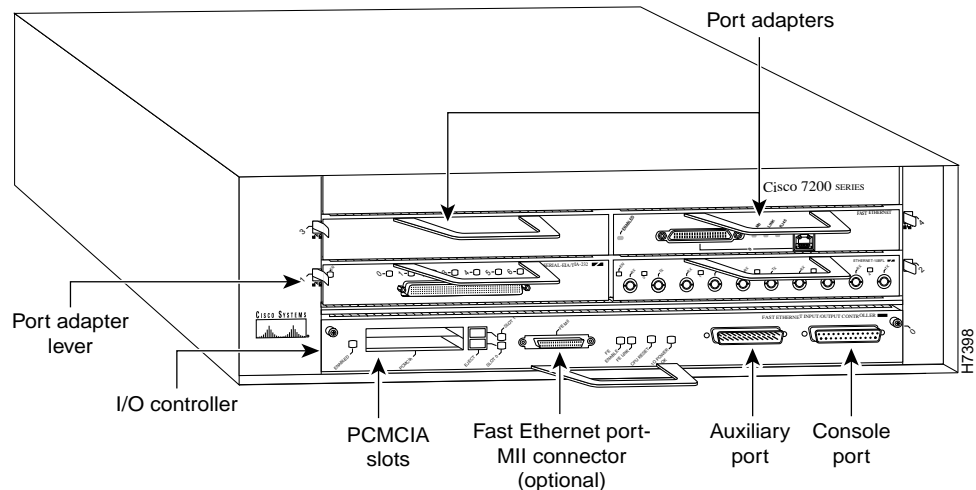
## Physical Description

The front of the Cisco 7204 provides access to an I/O controller and up to four network interface port adapters (see Figure 1-1). The I/O controller contains the following: a local console port for connecting a data terminal (or data terminal equipment [DTE]) and an auxiliary port for connecting a modem (or other data communications equipment [DCE]) or other devices for configuring and managing the router; two Personal Computer Memory Card International Association (PCMCIA) slots for Flash memory cards; an optional Fast Ethernet port. The Fast Ethernet port provides a 100-Mbps connection to the network.

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**Note** The I/O controller is available with or without a Fast Ethernet port. Figure 1-1 shows an I/O controller with a Fast Ethernet port.

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**Figure 1-1 Cisco 7204 Router—Front View**

The port adapters installed in the Cisco 7204 are of the same type as those installed on the second-generation Versatile Interface Processors (VIP2s) in the Cisco 7000 family routers. The port adapters installed in the Cisco 7204 support OIR. For an explanation of OIR, refer to the section “Online Insertion and Removal” later in this chapter.

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**Note** The I/O controller does not support OIR. You *must* power down the Cisco 7204 before removing the I/O controller from the router.

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Port adapter slots in the Cisco 7204 router are numbered from left to right, beginning with port adapter slot 1 and continuing through port adapter slot 4. Port adapter slot 0 is the Fast Ethernet port on the I/O controller (refer to Figure 1-2).

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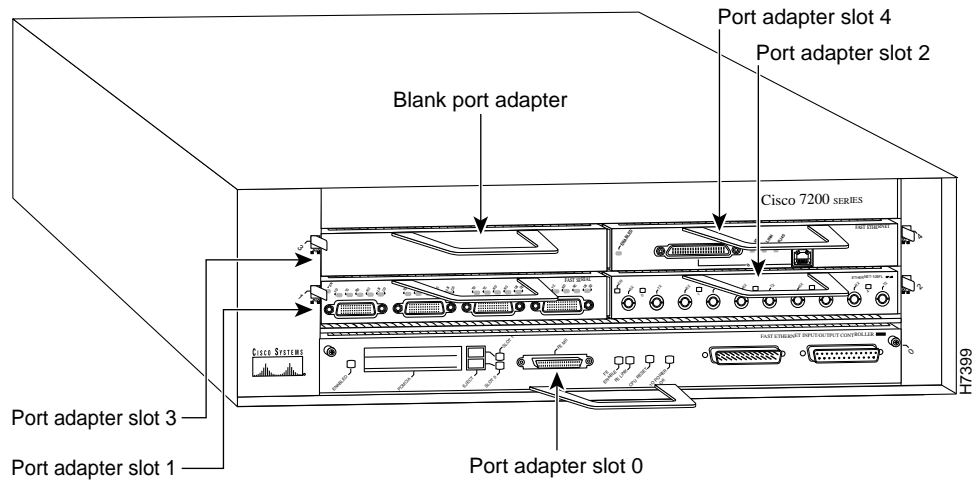
**Note** In Figure 1-1 and Figure 1-2, a blank port adapter is installed in the slot 3. To ensure adequate airflow across the port adapters, each port adapter slot must be filled with either a port adapter or a blank port adapter.

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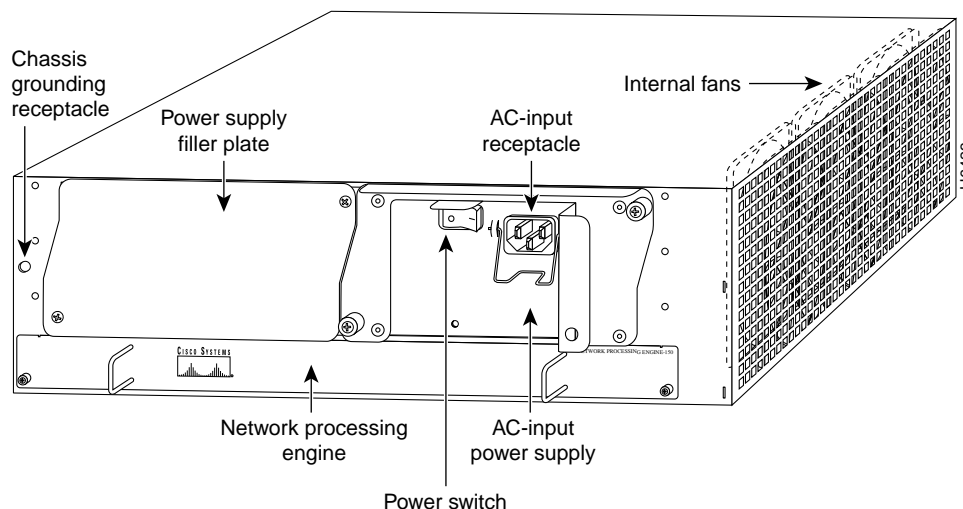
## Physical Description

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**Figure 1-2 Port Adapter Slot Numbering**



The rear of the Cisco 7204 router provides access to the network processing engine and up to two power supplies (refer to Figure 1-3).

**Figure 1-3 Cisco 7204 Router—Rear View**

**Note** The network processing engine does not support OIR. You *must* power down the Cisco 7204 before removing the network processing engine from the router.

The network processing engine has no external connectors or LEDs. There are two handles for removing and installing the network processing engine and two captive installation screws for securing it to the chassis.

The Cisco 7204 router comes equipped with one 280W AC-input or one 280W DC-input power supply. A fully configured Cisco 7204 router operates with only one installed power supply; however, a second, optional power supply provides hot-swappable, load-sharing, redundant power. Figure 1-3 shows the rear of a Cisco 7204 router configured with a single AC-input power supply. (A power supply filler plate is installed over the second power supply bay.)

## Physical Description

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The power supply has the router's main power switch and either an AC-input power receptacle or a hardwired DC-input power cable (depending on the type of installed power supply). Adjacent to the power supply bays there is a 10 x 32-inch chassis ground receptacle that provides a chassis ground connection for ESD equipment or a grounding wire (refer to Figure 1-3).



