Doc. No. 78-1812-05

Fast Ethernet Interface Processor (FEIP) Installation and Configuration

Product Numbers: CX-FEIP-1TX=, CX-FEIP-2TX=, CX-FEIP-1FX=, CX-FEIP-2FX=

This configuration note provides instructions for installing the Fast Ethernet Interface Processor (FEIP) in Cisco 7000 family routers: Cisco 7000, Cisco 7010, Cisco 7505, Cisco 7507 and Cisco 7513. Included are upgrade instructions with specific steps for upgrading the FEIP microcode by downloading a new image. Also included are basic configuration steps and examples for configuring the Fast Ethernet interfaces on a new FEIP, and steps for attaching appropriate interface cables.

This publication includes the following sections:

Note The following section contains important information about software and chassis hardware requirements, and microcode requirements for FEIP-FX functionality. Specifically, refer to the section “Software and Hardware Prerequisites” on page 16.

Caution The FEIP supports online insertion and removal (OIR), which allows you to remove and replace interface processors without first shutting down the system. Online insertion and removal maximizes router availability by letting you add or remove FEIPs during system operation; however, the system may indicate a hardware failure if you fail to follow proper procedures. To help avoid problems with the installation, review the functional description in the section “Online Insertion and Removal—An Overview” on page 18, and follow the FEIP installation and removal steps carefully.

If You Need More Information

The Cisco Internetwork Operating System (Cisco IOS) software running your router contains extensive features and functionality. The effective use of many of many of these features is easier if you have more information at hand. For additional information on configuring and maintaining the Cisco 7000 family routers and FEIP, the following documentation resources are available to you:

- Cisco Connection Documentation, Enterprise Series CD-ROM

  This publication and additional Cisco Systems publications are available on a CD-ROM called Cisco Connection Documentation, Enterprise Series, which is Cisco's online library of product information. The CD-ROM is updated and shipped monthly, so it might be more up to date than printed documentation. To order Cisco Connection Documentation, Enterprise Series CD-ROM, contact a Cisco Sales or Customer Service representative.

- For systems with Cisco IOS Release 10.0 (1) or later, refer to the following publications:
  - *Router Products Configuration Guide*
  - *Router Products Command Reference*
  - *Troubleshooting Internetworking Systems*
- For systems with Cisco IOS Release 11.1(1), a Cisco-approved Release 11.1(1) beta software version, or a later Cisco IOS release, refer to the following modular configuration and modular command reference publications, as appropriate for your configuration:
  - *Configuration Fundamentals Configuration Guide*
  - *Configuration Fundamentals Command Reference*
  - *Wide-Area Networking Configuration Guide*
  - *Wide-Area Networking Command Reference*
  - *Network Protocols Configuration Guide*
  - *Network Protocols Command Reference*
  - *Bridging and IBM Networking Configuration Guide*
  - *Bridging and IBM Networking Command Reference*
  - *Configuration Builder Getting Started Guide*
  - *Troubleshooting Internetworking Systems*
- For hardware installation and maintenance information on the Cisco 7000 family routers, refer to the following publications:
  - *Cisco 7000 Hardware Installation and Maintenance*
  - *Cisco 7010 Hardware Installation and Maintenance*
  - *Cisco 7505 Hardware Installation and Maintenance*
  - *Cisco 7507 Hardware Installation and Maintenance*
  - *Cisco 7513 Hardware Installation and Maintenance*
- To obtain information about documentation, refer the Cisco Connection Documentation, Enterprise Series CD-ROM, to the section "Cisco Connection Online," on page 40, or call Customer Service at 800 553-6387 or 408 526-7208. Customer Service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding company holidays). You can also send e-mail to `cs-rep@cisco.com`. You can also refer to the *Cisco Information Packet* that shipped with your router.

Product Overview

The FEIP provides up to two IEEE 802.3u 100BASE-T ports on two separate Fast Ethernet port adapters. The 100BASE-T interfaces are mounted on port adapters that attach to the FEIP motherboard. Each port adapter has two 100BASE-T interfaces: one RJ-45 and one Media Independent Interface (MII) connection. Only one connection can be used per port adapter. The FEIP uses a Reduced Instructions Set Computing (RISC), Mips 4600 processor for high performance, and has an internal operating frequency of 100 megahertz (MHz) and a 50-MHz system bus interface. The FEIP has 8-megabytes (MB) of dynamic random access memory (DRAM). Each 100BASE-T port on the FEIP has an RJ-45 connector to attach to Category 5 unshielded twisted-pair (UTP) for 100BASE-TX, and a media independent interface (MII) connector that permits connection through external transceivers to multimode fiber for 100BASE-FX, or to Category 3, 4 and 5 UTP or shielded twisted-pair (STP) for 100BASE-T4 physical media. Both full-duplex (FDX) and half-duplex (HDX) are supported. The FEIP is also interoperable with the Catalyst 5000 100BASE-T switch.

IEEE 802.3u 100BASE-T Overview

The term *Ethernet* is commonly used for all carrier sense multiple access/collision detection (CSMA/CD), local area networks (LANs) that generally conform to Ethernet specifications, including IEEE 802.3u. IEEE 802.3u is well suited to applications where a local communication medium must carry sporadic, occasionally heavy traffic at high peak data rates.

Note 100BASE-TX is intended for Environment A, and 100BASE-FX is intended for Environment B.

Stations on a CSMA/CD LAN can access the network at any time. Before sending data, the station *listens* to the network to see if it is already in use. If it is, the station waits until the network is not in use, then transmits; this is half-duplex operation. A collision occurs when two stations listen for network traffic, hear none, and transmit very close to simultaneously. When this happens, both transmissions are damaged, and the stations must retransmit them. The stations detect the collision and use backoff algorithms to determine when they should retransmit. Both Ethernet and IEEE 802.3u are broadcast networks, which means that all stations see all transmissions. Each station must examine received frames to determine whether it is the intended destination and, if it is, pass the frame to a higher protocol layer for processing. IEEE 802.3u specifies the following different physical layers for 100BASE-T:

- 100BASE-TX—100BASE-T, half and full duplex over Category 5 unshielded twisted-pair (UTP), Electronics Industry Association/Telecommunications Industry Association [EIA/TIA]–568-compliant cable
- 100BASE-FX—100BASE-T, half and full duplex over optical fiber
- 100BASE-T4—100BASE-T, half and full duplex over Category 3, 4, or 5 UTP or shielded twisted pair (STP) cabling with four pairs; also called *4T+* or *T2*, which is 2-pair UTP over Category 3 cable.

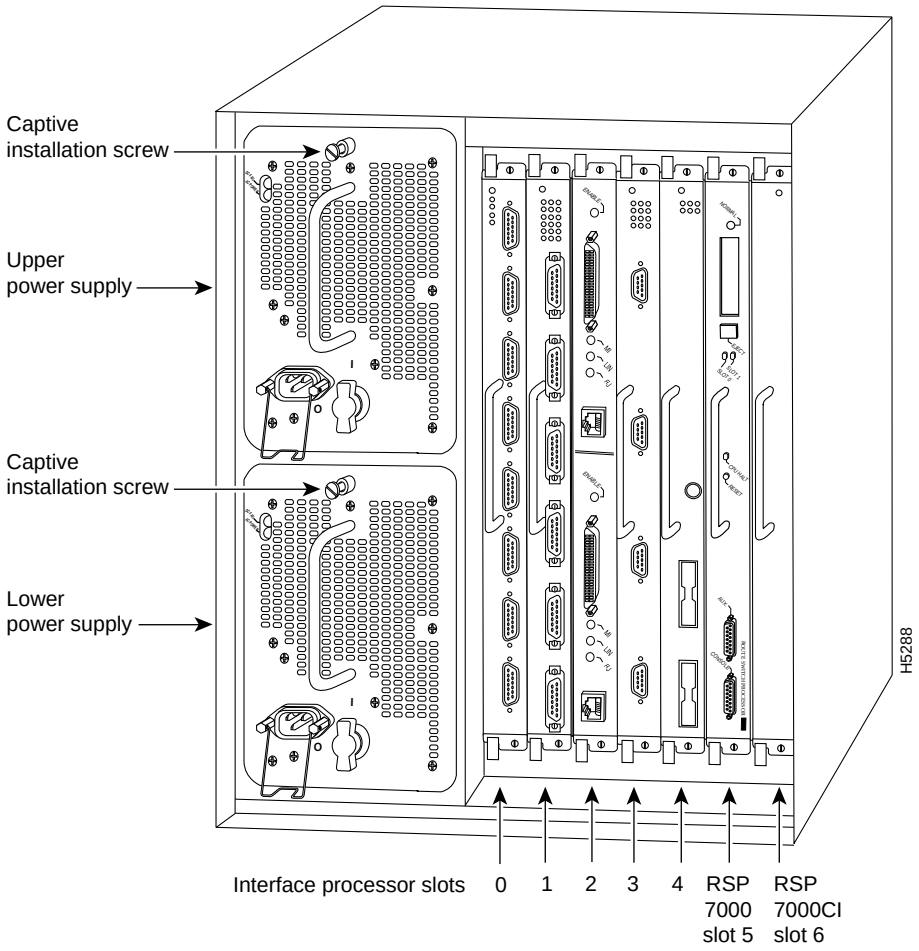
Each physical layer protocol has a name that summarizes it characteristics in the format *speed*/*signaling method*/*segment length* where *speed* is the LAN speed in megabits per second (Mbps), *signalling method* is the signalling method used (either baseband or broadband), and *segment length* is typically the maximum length between stations in meters. Therefore, 100BASE-T specifies a 100-Mbps, baseband LAN, with maximum network segments of 100 meters (or 400 meters for 100BASE-FX).

What Is the Cisco 7000 Series?

The Cisco 7000 series consists of the Cisco 7000 (see Figure 1) and Cisco 7010 (see Figure 2) routers. The FEIP will operate in Cisco 7000 series routers with a Route Processor (RP) and Switch Processor (SP) (or Silicon Switch Processor [SSP]) installed, or with a 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI) installed.

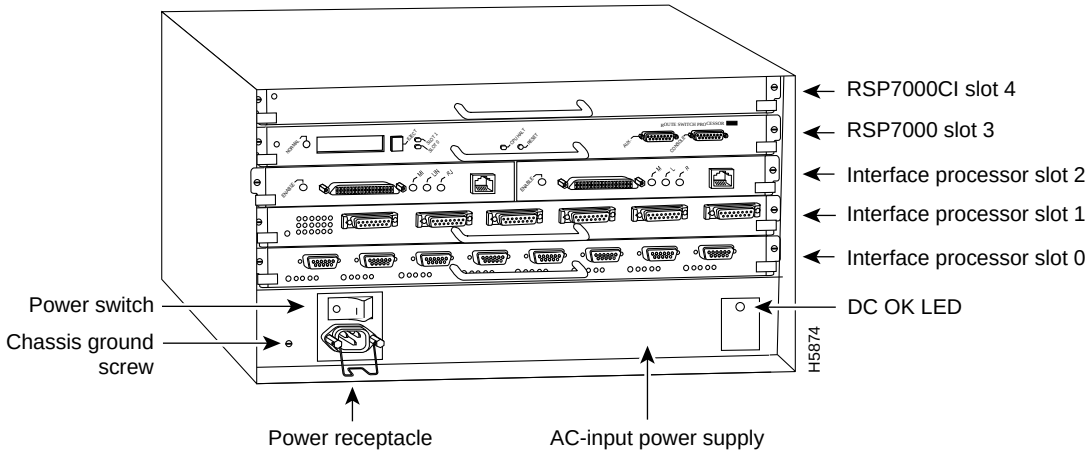
In the Cisco 7000 series routers, network interfaces reside on modular interface processors, including the FEIP, which provide a direct connection between external networks and the high-speed CxBus in the Cisco 7000 series. Chassis slots 0 through 4 are reserved for interface processors, including the FEIP.

