CISCO SYSTEMS ®

VIP-FE-TX/4E Installation and Configuration

Product Number VIP-FE-TX/4E(=)

This configuration note is a standalone publication that provides instructions for installing, configuring, and maintaining the Fast Ethernet/Ethernet Versatile Interface Processor (VIP-FE-TX/4E) in your Cisco 7000 series and Cisco 7500 series routers.

The VIP-FE-TX/4E operates with the CxBus in the Cisco 7000 series and CyBus in the Cisco 7500 series, and requires that the host Cisco 7000 series and Cisco 7500 series router is running Cisco Internetwork Operating System (Cisco IOS) Release 11.1(1) or later, or a Cisco-approved beta version of Cisco IOS Release 11.1 or later.

Note The entire VIP-FE-TX/4E assembly, with port adapters installed, is a field-replaceable unit (FRU). Individual port adapters are not available as spare parts.

Included are steps for VIP-FE-TX/4E hardware installation, and basic VIP configuration steps and examples for configuring the individual interfaces on a new VIP.

This publication has two main sections:

- Versatile Interface Processor Functions, page 3—this section discusses general VIP features, maintenance considerations, and overall functions

- VIP Port Adapter Functions, page 29—this section contains subsections that discuss each port adapter and its specific features, configuration and connection requirements, and functions

You need only refer to the information that is specific to your FE-TX and 4E port adapter or that applies to specific VIP functionality. A table of contents is included on page 2 so you can more easily find what you need.

Note For complete descriptions of interface subcommands and the configuration options available for VIP-related interfaces, and which support VIP functionality, refer to the section "If You Need More Information."

Table of Contents

This configuration note includes the following sections:

Note The following section contains important information about the latest Cisco IOS release.

If You Need More Information

The Cisco Internetwork Operating System (Cisco IOS) software running the 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.

To obtain general information about documentation, 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.

For additional information on configuring the Cisco 7000 series or Cisco 7500 series routers, the following documentation resources are available to you:

* UniverCD

  This publication and all other Cisco Systems publications are available on UniverCD, which is Cisco's online library of product information. UniverCD is updated and shipped monthly, so it might be more up to date than printed documentation. To order UniverCD, contact a Cisco Sales or Customer Service representative.

* For systems with Cisco IOS Release 11.1(1), a Cisco-approved 11.1 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*

  — *Standard Network Protocols Configuration Guide*

  — *Standard Network Protocols 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*

Versatile Interface Processor Functions

The following sections describe the Versatile Interface Processor (VIP) and discuss VIP-specific features and functions, such as installing and removing the VIP, installing and removing port adapters, and using and configuring common VIP interface functions.

What is the VIP?

The VIP is a new interface processor for use with the Cisco 7000 series and Cisco 7500 series routers, and it installs in the interface processor slots in your Cisco 7000 series or 7500 series router. The VIP uses a single motherboard with up to two port adapters. The VIP port adapters provide the individual LAN, WAN, or LAN/WAN interface ports. The VIP can be removed from a chassis while power is on and the system is operating.

Caution   The VIP supports online insertion and removal (OIR), which allows you to remove and replace a VIP without first shutting down the system. Online insertion and removal maximizes router availability by letting you add or remove VIPs 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 13, and follow the VIP installation steps carefully.

Note The VIP port adapters themselves do not support OIR, nor are they FRUs.

The VIP 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 VIP has 8 megabytes (MB) of dynamic random access memory (DRAM) as the default DRAM configuration.

Figure 1 shows a VIP-FE-TX/4E. The VIP firmware (microcode), which contains card-specific software instructions, resides in a Flash memory device in socket location U17. For pinouts, refer to the section "FE-TX Port Adapter Receptacles, Cables, and Pinouts" on page 33. Single in-line memory modules contain the DRAM. You can install VIPs in any available interface processor slots in your Cisco 7000 or Cisco 7500 series router.

Figure 1   VIP with One FE-TX and One 4E Port Adapter (Product Number VIP-FE-TX/4E[=])
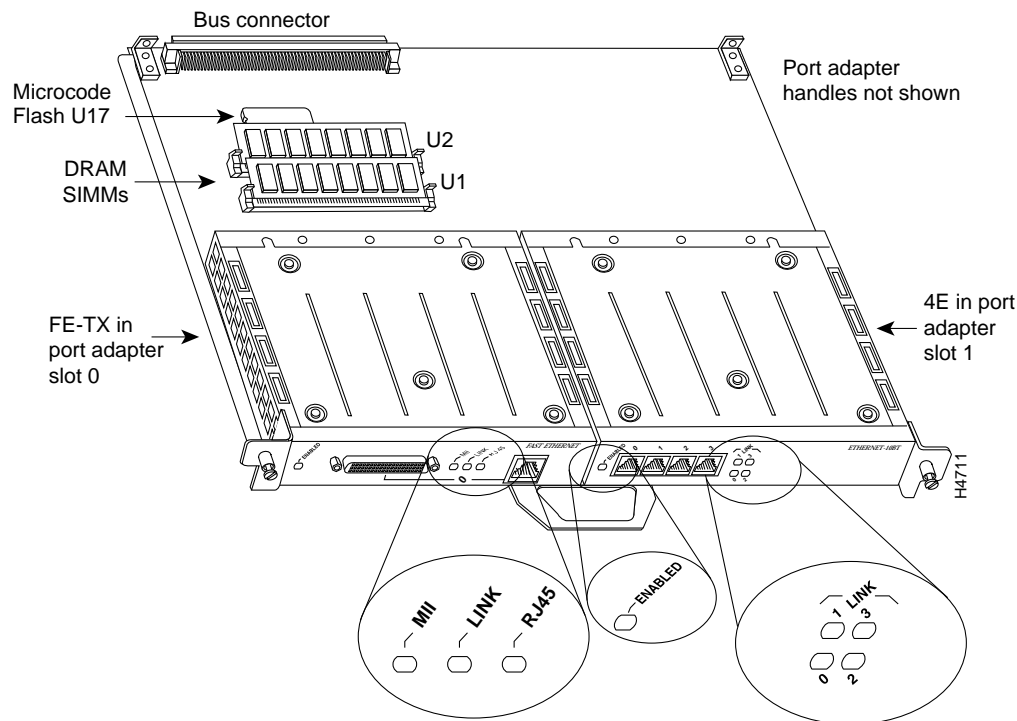
Note In the Cisco 7000, Cisco 7507 and Cisco 7513 chassis, the VIP is installed vertically. In the Cisco 7010 and Cisco 7505 chassis, the VIP is installed horizontally. Port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

VIP Software Prerequisites

The VIP requires that the host Cisco 7000 series and Cisco 7500 series router is running Cisco Internetwork Operating System (Cisco IOS) Release 11.1(1) or later, or a Cisco-approved beta version of Cisco IOS Release 11.1 or later.

Note The latest Cisco IOS release is available via anonymous File Transfer Protocol (FTP) from `ftp/beta111_dir@ftp.cisco.com`. Detailed information about the latest Cisco IOS release can be found in the ASCII file *vip1-readme*, which is also available via FTP from `ftp.cisco.com` in the directory `/ftp/beta111_dir`. This ASCII file includes information and instructions on how to get the current Cisco IOS software images and VIP microcode. To access information located in Cisco Information Online (CIO), refer to the section "SELV Circuit Warning Translations" at the end of this publication.

VIP Hardware Prerequisites

The VIP operates with the CxBus in the Cisco 7000 series and CyBus in the Cisco 7500 series, and operates with the optional RSP7000 and RSP7000CI RSP-based processor modules in the Cisco 7000 series routers: Cisco 7000 and Cisco 7010. The VIP will also operate with the Route Processor (RP) and Switch Processor (SP) in the Cisco 7000 series routers. The VIP operates with all RSP-based processor modules currently shipping in the Cisco 7000 series and Cisco 7500 series routers: Cisco 7505, Cisco 7507, and Cisco 7513.

What is the Cisco 7000 Family?

For the Cisco 7000 family of routers, which includes the Cisco 7000 series and Cisco 7500 series routers, network interfaces reside on modular interface processors, including the VIP, which provide a direct connection between external networks and the high-speed CxBus in the Cisco 7000 series and the high-speed CyBus in the Cisco 7500 series.

In all systems, the remaining slots support any combination of network interface types: Ethernet attachment unit interface (AUI), Ethernet 10BASE-T, Fast Ethernet 100BASE-TX, Asynchronous Transfer Mode (ATM), Token Ring, multichannel applications, Fiber Distributed Data Interface (FDDI), channel attachment, serial, or High-Speed Serial Interface (HSSI), and all VIP–based interfaces.

Cisco 7000 Series

Figure 2 and Figure 3 show the rear of the Cisco 7000 series routers: the seven-slot Cisco 7000 and the five-slot Cisco 7010, respectively. In the Cisco 7000 series, two slots are reserved for the SP (or SSP) and RP, or for the 7000 Series Route Switch Processor (RSP7000) and the 7000 Series Chassis Interface (RSP7000CI). The remaining slots are for interface processors: slots 0 through 4 in the Cisco 7000, and slots 0 through 2 in the Cisco 7010.