**Caution** Do not mix power supplies in the Cisco 7204. In dual power supply router configurations, both power supplies *must* be of the same type (two AC-input power supplies or two DC-input power supplies).

Three internal fans draw cooling air into chassis and across internal components to maintain an acceptable operating temperature. (Refer to Figure 1-3.) The three fans are enclosed in a tray that is located in the subchassis.



**Caution** To ensure the proper flow of cooling air across the internal components, make sure blank port adapters are installed in unoccupied port adapter slots, and power supply filler plates are installed in unoccupied power supply bays.

The I/O controller, port adapters, power supplies, and network processing engine slide into their respective chassis slots and connect directly to the router's midplane; there are no internal cables to connect. The midplane distributes DC power from the power supplies to the I/O controller, port adapters, fan tray, and network processing engine.

The midplane also identifies OIR of the port adapters, bridges the PCI buses from the port adapters to packet static random-access memory (SRAM) on the network processing engine, arbitrates traffic across the PCI buses, and generates the clock signals for the port adapters on each PCI bus.

The Cisco 7204 operates as either a tabletop or rack-mounted unit. A rack-mount kit is standard equipment included with all Cisco 7204 routers when they are shipped from the factory. The kit provides the hardware needed to mount the router in a standard 19-inch equipment rack or a Telco rack. Steps for installing the Cisco 7204 router in an equipment rack are explained in the chapter "Installing the Cisco 7204." If you are not rack-mounting your Cisco 7204, place it on a sturdy tabletop or platform.

A fully configured Cisco 7204, with two installed power supplies and all chassis slots filled, weighs approximately 50 pounds (22.7 kilograms [kg]). For clearance requirements and rack-mount installation considerations, refer to the section “Site Environment” in the chapter “Preparing for Installation.”

## System Specifications

Table 1-1 lists the Cisco 7204 router physical specifications and power requirements.

**Table 1-1 Cisco 7204 Physical Specifications**

Description	Specification
Midplane	Three PCI buses with an aggregate bandwidth of 1.6 Gbps <sup>1</sup>
Dimensions (H x W x D)	5.25in. x 16.8in. x 17in. (13.34 cm x 42.67 cm x 43.18 cm)
Weight	Chassis fully configured with a network processing engine, I/O controller, 4 port adapters, 2 power supplies, and a fan tray: ~ 50 lbs (22.7 kg)
Heat dissipation	370W (1262 Btu <sup>2</sup> )
AC-input power	370W maximum (with either a single or dual power supply configuration)
AC-input voltage	100-240 VAC <sup>3</sup> wide input with power factor correction
AC-input current rating	5A <sup>4</sup> maximum at 110 VAC, and 2.5A maximum at 240 VAC with the chassis fully configured
AC-input cable	18 AWG <sup>5</sup> three-wire cable, with a three-lead IEC-320 receptacle on the power supply end, and a country-dependent plug on the power source end
DC-output power	280W maximum (with either a single or dual power supply configuration)
DC-input power	370W maximum (with either a single or dual power supply configuration)
DC-input voltage	–48 VDC <sup>6</sup> nominal in North America –60 VDC nominal in the European Community
DC-input current rating	14A maximum at –48 VDC 7.5A maximum at –60 VDC

## Physical Description

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Description	Specification
DC voltages supplied and maximum, steady-state current ratings	+5.2V @ 30A +12.2V @ 9A -12.0V @ 1.5A +3.5V @ 13A
DC-input cable	14 AWG (2.08 mm <sup>2</sup> ) recommended minimum, with at least three conductors rated for at least 140 F (60 C).
Frequency	50/60Hz <sup>7</sup>
Airflow	~80 cfm <sup>8</sup>
Temperature	32 to 104 F (0 to 40 C) operating; -4 to 149 F (-20 to 65 C) nonoperating
Humidity	10 to 90% noncondensing
Software requirement	Cisco IOS Release 11.1(6) or later
Agency approvals	Safety: UL 1950, CSA 22.2 No. 950, EN60950, AUSTEL TS001, AS/NZS 3260 EMI: FCC Class A, CSA Class A, EN60555-2, EN55022 Class B, VCCI Class 2, AS/NRZ 3548 Class A Immunity: IEC-1000-4-2, IEC-1000-4-3, IEC-1000-4-4, IEC-1000-4-5, IEC-1000-4-6, IEC-1000-4-11, IEC 1000-3-2

1. Gbps = gigabits per second.

2. Btu = British thermal units.

3. VAC = volts alternating current.

4. A = ampere.

5. AWG = American Wire Gauge.

6. VDC = volts direct current.

7. Hz = hertz.

8. cfm = cubic feet per minute.

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**Note** For a chassis footprint, additional dimensions, and clearance requirements for the Cisco 7204 perimeter, refer to the section “Site Requirements” in the chapter “Preparing for Installation.”

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## Field-Replaceable Units

The Cisco 7204 router is easy to service; all its major components are field replaceable units (FRUs). The following Cisco 7204 components are FRUs:

- Network processing engine
- Input/Output controller
- Port adapters
- Power supplies
- Fan tray
- Subchassis (including the midplane)
- Chassis
- Flash memory cards

The following sections provide brief overviews of each FRU. Instructions for removing and replacing FRUs are contained in separate documents called configuration notes. For example, If you need to replace the fan tray in your Cisco 7204 router, refer to the configuration note *Cisco 7200 Series Subchassis and Fan Tray Replacement Instructions* (Document Number 78-3228-xx). This configuration note accompanies every subchassis and fan tray shipped from the factory as a FRU. The configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

For ordering information, contact a customer service representative.

## Network Processing Engine

The network processing engine maintains and executes the system management functions for the Cisco 7204 router. The network processing engine also shares the system memory and environmental monitoring functions with the I/O controller.

## Physical Description

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**Note** Detailed instructions for removing and replacing the network processing engine are contained in the configuration note *Cisco 7200 Series Network Processing Engine Replacement Instructions* (Document Number 78-3225-xx). This configuration note accompanies every network processing engine that is shipped from the factory as a FRU. The configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

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The network processing engine consist of the following components (refer to Figure 1-4):

- Orion/R4700 reduced instruction set computing (RISC) microprocessor operating at an internal clock speed of 150 megahertz (MHz).
- Galileo GT-64010 system controller that uses direct memory access (DMA) to transfer data between DRAM and packet SRAM on the network processing engine.
- DRAM for storing routing tables, protocols, network accounting applications, packets of information in preparation for process switching, and packet buffering for SRAM overflow. The standard configuration is 16 megabytes (MB), with up to 128 MB available through single in-line memory module (SIMM) upgrades.
- Packet SRAM for storing packets of information in preparation for fast switching.
- Unified cache SRAM that functions as the secondary cache for the R4700 RISC processor. (The primary cache is within the processor.)
- Two environmental sensors for monitoring the cooling air as it leaves the Cisco 7204 chassis.