Figure 1 Cisco 7000 with RSP7000 and RSP7000CI Installed, Interface Processor End



In the Cisco 7010 (see Figure 2), chassis slots 0 through 2 are reserved for interface processors, including the FEIP.

Figure 2 Cisco 7010 with RSP7000 and RSP7000CI Installed, Interface Processor End



What Is the Cisco 7500 Series?

The Cisco 7500 series consists of the Cisco 7505, Cisco 7507, and Cisco 7513 routers. The FEIP will operate in the Cisco 7500 series routers. Network interfaces reside on modular interface processors, including the FEIP, which provide a direct connection between external networks and the high-speed CyBus in the Cisco 7500 series.

Figure 3, Figure 4, and Figure 5 show the rear of the Cisco 7500 series routers: the five-slot Cisco 7505, the seven-slot Cisco 7507, and the thirteen-slot Cisco 7513, respectively.

In the Cisco 7505 (see Figure 3), one slot (4) is reserved for the Route Switch Processor (RSP1), which contains the system processor and performs packet switching functions. Slots 0 through 3 are for interface processors, including the FEIP.

Figure 3 Cisco 7505, Interface Processor End

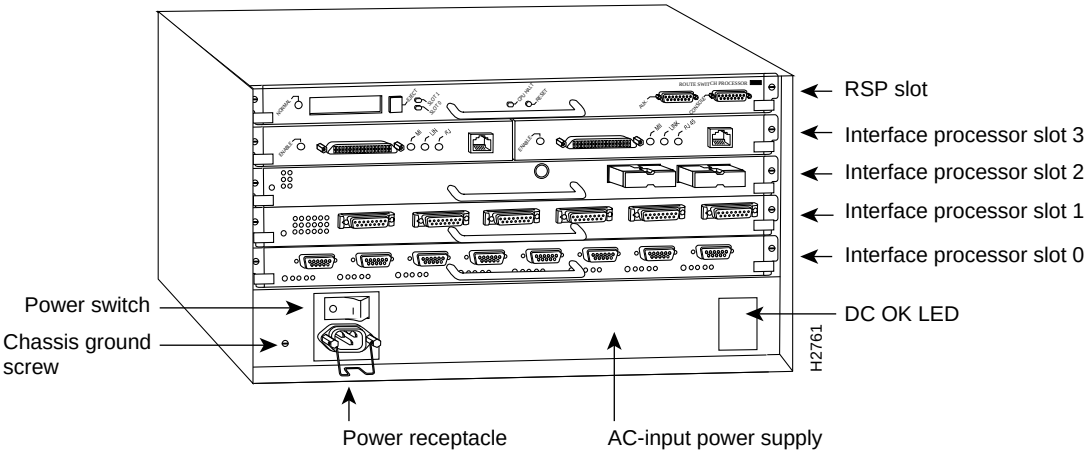


Figure 4 shows the rear of the seven-slot Cisco 7507 router. In the Cisco 7507, up to two slots (2 and 3) are reserved for the Route Switch Processor (RSP2), which contains the system processor and performs packet switching functions. Slots 0 and 1 and 4 through 6 are for interface processors, including the FEIP.

Figure 4 Cisco 7507, Interface Processor End

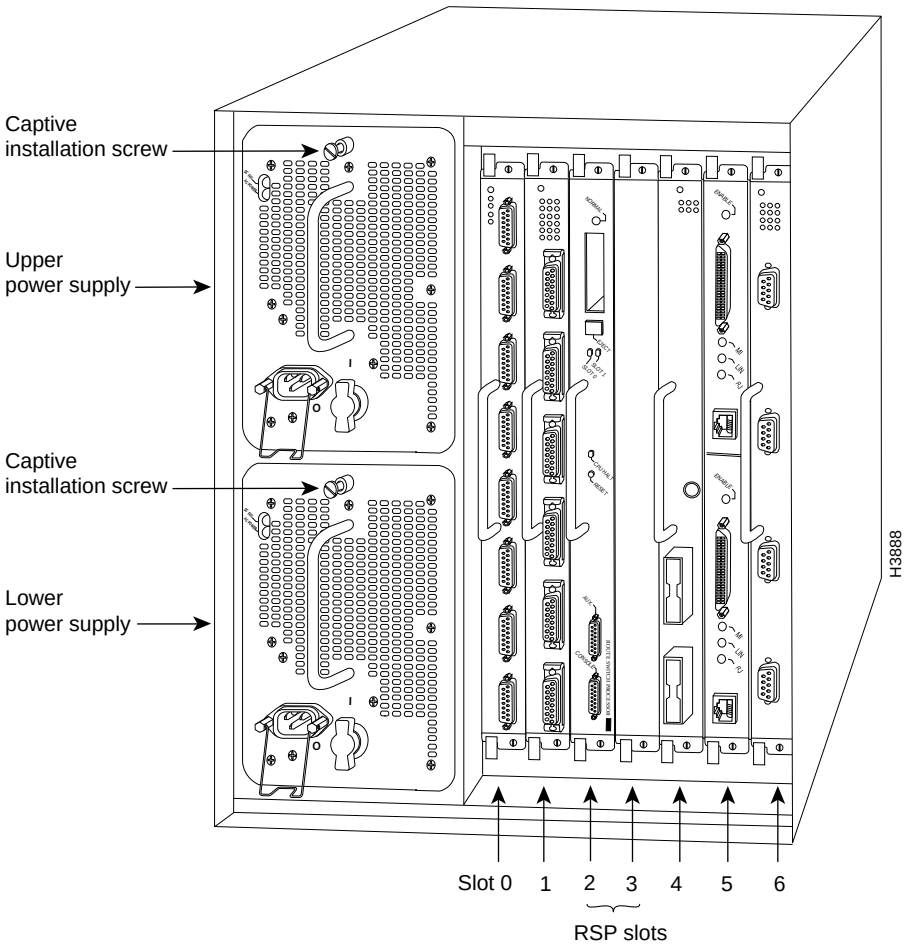
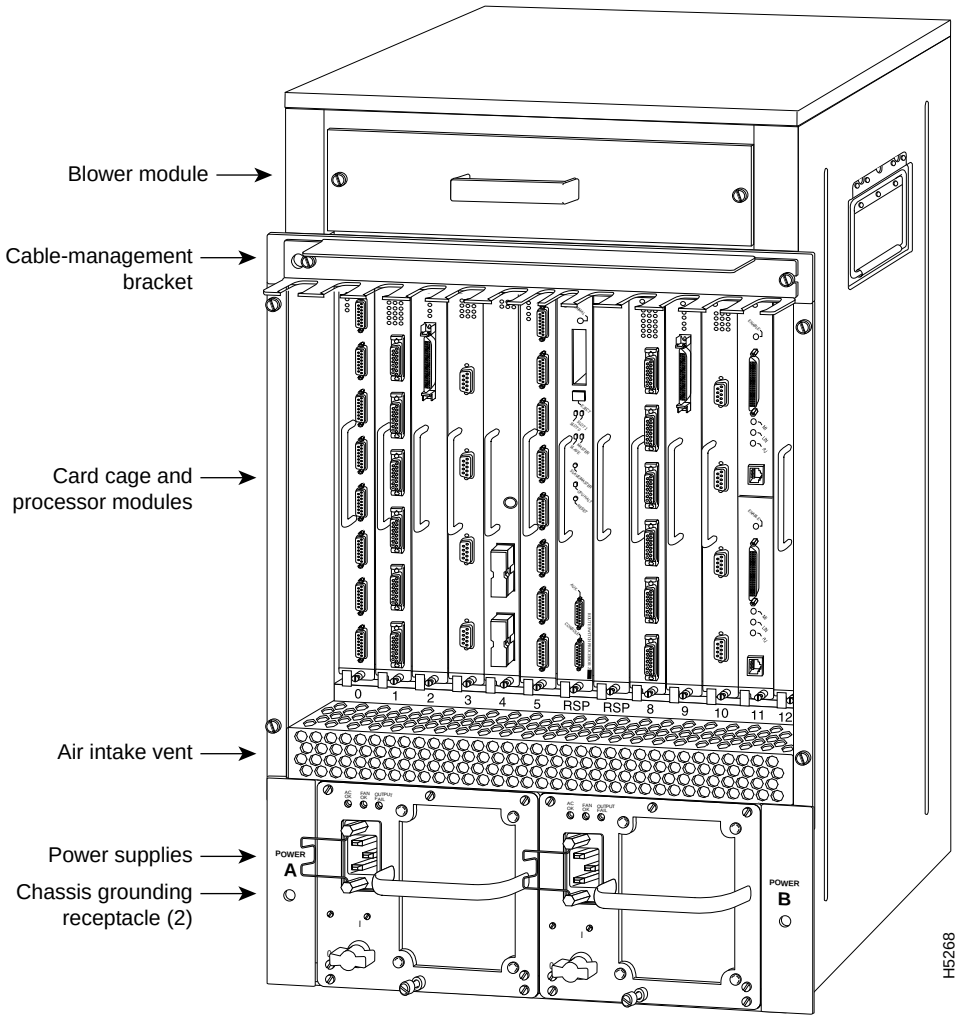


Figure 5 shows the rear of the Cisco 7513 with two AC-input power supplies installed. Two slots (6 and 7) are reserved for the second generation Route Switch Processor (RSP2), which contains the system processor and performs packet switching functions. Slots 0 through 5 and 8 through 12 are for interface processors, including the FEIP.

Figure 5 Cisco 7513, Interface Processor End

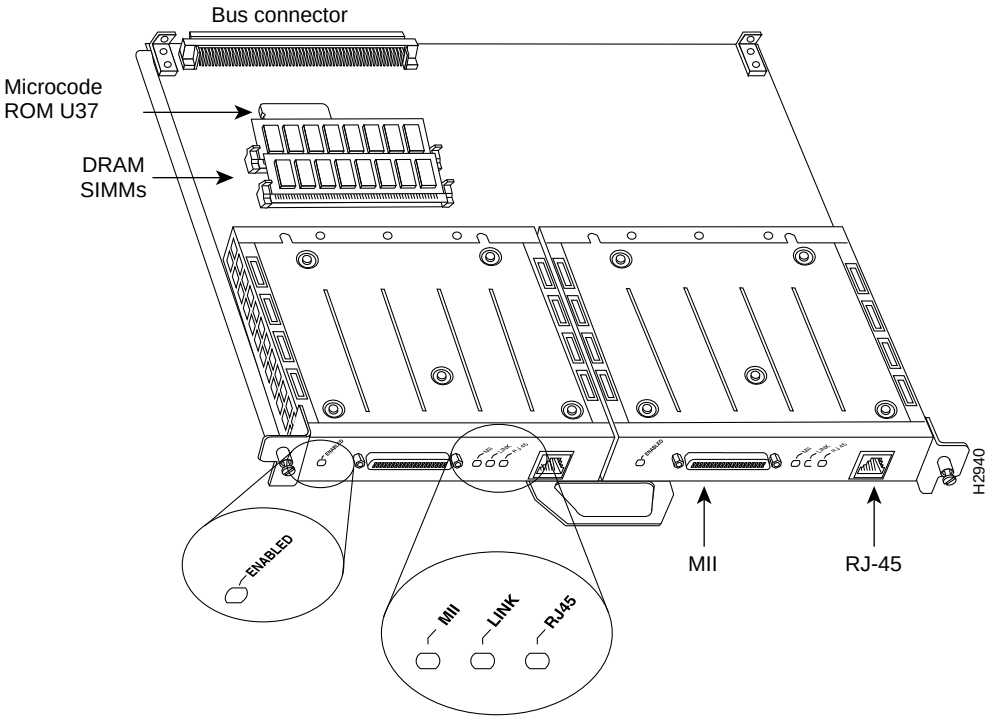


The FEIP and all other interface processors support online insertion and removal (OIR), which allows you to install or remove an FEIP while the system is operating, without shutting down system power.