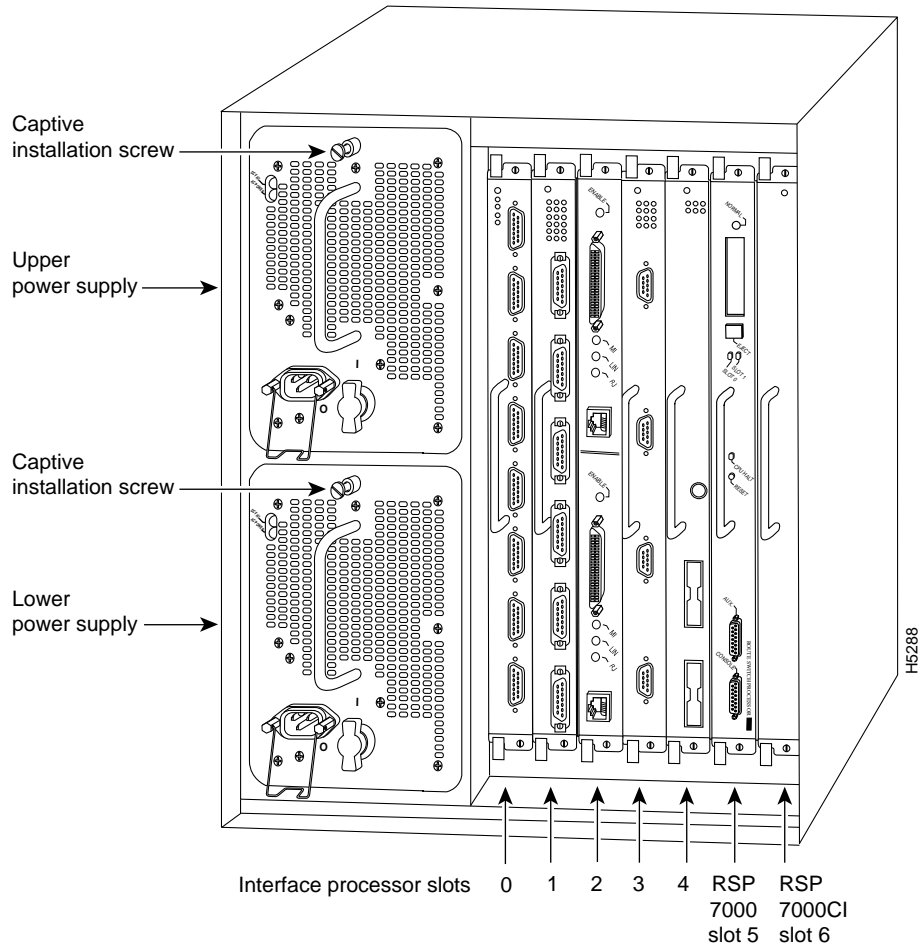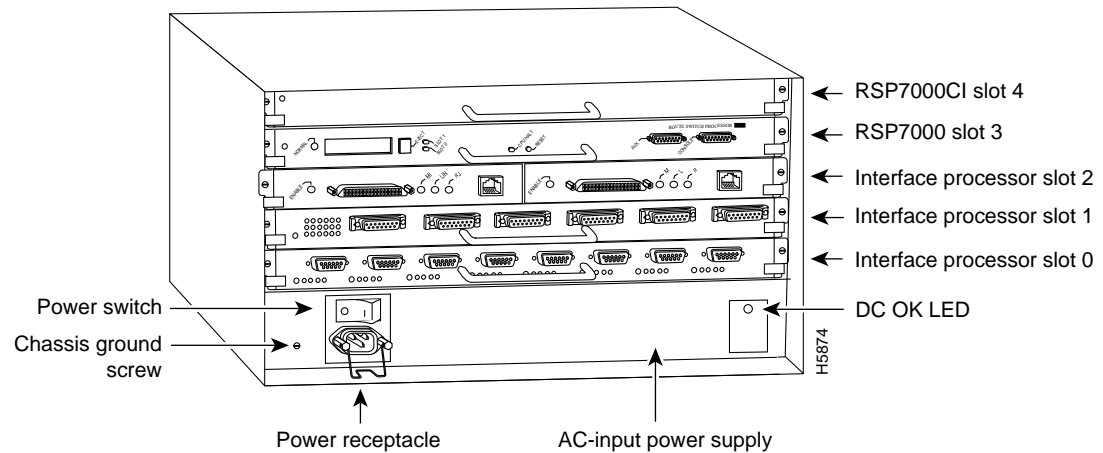**Figure 2   Cisco 7000, Interface Processor End**

Figure 3   Cisco 7010, Interface Processor End

Figure 3   Cisco 7010, Interface Processor End

Labels:
- RSP7000CI slot 4
- RSP7000 slot 3
- Interface processor slot 2
- Interface processor slot 1
- Interface processor slot 0
- DC OK LED
- Power switch
- Chassis ground screw
- Power receptacle
- AC-input power supply
- H5874

Cisco 7500 Series

Figure 4, Figure 5, and Figure 6 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, 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.

Figure 4   Cisco 7505, Interface Processor End

Labels:
- RSP slot
- Interface processor slot 3
- Interface processor slot 2
- Interface processor slot 1
- Interface processor slot 0
- DC OK LED
- Power switch
- Chassis ground screw
- Power receptacle
- AC-input power supply
- H2761