The network processing engine performs the following system management functions:

- Sending and receiving routing protocol updates
- Managing tables, caches, and buffers
- Monitoring interface and environmental status
- Providing Simple Network Management Protocol (SNMP) management and the console/Telnet interface

- Accounting and switching of data traffic
- Booting and reloading images
- Managing port adapters (recognition and initialization during OIR)

**Figure 1-4 Network Processing Engine**

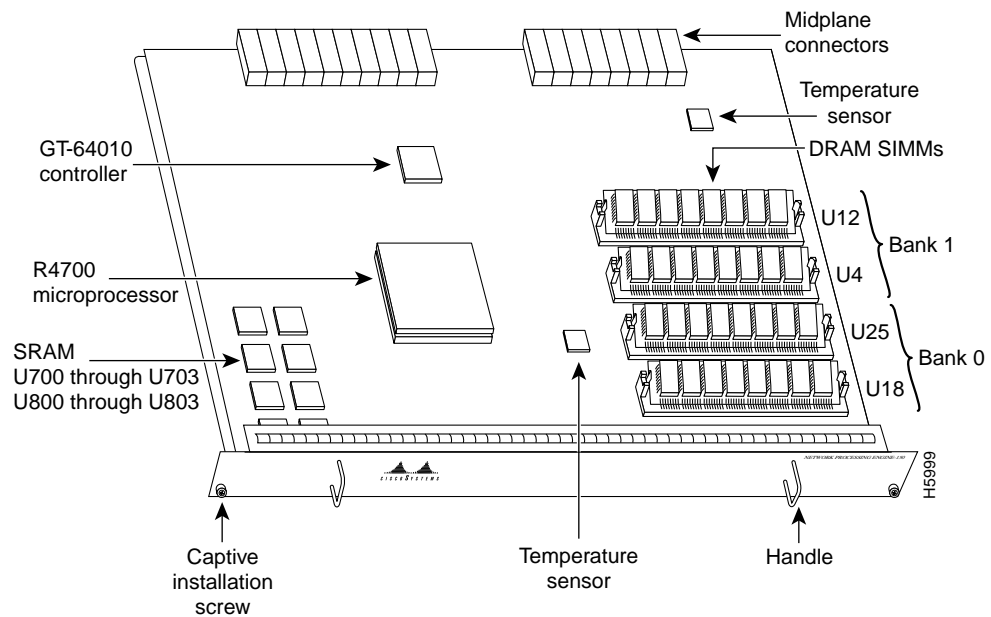


Table 1-2 lists the network processing engine memory components.

## Physical Description

**Table 1-2 Network Processing Engine Memory Components**

Memory Type	Size	Quantity	Description	Location
DRAM	16 to 128 MB	2 to 4	4-, 8-, 16-, or 32-MB SIMMs (based on maximum DRAM required)	Bank 1: U12 and U4 Bank 0: U25 and U18
SRAM	1 MB	8	8 chips each being 128K words x 9 bits wide	U700 through U703 U800 through U803
Unified cache	512 KB	4	Secondary cache for the R4700 RISC processor	U2, U10, U14, and U26

Table 1-3 lists the network processing engine factory-installed DRAM configurations and their product numbers.

**Table 1-3 DRAM SIMM Configurations**

Total DRAM	DRAM Bank 0	Quantity	DRAM Bank 1	Quantity	Product Number
16 MB	U18 and U25	2 8-MB SIMMs	U4 and U12	–	MEM-NPE-16MB <sup>1</sup>
24 MB	U18 and U25	2 8-MB SIMMs	U4 and U12	2 4-MB SIMMs	MEM-NPE-24MB
32 MB	U18 and U25	2 16-MB SIMMs	U4 and U12	–	MEM-NPE-32MB <sup>1</sup>
64 MB	U18 and U25	2 32-MB SIMMs	U4 and U12	–	MEM-NPE-64MB <sup>1</sup>
128 MB	U18 and U25	2 32-MB SIMMs	U4 and U12	2 32-MB SIMMs	MEM-NPE-128MB <sup>1</sup>

1. These products are also available as DRAM upgrades. For example, to upgrade a network processing engine from 16 MB to 32 MB of DRAM, order product number MEM-NPE-16MB=.

## Input/Output Controller

The Input/Output controller shares the system memory functions and the environmental monitoring functions for the Cisco 7204 router with the network processing engine.

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**Note** Detailed instructions for removing and replacing the I/O controller are contained in the configuration note *Cisco 7200 Series Input/Output Controller Replacement Instructions* (Document Number 78-3224-xx). This configuration note accompanies every I/O controller that is shipped from the factory as a FRU. The configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

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The I/O controller is available with an optional Fast Ethernet port. Figure 1-5 shows an I/O controller without the Fast Ethernet port. Figure 1-6 shows an I/O controller with the Fast Ethernet port. The I/O controller consists of the following components:

- Dual EIA/TIA-232 channels for local console and auxiliary ports. The console port has full DCE functionality and a DB-25 receptacle. The auxiliary port has full DTE functionality and a DB-25 plug.
- An optional Fast Ethernet port with a single female MII receptacle that is configurable for 100 Mbps.
- Nonvolatile random-access memory (NVRAM) for storing the system configuration and environmental monitoring logs. NVRAM uses lithium batteries to maintain its contents when disconnected from power.
- Flash memory SIMM for storing the boot helper image.
- Two PCMCIA slots for Flash memory cards, which contain the default Cisco IOS software image.
- Erasable programmable read-only memory (EPROM) for storing sufficient code for booting the Cisco IOS software.
- Two environmental sensors for monitoring the cooling air as it enters and leaves the Cisco 7204 chassis.

## Physical Description

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**Figure 1-5 I/O Controller—Without Fast Ethernet Port**

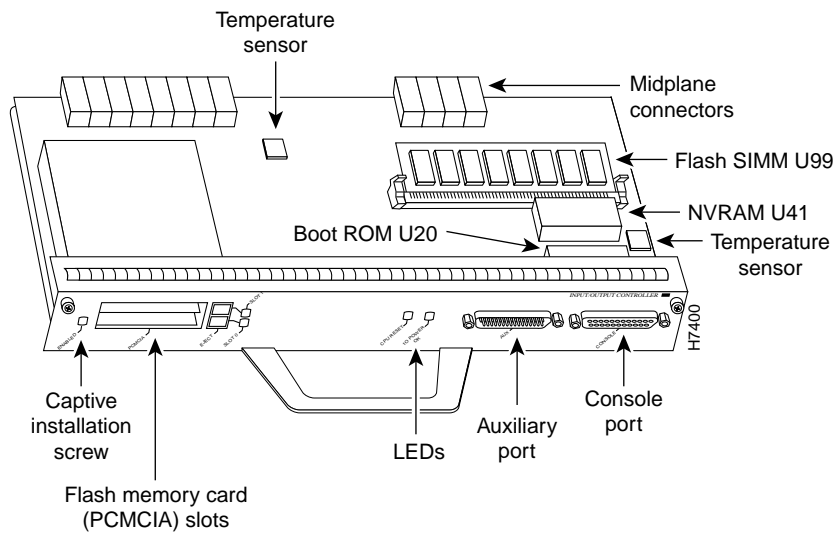


Figure 1-6 I/O Controller—With Fast Ethernet Port

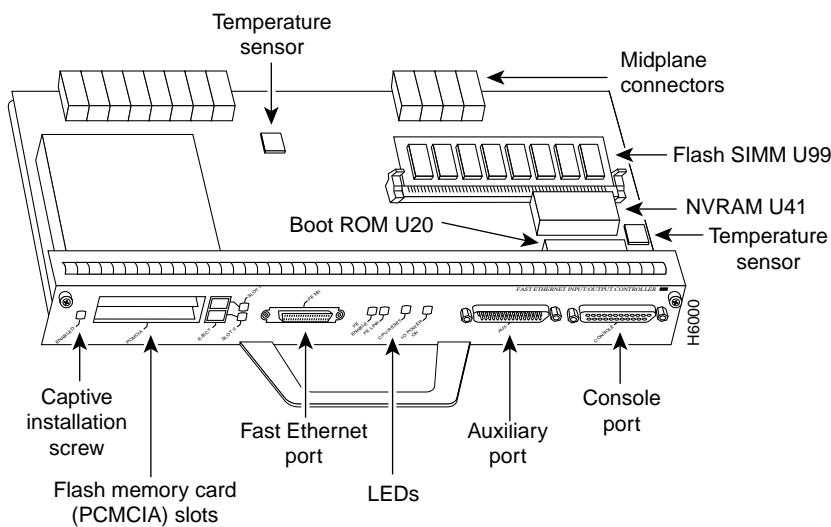


Table 1-4 lists the I/O controller memory components.