What Is the FEIP?

The FEIP provides up to two 100-Mbps, 100BASE-TX or 100BASE-FX, Fast Ethernet interfaces. (Figure 6 shows a two-port 100BASE-TX FEIP.) The interfaces on an FEIP can both be configured at 100 Mbps, half duplex or full duplex, for a maximum aggregate bandwidth of 200 Mbps. The FEIP firmware (microcode), which contains card-specific software instructions, resides in a Flash memory device in socket location U37. (See Figure 6.) For pinouts, refer to the section "Fast Ethernet Receptacles, Cables, and Pinouts" on page 12. The standard dynamic random access memory (DRAM) size for the FEIP is 8 megabytes (MB). You can install FEIPs in any available interface processor slots.

Figure 6 Fast Ethernet Interface Processor (Horizontal Orientation Shown)



The FEIP is available in the following four fixed configurations. (An equal sign [=] indicates the FEIP is available as a spare part.)

- CX-FEIP-1TX(=)—FEIP with one 100BASE-TX port adapter in port adapter slot 0
- CX-FEIP-2TX(=)—FEIP with two 100BASE-TX port adapters
- CX-FEIP-1FX(=)—FEIP with one 100BASE-FX port adapter in port adapter slot 0
- CX-FEIP-2FX(=)—FEIP with two 100BASE-FX port adapters

Note Each FEIP is a fixed configuration; therefore, individual port adapters are not available as spare parts and are not field-replaceable or removable. The entire FEIP card is treated as a field-replaceable unit (FRU). Do not attempt to remove an FEIP's port adapter and replace it with another. Do not attempt to install 100BASE-TX and 100BASE-FX port adapters on the same FEIP.

FEIP Port Adapters

The FEIP configured with 1FE-TX or 1FE-FX port adapters provides a 100-Mbps, 100BASE-T Fast Ethernet (FE) interface. Each Fast Ethernet port on the 1FE-TX port adapter has an RJ-45 connector to attach to Category 5 unshielded twisted-pair (UTP) for 100BASE-TX, and a MII connector that permits connection through external transceivers to multimode fiber for 100BASE-FX, or to Category 3, 4, and 5 UTP or shielded twisted-pair (STP) for 100BASE-T4 physical media.

Each Fast Ethernet port on the 1FE-FX port adapter has an SC-type fiber-optic connector for 100BASE-FX, and an MII connector that permits connection through external transceivers to multimode fiber for 100BASE-FX, or to Category 3, 4, and 5 UTP or shielded twisted-pair (STP) for 100BASE-T4 physical media. The 1FE-TX and 1FE-FX port adapters are shown in Figure 7 and Figure 8.

Note The entire FEIP card is treated as a field-replaceable unit (FRU). Do not attempt to remove an FEIP's port adapter and replace it with another. Do not attempt to install 100BASE-TX and 100BASE-FX port adapters on the same FEIP

Figure 7 1FE-TX Port Adapter, Faceplate View

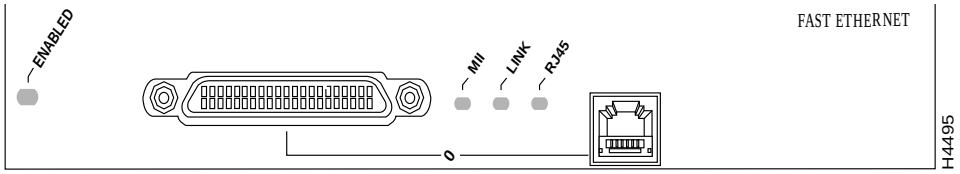
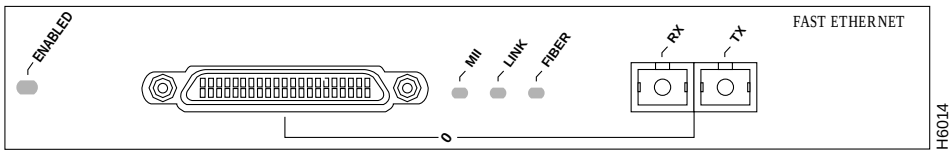


Figure 8 1FE-FX Port Adapter, Faceplate View



FEIP LEDs

The FEIP contains the enabled LED, standard on all interface processors, and a bank of three status LEDs for the ports. After system initialization, the enabled LED goes on to indicate that the FEIP has been enabled for operation. (The LEDs are shown in Figure 9.) The following conditions must be met before the enabled LED goes on:

- The FEIP is correctly connected to the backplane and receiving power
- The FEIP contains a valid microcode version that has been downloaded successfully
- The bus recognizes the FEIP

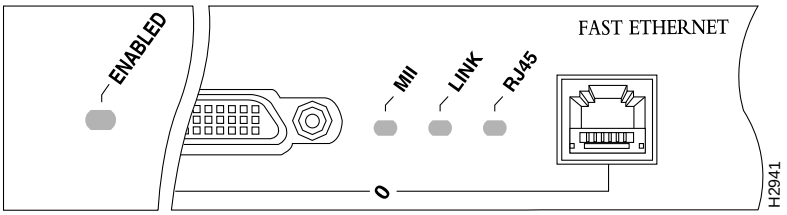
If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on.

The bank of three LEDs indicates the following:

- MII—On when the MII port is selected as the active port by the controller.
- Link—When the RJ-45 or SC port is active, this LED is on when the FEIP is receiving a carrier signal from the network. When the MII port is active, this LED is an indication of network activity, and it flickers on and off proportionally to this activity.
- RJ-45 (or FIBER on the 1FE-FX port adapter)—On when the RJ-45 (or FIBER) port is selected as the active port by the controller.

Either the MII LED *or* the RJ-45 (or FIBER) LED should be on at any one time; never both.

Figure 9 LEDs for the FEIP (Partial Faceplate View)



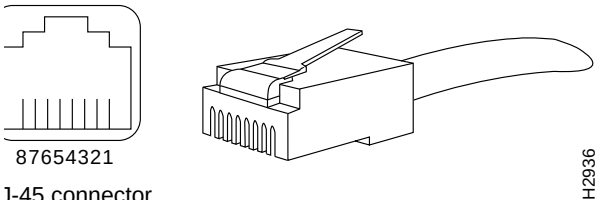
Fast Ethernet Receptacles, Cables, and Pinouts

The two interface receptacles on the FEIP port adapter are a single MII, 40-pin, D-shell type, and a single RJ-45. You can use either one or the other. Only one receptacle can be used at one time. Each connection supports IEEE 802.3u interfaces compliant with the 100BASE-FX and 100BASE-TX standards.

Note 100BASE-TX is intended for Environment A, and 100BASE-FX is intended for Environment B.

The RJ-45 connection does not require an external transceiver. The MII connection requires an external physical sublayer (PHY) and an external transceiver. Figure 10 shows the RJ-45 cable connectors. RJ-45 cables are not available from Cisco Systems, but are available from commercial cable vendors. Table 1 lists the pinouts and signals for the RJ-45 connectors.

Figure 10 RJ-45 Connections (Connector and Plug)



Warning 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. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits. (For translated versions of this warning, refer to the section “SELV Circuit Warning Translations” on page page 39.)

Table 1 RJ-45 Connector Pinout

Pin	Description
1	Receive Data + (RxD+)
2	RxD–
3	Transmit Data + (TxD+)
6	TxD–

Note Referring to the RJ-45 pinout in Table 1, proper common-mode line terminations should be used for the unused Category 5, UTP cable pairs 4/5 and 7/8. Common-mode termination reduces the contributions to electromagnetic interference (EMI) and susceptibility to common-mode sources. Wire pairs 4/5 and 7/8 are actively terminated in the RJ-45, 100BASE-TX port circuitry in the FEIP port adapter.

Depending on your RJ-45 interface cabling requirements, use the pinouts in Figure 11 and Figure 12.

Figure 11 Straight-Through Cable Pinout (Connecting FEIP RJ-45 Interface to a Hub or Repeater)

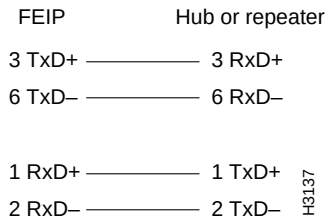


Figure 12 Crossover Cable Pinout (RJ-45 Connections Between Hubs and Repeaters)

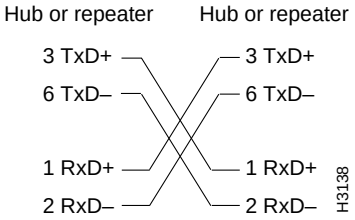


Figure 13 shows the duplex SC connector (one required for both transmit and receive), and Figure 14 shows the simplex SC connector (two required, one for each transmit and receive) used for 1FE-FX optical-fiber connections. These multimode optical-fiber cables are commercially available, and they are not available from Cisco Systems.

Figure 13 1FE-FX Duplex SC Connector

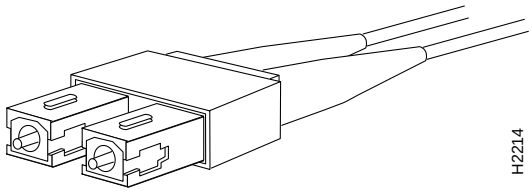
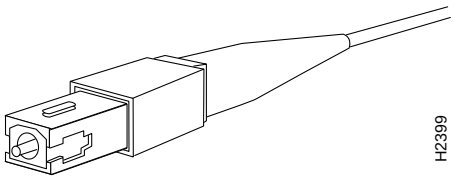


Figure 14 1FE-FX Simplex SC Connector



Depending on the type of media you use between the MII connection on the port adapter and your switch or hub, the network side of your 100BASE-T transceiver should be appropriately equipped: with SC-type or ST-type connectors (for optical fiber), BNC connectors, and so forth. Figure 15 shows the pin orientation of the female MII connector on the port adapter.

The MII receptacle uses 2-56 screw-type locks, called *jackscrews* (shown in Figure 15), to secure the cable or transceiver to the MII port. MII cables and transceivers have knurled thumbscrews (screws you can tighten with your fingers) that you fasten to the jackscrews on the FEIP MII connector. Use the jackscrews to provide strain relief for your MII cable. (The RJ-45 modular plug has strain relief functionality incorporated into the design of its standard plastic connector.) Figure 15 shows the MII connector.