Figure 5 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.
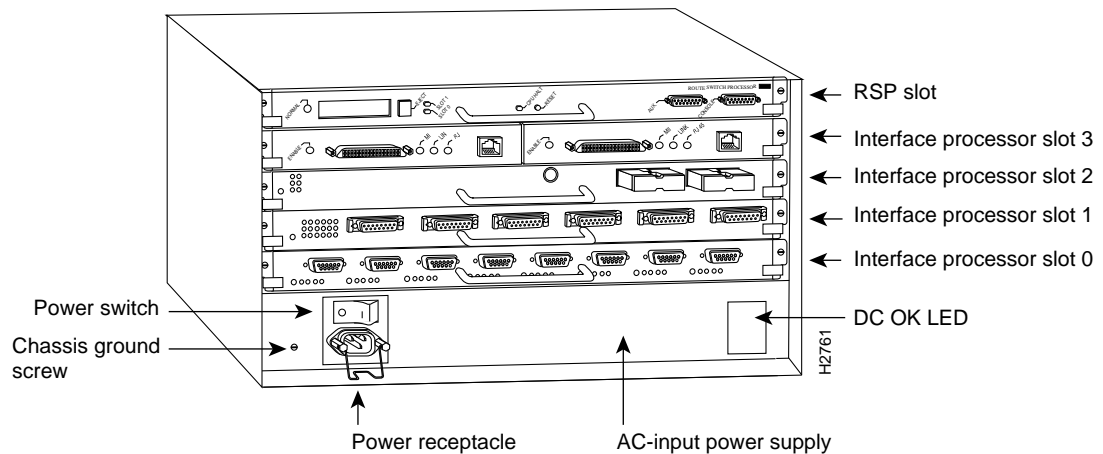
Figure 5   Cisco 7507, Interface Processor End
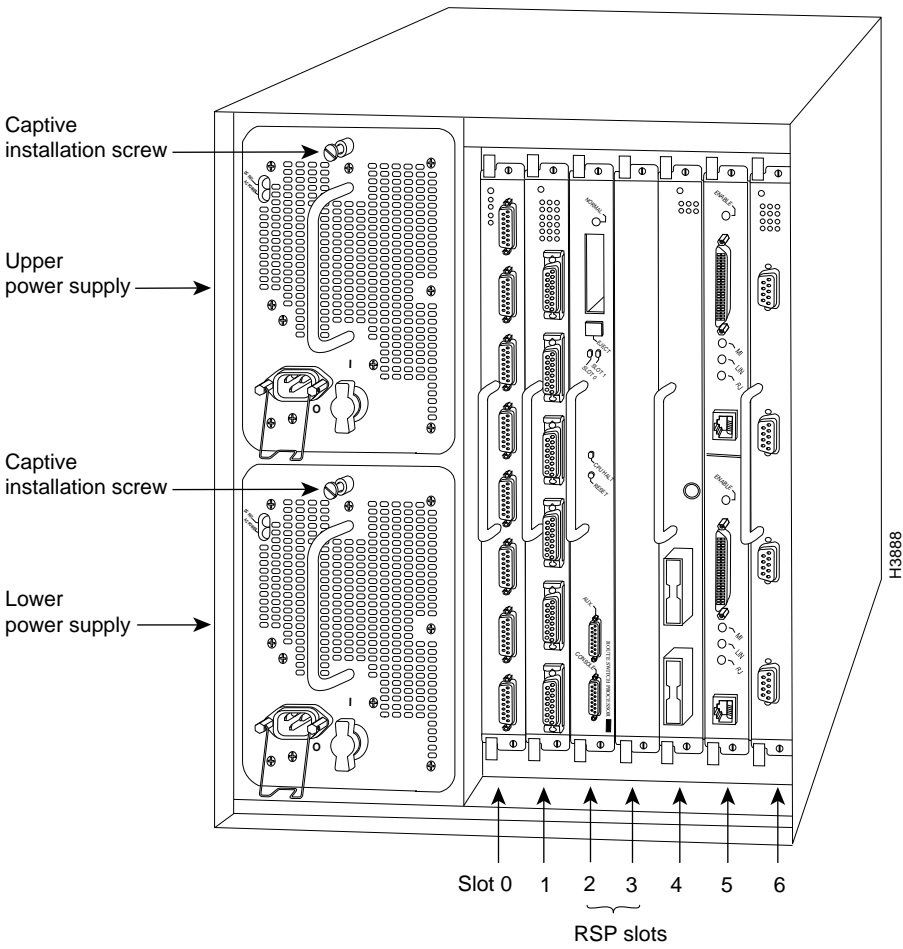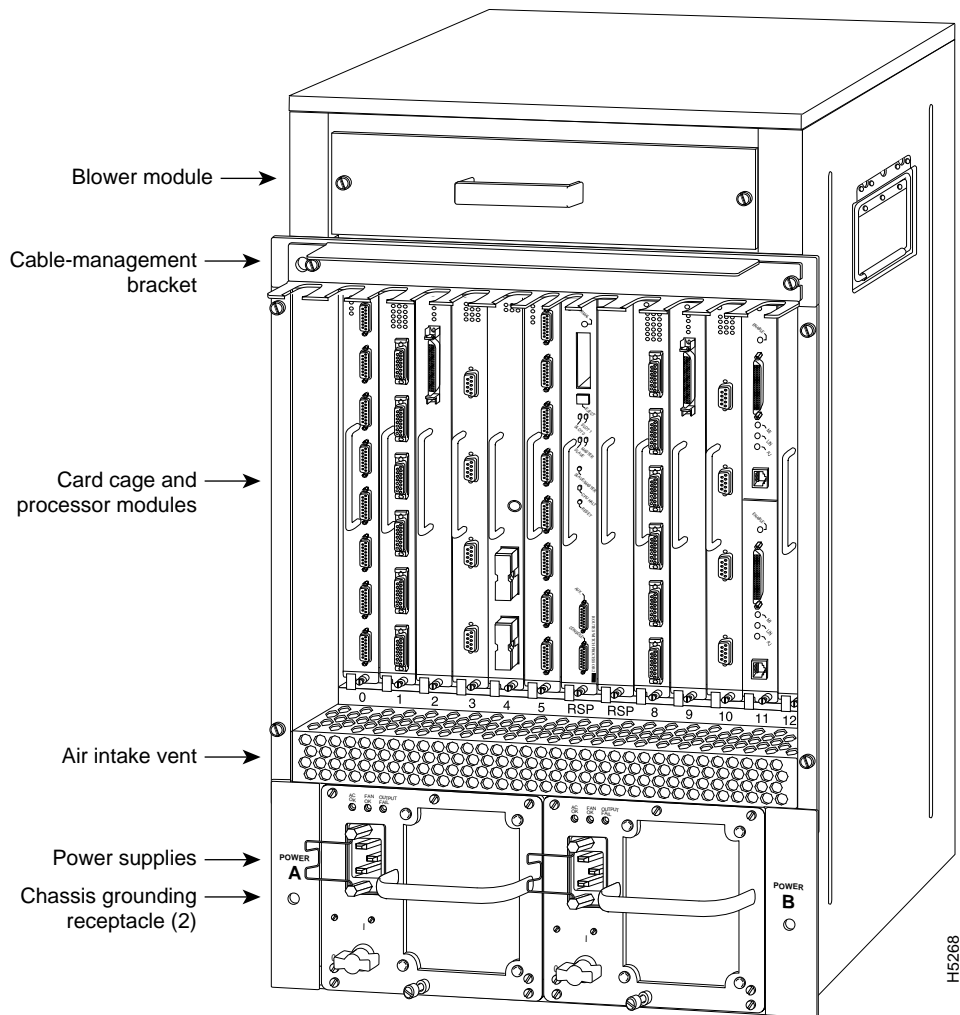
Figure 6 shows the rear of the Cisco 7513 with two AC-input power supplies installed. Two slots (6 and 7) are reserved for the second generation Route Switch Processor (RSP2), which contains the system processor and performs packet switching functions. Slots 0 through 5 and 8 through 12 are for interface processors.
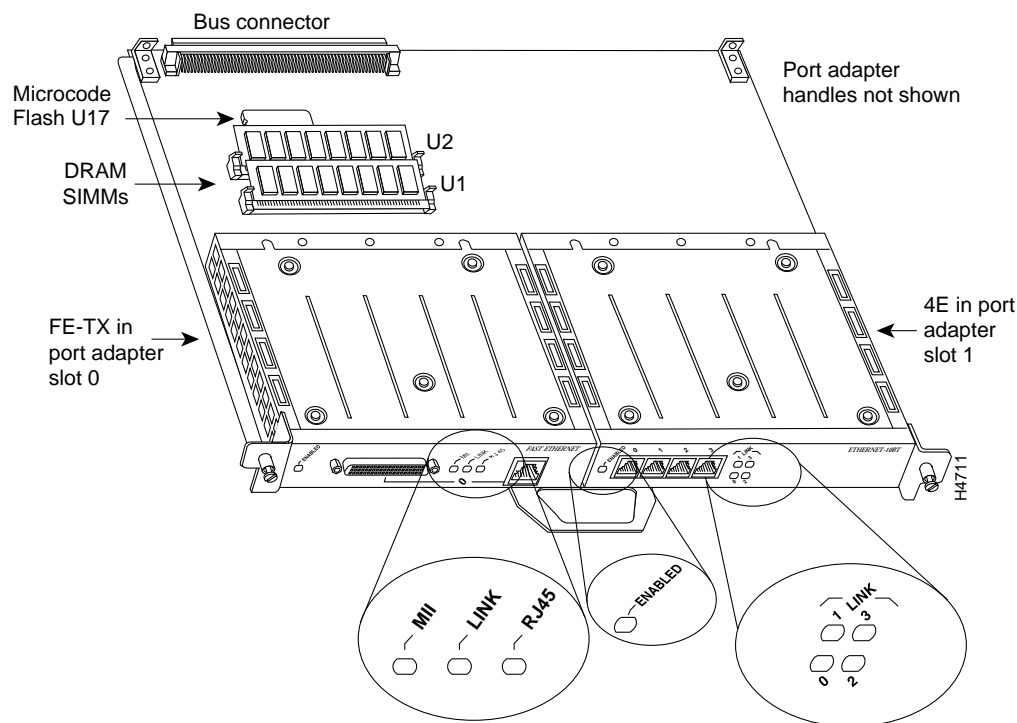
Figure 6   Cisco 7513, Interface Processor End

VIP Port Adapter Hardware Configuration Overview

The port adapters attach to the VIP motherboard. (See Figure 7.) Each port adapter contains the physical connections for the VIP interface types to connect to your network.

Figure 7   VIP with One FE-TX and One 4E Port Adapter (Product Number VIP-FE-TX/4E[=])

Following are the VIP port adapters by interface type:

- Ethernet 10BASE-T—4E
- Fast Ethernet 100BASE-TX—FE-TX
- Synchronous serial—4T
- Token Ring—4R

Following are the supported electrical interfaces:

- 4E port adapter—10BASE-T Ethernet, using RJ-45
- FE-TX port adapter—IEEE 802.3u Fast Ethernet 100BASE-TX, using Media Independent Interface (MII) or RJ-45
- 4T port adapter—synchronous serial (EIA/TIA-232, EIA-TIA-449, EIA-530, V.35, and X.21; determined by the cable), using DB-60, 60-pin mini-D-sub connectors
- 4R port adapter—IEEE 802.5 Token Ring, using DB-9, 9-pin D-sub connectors

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Note   The VIP-FE-TX/4E is a fixed configuration. The FE-TX and 4E port adapters are not available as individual spare parts. The entire VIP-FE-TX/4E assembly is a FRU. The FE-TX and 4E port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

> ⚠ **Caution**   To prevent system problems, do not remove port adapters from the VIP motherboard or attempt to install other port adapters on the VIP motherboard.

VIP Microcode Overview

The VIP microcode (firmware) is an image that provides card-specific software instructions. A Flash memory device in socket U17 of the VIP 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 system Flash memory, and instructing the system to load its image from Flash instead of the default VIP image. (The RP in the Cisco 7000 and 7010 loads software from ROM or Flash memory; the RSP loads 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 (VIP, and so on) will load the same microcode image, either from the default ROM image or from a single image stored in system 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 or SSP (in the Cisco 7000 series routers), each interface processor, and VIP. The **show startup-config** 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 VIP Microcode" on page 23.

VIP Installation Prerequisites

This section provides a list of parts and tools you will need to perform the installation, and it also includes safety and ESD-prevention guidelines to help you avoid injury and damage to the equipment. This section 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 VIP, be sure to review the equipment descriptions and distance limitations in the section "FE-TX Port Adapter Receptacles, Cables, and Pinouts" on page 33 when preparing your site and planning network connections.

List of Parts and Tools

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

- Cables appropriate for the port adapter interfaces on your VIP

- 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 Guidelines

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

Electrical Equipment Guidelines

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 Guidelines

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 8.) 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 you plan to return the component 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 a VIP board while the system is operating; you do not need to notify the software or shut down the system power.

Note   The VIP port adapters themselves do not support OIR, nor are they FRUs.

This section describes mechanical functions of system components, emphasizes the importance of following correct procedures to avoid unnecessary board failures, and is for background only; specific VIP procedures follow in the section "VIP Installation" on page 16.

Each interface processor contains a receptacle with which it connects to the system backplane. Each backplane connector comprises a set of tiered pins, in three lengths. The pins send specific signals to the system as they make contact with the card. 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 8) 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 card or interface processor. Follow the VIP installation and removal instructions carefully, and review the following examples of *incorrect* insertion practices and their 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 card or interface processor) 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 backplane pins are not damaged, the pins mating with and disconnecting from the card or interface processor 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 fully against the interface processor, can leave some (not all) of the connector pins mated to the card or interface processor, 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 backplane connector pins disconnect from the card or interface processor 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 VIP.