## Physical Description

**Table 1-4 I/O Controller Memory Components**

Memory Type	Size	Quantity	Description	Location
Boot ROM	256 KB	1	EPROM for the ROM monitor program	U20
Flash SIMM	4 MB	1	Contains the default boot helper image	U99
Flash memory card	8 MB to 20 MB	Up to 2	Contains the default Cisco IOS image	PCMCIA slot 0 and slot 1
NVRAM	128 KB	1	Nonvolatile EPROM for the system configuration file	U41

Depending on whether the Fast Ethernet port is present, either two or four LEDs on the I/O controller faceplate indicate system status; two additional LEDs indicate the status of the Flash memory cards installed in either PCMCIA slot.

Figure 1-7 shows the LEDs of an I/O controller that does not have the Fast Ethernet port. Figure 1-8 shows the LEDs of an I/O controller that has the Fast Ethernet port. Table 1-5 lists I/O controller LEDs and their functions. To use the LEDs for troubleshooting the I/O controller, refer to the section “Identifying Startup Problems” in the chapter “Troubleshooting the Installation.”

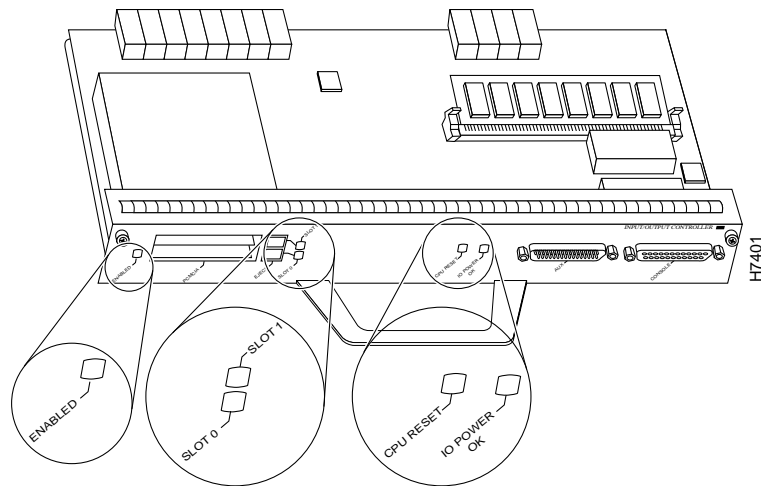
Next to the IO power OK LED on the I/O controller faceplate is the CPU reset button. The CPU reset button resets the entire system.



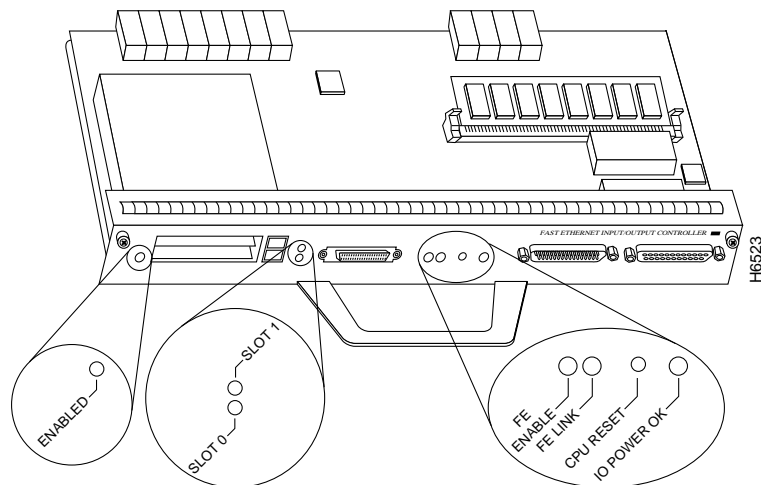
**Caution** To prevent system errors and problems, use the CPU reset button only at the direction of your service representative.



**Figure 1-7 I/O Controller LEDs and CPU Reset Button—Without Fast Ethernet Port**



**Figure 1-8 I/O Controller LEDs and CPU Reset Button—With Fast Ethernet Port**



## Physical Description

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**Table 1-5 I/O Controller LEDs**

LED	Function
IO Power OK	Indicates that the I/O controller is on and receiving DC power from the router midplane. This LED comes on during a successful router boot and remains on during normal operation of the router.
Enabled	Indicates that the network processing engine and the I/O controller are enabled for operation by the system; however, it does not mean that the Fast Ethernet port on the I/O controller is functional or enabled. This LED comes on during a successful router boot and remains on during normal operation of the router.
FE enable	Indicates that the Fast Ethernet port on the I/O controller is initialized and enabled for operation by the system. This LED comes on after the I/O controller has been enabled and remains on during normal operation of the router.
FE link	Indicates that the Fast Ethernet port on the I/O controller is receiving a carrier signal from the network. This LED remains off during normal operation of the router, unless there is an incoming carrier signal.
Slot 0 Slot 1	The slot 0 and slot 1 LEDs indicate which PCMCIA slot is in use and blink when either slot is being accessed by the system.

## Port Adapters

The Cisco 7204 is shipped from the factory with up to four installed port adapters that provide a variety of network media types (based on your order). The port adapters connect directly to the router's midplane. Port adapters installed in the Cisco 7204 router support OIR.

For a description of OIR, refer to the section "Online Insertion and Removal" later in this chapter. For general instructions about how to remove and replace a port adapter, refer to the section "Replacing a Port Adapter" in the chapter "Maintaining the Cisco 7204."



**Caution** To ensure adequate airflow across the router's port adapters, a port adapter or a blank port adapter must be installed in each port adapter slot.

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**Note** Detailed instructions for removing, replacing, and configuring the port adapter types supported by the Cisco 7204 are contained in the configuration note for the port adapter. For example, if you plan to replace a Token Ring port adapter in your Cisco 7204 router, refer the configuration note *PA-4R Token Ring Port Adapter Installation and Configuration* (Document Number 78-2661-xx). This configuration note accompanies every Token Ring port adapter that is shipped from the factory as installed item in a Cisco 7204 or as a FRU. The configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

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## Power Supplies

The Cisco 7204 comes equipped with one 280W AC-input power supply or one 280W DC-input power supply. You must order the second power supply separately.



**Caution** Do not mix power supplies in the Cisco 7204. In dual power supply router configurations, both power supplies *must* be of the same type (two AC-input power supplies or two DC-input power supplies).