Figure 15 MII Connection (Female)

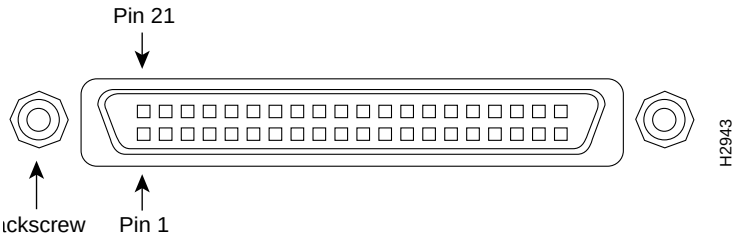


Table 2 lists the MII connector pinout and signals. MII cables are available commercially.

Table 2 MII Connector Pinout

Pin[1]	In	Out	In/Out	Description
14–17	–	Yes	–	Transmit Data (TxD)
12	Yes	–	–	Transmit Clock (Tx_CLK)[2]
11	–	Yes	–	Transmit Error (Tx_ER)
13	–	Yes	–	Transmit Enable (Tx_EN)
3	–	Yes	–	MII Data Clock (MDC)
4–7	Yes	–	–	Receive Data (RxD)
9	Yes	–	–	Receive Clock (Rx_CLK)
10	Yes	–	–	Receive Error (Rx_ER)
8	Yes	–	–	Receive Data Valid (Rx_DV)
18	Yes	–	–	Collision (COL)
19	Yes	–	–	Carrier Sense (CRS)
2	–	–	Yes	MII Data Input/Output (MDIO)
22–39	–	–	–	Common (ground)
1, 20, 21, 40	–	–	–	+5.0 volts (V)

1. Any pins not indicated are not used.
2. Tx_CLK and Rx_CLK are generated by the external transceiver.

Table 3 lists the cabling specifications for 100-Mbps transmission over UTP, STP, and fiber-optic cables. Table 4 lists IEEE 802.3u physical characteristics for 100BASE-FX and 100BASE-TX.

Table 3 Specifications and Connection Limits for 100-Mbps Transmission

Parameter	RJ-45	MII	SC-Type
Cable specification	Category 5[1] UTP[2], 22 to 24 AWG[3]	Category 3, 4, or 5, 150-ohm UTP or STP, or multimode optical fiber	62.5/125 multimode optical fiber
Maximum cable length	–	0.5 m (1.64 ft.) (MII-to-MII cable[4])	–
Maximum segment length	100 m (328 ft.) for 100BASE-TX	1 m (3.28 ft.)[5] or 400 m (1,312 ft.) for 100BASE-FX	100 m (328 ft.)
Maximum network length	200 m (656 ft)[5.] (with 1 repeater)	–	200 m (656 ft)[5.] (with 1 repeater)

1. EIA/TIA-568 or EIA-TIA-568 TSB-36 compliant.
2. Cisco Systems does not supply Category 5 UTP RJ-45 or 150-ohm STP MII cables. Both are available commercially.
3. AWG = American Wire Gauge. This gauge is specified by the EIA/TIA-568 standard.
4. This is the cable between the MII port on the FE port adapter and the appropriate transceiver.
5. This length is specifically between any two stations on a repeated segment.

Table 4 IEEE 802.3u Physical Characteristics

Parameter	100BASE-FX	100BASE-TX
Data rate (Mbps)	100	100
Signaling method	Baseband	Baseband
Maximum segment length (meters)	100 m between repeaters	100 m between DTE[1] and repeaters
Media	SC-type: dual simplex or single duplex for Rx and Tx	RJ-45MII
Topology	Star/Hub	Star/Hub

1. DTE = data terminal equipment.

Microcode Overview

The FEIP microcode provides card-specific software instructions. (See the section “Software and Hardware Prerequisites” page 16.) A Flash memory device in socket U37 of the FEIP contains the default microcode boot image. The router supports downloadable microcode, which enables you to upgrade microcode versions by downloading new microcode images, storing them in Flash memory, and instructing the system to load an image from Flash instead of the default ROM image (the RP runs software from ROM; the RSP1 runs software from Flash only). You can store multiple images for an interface type and, with a configuration command, instruct the system to load any one of them or the default ROM image. All interfaces of the same type (FEIP, HIP, and so on) will load the same microcode image, either from the default ROM image or from a single image stored in Flash. Although multiple microcode versions for a specific interface type can be stored concurrently in Flash, only one image can load at startup. The **show controllers cbus** command displays the currently loaded and running microcode version for the SP and for each interface processor. The **show configuration** EXEC command shows the current system instructions for loading microcode at startup. Software and interface processor microcode images are carefully optimized and bundled to work together. Overriding the bundle can result in system incompatibilities. We recommend that you use the microcode included in the software bundle. For a complete description of microcode and downloading procedures, refer to the section “Upgrading Microcode” on page 35.

Installation Prerequisites

This section provides software and hardware prerequisites, a list of parts and tools you will need to perform the installation, and safety and ESD-prevention guidelines to help you to avoid injury and damage to the equipment. It also provides a detailed description of the OIR function to help you perform online installation successfully and avoid error message and system restarts. If you are installing a new FEIP, be sure to review the equipment descriptions and distance limitations in the section "Fast Ethernet Receptacles, Cables, and Pinouts" on page 12.

Software and Hardware Prerequisites

The FEIP with 100BASE-TX port adapters operates with the CxBus and CyBus and requires that the host Cisco 7000 series router is running Cisco Internetwork Operating System (Cisco IOS) Release 10.3(5), or later, and the host Cisco 7500 series routers are running Cisco IOS Release 10.3(6) or later.

The FEIP with 100BASE-FX port adapters operates with the CxBus and CyBus and requires that the host Cisco 7000 family router is running Cisco Internetwork Operating System (IOS) Release 10.3(13), or later, Release 11.0(10), or later, or Release 11.1(5), or later.

Note The latest FEIP microcode images are available via anonymous File Transfer Protocol (FTP) from `/ftp/feip-fx` at `ftp.cisco.com`. Detailed information about the latest FEIP microcode images can be found in the ASCII file *feip.readme.txt*, which is also available via FTP from `ftp.cisco.com` in the directory `/ftp/feip-fx/`. This ASCII file includes information and instructions on how to get the current FEIP microcode image. To access Cisco IOS images and information located in Cisco Connection Online (CIO), refer to the section "Cisco Connection Online" at the end of this publication.

Caution If you use the FEIP with a single port adapter, you must have the port adapter in slot 0 for the FEIP to function properly. A single port adapter in slot 1 will not be recognized by the system.

Each FEIP is a fixed configuration; therefore, individual port adapters are not available as spare parts and are not field-replaceable or removable. The entire FEIP assembly is treated as a field-replaceable unit (FRU). Do not attempt to remove an FEIP's port adapter and replace it with another. Do not attempt to simultaneously operate 100BASE-TX and 100BASE-FX port adapters on the same FEIP.

List of Parts and Tools

You need the following tools and parts to install or upgrade an FEIP. If you need additional equipment, contact a service representative for ordering information.

- MII Category 3, 4, or 5, STP or UTP cable or Category 5, UTP RJ-45 cable for 100BASE-TX, and MII Category 3, 4, or 5, STP or UTP cable or multimode ST-type optical fiber for 100BASE-FX
- Number 1 Phillips and a 3/16-inch, flat-blade screwdriver
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, FRUs, and spares

Safety

Following are safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

Electrical Equipment

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. A processor module comprises a printed circuit board that is fixed in a metal carrier. Electromagnetic interference (EMI) shielding, connectors, and a handle are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap whenever handling a processor module.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to a captive installation screw on an installed power supply.
- When installing a processor module, use the ejector levers to properly seat the bus connectors in the backplane, then tighten both captive installation screws. (See Figure 16.) These screws prevent accidental removal, provide proper grounding for the system, and help to ensure that the bus connectors are seated in the backplane.

- When removing a processor module, use the ejector levers to release the bus connectors from the backplane. Use the handle to pull the processor module out slowly while keeping your other hand underneath the carrier to guide it straight out of the slot.
- Handle carriers by the handles and carrier edges only; avoid touching the board or connectors.
- Place a removed processor module board-side-up on an antistatic surface or in a static shielding bag. If the component will be returned to the factory, immediately place it in a static shielding bag.
- Avoid contact between the processor module and clothing. The wrist strap only protects the board from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal interface processor carrier.

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms.

Online Insertion and Removal—An Overview

The OIR feature allows you to remove and replace interface processors while the system is operating; you do not need to notify the software or shut down the system power.

Note This section describes the mechanical functions of the system components and emphasizes the importance of following the correct procedures to avoid unnecessary board failures. This section is for background information only; specific procedures for the FEIP follow in the “Installation” section.

Each interface processor contains a male connector with which it connects to the system backplane. Each card (male) connector comprises a set of tiered pins, in three lengths. The pins send specific signals to the system as they make contact with the backplane. The system assesses the signals it receives and the order in which it receives them to determine what event is occurring and what task it needs to perform, such as reinitializing new interfaces or shutting down removed ones.

For example, when inserting an interface processor, the longest pins make contact with the backplane first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them. The system expects to receive signals from the individual pins in this logical sequence, and the ejector levers help to ensure that the pins mate in this sequence.

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

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

The system brings on line only interfaces that match the current configuration and were previously configured as up; all others require that you configure them with the **configure** command.

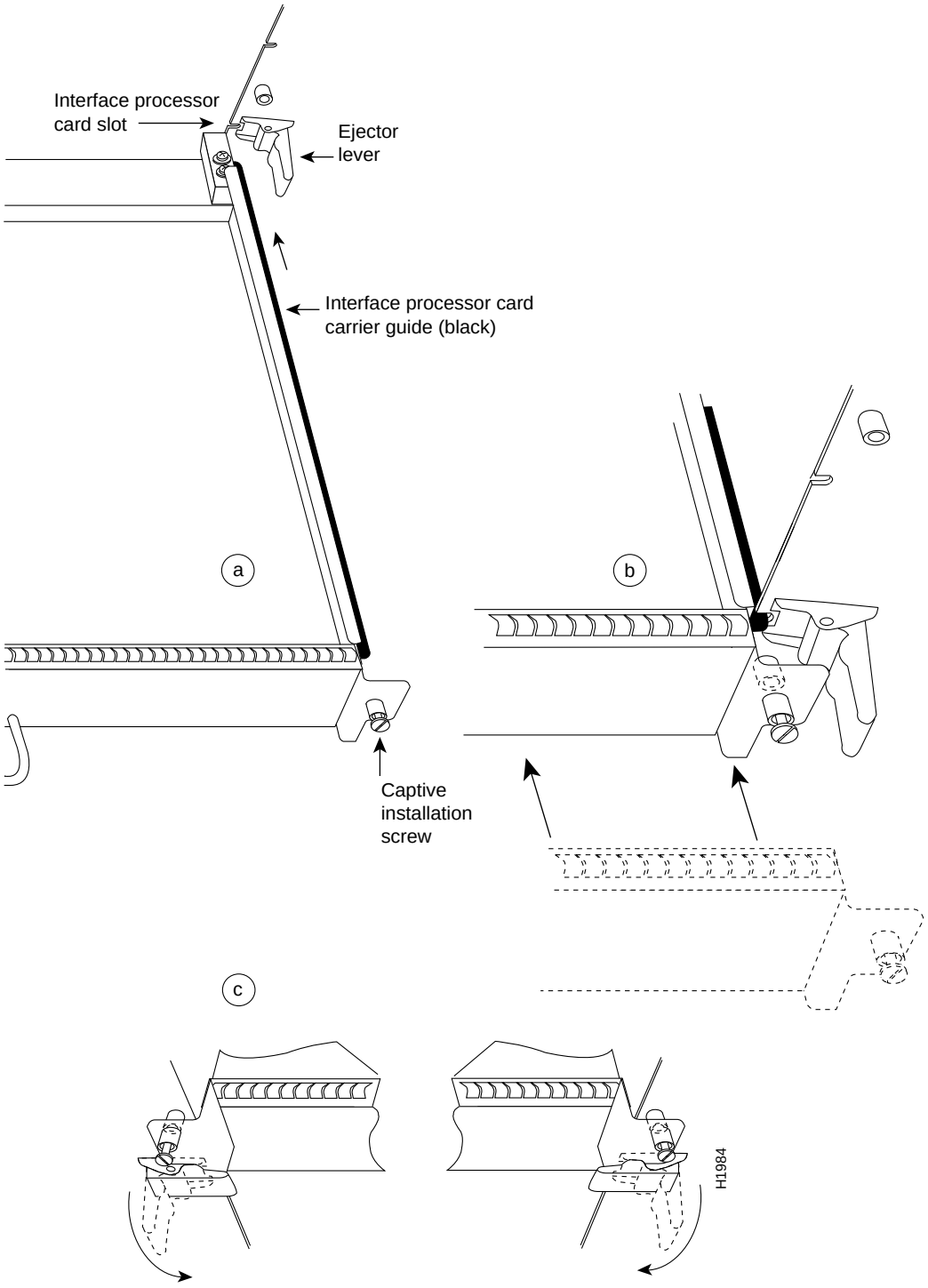
OIR functionality enables you to add, remove, or replace interface processors with the system online, which provides a method that is seamless to end users on the network, maintains all routing information, and ensures session preservation.