Figure 8   Ejector Levers and Captive Installation Screws on the VIP (Horizontal Orientation Shown)
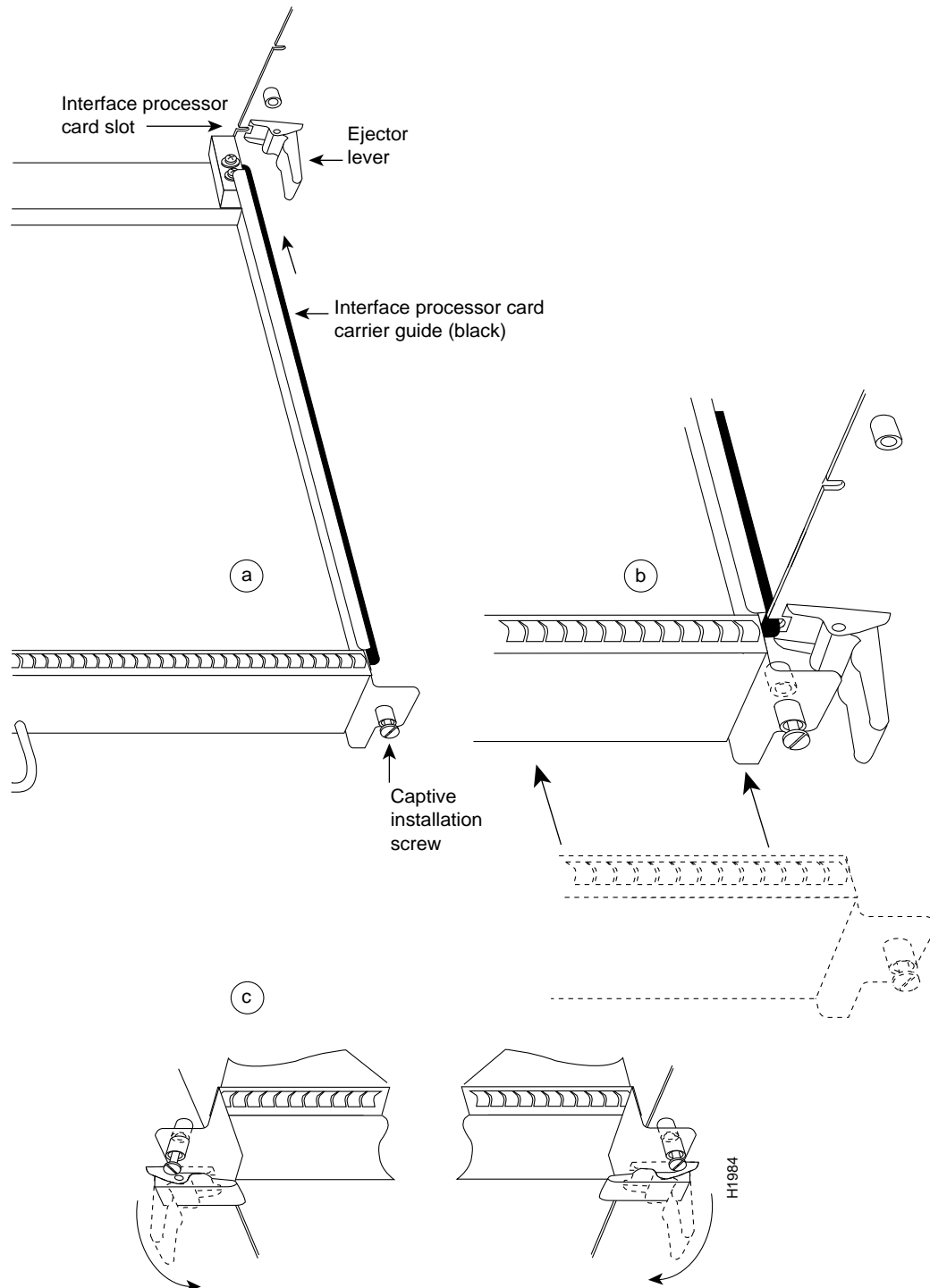
Interface processor
card slot

Ejector
lever

Interface processor card
carrier guide (black)

a

b

Captive
installation
screw

c

H1984

Note   The VIP is oriented horizontally in the Cisco 7010 and Cisco 7505 and vertically in the Cisco 7000, Cisco 7507, and Cisco 7513.

VIP Installation

The following sections describe the procedures for removing or installing a VIP in the Cisco 7000 series and 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 a VIP without first shutting down the system; however, you must follow the instructions carefully. Failure to insert the VIP 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 13.

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 VIP 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 a VIP or upgrading the microcode Flash EPROM on a VIP, proceed to the section "Removing a VIP."

Note   If you suspect that a port adapter has failed, you must replace the entire VIP processor module. Port adapters are not available as FRUs.

Caution   If you use the VIP with a single port adapter, the port adapter must be in slot 0 for the VIP 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 VIP and remove the interface processor filler as follows:

Step 1   Choose an available slot for the VIP and make a note of it.

Step 1   Use a screwdriver to loosen the captive installation screws on the interface processor filler. (See Figure 8.)

Step 2   Place your thumbs on both ejector levers and simultaneously pull them both outward to release the VIP from the backplane connector (in the opposite direction from that shown in Figure 8c).

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 9.) 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 a VIP" on page 18.

Removing a VIP

Remember, the VIP supports OIR; therefore, you need not shut down the interface or the system power when removing a VIP. If you are replacing a failed VIP, remove the existing board first, then replace the new VIP in the same slot.

Figure 9 shows proper handling of an interface processor during installation.

Figure 9   Handling Processor Modules for Installation and Removal (Horizontal Orientation Shown)

Captive installation
screws
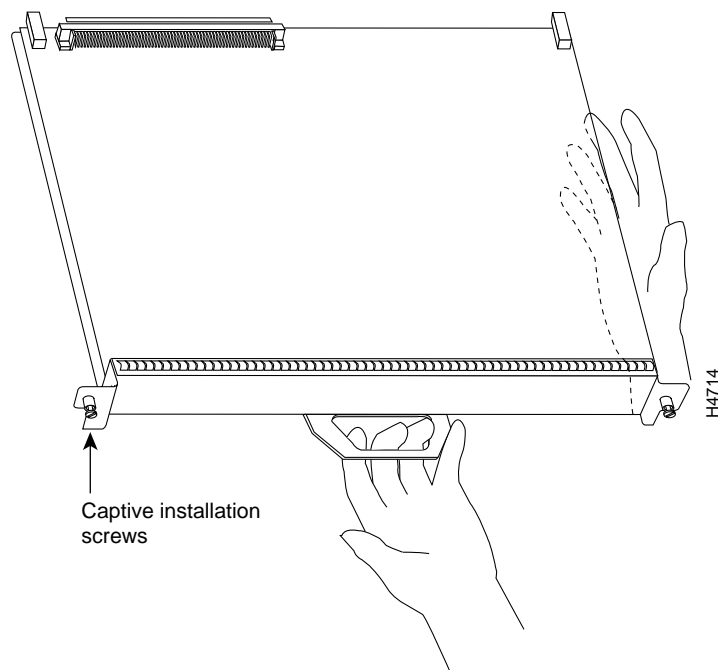
To remove a VIP, follow these steps:

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

Step 2   Use a screwdriver to loosen the captive installation screws at both ends of the VIP. (See Figure 8.)

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

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 8c) to release the VIP from the backplane connector.

Step 4   Use the VIP handle to carefully pull the VIP straight out of the slot, keeping your other hand under the carrier to guide it. (See Figure 9.) Keep the VIP parallel to the backplane.

Step 5   Place the removed VIP on an antistatic mat or foam pad, or place it in an antistatic bag if you plan to 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 a VIP."

Installing a VIP

The VIP 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 VIP can be installed only in an interface processor slot. Figure 8 shows the functional details of inserting an interface processor and using the ejector levers. Figure 9 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 a VIP:

Step 1   Ensure that a console terminal is connected to the console port (on the RP or RSP) and that your console is turned ON.

Step 2   Hold the VIP handle with one hand and place your other hand under the carrier to support the VIP and guide it into the slot. (See Figure 9.) 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, the Cisco 7507, and the Cisco 7513.

Step 3   Place the back of the VIP in the slot and align the notch on the carrier with the groove in the slot. (See Figure 8.)

Step 4   While keeping the VIP 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 8b.)

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 pins and board.

Step 5   Using your thumbs, simultaneously push both ejector levers inward until the VIP is pushed entirely into its slot. (See Figure 8c.)

Step 6   To ensure that EMI shielding is properly maintained for the chassis, immediately tighten both of the captive installation screws.