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**Note** Detailed instructions for handling and replacing the Cisco 7204 power supplies are contained in the configuration notes *Cisco 7200 Series 280-Watt AC-Input Power Supply Replacement Instructions* (Document Number 78-3227-xx) and *Cisco 7200 Series 280-Watt DC-Input Power Supply Replacement Instructions* (Document Number 78-3420-xx). These configuration notes accompany every 280W AC-input power supply and every 280W DC-input power supply that is shipped from the factory as a FRU. These configuration notes are also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

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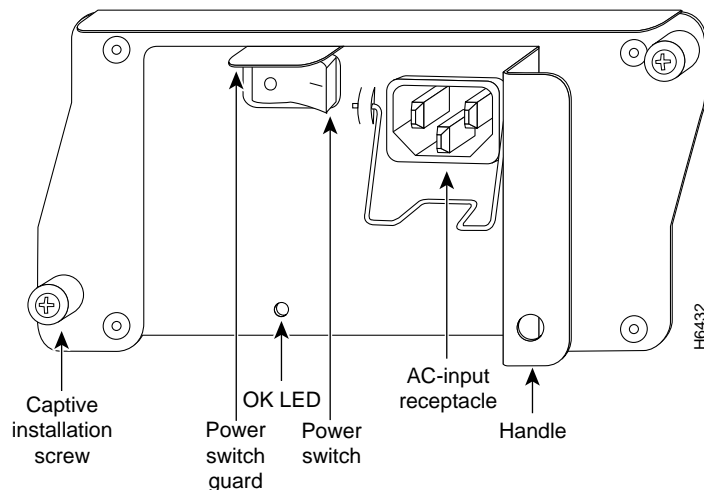
## Physical Description

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A handle on the AC and DC power supplies provides a grip point for removing and replacing the power supply. (Figure 1-9 shows the faceplate of the AC-input power supply.) Two captive installation screws secure the power supply to the chassis and seat the power supply in the router midplane. A Power OK LED indicates that the power supply is delivering +5 VDC to the router midplane.

The AC-input power supply has a receptacle for an AC-input power cable. A modular power cable connects the AC-input power supply to the site AC power source. A cable-retention clip secures the power cable to the AC-input power supply. The DC-input power supply has a DC-input power cable hardwired to a DC-input terminal block.

**Figure 1-9 AC-Input Power Supply**



**Caution** To ensure adequate airflow across the router's power supplies, a power supply or a power supply filler plate must be installed in each power supply bay. Figure 1-3 shows a Cisco 7204 with an installed power supply filler plate.

Table 1-1 lists the AC-input and DC-input power supply system power specifications, including input voltage and operating frequency ranges.

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**Note** Each AC-input power supply operating at 120 VAC requires a minimum of 5A service. We recommend powering the Cisco 7204 from a 15A receptacle at the power source.

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The power supplies monitor their own temperatures and internal voltages. If either power supply detects an overvoltage or overtemperature condition, it shuts down to avoid damage to itself or other system components. For a description of power-supply shutdown conditions and thresholds, refer to the section “Environmental Monitoring and Reporting Functions” in this chapter.

## Fan Tray

The fan tray, shown in Figure 1-10, consists of three fans that are enclosed in a metal case. The fan tray is located in the subchassis and receives –12 VDC through a DC power harness that connects directly to the router midplane. You must remove the subchassis to access the fan tray.

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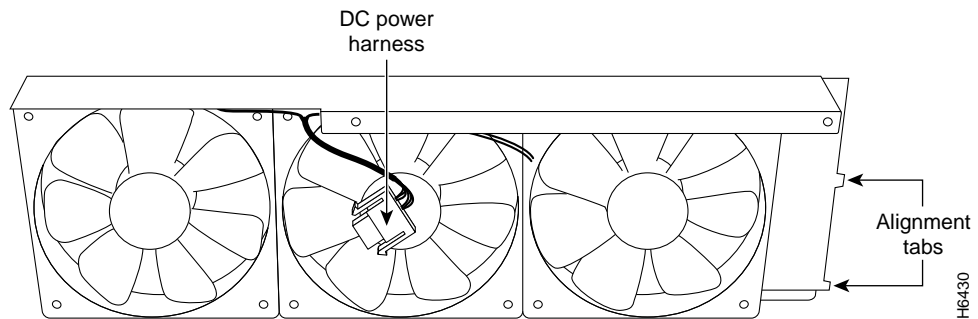
**Note** Detailed instructions for removing and replacing fan tray are contained in the configuration note *Cisco 7200 Series Subchassis and Fan Tray Replacement Instructions* (Document Number 78-3228-xx). This configuration note accompanies every fan tray that is shipped from the factory as a FRU. The configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

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## Physical Description

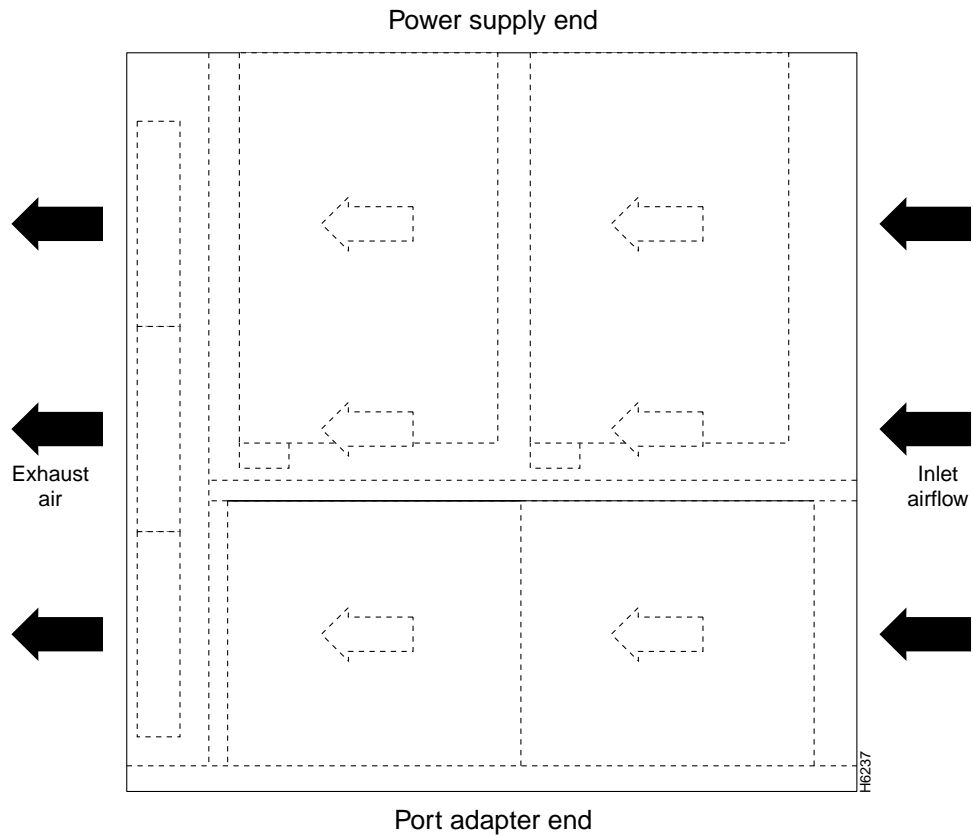
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**Figure 1-10 Cisco 7204 Fan Tray**



The fan tray draws cooling air in through the intake vent on the right side of the chassis (when viewing the router from the front), and moves the air across the internal components and out the exhaust vent on the left side of the chassis.

Figure 1-11 shows the air flow through the router.

**Figure 1-11 Internal Air Flow—Top View**

The left and right sides of the chassis must remain unobstructed to ensure adequate air flow and prevent overheating inside the chassis; we recommend at least three inches of clearance. (See the section “Site Requirements” in the chapter “Preparing for Installation.”)

Temperature sensors on the network processing engine and I/O controller monitor the internal air temperature and send warning messages when the internal air temperature approaches a specified threshold. If the internal temperature exceeds the specified threshold, the system environmental monitor shuts down all internal power to prevent equipment damage from excessive heat.