The function of the ejector levers (see Figure 16) is to align and seat the card connectors in the backplane. Failure to use the ejector levers and insert the interface processor properly can disrupt the order in which the pins make contact with the backplane. Follow the FEIP installation and removal instructions carefully, and review the following examples of *incorrect* insertion practices and results:

- Using the handle to force the interface processor all the way into the slot can pop the ejector levers out of their springs. If you then try to use the ejector levers to seat the interface processor, the first layer of pins (which are already mated to the backplane) can disconnect and then remate with the backplane, which the system interprets as a board failure.
- Using the handle to force or slam the interface processor all the way into the slot can damage the pins on the board connectors if they are not aligned properly with the backplane.
- When using the handle (rather than the ejector levers) to seat the interface processor in the backplane, you might need to pull the interface processor back out and push it in again to align it properly. Even if the connector pins are not damaged, the pins mating with and disconnecting from the backplane will cause the system to interpret a board failure. Using the ejector levers ensures that the board connector mates with the backplane in one continuous movement.
- Using the handle to insert or remove an interface processor, or failing to push the ejector levers to their fully parallel position, can leave some (not all) of the connector pins mated to the backplane, a state which will hang the system. Using the ejector levers and making sure that they are pushed fully into position ensures that all three layers of pins are mated with (or free from) the backplane.

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

Figure 16 Ejector Levers and Captive Installation Screws on Processor Modules (Horizontal Orientation Shown)



Note The processor modules are oriented horizontally in the Cisco 7010 and Cisco 7505, and vertically in the Cisco 7000, Cisco 7507, and Cisco 7513.

Installation

The following sections describe the procedures for removing or installing an FEIP in the Cisco 7000 series routers or a Cisco 7500 series routers. The functionality is the same for each router model; therefore, the term *the chassis* will be used except where specific model issues arise. The OIR function allows you to install and remove an FEIP without first shutting down the system; however, you must follow the instructions carefully. Failure to insert the FEIP properly can cause system error messages indicating a board failure. For a complete description of OIR, refer to the section "Online Insertion and Removal—An Overview" on page 18.

Each unused interface processor slot contains an interface processor filler (which is an interface processor carrier without an interface board) to keep dust out of the chassis and to maintain proper air flow through the interface processor compartment. If you are installing a new FEIP that is not a replacement, you must first remove the interface processor filler from an unused slot; proceed to the next section "Removing an Interface Processor Filler." If you are replacing an FEIP or upgrading the microcode EPROM on an FEIP, proceed to the section "Removing an FEIP" on page 22.

Caution To avoid erroneous failure messages, remove or insert only one interface processor at a time. Also, after inserting or removing an interface processor, allow at least 15 seconds before removing or inserting another interface processor so that the system can reinitialize and note the current configuration of all interfaces.

Note Each FEIP is a fixed configuration; therefore, individual port adapters are not available as spare parts and are not field-replaceable or removable. The entire FEIP card is treated as a field-replaceable unit (FRU). Do not attempt to remove an FEIP's port adapter and replace it with another. Do not attempt to install 100BASE-TX and 100BASE-FX port adapters on the same FEIP.

Caution If you use the FEIP with a single port adapter, you must have the port adapter in slot 0 for the FEIP to function properly. A single port adapter in slot 1 will not be recognized by the system.

Removing an Interface Processor Filler

Select an unused interface processor slot for the new FEIP and remove the interface processor filler as follows:

Step 1 Use a screwdriver to loosen the captive installation screws on the interface processor filler. (See Figure 16.)

Step 2 Place your thumbs on both ejector levers and simultaneously pull them both outward to release the interface processor filler from the backplane connector (in the opposite direction from that shown in Figure 16c).

Note The processor modules are oriented horizontally in the Cisco 7010 and Cisco 7505, and vertically in the Cisco 7000 and Cisco 7513.

Step 3 Grasp the handle with one hand and pull the filler straight out of the slot, keeping your other hand under the carrier to guide it. (See Figure 17.) Keep the carrier parallel to the backplane.

Step 4 Store the interface processor filler for future use.

To help prevent dust and contaminants from entering the chassis, do not leave the interface processor slot open. Immediately proceed to the section “Installing an FEIP” on page 23.

Removing an FEIP

The FEIP supports OIR; therefore, you need not shut down the interface or the system power when removing an FEIP. If you are replacing a failed FEIP, remove the existing board first, then replace the new FEIP in the same slot. Figure 17 shows proper handling of an interface processor during installation.

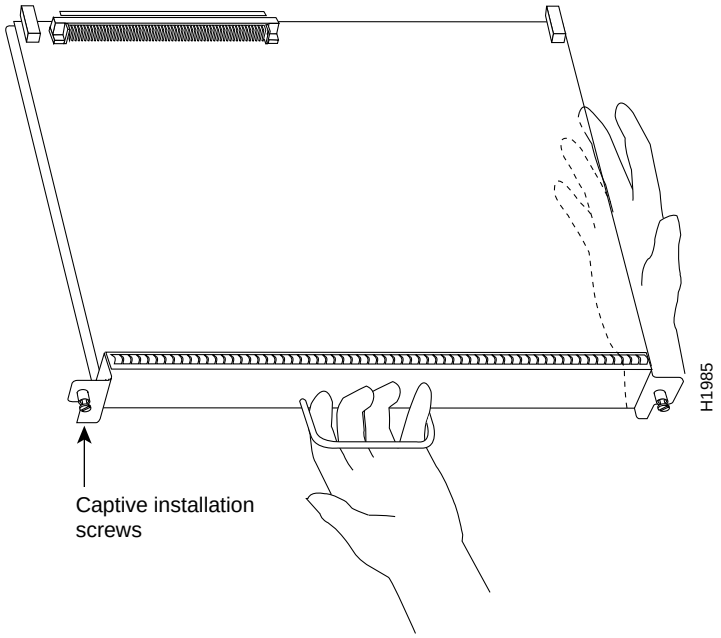
To remove an FEIP, follow these steps:

Step 1 If you are replacing a failed FEIP, disconnect all cables from the FEIP ports; however, if you are only moving an FEIP to another slot, this step is not necessary.

Step 2 Use a screwdriver to loosen the captive installation screws at both ends of the FEIP. (See Figure 16.)

Caution Always use the ejector levers to remove or install the FEIP. Failure to do so can cause erroneous system error messages indicating a board failure.

Figure 17 Handling Processor Modules for Installation and Removal (Horizontal Orientation Shown)



Step 3 Place your thumbs on the ejector levers and simultaneously pull both of the ejectors outward (in the opposite direction from that show in Figure 16c) to release the FEIP from the backplane connector.

Step 4 Use the FEIP handle to carefully pull the FEIP straight out of the slot, keeping your other hand under the carrier to guide it. (See Figure 17.) Keep the FEIP parallel to the backplane.

Step 5 Place the removed FEIP on an antistatic mat or foam pad, or place it in an antistatic bag if you will return it to the factory.

Step 6 If the interface processor slot is to remain empty, install a filler (MAS7K-BLANK) to keep dust out of the chassis and to maintain proper air flow inside the chassis. *Do not* leave the interface processor slot open. Immediately proceed to the section "Installing an FEIP."

Installing an FEIP

The FEIP slides into the open interface processor slot and connects directly to the backplane. The interface processors are keyed to guide pins on the backplane, so the FEIP can be installed only in an interface processor slot. Figure 16 shows the functional details of inserting an interface processor and using the ejector levers. Figure 17 shows proper handling of an interface processor during installation.

Caution Remove or insert only one interface processor at a time. Allow at least 15 seconds for the system to complete its discovery and initialization before removing or inserting another interface processor. Disrupting the sequence before the system has completed verification can cause the system to interpret hardware failures.

Follow these steps to install an FEIP:

Step 1 Ensure that the console terminal is connected to the console port and that your console is turned ON.

Step 2 Hold the FEIP handle with one hand and place your other hand under the carrier to support the FEIP and guide it into the slot. (See Figure 17.) Avoid touching the card or any connector pins.

Caution To prevent ESD damage, handle interface processors by the handles and carrier edges only.

Note The processor modules are oriented horizontally in the Cisco 7010 and Cisco 7505, and vertically in the Cisco 7000, Cisco 7507, and Cisco 7513.

Step 3 Place the back of the FEIP in the slot and align the notch on the carrier with the groove in the slot. (See Figure 16.)

Step 4 While keeping the FEIP parallel to the backplane, carefully slide it into the slot until the back of the faceplate makes contact with the ejector levers, then *stop*. (See Figure 16b.)

Caution Always use the ejector levers when installing or removing processor modules. A module that is partially seated in the backplane will cause the system to hang and subsequently crash, and shoving or slamming the interface processor into the slot can damage the backplane and connector pins.

Step 5 Using your thumbs, simultaneously push both ejector levers inward until the FEIP is pushed entirely into its slot. (See Figure 16c.)

Step 6 Tighten both of the captive installation screws.

Attaching FE Port Adapter Interface Cables

On a single FE port adapter, you can use *either* the RJ-45 (or SC for 1FE-FX) connection *or* the MII connection. If you have two FE port adapters on your FEIP, you can use the RJ-45 (or SC for 1FE-FX) connection on one port adapter and the MII connection on the other port adapter.

Note RJ-45, SC, and MII cables are not available from Cisco Systems; they are available from outside commercial cable vendors.

Connect RJ-45, SC (1FE-FX), or MII cables as follows:

Step 1 If you have MII connections, attach an MII cable directly to the MII port on the FE port adapter or attach a 100BASE-T transceiver, with the media appropriate to your application, to the MII port on the FE port adapter. (See Figure 18 for 1FE-TX or Figure 19 for 1FE-FX.)