Checking the Installation and Verifying VIP Status

You can use the **configure** command to configure a VIP interface. To use the **configure** command, 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#
```

Checking the VIP Installation

After you install the VIP and connect cables (using connection procedures in the respective port adapter subsections), verify the installation by observing the LED states and the console display. When the system has reinitialized all interfaces, the enabled LED on the VIP 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 VIP 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.

Note Fast Ethernet interfaces are used in the following examples.

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

```
Router#
%OIR-6-REMCARD: Card removed from slot 2, interfaces disabled
%LINK-5-CHANGED: Interface FastEthernet2/0/0, changed state to administratively down

Router#
%OIR-6-INSCARD: Card inserted in slot 2, interfaces administratively shut down
%LINK-5-CHANGED: Interface FastEthernet2/0/0, changed state to up
```

Note   When a new VIP is inserted or when a VIP is moved to a new slot, the system recognizes the new 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* VIP is inserted in slot 3.

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

Verify that the VIP 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 VIP as follows:

- If you installed a new VIP, the system should recognize all new Fast Ethernet interfaces but leave them configured as *down*.

- If you replaced a VIP, the system should recognize each interface and place it in the same state (*up* or *down*) each was in when you removed the VIP.

Step 2   When the reinitialization is complete, verify that the enabled LED on each port adapter 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 a port adapter fails to go on, suspect that the VIP 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 VIP faceplate. Tighten the captive installation screws. After the system reinitializes the interfaces, the enabled LED on the port adapter 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 VIP and try installing it in another available interface processor slot.

- If the enabled LED goes on when the VIP 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 VIP go on to indicate activity, proceed to step 5 to resume the installation checkout and suspect that the enabled LED on the port adapter has failed.

- If no LEDs on the VIP go on, suspect that the VIP 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.

Step 5   If the VIP is new and not a replacement, you have to configure the new interfaces. Proceed to the appropriate configuration section for your port adapter. (This does not have to be done immediately, but new interfaces will not be available until you configure them.)

Step 6   If the VIP is a replacement, use the **show interfaces** *type slot/port adapter/port* or **show controllers cbus** command to verify the status of the interfaces. (Refer to the section "Verifying VIP Status Using show Commands" on page 21.)

If you replaced a VIP with a new VIP with a greater number of ports (for example, if you replaced a one-port VIP with a two-port VIP), 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 appropriate LED section for your port adapter type.

Step 8 In general, if an interface's 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.

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

Verifying VIP 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** or **show hardware** commands 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 VIP appears in the correct slot.

Step 3 Specify one of the new VIP interfaces with the **show interfaces** *type 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.

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. The following example shows a VIP, with Fast Ethernet interfaces, installed in interface processor slot 3:

```
Router# show controller cbus

(display text omitted)
slot3: VIP, hw 2.1, sw 200.09, ccb 5800FF70, cmdq 480000A0, vps 8192
    software loaded from system
    FLASH ROM version 255.255, VPLD version 20.0
    FastEthernet3/0/0, addr 0000.0ca5.2380 (bia 0000.0ca5.2380)
      gfreeq 48000140, lfreeq 48000238 (1536 bytes), throttled 0
      rxlo 4, rxhi 123, rxcurr 16, maxrxcurr 16
      txq 48000240, txacc 480000EA (value 77), txlimit 77

(display text omitted)
```

The **show startup-config** 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 **show running-config** command. (A Fast Ethernet interface is used in this example.)

```
Router# show startup-config

Using 1652 out of 130048 bytes
version 11.1(1)
!
hostname Router
!
enable-password hello
!
microcode VIP flash VIP11-0
microcode reload
!
(display text omitted)
!
interface FastEthernet 3/0/0
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
FastEthernet3/1/0 is up, line protocol is up
```

Upgrading VIP Microcode

The Cisco 7000 series and the Cisco 7500 series 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. 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.

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 system Flash memory, 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 memory.

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

-#- ED --type-- --crc--- -seek-- nlen -length- -----date/time------ name
1   .. FFFFFFFF B4A18E0B 3F6494  30   4023316  Jun 26 1994 19:44:29 image/file/1
2   .. FFFFFFFF 8075AA5D 4118B4  23   111518   Jun 29 1994 11:05:57 image/file/2

12044568 bytes available (8533736 bytes used)
```

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. 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* [**flash** | **slot0** | **slot1**]:*filename* to copy an image to Flash memory. (**tftp:***filename* is the file's source, and [**flash** | **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:vip11-1 slot0:vip11-1
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]
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
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 (*vip11-1* in the following example):

```
Router# show flash

-#- ED --type-- --crc--- -seek-- nlen -length- -----date/time------ name
1   .. FFFFFFFF B4A18E0B 3F6494  30   4023316  Jun 26 1994 19:44:29 image/file/1
2   .. FFFFFFFF 8075AA5D 4118B4  23   111518   Jun 29 1994 11:05:57 image/file/2
3   .. FFFFFFFF EEA1FEEB 8436E8  22   4398516  Oct 10 1995 19:35:25 vip11-1

7646052 bytes available (16179788 bytes used)
```

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 **configure terminal** command, as follows:

```
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 VIP (*microcode vip*), and that it will load from Flash memory *(flash)*. Then add the filename of the new microcode image to be loaded from Flash:

```
Router(config)# microcode vip flash slot0:vip11-1
```

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 VIP 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, press **Ctrl-Z** to exit from Configuration mode and return to the system prompt.

Step 10   To verify that the VIP is using the correct microcode, issue the **show startup-config** or **show controllers cbus** command, which indicates the currently loaded and running microcode version for each interface processor and the SP or SSP in the Cisco 7000 series routers.