## Physical Description

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### Subchassis (including the Midplane)

The subchassis (shown in Figure 1-12) has one slot for the network processing engine, two bays for power supplies, and one slot for the fan tray. The subchassis also houses the router midplane. To replace the router midplane, you must replace the entire subchassis.

The port adapter side of the midplane has four plugs for the port adapters and one plug for the I/O controller. The power supply side of the midplane has two plugs for power supplies, a plug for the fan tray's power harness, and one plug for the network processing engine. The midplane distributes DC power to the router's internal components.

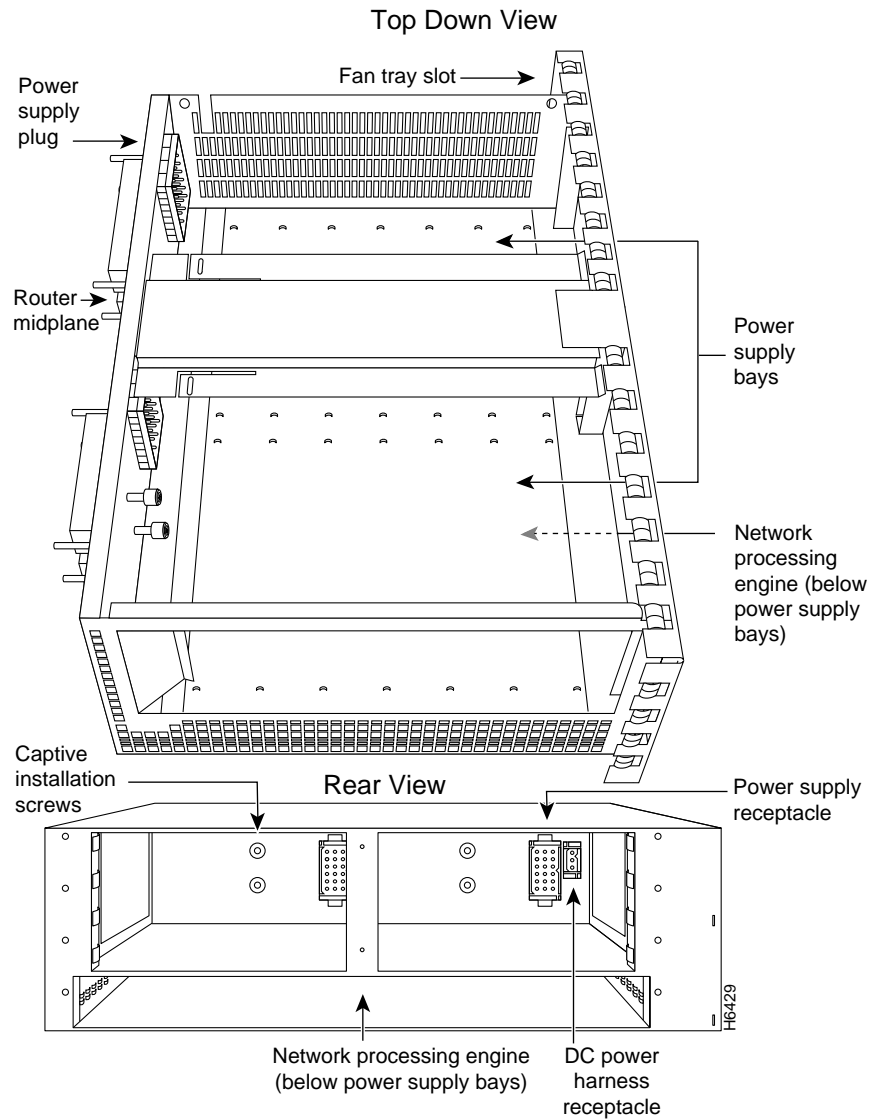
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**Note** Detailed instructions for removing and replacing subchassis are contained in the configuration note *Cisco 7200 Series Subchassis and Fan Tray Replacement Instructions* (Document Number 78-3228-xx). This configuration note accompanies every subchassis that is shipped from the factory as a FRU. The configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

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**Figure 1-12 Cisco 7204 Subchassis—Top Down and Rear Views**



## Physical Description

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### Chassis

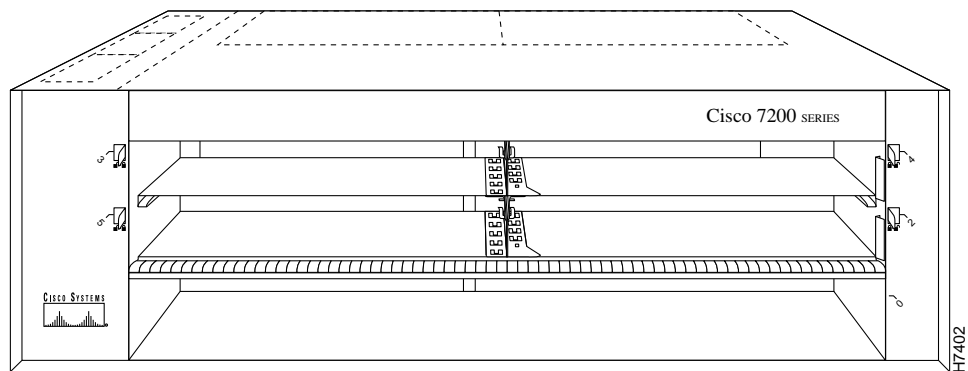
The Cisco 7204 chassis, shown in Figure 1-13, has four slots for the port adapters, one slot for the I/O controller, and one bay for the subchassis. To replace the chassis, you must remove all of the internal components, including the subchassis.

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**Note** Because you must remove all the internal components when replacing the chassis, refer to the configuration notes that explain how to remove and replace the internal components. These configuration notes accompany every chassis that is shipped from the factory as a FRU. The configuration notes are also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

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**Figure 1-13** Cisco 7204 Chassis



## Flash Memory Cards

The Cisco 7204 supports up to two installed Intel Series 2+ Flash memory cards.

Flash memory (Flash memory cards and the Flash SIMM on the I/O controller) allows you to remotely load and store multiple system and boot helper images. You can download a new image over the network and then add the new image to Flash memory or replace existing files. You can also transfer images between Flash memory cards and the onboard Flash memory SIMM. You can then boot the router either manually or automatically from any of the stored images. Flash memory can also function as a TFTP server to allow other routers to boot remotely from stored images or copy them into their own Flash memory.

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**Note** Detailed instructions for removing and replacing Flash memory cards and memory SIMMs are contained in the configuration note *Cisco 7200 Series Memory Replacement Instructions* (Document Number 78-3226-xx). This configuration note accompanies every Flash memory card that is shipped from the factory as a FRU. The configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO). Instructions for installing and removing a Flash memory card are also contained in the section “Installing and Removing a Flash Memory Card” in Chapter 6 of this guide.

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Table 1-6 lists the Flash memory card options supported by the Cisco 7204.

**Table 1-6 Flash Memory Card Options**

Memory Size	Product Number
8 MB	MEM-I/O-FLC8M <sup>1</sup>
16 MB	MEM-I/O-FLC16M <sup>1</sup>
20 MB	MEM-I/O-FLC20M <sup>1</sup>

1. These products are also available as Flash card upgrades. To order an upgrade, add an equal sign (=) after the product number, for example, MEM-I/O-FLC16M=.

## Functional Overview

This section provides a functional overview of the Cisco 7204. It describes the numbering and addressing of the port adapters for the router, the environmental monitoring and reporting functions, and online insertion and removal (OIR). These descriptions will help you become familiar with the capabilities of the Cisco 7204 router.