Figure 18 Connecting 1FE-TX MII or RJ-45 Cables (Horizontal Orientation)

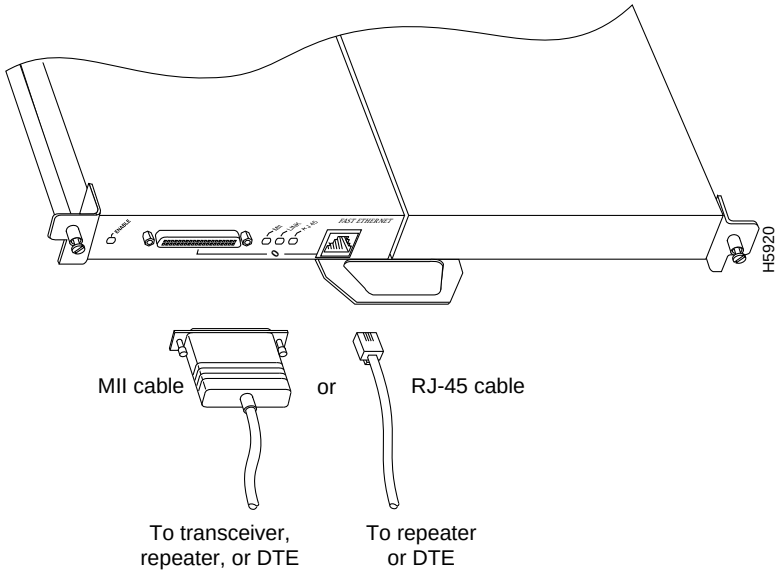
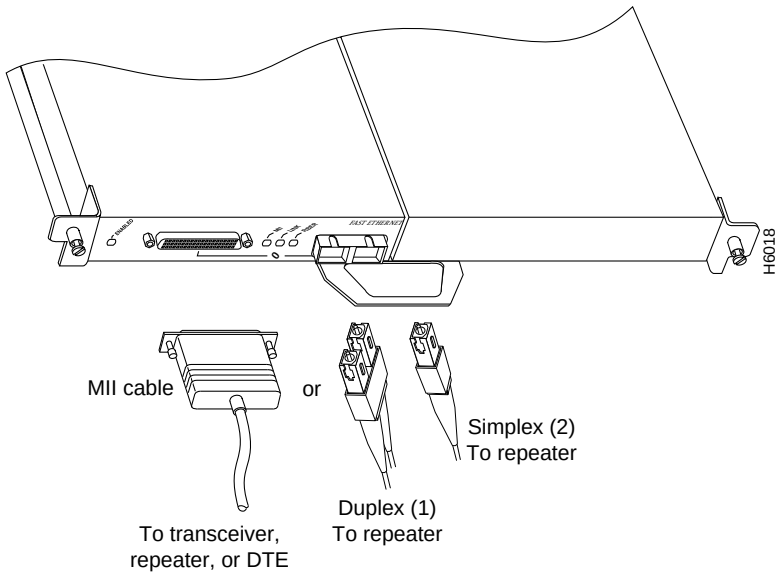


Figure 19 Connecting 1FE-FX MII or SC Cables (Horizontal Orientation)



If you have RJ-45 connections, attach the Category 5 UTP cable directly to the RJ-45 port on the FE port adapter. (See Figure 18 for 1FE-TX or Figure 19 for 1FE-FX.) The FE port adapter is an end station device and not a repeater. You *must* connect the FE port adapter to a repeater or hub.

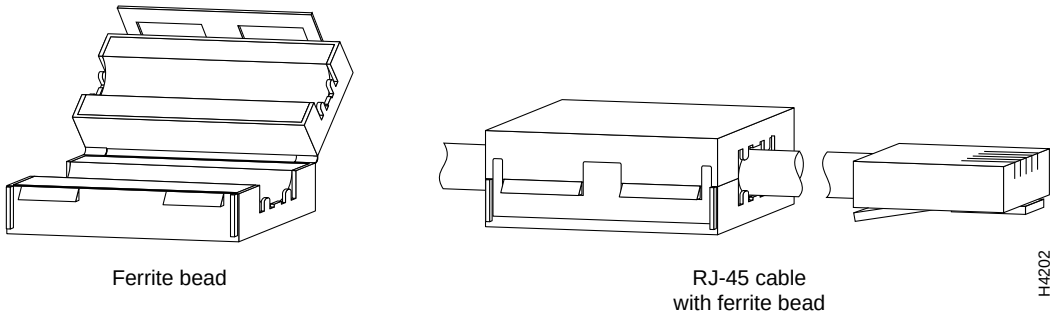
If you have SC connection (1FE-FX port adapter), attach the cable directly to the SC port on the 1FE-FX port adapter. (See Figure 19.) Use either one duplex SC connector, or two simplex SC connectors, and observe the correct relationship between the receive (RX) and transmit (TX) ports on the 1FE-FX port adapter and your repeater.

Note Each Fast Ethernet port adapter can have *either* an MII attachment or an RJ-45 (or SC) attachment, but not both simultaneously. The MII and RJ-45 (or SC) receptacles represent two physical connection options for *one* Fast Ethernet interface.

Step 2 For the 1FE-TX, attach the ferrite bead to the RJ-45 cable (at either end), as shown in Figure 20.

Caution The ferrite bead prevents electromagnetic interference (EMI) from affecting the FEIP system and is a required component for proper system operation.

Figure 20 Attaching the Ferrite Bead around the RJ-45 Cable



Caution To prevent problems on your FEIP and network, do not simultaneously connect RJ-45 (or SC) *and* MII cables to one 100BASE-T port adapter. On a single 100BASE-T port adapter, only one network connection can be used at one time. Only connect cables that comply with EIA/TIA-568 standards. (Refer to Table 3 on page 15 and Table 4 on page 15 for cable recommendations and specifications.)

Step 3 Attach the network end of your RJ-45 (or SC) or MII cable to your 100BASE-T transceiver, switch, hub, repeater, DTE, or other external 100BASE-TX or 10BASE-FX equipment.

This completes the FEIP installation. Proceed to the section “Checking the Installation.”

Checking the Installation

After you install the FEIP and connect cables, verify the installation by observing the LED states and the console display. When the system has reinitialized all interfaces, the enabled LED on the FEIP and on all interface processors should go on. One or the other of the MII and RJ-45 LEDs should be on, depending on your connection, and the link LED should be on if the FEIP is receiving a carrier signal from the network.

The console screen will also display a message as the system discovers each interface during its reinitialization.

When you remove and replace interface processors, the system provides status messages on the console screen. The messages are for information only.

The following sample display shows the events logged by the system as an FEIP was removed from slot 1; the system then reinitialized the remaining interface processors and marked as *down* the Fast Ethernet interfaces on the FEIP that was removed from slot 2. When a new FEIP was reinserted, the system automatically brought up the interfaces that were up when the FEIP was removed.

```
Router#

%OIR-6-REMCARD: Card removed from slot 1, interfaces disabled
%LINK-5-CHANGED: Interface FastEthernet2/0, changed state to administratively down
%LINK-5-CHANGED: Interface FastEthernet2/1, changed state to administratively down

Router#

%OIR-6-INSCARD: Card inserted in slot 1, interfaces administratively shut down
%LINK-5-CHANGED: Interface FastEthernet2/0, changed state to up
%LINK-5-CHANGED: Interface FastEthernet2/1, changed state to up
```

When a new FEIP is inserted or when an FEIP is moved to a new slot, the system recognizes the new Ethernet interfaces, but leaves them in a *shutdown* state until you configure them and change their state to *up* with the **configure** command.

The following example display shows the events logged by the system as a new FEIP is inserted in slot 3:

```
Router#

%OIR-6-INSCARD: Card inserted in slot 3, interfaces administratively shut down
%LINK-5-CHANGED: Interface FastEthernet3/0, changed state to administratively down
%LINK-5-CHANGED: Interface FastEthernet3/1, changed state to administratively down
```

Verify that the FEIP is installed correctly as follows:

Step 1 While the system reinitializes each interface, observe the console display messages and verify that the system discovers the FEIP as follows:

- If you installed a new FEIP, the system should recognize all new Fast Ethernet interfaces but leave them configured as *down*.
- If you replaced an FEIP, the system should recognize each interface and place it in the same state (*up* or *down*) each was in when you removed the FEIP.

Step 2 When the reinitialization is complete, verify that the enabled LED on the FEIP goes on and remains on. If it does, proceed to Step 5. If it does not, proceed to the next step.

Step 3 If the enabled LED on the FEIP fails to go on, suspect that the FEIP board connector is not fully seated in the backplane. Loosen the captive installation screws, then firmly push both ejector levers into place until they are approximately in the same orientation as the FEIP faceplate. Tighten the captive installation screws. After the system reinitializes the interfaces, the enabled LED on the FEIP should go on. If it does, proceed to Step 5. If it does not, proceed to Step 4.

Step 4 If the enabled LED still fails to go on, remove the FEIP and try installing it in another available interface processor slot.

- If the enabled LED goes on when the FEIP is installed in the new slot, suspect a failed backplane port in the original interface processor slot.
- If the enabled LED still fails to go on, but other LEDs on the FEIP go on to indicate activity, proceed to Step 5 to resume the installation checkout and suspect that the enabled LED on the FEIP has failed.
- If no LEDs on the FEIP go on, suspect that the FEIP is faulty.
- If the enabled LED still does not go on, do not proceed with the installation. Contact a service representative to report the problem and obtain further instructions. Instructions for obtaining technical assistance are provided at the end of this publication.

Step 5 If the FEIP is new and not a replacement, proceed to the section "Configuring the Interfaces" on page 29, to configure the new interfaces. (This does not have to be done immediately, but new interfaces will not be available until you configure them.)

Step 6 If this installation was a replacement FEIP, use the **show interfaces** or **show controllers cbus** command to verify the status of the interfaces. (Refer to the section "Using the configure Command—Descriptions and Examples" on page 32.) If you replaced an FEIP with a new FEIP with a greater number of ports (for example, if you replaced a one-port FEIP with a two-port FEIP), the system will recognize the first interface, but will not recognize the additional interface. The new interface will remain in the shutdown state until you configure it.

Step 7 When the interfaces are up, check the activity of each interface by observing the status LEDs, which are described in the section "FEIP LEDs" on page 11.

Step 8 If the MII or RJ-45 LED fails to go on and a cable is connected to the port, check the cable connection and make certain it is properly seated in the connector.

Step 9 If the link LED fails to go on and you are certain that the interface is (verifiably) operating correctly, the LED has probably failed. The link LED goes on only when a carrier signal has been detected and received by the FEIP.

If an error message is displayed on the console terminal, refer to the *System Error Messages* publication for error message definitions. If you experience other problems that you are unable to solve, contact a service representative for assistance.

This completes the FEIP installation. If you installed a new FEIP or if you installed a replacement FEIP with an additional port, you must now configure the new interface as described in the following section.

Configuring the Interfaces

If you installed a new FEIP or if you want to change the configuration of an existing interface, you must enter the Configuration mode. If you replaced an FEIP that was previously configured, the system will recognize the new FEIP interfaces and bring them up in their existing configuration.

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

- Protocols you plan to route on each new interface
- Internet protocol (IP) addresses if you will configure the interfaces for IP routing
- Whether the new interfaces will use bridging

For a summary of the configuration options available and instructions for configuring the interfaces on the FEIP, and depending on the Cisco IOS running on your system, refer to the appropriate software configuration publications listed in the section "If You Need More Information" on page 2.