```
Router# show controllers cbus
```

This completes the procedure for downloading microcode to Flash memory.

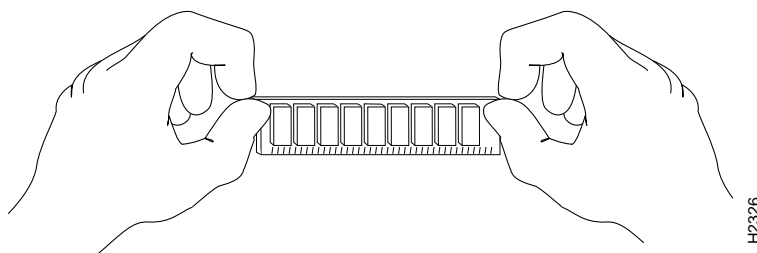## Upgrading and Replacing DRAM SIMMs

VIPs are shipped with 8 MB of DRAM as the default memory configuration. Depending on memory requirements, you might need to upgrade the amount of DRAM by replacing the DRAM SIMMs on the VIP. You also might need to replace a single SIMM in the case of a diagnosed DRAM SIMM failure.

Note   DRAM SIMMs should be upgraded or replaced in the field by a Cisco-certified maintenance provider. Both DRAM SIMMs are replaced for all upgrades.

Caution   SIMMs are sensitive components that are susceptible to ESD damage. Handle SIMMs by the edges only; avoid touching the memory modules, pins, or traces (the metal fingers along the connector edge of the SIMM). (See Figure 10.)

Figure 10   Handling a DRAM SIMM—Example Only

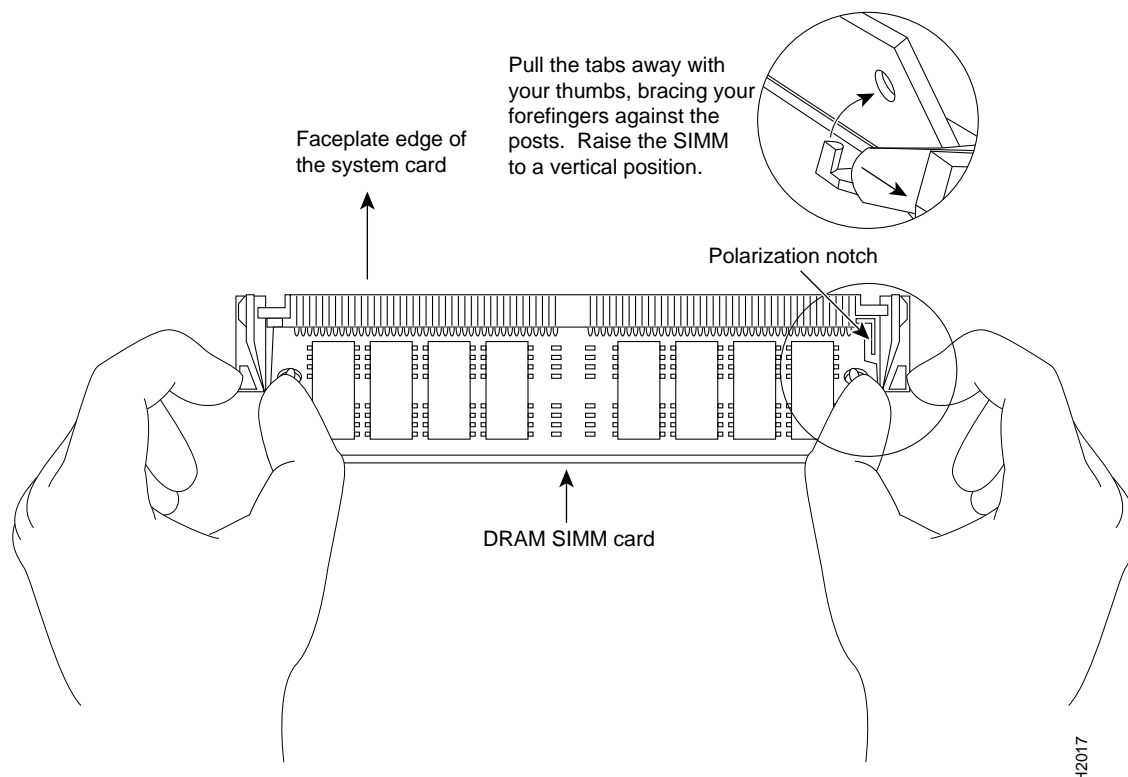Following is the procedure for replacing or upgrading DRAM SIMMs.

Step 1   Attach an ESD-preventive wrist strap between you and an unpainted chassis or VIP surface.

Step 2   Disconnect all cables from the VIP and remove it from the chassis using the procedure in the section "Removing a VIP" on page 16.

Step 3   Place the VIP on a flat surface (preferably an antistatic mat or foam), and turn it so the face plate is away from you and the connector edge is toward you. (approximately opposite of the orientation shown in Figure 11).

Step 4   Locate the DRAM SIMMs in U1 and U2. (See Figure 11.)

Figure 11   Orientation of DRAM SIMMs (U1 and U2) on VIP Motherboard (VIP-1FE-TX/4E Shown)
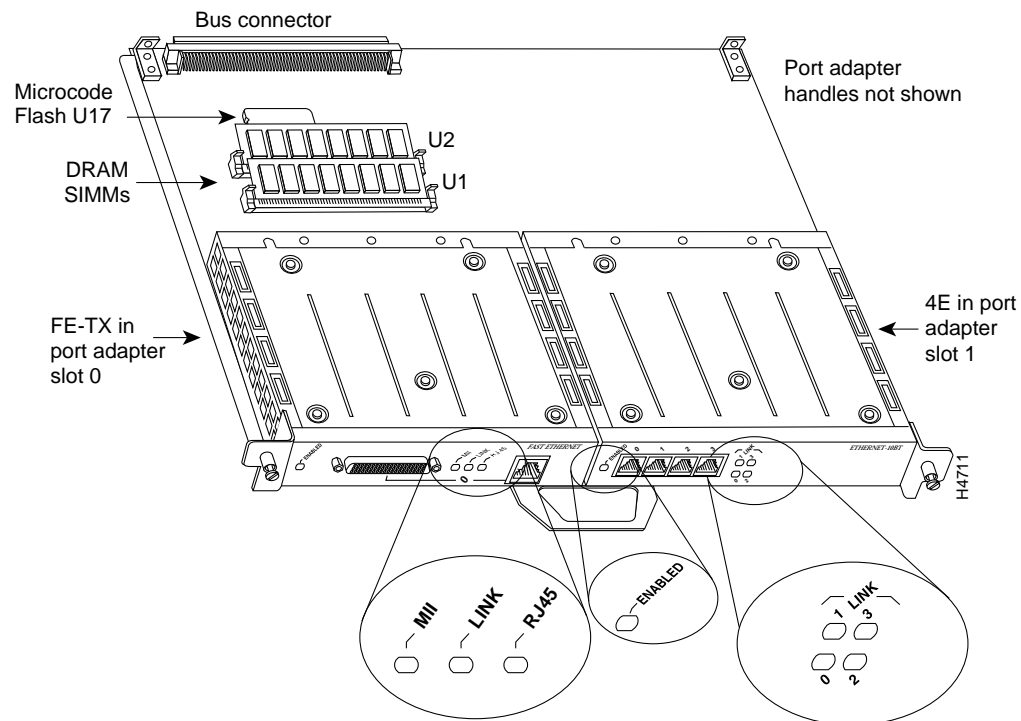
Step 5   Remove a SIMM by pulling outward on the connectors to unlatch it, as shown in the enlargement in Figure 12. Be careful not to break the holders on the SIMM connector.

Figure 12   Removing and Replacing DRAM SIMMs

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

Faceplate edge of the system card

Polarization notch

DRAM SIMM card

H2017

Step 6   Using the SIMM orientation shown in Figure 12, position the new SIMM so that the polarization notch is located at the right end of the SIMM socket.

Step 7   Insert the new SIMM by sliding the end with the metal fingers into the SIMM connector socket at approximately a 45-degree angle to the system card. Gently rock the SIMM back into place until the latch on either side snaps into place. (See Figure 12.)

⚠ **Caution**   Do not use excessive force, or the connector could break. To prevent damage, do not push on the center of the SIMMs. Handle each SIMM with care.

Step 8   As required, repeat Steps 5 through 7 for the second SIMM.

Step 9   Reinstall the VIP in the chassis using the procedure in the section "Installing a VIP" on page 18.

If error messages relating to memory are displayed once power to the chassis is turned back on, or the VIP card is installed in a chassis that is already on, repeat Steps 1 through 8, taking care to firmly reseat each SIMM in its socket.

This completes the procedure for upgrading or replacing DRAM SIMMs on your VIP.

VIP Port Adapter Functions

The following sections discuss the port adapters used with the VIP:

- FE-TX Port Adapter
- 4E Port Adapter, page 44

FE-TX Port Adapter

The following sections discuss the FE-TX port adapter, which is shown in Figure 13.

- Fast Ethernet Overview
- FE-TX Port Adapter Description and Fast Ethernet Specifications, page 31
- FE-TX Port Adapter LEDs, page 32
- FE-TX Port Adapter Receptacles, Cables, and Pinouts, page 33
- Attaching FE-TX Port Adapter Interface Cables, page 36
- Configuring the FE-TX Interface, page 37

Figure 13   FE-TX Port Adapter, Faceplate View
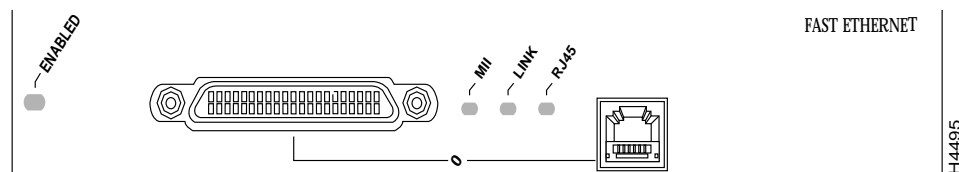
Fast Ethernet Overview

The VIP configured with two FE-TX port adapters provides up to two 100-Mbps, 100BASE-T, Fast Ethernet interfaces. Each 100BASE-T port on the FE-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. Both full-duplex and half-duplex operation are supported. 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.

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

IEEE 802.3u is well suited to applications where a local communication medium must carry sporadic, occasionally heavy traffic at high peak data rates. 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.

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.

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), signaling method is the signaling method used (either baseband or broadband), and segment length is typically the maximum length between stations in hundreds of meters. Therefore, 100BASE-T specifies a 100-Mbps, baseband LAN with maximum network segments of 100 meters (or 400 meters for 100BASE-FX).

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.

FE-TX Port Adapter Description and Fast Ethernet Specifications

The FE-TX port adapter is available in the following VIP configurations: FE-TX/blank, FE-TX/4E, or FE-TX/FE-TX. (For a description of the 4E port adapter, refer to the section "4E Port Adapter" on page 44.) Figure 14 shows VIP-FE-TX/4E. The FE-TX and 4E port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Figure 14   VIP with One FE-TX and One 4E Port Adapter Installed (Horizontal Orientation Shown)
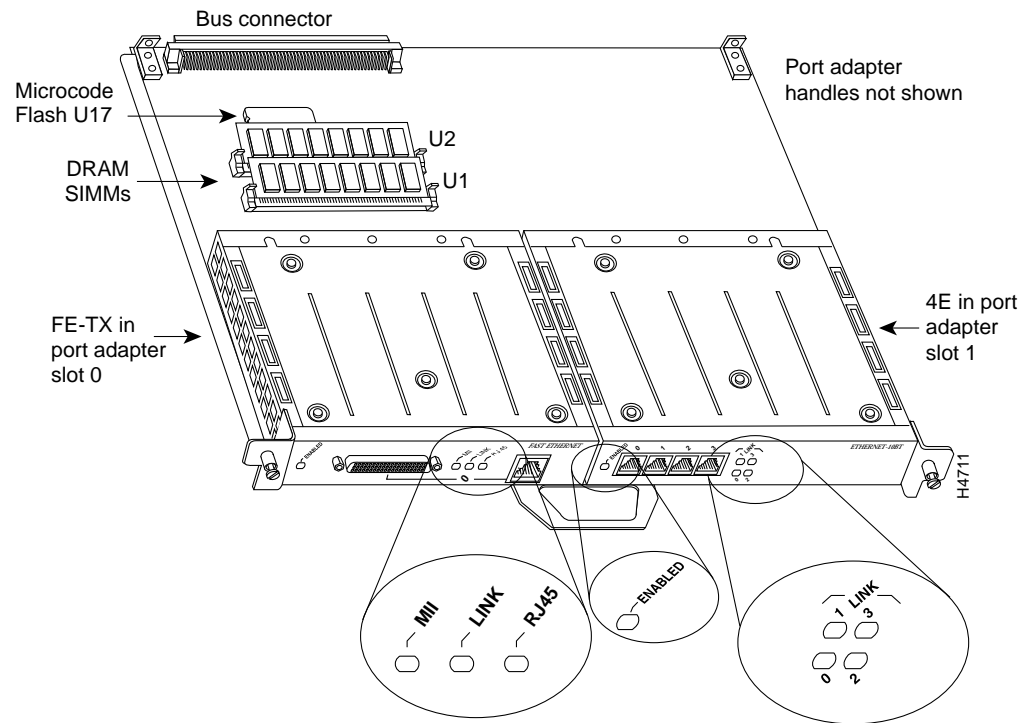
> ⚠️ **Caution**   To prevent system problems, do not remove port adapters from the VIP motherboard, or attempt to install other port adapters on the VIP motherboard.

Table 1 lists the cabling specifications for 100-Mbps Fast Ethernet transmission over UTP and STP cables. Table 2 summarizes IEEE 802.3u 100BASE-T physical characteristics.

Table 1   Specifications and Connection Limits for 100-Mbps 100BASE-T Transmission

Parameter	RJ-45	MII
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
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
Maximum network length	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-TX port adapter and the appropriate transceiver.
5. This length is specifically between any two stations on a repeated segment.

Table 2   IEEE 802.3u Physical Characteristics

Parameter	100BASE-T
Data rate (Mbps)	100
Signaling method	Baseband
Maximum segment length (meters)	100 m between DTE[1] and repeaters
Media	RJ-45: Category 5 UTP MII: Category 3, 4, or 5, 150-ohm UTP or STP, with appropriate transceiver
Topology	Star/Hub

1. DTE = data terminal equipment.

FE-TX Port Adapter LEDs

The FE-TX port adapter contains the enabled LED, standard on all port adapters, and a bank of three status LEDs for the ports. After system initialization, the enabled LED goes on to indicate that the FE-TX port adapter has been enabled for operation. (The LEDs are shown in Figure 15.) The following conditions must be met before the enabled LED goes on:

- The FE-TX interface is correctly connected to the backplane and receiving power.

- The FE-TX-equipped VIP contains a valid microcode version that has been downloaded successfully.

- The bus recognizes the FE-TX-equipped VIP.

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 status LEDs indicates the following:

- MII—On when the MII port is selected as the active port by the controller.

- Link—When the RJ-45 port is active, this LED is on when the FE-TX port adapter 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—On when the RJ-45 port is selected as the active port by the controller.

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

**Figure 15   LEDs on the FE-TX Port Adapter (Horizontal Orientation Shown)**
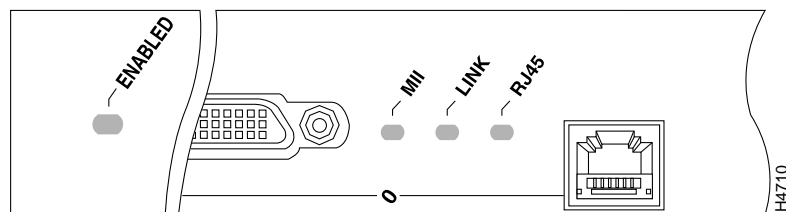
Note   The VIP is oriented horizontally in the Cisco 7010 and Cisco 7505, and vertically in the Cisco 7000, the Cisco 7507, and the Cisco 7513.

FE-TX Port Adapter Receptacles, Cables, and Pinouts

The two interface receptacles on the FE-TX 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-X and 100BASE-T standards. The RJ-45 connection does not require an external transceiver. The MII connection requires an external physical sublayer (PHY) and an external transceiver.

Figure 16 shows the RJ-45 connectors. Table 3 lists the pinouts and signals for the FE-TX RJ-45 connectors.

Figure 16   FE-TX RJ-45 Connections, Plug and Receptacle
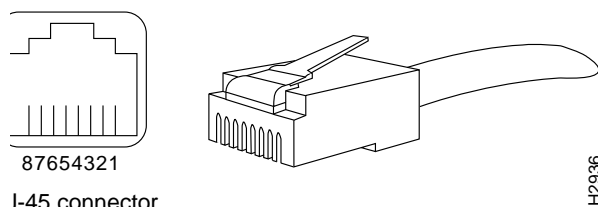
87654321

J-45 connector

Warning   The ports labeled "Ethernet," "10BaseT," "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 57.)

Table 3   FE-TX 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 3, 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 FE-TX port adapter.

Depending on your RJ-45 interface cabling requirements, use the pinouts in Figure 17 and Figure 18.

Figure 17   Straight-Through Cable Pinout, FE-TX RJ-45 Connection to a Hub or Repeater
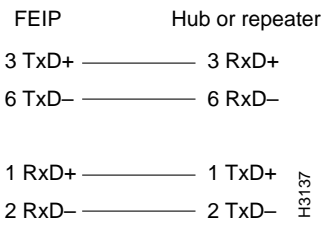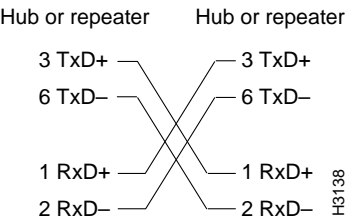