### Port Adapter Slot and Logical Interface Numbering

The four port adapters in the Cisco 7204 provide the connection between the router's three Peripheral Component Interconnect (PCI) buses, called mb0, mb1, and mb2, and external networks. Bus mb0 is for the optional Fast Ethernet port on the I/O controller, bus mb1 is for port adapter slots 1 and 3, and bus mb2 is for port adapter slots 2 and 4.

The port adapters are categorized as high, medium, and low bandwidth. The high and medium bandwidth port adapters should be evenly distributed between bus mb1 and bus mb2. Information on port adapter categories and bus configurations is contained in the configuration note *Cisco 7204 Port Adapter Hardware Configuration Guidelines* (Document Number 78-3642-xx). This configuration note accompanies every Cisco 7204 router that is shipped from the factory. This configuration note is also available on the Cisco Connection Documentation, Enterprise Series CD, and on Cisco Connection Online (CCO).

In the Cisco 7204, the *port adapter slot number* is the chassis slot in which a port adapter is installed, while the *logical interface number* is the physical location of the interface port on a port adapter. Port adapter slots are numbered from 1 through 4; port adapter slot 0 is the Fast Ethernet port on the I/O controller. (Refer to Figure 1-2 for the numbering scheme of the port adapter slots.) The number of logical interfaces depends on the type of port adapter.

The *Media Access Control (MAC)-layer* or *hardware* address is a standardized data link layer address that is required for certain network interface types. These addresses are not used by other devices in the network; they are specific and unique to each port. The Cisco 7204 uses a specific method to assign and control the MAC-layer addresses of its port adapters. For a description of the MAC-layer address, refer to the section "MAC-Layer Address" later in this chapter.

Port adapter slots maintain the same slot number regardless of whether other port adapters are installed or removed. However, when you move a port adapter to a different slot, the port adapter's logical interface number changes to reflect the new slot number.

You can identify port adapter slots by using software commands to display information about a specific port adapter or for all port adapters in the Cisco 7204. To display information about all port adapter slots, use the **show interfaces** command. To display information about a specific port adapter slot, use the **show interfaces** command with the port adapter type and slot number in the format **show interfaces** (*port adapter type and slot number/port number*). If you abbreviate the command (**sho int**) and do not specify port adapter type and slot number (or arguments), the system interprets the command as **show interfaces** and displays the status of all port adapters and ports.

Following is an example of how the **show interfaces** command, used without arguments, displays status information (including the physical port adapter number) for each port adapter in the Cisco 7204. In the following example, most of the status information for each interface is omitted.

```
Router# sh int

FastEthernet0/0 is administratively up, line protocol is up
  Hardware is DEC21140, address is 0000.0000.0000 (bia 0000.0000.0000)
  Internet address is 1.1.1.3
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  (display text omitted)
Fddi1/0 is administratively down, line protocol is down
  Hardware is MIF68840_MM, address is 0000.0000.0000 (bia 0000.0000.0000)
  Internet address is 1.1.1.0
  MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  (display text omitted)
Ethernet2/0 is administratively up, line protocol is up
  Hardware is AmdP2, address is 0000.0000.0000 (bia 0000.0000.0000)
  Internet address is 1.1.1.7
  MTU 1500 bytes, BW 100000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  (display text omitted)
```

You can also use arguments such as the interface type (Ethernet, TokenRing, Fddi, and so forth) and the port address (slot/port) to display information about a specific interface only.

## Functional Overview

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The following example shows the display for the first port on the Token Ring port adapter in port adapter slot 3:

```
Router# sh int tokenring 3/0

TokenRing3/0 is administratively down, line protocol is down
  Hardware is IBM2692, address is 0000.0000.0000 (bia 0000.0000.0000)
  Internet address is 1.1.1.8
  MTU 4464 bytes, BW 1600 Kbit, DLY 630 usec, rely 255/255, load 1/255
  Encapsulation SNAP, loopback not set, keepalive set (10 sec)
  ARP type: SNAP, ARP Timeout 04:00:00
  Ring speed: 16 Mbps
  (display text omitted)
```

For complete descriptions and instructions of the commands used to configure your Cisco 7204, refer to the *Configuration Fundamentals Configuration Guide* and *Configuration Fundamentals Command Reference* publications, which are available on the Cisco Connection Documentation, Enterprise Series CD, or in print.

## MAC-Layer Address

All local-area network (LAN) interfaces (ports) require unique MAC-layer addresses, also known as *hardware* addresses. Typically, the MAC address of an interface is stored on a memory component that resides directly on the interface circuitry; however, the OIR feature requires a different method. For a description of OIR, refer to the section “Online Insertion and Removal” later in this chapter.

The OIR feature allows you to remove a port adapter and replace it with another identically configured one. If the new port adapter matches the port adapter you removed, the system immediately brings it on line. In order to allow OIR, an address allocator with a unique MAC addresses is stored in an EEPROM on the router midplane. Each address is reserved for a specific port and slot in the router regardless of whether a port adapter resides in that slot. The MAC addresses are assigned to the slots in sequence. The first address is assigned to slot 0, and the last address is assigned to slot 4. This address scheme allows you to remove port adapters and insert them into other routers without causing the MAC addresses to move around the network or be assigned to multiple devices.

Note that if the MAC addresses were stored on each port adapter, OIR would not function because you could never replace one port adapter with an identical one; the MAC addresses would always be different. Also, each time a port adapter was replaced, other devices on the network would have to update their data structures with the new address, which, if they did not do so quickly enough, could cause the same MAC address to appear in more than one device at the same time.

---

**Note** Storing the MAC addresses for every slot in one central location means the addresses stay with the memory device on which they are stored.

---

## Online Insertion and Removal

All port adapters in the Cisco 7204 support online insertion and removal (OIR). This function allows you to install and replace port adapters while the router is operating; you do not need to notify the software or shut down the system power.

The following is a functional description of OIR for background information only; for specific procedures for installing and replacing a port adapter in a Cisco 7204 router, refer to the appropriate configuration note.



**Caution** The network processing engine and the I/O controller are required system components that cannot be removed if the router is operating. Removing the network processing engine or the I/O controller while the router is operating will cause the router to shut down or crash, and might damage or destroy memory files.

Each port adapter has a bus connector that connects it to the router's midplane. Each midplane connector has a set of tiered pins in three lengths. The pins send specific signals to the system as they make contact with the port adapter. The system assesses the signals it receives and the order in which it receives them to determine if a port adapter is being removed or inserted into the midplane. From these signals, the system determines whether to reinitialize a new interface or shut down a removed interface. For example, when inserting a port adapter, the longest pins make contact with the port adapter first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them.

## Functional Overview

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When you remove or insert a port adapter in a Cisco 7204 router, the midplane pins send signals to notify the system, which then performs as follows:

- 1 Rapidly scans the midplane for configuration changes.
- 2 Initializes all newly inserted port adapters, noting any removed interfaces and placing them in the administratively shut down state.
- 3 Brings all previously configured interfaces on the port adapter back to the state they were in when they were removed. Any newly inserted interfaces are put in the administratively shut down state, as if they were present (but not configured) at boot time. If a similar port adapter type is reinserted into a slot, its ports are configured and brought on line up to the port count of the original port adapter.

OIR functionality allows you to add, remove, or replace port adapters while the system is on line. This provides a method that is seamless to end users on the network, maintains all routing information, and ensures session preservation.