Note The **configure** command requires privileged-level access to the EXEC command interpreter, which usually requires a password. Contact your system administrator if necessary to obtain EXEC-level access. The interfaces on an FEIP can both be configured at 100 Mbps, half duplex or full duplex, for a maximum aggregate bandwidth of 200 Mbps.

Using the EXEC Command Interpreter

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

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

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

```
Router> enable
Password:
```

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

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

```
Router#
```

Step 4 Proceed to the following section, "Selecting Chassis Slot, Port Adapter, and Fast Ethernet Interface Port Numbers," to configure the new interfaces.

Selecting Chassis Slot, Port Adapter, and Fast Ethernet Interface Port Numbers

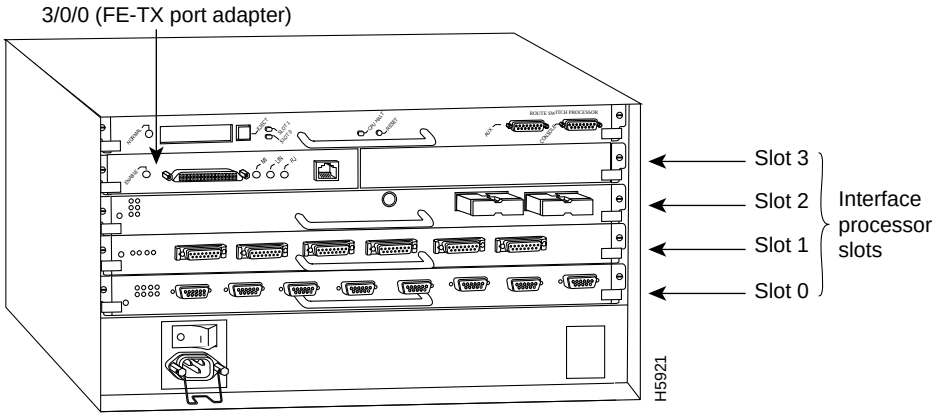
In the router, physical port addresses specify the actual physical location of each interface port on the router interface processor end. (See Figure 21.) For the FEIP, the address is composed of a three-part number in the format *slot//port adapter/port number,* as follows:

- The first number identifies the chassis slot in which the interface processor is installed.
- The second number indicates the port adapter slot in which the port adapter is installed. Port adapter slots are designated 0 and 1.
- The third number identifies the physical port number on the interface processor. The ports on each interface processor are numbered sequentially beginning with the port 0.

Interface ports maintain the same address regardless of whether other interface processors are installed or removed. However, when you move an interface processor to a different slot, the first number in the address changes to reflect the new slot number. For example, on the one-port FEIP in chassis slot 3 (shown in Figure 21), the address of the Fast Ethernet port is 3/0/0: chassis slot 3, port adapter slot 0, and interface 0. If you remove the FEIP from chassis slot 3 and install it in slot 2, the address of the Fast Ethernet port becomes 2/0/0.

Note Although the processor slots in the Cisco 7000, Cisco 7507, and Cisco 7513 are vertically oriented and those in the Cisco 7010 and Cisco 7505 are horizontally oriented, all models use the same method for slot and port numbering. (Refer to Figure 1, Figure 2, Figure 3, Figure 4, or Figure 5 for interface processor slot orientation in your chassis.)

Figure 21 Interface Port Numbers Examples (Cisco 7505 Shown)



Note: The MII and RJ-45 interface ports on the first port adapter are both numbered as interface port 0. Only one of them can be used on each port adapter, at one time.

Note FEIP interface port numbers are always 0. Fast Ethernet interfaces can be numbered from 0 through 1 because FEIPs support up to two 100BASE-T port adapters per FEIP card. The MII and RJ-45 (or SC) ports on a port adapter each have the same port number because only one of them can be used at one time.

You can identify interface ports by physically checking the slot/port location on the rear of the router or by using software commands to display information about a specific interface or all interfaces in the router. To display information about every interface, use the **show interfaces** command (*interfaces* is plural) without variables. To display information about a specific interface, use the **show interfaces** command with the interface type and port address in the format **show interfaces** [*type slot/port*]. If you abbreviate the command (**sho int**) and do not include variables, the system interprets the command as **show interfaces** and displays the status of all interfaces.

Following is an example of how the **show interfaces** command displays status information (including the physical slot and port address) for each interface in the router. In this example, most of the status information for each interface is omitted.

```
Router# show int

FastEthernet3/0/0 is up, line protocol is up
  Hardware is cxBus FastEthernet, address is 0000.0c03.4a3b (bia 0000.0c03.4a3b)

  (additional display text omitted)
```

You can also use arguments such as the interface type (fastethernet, and so forth) and the port number (slot/port) to display information about a specific interface only. The following example of the **show interfaces fastethernet** command shows information specific to the FEIP port in chassis slot 3:

```
Router# show interfaces fastethernet 3/0/0
FastEthernet3/0/0 is administratively down, line protocol is down
  Hardware is cxBus FastEthernet, address is 0000.0c35.dc16 (bia 0000.0c35.dc16)
  Internet address is 1.1.0.64 255.255.0.0
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive not set, hdx, MII
  ARP type: ARPA, ARP Timeout 4:00:00
  Last input never, output 2:03:52, output hang never
  Last clearing of "show interface" counters never
  Output queue 0/40, 0 drops; input queue 0/75, 1 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 watchdog, 0 multicast
     0 input packets with dribble condition detected
     5 packets output, 805 bytes, 0 underruns
     0 output errors, 0 collisions, 4 interface resets, 0 restarts
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

For complete command descriptions and instructions, refer to the software configuration publications listed in the section “If You Need More Information” on page 2.

Using the configure Command—Descriptions and Examples

Following are descriptions and examples of the commands for configuring the FEIP interface 3/0/0 (chassis slot 3, port adapter 0, interface port 0). Configuring other FEIP interfaces is identical except that the chassis slot and port adapter slot numbers will change accordingly.

Descriptions are limited to fields that are relevant for establishing and verifying the configuration. After configuring the new FEIP interface, use **show** commands to display the status of the new interface or all interfaces, or to verify changes you have made.

Depending on the requirements for your system configuration and the protocols you plan to route on the interface, you might also need to enter other configuration subcommands. For complete descriptions of configuration subcommands and the configuration options available for Fast Ethernet interfaces, refer to the publications listed in the section "If You Need More Information" on page 2.

FEIP half-duplex operation is the default. To change to full-duplex operation, use the following series of commands:

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

Router(config)# interface fastethernet 3/0/0
Router(config-if)# full-duplex
Ctrl-z
Router#
```

Using the **show interfaces fastethernet 3/0/0** command, you can see that the Fast Ethernet interface is now configured for full-duplex operation, as follows:

```
Router# sh int fa 3/0/0
FastEthernet3/0/0 is administratively down, line protocol is down

  (display text omitted)
  Encapsulation ARPA, loopback not set, keepalive not set, fdx, 100BaseTX
  (display text omitted)
```

To return the interface to half-duplex operation, use the **no full-duplex** configuration command as follows:

```
Router# config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# int fa 3/0/0
Router(config-if)# no full
Ctrl-z
Router#
```

Using the **show interfaces fastethernet 3/0/0** command, you can see that the Fast Ethernet interface is now configured for half-duplex operation, as follows:

```
Router# sh int fa 3/0/0
FastEthernet3/0/0 is administratively down, line protocol is down

  (display text omitted)
  Encapsulation ARPA, loopback not set, keepalive not set, hdx, 100BaseTX
  (display text omitted)
```

The RJ-45 connection is the default for 1FE-TX (or SC for 1FE-FX). To change to an MII connection and then verify it, use the following series of commands, including the **media-type** configuration command:

```
Router# config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# int fa 3/0/0
Router(config-if)# media-type mii
Ctrl-z
Router#

Router# sh int fa 3/0/0
FastEthernet3/0/0 is administratively up, line protocol is up

  (display text omitted)

  Encapsulation ARPA, loopback not set, keepalive not set, hdx, MII

  (display text omitted)
```

Use the **media-type 100** configuration command to return the interface to its default state for RJ-45 or SC (fiber-optic) connections.

The **show version** command displays the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images. Following is an example of the **show version** command used with a Cisco 7000 series system:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (GS7-K-M), Version 10.3(5)
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Wed 10-May-95 21:15 by mpo
Image text-base: 0x00001000, data-base: 0x005FE99C

ROM: System Bootstrap, Version 5.3(1), SOFTWARE
ROM: GS Software (GS7-K-M), Version 10.3(5), RELEASE SOFTWARE

Router uptime is 2 hours, 3 minutes
System restarted by reload
System image file is "gs7-k-m", booted via tftp from 1.1.1.2

RP (68040) processor with 16384K bytes of memory.
G.703/E1 software, Version 1.0.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Bridging software.
1 Silicon Switch Processor.
1 EIP controller (6 Ethernet).
1 FEIP controller (1 Fast Ethernet).
6 Ethernet/IEEE 802.3 interfaces.
1 FastEthernet/IEEE 802.3 interfaces.
128K bytes of non-volatile configuration memory.
4096K bytes of flash memory on embedded flash (in RP1).
Configuration register is 0x0
```

The **show controllers cbus** command displays the internal status of each interface processor, including the slot location, the card hardware version, and the currently running microcode version. It also lists each interface (port) on each interface processor including the logical interface number, interface type, physical (slot/port adapter/port) address, and hardware (station address) of each interface. This example shows an FEIP installed in interface processor slot 3:

```
Router# show controllers cbus

(display text omitted)
 FEIP 3, hardware version 2.0, microcode version 10.0
  Interface 32 - FastEthernet3/0/0, station addr 0000.0c02.d0cc (bia 0000.0c02.d0cc)
    18 buffer RX queue threshold, 25 buffer TX queue limit, buffer size 1520
    ift 0000, rql 18, tq 0000 0000, tql 25
    Transmitter delay is 0 microseconds

(display text omitted)
```

The **show configuration** command displays the contents of the system configuration file stored in NVRAM. This file should reflect all new configuration changes you made and wrote to memory with the **copy running-config startup-config** or **write memory** commands, depending on the version of Cisco IOS running on your router.