```
FEIP                 Hub or repeater

3 TxD+ ————————  3 RxD+
6 TxD– ————————  6 RxD–


1 RxD+ ————————  1 TxD+
2 RxD– ————————  2 TxD–     H3137
```

Figure 18   Crossover Cable Pinout, FE-TX RJ-45 Connections between Hubs and Repeaters


```
Hub or repeater      Hub or repeater

3 TxD+ —            — 3 TxD+
6 TxD– —            — 6 TxD–

1 RxD+ —            — 1 RxD+
2 RxD– —            — 2 RxD–     H3138
```

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 ST-type connectors (for optical fiber), BNC connectors, and so forth. Figure 19 shows the pin orientation of the female MII connector on the port adapter. The port adapters are field-replacable units (FRUs).

The MII receptacle uses 2-56 screw-type locks, called *jackscrews* (shown in Figure 19), 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 FE-TX port adapter's 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 19 shows the MII female connector.
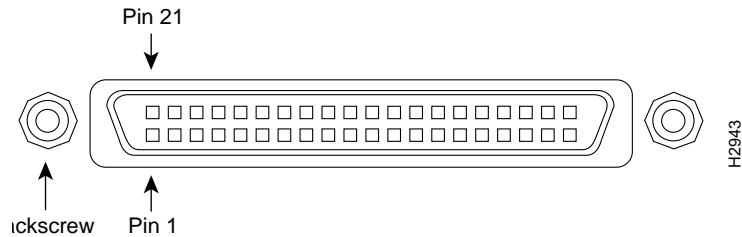
Figure 19   FE-TX MII Connection, Receptacle

Pin 21

Jackscrew   Pin 1

H2943

Table 4 lists the MII connector pinout and signals. MII cables are available commercially.

Table 4   FE-TX 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.

Attaching FE-TX Port Adapter Interface Cables

On a single 100BASE-T port adapter, you can use *either* the RJ-45 connection *or* the MII connection. If you have two FE-TX, 100BASE-T port adapters on your VIP, you can use the RJ-45 connection on one and the MII connection on the other.

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


Connect RJ-45 and MII cables as follows:

Step 1 If you have RJ-45 connections, attach the Category 5 UTP cable directly to the RJ-45 port on the FE-TX port adapter. (See Figure 20.)

If you have MII connections, attach an MII cable directly to the MII port on the FE-TX port adapter or attach a 100BASE-T transceiver, with the media appropriate to your application, to the MII port on the FE-TX port adapter. (See Figure 20.)

The FE-TX port adapter is an end station device and not a repeater. You *must* connect the FE-TX port adapter to a repeater or hub.

Note The FE-TX and 4E port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Figure 20 Connecting FE-TX MII and RJ-45 Cables (Horizontal Orientation—Shown without Handles)
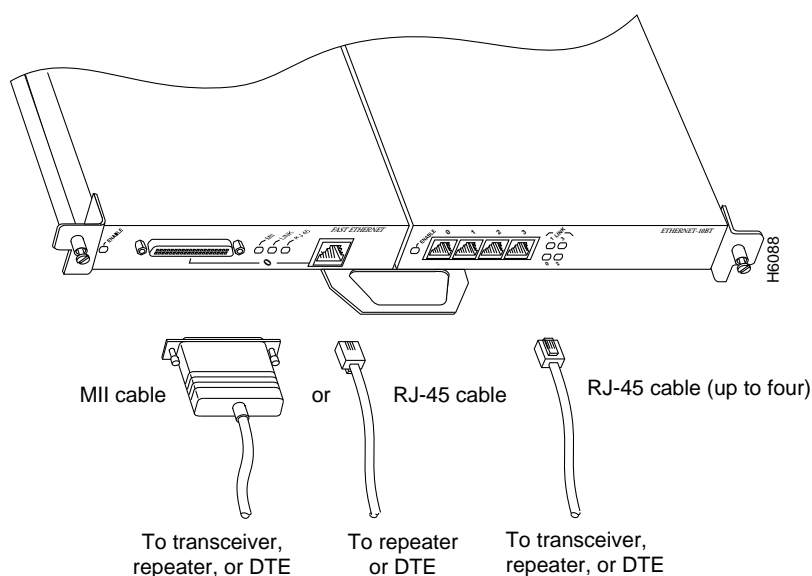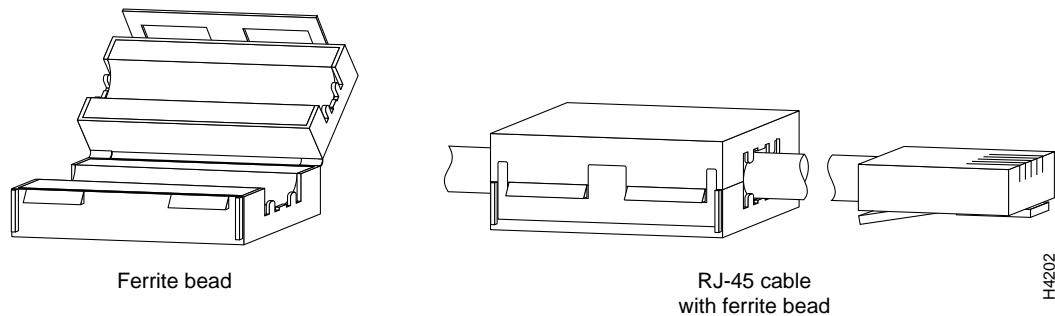
Step 2   Attach the ferrite bead to the RJ-45 cable (at either end), as shown in Figure 21.

⚠ **Caution**   The ferrite bead prevents electromagnetic interference (EMI) from affecting the FE-TX-equipped system and is a required component for proper system operation.

Figure 21   Attaching the Ferrite Bead around the RJ-45 Cable

Ferrite bead   RJ-45 cable
                                                        with ferrite bead

⚠ **Caution**   To prevent problems on your FE-TX port adapter and network, do not simultaneously connect RJ-45 *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 1 and Table 2 on page 32 for cable recommendations and specifications.)

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

This completes the FE-TX installation. Proceed to the section "Checking the VIP Installation."

Configuring the FE-TX Interface

If you installed a new FE-TX interface or if you want to change the configuration of an existing interface, you must enter Configuration mode, using the **configuration** command. If you replaced an interface that was previously configured, the system will recognize the new interface and bring it up in its existing configuration.

After you verify that the new FE-TX 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 plan to configure the interfaces for IP routing.

- Whether the new interfaces will use bridging.

Note   For a summary of the configuration options available and instructions for configuring the FE-TX interfaces on the VIP, refer to the 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.

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

The following section describes how to identify chassis slot, port adapter, and Fast Ethernet interface port numbers.

> **Note** Although the processor slots in the seven-slot Cisco 7000 and 13-slot Cisco 7513 are vertically oriented and those in the five-slot Cisco 7010 and Cisco 7505 are horizontally oriented, all models use the same method for slot and port numbering. (Refer to Figure 2, Figure 3, Figure 4, Figure 5, or Figure 6 for interface processor slot orientation in your chassis.)

In the router, physical port addresses specify the actual physical location of each interface port on the router interface processor end. (See Figure 22.) This address is composed of a three-part number in the format *chassis slot number/port adapter number/interface port number.*

The first number identifies the chassis slot in which the VIP is installed (as shown in the example system in Figure 22). The second number identifies the physical port adapter number on the VIP, and is either 0 or 1. The interface ports on each FE-TX port adapter are always numbered as interface 0.

Interface ports on the VIP maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP to a different slot, the first number in the address changes to reflect the new slot number.

Figure 22 shows some of the slot port adapter and interface ports of a sample Cisco 7505 system. For example, on a FE-TX/FE-TX VIP in slot 3, the address of the first Fast Ethernet port adapter is 3/0/0 (chassis slot 3, port adapter slot 0, and interface port 0), and the address of the second Fast Ethernet port adapter is 3/1/0 (chassis slot 3, port adapter slot 1, and interface port 0).

The individual port adapter numbers are always 0 and 1. The individual interface port numbers always begin with 0. For example, the FE-TX port adapters in the first and second port adapter slots in chassis slot 3 would have the following addresses: 3/0/0 and 3/1/0. The number of additional ports depends on the number of ports on a port adapter.

Note   If you remove the VIP from slot 3 and install it in slot 2, the addresses of those same ports become 2/0/0 and 2/1/0.

Figure 22   Fast Ethernet Interface Port Number Example (Cisco 7505 Shown)
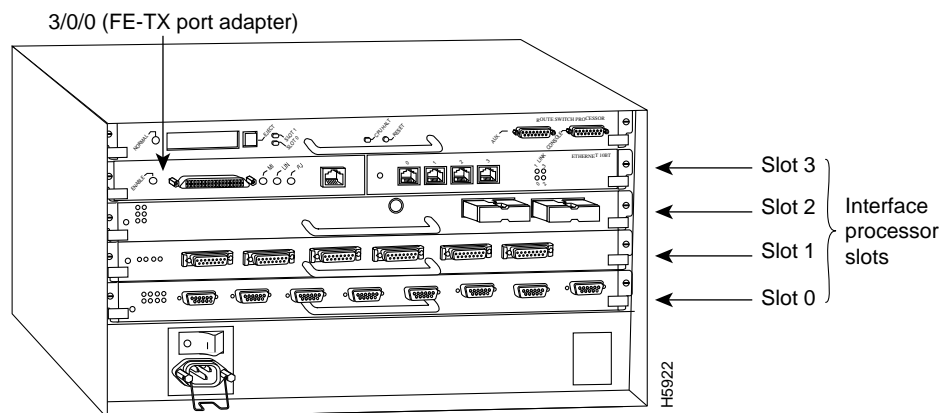
Note: The MII and RJ-45 interface ports on the first port adapter are both numbered as interface port 0. Only one of them can be used on each port adapter, at one time.

You can identify interface ports by physically checking the slot/port adapter/interface port location on the back 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 a specific interface, use the **show interfaces** command with the interface type and port address in the format **show interfaces** [*type slot/port adapter/port*].

Following is an example of how the **show interfaces** command displays status information (including the physical slot and port address) for the interface you specify. In this example, most of the status information for each interface is omitted, and a Fast Ethernet interface in slot 3 is used.