## Environmental Monitoring and Reporting Functions

Environmental monitoring and reporting functions are controlled by the network processing engine and allow you to maintain normal system operation by identifying and resolving adverse conditions prior to loss of operation. The environmental monitoring functions constantly monitor the internal chassis air temperature and DC supply voltages and currents. Each power supply monitors its own voltage and temperature and shuts itself down if it detects a critical condition within the power supply. If conditions reach shutdown thresholds, the system shuts down to avoid equipment damage from excessive heat. The reporting functions periodically log the values of measured parameters so that you can retrieve them for analysis later, and the reporting functions display warnings on the console if any of the monitored parameters exceed defined thresholds.

### Environmental Monitoring

The environmental monitoring functions use the following levels of status conditions to monitor the system. Four sensors, two on the network processing engine and two on the I/O controller, monitor the temperature of the cooling air as it moves through the chassis. Table 1-7 lists the temperature thresholds for the processor-monitored levels.



Table 1-8 lists the DC power thresholds for the normal, warning, and critical (power supply-monitored) levels.

- Normal—All monitored parameters are within normal tolerances.
- Warning—The system has exceeded a specified threshold. The system will continue to operate, but operator action is recommended to bring the system back to a normal state.
- Critical—An out-of-tolerance temperature or voltage condition exists. The system will continue to operate; however, the system is approaching shutdown. Immediate operator action is required.
- Shutdown—The processor has detected a temperature condition that could result in physical damage to system components and has disabled DC power to all internal components. Requires immediate operator action. All DC power will remain disabled until you toggle the power switch. Before any shutdown, the system logs the status of monitored parameters in NVRAM so you can retrieve it later to help determine the cause of the problem.
- Power supply shutdown—The power supply detected an internal out-of-tolerance overvoltage, overcurrent, or temperature condition and shut itself down. All DC power will remain disabled until you toggle the power switch.

**Table 1-7      Typical Processor-Monitored Temperature Thresholds**

Parameter	High Warning	High Critical	Shutdown
Chassis inlet	104 F (40 C)	122 F (50 C)	–
Chassis outlet 1	109 F (43 C)	127 F (53 C)	136 F (58 C)
Chassis outlet 2	167 F (75 C)	167 F (75 C)	–
Chassis outlet 3	131 F (55 C)	149 F (65 C)	158 F (70 C)

## Functional Overview

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**Table 1-8** Typical Power Supply-Monitored DC-Voltage Thresholds

Parameter	Low Critical	Low Warning	High Warning	High Critical
+3.45V	+3.26V	+3.34V	+3.55V	+3.63V
+5.15V	+4.86V	+4.99V	+5.31V	+5.43V
+12.15V	+11.39V	+11.67	+12.62V	+12.91V
-11.95V	-9.52V	-10.73	-13.16V	-14.38V

If the air temperature exceeds a defined threshold, the system controller displays warning messages on the console terminal and, if the temperature exceeds the shutdown threshold, it shuts down the system. The system stores the present parameter measurements for both temperature and DC voltage in NVRAM, so that you can retrieve them later as a report of the last shutdown parameters.

The power supplies monitor internal power supply temperature and voltages. A power supply is either within tolerance (Normal) or out of tolerance (Critical), as shown in Table 1-8. If an internal power supply temperature or voltage reaches a critical level, the power supply shuts down without any interaction with the system processor.

## Reporting Functions

The Cisco 7204 displays warning messages on the console if chassis interface-monitored parameters exceed a desired threshold. You can also retrieve and display environmental status reports with the **show environment**, **show environment all**, **show environment last** and **show environment table** commands. Parameters are measured and reporting functions are updated every 60 seconds. A brief description of each of these commands follows.



**Caution** To prevent overheating the chassis, ensure that your system is drawing cool inlet air. Overtemperature conditions can occur if the system is drawing in the exhaust air of other equipment. Ensure adequate clearance around the sides of the chassis so that cooling air can flow through the chassis interior unimpeded and exhaust air exits the chassis and is not drawn into the inlet vent of other device.

The **show environment** command display reports the current environmental status of the system. The report displays parameters that are out of the normal values. No parameters are displayed if the system status is normal. The example that follows shows the display for a system in which all monitored parameters are within Normal range:

```
Router# show env

All measured values are normal
```

If the environmental status is *not* normal, the system reports the worst-case status level. Following is an example overvoltage warning:

```
Router# show env

Warning: +3.45 V measured at +3.83 V
```

The **show environment last** command retrieves and displays the NVRAM log, which shows the reason for the last system shutdown (if the shutdown was related to voltage or temperature) and the environmental status at that time. Air temperature is measured and displayed, and the DC voltage supplied by the power supply is also displayed.

Following is sample output of the **show env last** command:

```
Router# show env last

Temperature readings:
  chassis inlet previously measured at 27C/80F
  chassis outlet 1 previously measured at 31C/87F
  chassis outlet 2 previously measured at 37C/98F
  chassis outlet 3 previously measured at 45C/113F

Voltage readings:
  +3.45 V previously measured at +3.51 V
  +5.2 V  previously measured at +5.19 V
  +12.2 V previously measured at +12.42 V
  -12.2 V previously measured at -12.14 V

Reason for last shutdown:
  power supply
```

## Functional Overview

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The **show environment table** command displays the temperature and voltage thresholds for each temperature sensor and for each monitored status level, which are related to those thresholds listed in Table 1-7 and Table 1-8. The display also lists the shutdown threshold for the system.

Following is sample output of the **sh env table** command:

```
Router# show env table

Sample Point      LowCritical  LowWarning  HighWarning  HighCritical
chassis inlet          40C/104F    50C/122F
chassis outlet 1      43C/109F    53C/127F
chassis outlet 2      75C/167F    75C/167F
chassis outlet 3      55C/131F    65C/149F
+3.45 V              +3.26       +3.34       +3.55       +3.63
+5.15 V              +4.86       +4.99       +5.31       +5.43
+12.15 V             +11.39      +11.67      +12.62      +12.91
-11.95 V             -9.52       -10.73      -13.16      -14.38
Shutdown system at 70C/158F
```

---

**Note** Temperature ranges and values are subject to change.

---

The **show environment all** command displays an extended report that includes temperature readings and voltage readings. The **show environment all** command also displays a report showing which power supply slots are occupied and which are empty.

Following is sample of the **sh env all** command:

```
Router# show env all

Power Supplies:
  Power supply 1 is Zytek AC Power Supply. Unit is on.
  Power supply 2 is Zytek AC Power Supply. Unit is on.

Temperature readings:
  chassis inlet      measured at 47C/116F:Temperature in Warning range!
  chassis outlet 1 measured at 49C/120F:Temperature in Warning range!
  chassis outlet 2 measured at 55C/131F
  chassis outlet 3 measured at 65C/149F:Temperature in Warning range!

Voltage readings:
  +3.45 V measured at +3.51 V
  +5.2 V  measured at +5.19 V
  +12.2 V measured at +12.42 V
  -12.2 V measured at -12.14 V
```

## Fan Failures

When the system power is on, all three fans should be operational. The system will continue to operate if a fan fails; however, if the air temperature exceeds a defined threshold, the system controller displays warning messages on the console terminal and, if the temperature exceeds the shut down threshold, it shuts down the system.

If the system does shutdown because the temperature exceeded the shutdown threshold, the system will display the following message on the console screen and in the environment display when the system restarts:

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

For complete descriptions and instructions of the environmental monitor commands, refer to the *Configuration Fundamentals Configuration Guide* and *Configuration Fundamentals Command Reference* publications, which are available on the Cisco Connection Documentation, Enterprise Series CD, or in print.

## Functional Overview

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