```
Router# show config

Using 1652 out of 130048 bytes
version 10.3(5)
!
hostname Router
!
enable-password hello
!
microcode FEIP flash feip10-0
microcode reload
(display text omitted)
!
interface FastEthernet3/0/0
ip address 1.1.1.1 255.255.255.248
ip route-cache cbus
(display text omitted)
```

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

```
Router# show protocols

Global values:
  Internet Protocol routing is enabled
FastEthernet3/0/0 is up, line protocol is up
(display text omitted)
```

Verifying FEIP Status Using show Commands

The following procedure describes how to use the **show** commands to verify that the new interfaces are configured correctly:

Step 1 Use the **show version** command to display the system hardware configuration. Ensure that the list includes the new Fast Ethernet interfaces.

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

Step 3 Specify one of the new FEIP interfaces with the **show interface fastethernet** *slot/port adapter/port* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 4 Display the protocols configured for the entire system and specific interfaces with the command **show protocols**. If necessary, return to the Configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 5 Display the entire system configuration file with the **show configuration** command. Verify that the configuration is accurate for the system and each interface.

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

This completes the configuration procedure for new FEIP interfaces.

Reference Information

Following is general information on upgrading microcode, translated safety warnings, and obtaining technical information and assistance.

Upgrading Microcode

The Cisco 7000 series and the Cisco 7500 series routers support downloadable microcode, which enables you to upgrade microcode versions without having to physically replace the microcode Flash memory device on the board. You can download new microcode versions and store multiple versions in Flash memory, and you can boot from them just as you can with the system software images.

Note The latest FEIP microcode images are available via anonymous File Transfer Protocol (FTP) from `/ftp/feip-fx` at `ftp.cisco.com`. Detailed information about the latest FEIP microcode images can be found in the ASCII file *feip.readme.txt*, which is also available via FTP from `ftp.cisco.com` in the directory `/ftp/feip-fx/`. This ASCII file includes information and instructions on how to get the current FEIP microcode image.To access Cisco IOS images and information located in Cisco Information Online (CIO), refer to the section “Cisco Connection Online” at the end of this publication.

System software upgrades may also contain upgraded microcode images, which will load automatically when the new software image is loaded (unless the configuration states otherwise).

Note Software and interface processor microcode images are carefully optimized and bundled to work together. Overriding the bundle can result in system incompatibilities. We recommend that you use the microcode included in the software bundle.

This section describes how to use and configure downloadable microcode and, if necessary, how to replace the microcode EPROM on the FEIP.

You can download microcode to Flash memory by copying the TFTP image of a microcode version to Flash memory. When the microcode image is stored in Flash memory, you can use the **microcode reload** command to manually load the new microcode file, and the **configure** command to instruct the system to load the new image automatically at each system boot.

To compare the size of the microcode image and the amount of Flash memory available, you must know the size of the new microcode image. The image size is specified in the README file that is included on the floppy disk with the new image.

Note Note the size of the new image before proceeding to ensure that you have sufficient available Flash memory for the new image.

Caution Before you copy a file to Flash, be sure there is ample space available in Flash memory. Compare the size of the file you want to copy to the amount of available Flash memory shown. If the space available is less than the space required by the file you want to copy, the copy process will continue, but the entire file will not be copied into Flash.

Follow these steps to download (copy) a microcode version from a TFTP server to Flash memory.

Step 1 To display the total amount of Flash memory present, its location, any files that currently exist in Flash memory and their size, and the amount of Flash memory remaining, use the **show flash** command. Following is an example of the output that is displayed:

```
Router# show flash

4096K bytes of flash memory on embedded flash (in RP1).
(note that the RSP has 8 MB of Flash)

file    offset      length        name

  [4194304/4194304 bytes free]
(display text omitted)
```

Step 2 Compare the amount of available Flash memory (last line in the preceding example) to the size of the new microcode image on the floppy disk to ensure that there is sufficient space available. If you attempt to copy in a new image, and the size of the new image exceeds the available space in Flash, only part of the new image will be copied and the following error message will be displayed:

```
buffer overflow - xxxx/xxxx
```

where *xxxx/xxxx* is the number of bytes read in/number of bytes available.

Step 3 After you verify that there is sufficient space available in Flash memory for the new image, use the command **copy tftp:***filename* [**bootflash** | **slot0** | **slot1**]:*filename* to copy an image to Flash memory. (**tftp:***filename* is the file's source and [**bootflash** | **slot0** | **slot1**]:*filename* is the destination in onboard Flash memory or on either of the Flash memory cards.)

An example of the **copy tftp:***filename* command follows:

```
Router# copy tftp:feip10-1 slot0:feip10-1
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet1/0): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!![OK - 7799951/15599616 bytes]
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Router#
```

Step 4 Use the **show flash** command to verify that the microcode has been copied to Flash. The output should display the filename of the image you copied to Flash (*feip10-1* in the following example):

```
Router# show flash
4096K bytes of flash memory on embedded flash (in RP1).
(note that the RSP has 8 MB of Flash)

file   offset    length      name
 1     0xD0D4    53364       feip10-1
  [4085336/4194304 bytes free]
```

Step 5 To ensure that the new microcode is used when you reboot the system, add the appropriate commands to the configuration file. To modify the configuration file, enter the following command:

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

Step 6 Specify that you are changing the microcode for the FEIP (*microcode feip*), and that it will load from Flash memory *(flash)*. Then add the filename of the new microcode image to be loaded from Flash:

```
microcode feip flash feip10-1
```

Step 7 To save the configuration file, press **Ctrl-Z**.

Step 8 Copy the new configuration to nonvolatile random-access memory (NVRAM):

```
Router# copy running-config startup-config
```

The **microcode reload** command is automatically added to your running configuration. The new FEIP microcode image will load automatically the next time the system boots or reinitializes.

Step 9 To load the new microcode immediately, you can issue the **microcode reload** configuration command (you must be in Configuration mode to enter this command):

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

Immediately after you enter the **microcode reload** command and press **Return**, the system reloads all microcode. Configuration mode remains enabled; after the reload is complete, enter **Ctrl-Z** to exit from Configuration mode and return to the system prompt.

Step 10 To verify that the FEIP is using the correct microcode, issue the **show configuration** or **show controllers cbus** command, which indicates the currently loaded and running microcode version for each interface processor and the SP or SSP (or RSP1 in the Cisco 7505 or the RSP2 in the Cisco 7507 and Cisco 7513).

```
Router# show configuration
```

This completes the procedure for downloading microcode to Flash memory.

SELV Circuit Warning Translations

Warning 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. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

Waarschuwing De poorten die "Ethernet", "10BASE-T", "Token Ring", "Console" en "AUX" zijn gelabeld, zijn veiligheidscircuits met extra lage spanning (genaamd SELV = Safety Extra-Low Voltage). SELV-circuits mogen alleen met andere SELV-circuits verbonden worden. Omdat de BRI-circuits op dezelfde manier als telefoonnetwerkspanning behandeld worden, mag u het SELV-circuit niet verbinden met de telefoonnetwerkspanning (TNV) circuits.

Varoitus Portit, joissa on nimet "Ethernet", "10BASE-T", "Token Ring", "Console" ja "AUX", ovat erityisen pienen jännityksen omaavia turvallisuuspiirejä (SELV-piirejä). Tällaiset SELV-piirit tulee yhdistää ainoastaan muihin SELV-piireihin. Koska perusluokan liitäntöjen (Basic Rate Interface- eli BRI-liitännät) jännite vastaa puhelinverkoston jännitettä, vältä SELV-piirin yhdistämistä puhelinverkoston jännitepiireihin (TNV-piireihin).

Attention Les ports étiquetés « Ethernet », « 10BASE-T », « Token Ring », « Console » et « AUX » sont des circuits de sécurité basse tension (Safety Extra-Low Voltage ou SELV). Les circuits SELV ne doivent être interconnectés qu'avec d'autres circuits SELV. Comme les circuits BRI sont considérés comme des sources de tension de réseau téléphonique, éviter de connecter un circuit SELV à un circuit de tension de réseau téléphonique (telephone network voltage ou TNV).

Warnung Die mit "Ethernet", "10BASE-T", "Token Ring", "Console" und "AUX" beschrifteten Buchsen sind Sicherheitskreise mit Sicherheitskleinspannung (Safety Extra-Low Voltage, SELV). SELV-Kreise sollten ausschließlich an andere SELV-Kreise angeschlossen werden. Da die BRI-Kreise wie Telefonnetzspannungen behandelt werden, ist der SELV-Kreis nicht an Telefonnetzspannungskreise (TNV) anzuschließen.

Avvertenza Le porte contrassegnate da "Ethernet", "10BASE-T", "TokenRing", "Console" e "AUX" sono circuiti di sicurezza con tensione molto bassa (SELV). I circuiti SELV devono essere collegati solo ad altri circuiti SELV. Dato che i circuiti BRI vengono trattati come tensioni di rete telefonica, evitare di collegare il circuito SELV ai circuiti in cui è presente le tensione di rete telefonica (TNV).

Advarsel Utgangene merket "Ethernet", "10BASE-T", "Token Ring", "Console" og "AUX" er lavspentkretser (SELV) for ekstra sikkerhet. SELV-kretser skal kun kobles til andre SELV-kretser. Fordi BRI-kretsene håndteres som telenettspenning, unngå å koble SELV-kretsen til kretser for telenettspenning (TNV).

Aviso As portas "Ethernet", "10BASE-T", "Token Ring", "Console", and "AUX" são circuitos de segurança de baixa tensão (SELV). Estes circuitos deverão ser apenas ligados a outros circuitos SELV. Devido ao facto de os circuitos BRI (Interface de Ritmo Básico) serem tratados como sendo de tensão equivalente à da rede telefónica, evite ligar o circuito SELV aos circuitos TNV (tensão de rede telefónica).

¡Advertencia! Los puertos "Ethernet", "10BASE-T", "Token Ring", "Console" y "AUX" son circuitos de muy baja señal que garantizan ausencia de peligro (Safety Extra-Low Voltage = SELV). Estos circuitos SELV deben ser conectados exclusivamente con otros también de tipo SELV. Puesto que los circuitos tipo BRI se comportan como aquéllos con voltajes de red telefónica, debe evitarse conectar circuitos SELV con circuitos de voltaje de red telefónica (TNV).

Varning! De portar som är märkta "Ethernet", "10BASE-T", "Token Ring", "Console" och "AUX" är SELV-kretsar, d.v.s. skyddskretsar med extra låg spänning (SELV: Safety Extra-Low Voltage = skyddsklenspänning). SELV-kretsar får endast anslutas till andra SELV-kretsar. Eftersom BRI-kretsar behandlas liksom telefonnätsspänning bör SELV-kretsen inte anslutas till telefonnätsspänningskretsar (TNV-kretsar).

Cisco Connection Online

Cisco Connection Online (CCO), formerly Cisco Information Online (CIO), is Cisco Systems' primary, real-time support channel. Maintenance customers and partners can self-register on CCO to obtain additional content and services.

Available 24 hours a day, 7 days a week, CCO provides a wealth of standard and value-added services to Cisco's customers and business partners. CCO services include product information, software updates, release notes, technical tips, the Bug Navigator, configuration notes, brochures, descriptions of service offerings, and download access to public and authorized files.

CCO serves a wide variety of users through two interfaces that are updated and enhanced simultaneously—a character-based version and a multimedia version that resides on the World Wide Web (WWW). The character-based CCO supports Zmodem, Kermit, Xmodem, FTP, Internet e-mail, and fax download options, and is excellent for quick access to information over lower bandwidths. The WWW version of CCO provides richly formatted documents with photographs, figures, graphics, and video, as well as hyperlinks to related information.

You can access CCO in the following ways:

- WWW: `http://www.cisco.com`.
- Telnet: `cco.cisco.com`.
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and baud rates up to 14.4 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact `cco-help@cisco.com`. For additional information, contact `cco-team@cisco.com`.

Note If you are a network administrator and need personal technical assistance with a Cisco product that is under warranty or covered by a maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or `tac@cisco.com`. To obtain general information about Cisco Systems, Cisco products, or upgrades, contact 800 553-6387, 408 526-7208, or `cs-rep@cisco.com`.

This document is to be used in conjunction with the *Cisco 7010 Hardware Installation and Maintenance*, *Cisco 7000 Hardware Installation and Maintenance*, *Cisco 7505 Hardware Installation and Maintenance*, *Cisco 7507 Hardware Installation and Maintenance*, or *Cisco 7513 Hardware Installation and Maintenance* publications. (1812-01.FEIP.CN.)

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