```
Router# sh int fa 3/0/0
FastEthernet3/0/0 is administratively down, line protocol is down
  Hardware is cyBus FastEthernet Interface, address is 0000.0ca5.2380 (bia 0000)
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec), hdx, 100BaseTX

(display text omitted)
```

Fast Ethernet interface port adapters are numbered from 0 and 1 because VIPs support up to two 100BASE-T ports. The MII and RJ-45 ports on a port adapter each have the same port number because only one of them can be used at one time.

Refer to Table 5, Table 6, Table 7, Table 8, and Table 9 for the FE-TX port numbers associated with the interface processor slots in your chassis. If you install a VIP with two FE-TX port adapters, you can configure both ports; if you install a VIP with one FE-TX port adapter, you need configure only that port.

Note   Table 5, Table 6, Table 7, Table 8, and Table 9 indicate FE-TX interface port numbers based on the slots in which they can be installed; they do not represent examples of maximum FE-TX configurations.

Table 5   FE-TX Slot, Port Adapter, and Port Numbers in a Cisco 7000

Slot 0/ Adapter n/ Port 0	Slot 1/ Adapter n/ Port 0	Slot 2/ Adapter n/ Port 0	Slot 3/ Adapter n/ Port 0	Slot 4/ Adapter n/ Port 0
0/0/0	1/0/0	2/0/0	3/0/0	4/0/0
0/1/0	1/1/0	2/1/0	3/1/0	4/1/0

Table 6   FE-TX Slot, Port Adapter, and Port Numbers in a Cisco 7010

Slot 0/ Adapter n/ Port 0	Slot 1/ Adapter n/ Port 0	Slot 2/ Adapter n/ Port 0
0/0/0	1/0/0	2/0/0
0/1/0	1/1/0	2/1/0

Table 7   FE-TX Slot, Port Adapter, and Port Numbers in a Cisco 7505

Slot 0/ Adapter n/ Port 0	Slot 1/ Adapter n/ Port 0	Slot 2/ Adapter n/ Port 0	Slot 3/ Adapter n/ Port 0
0/0/0	1/0/0	2/0/0	3/0/0
0/1/0	1/1/0	2/1/0	3/1/0

Table 8   FE-TX Slot, Port Adapter, and Port Numbers in a Cisco 7507

Slot 0/ Adapter n/ Port 0	Slot 1/ Adapter n/ Port 0	Slot 4/ Adapter n/ Port 0	Slot 5/ Adapter n/ Port 0	Slot 6/ Adapter n/ Port 0
0/0/0	1/0/0	4/0/0	5/0/0	6/0/0
0/1/0	1/1/0	4/1/0	5/1/0	6/1/0

Table 9   FE-TX Slot, Port Adapter, and Port Numbers in a Cisco 7513

Slot 0/ Adapter[1]/ Port 0	Slot 1/ Adapter/ Port 0	Slot 2/ Adapter/ Port 0	Slot 3/ Adapter/ Port 0	Slot 4/ Adapter/ Port 0	Slot 5/ Adapter/ Port 0	Slot 8/ Adapter/ Port 0	Slot 9/ Adapter/ Port 0	Slot 10/ Adapter/ Port 0	Slot 11/ Adapter/ Port 0	Slot 12/ Adapter/ Port 0
0/0/0	1/0/0	2/0/0	3/0/0	4/0/0	5/0/0	8/0/0	9/0/0	10/0/0	11/0/0	12/0/0
0/1/0	1/1/0	2/1/0	3/1/0	4/1/0	5/1/0	8/1/0	9/1/0	10/1/0	11/1/0	12/1/0

1. The FE-TX port adapters are installed in port adapter slot 0 on VIP-FE-TX(=) and VIP-FE-TX/4E(=), and in port adapter slots 1 and 2 on the VIP-FE-TX/FE-TX (=).

With the **show interfaces** *type slot/port adapter/por*t command, 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 Fast Ethernet interface on the first FE-TX port adapter in slot 3:

```
Router# show interfaces fastethernet 3/0/0
FastEthernet3/0/0 is administratively down, line protocol is down
  Hardware is cyBus FastEthernet Interface, address is 0000.0ca5.2380 (bia 0000)
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec), hdx, 100BaseTX
  ARP type: ARPA, ARP Timeout 4:00:00
  Last input 3:08:43, output 3:08:42, output hang never
  Last clearing of "show interface" counters 2:58:36
  Output queue 0/40, 0 drops; input queue 0/75, 0 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
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 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
```

Configuring the FE-TX Port Adapters—Descriptions and Examples

Following are descriptions and examples of the commands for configuring the VIP FE-TX interface 3/0/0 (slot 3, port adapter 0, Fast Ethernet interface port 0). If a second Fast Ethernet interface is present, configure it the same way except that the port adapter number is port adapter 1 (3/1/0).

Descriptions are limited to fields that are relevant for establishing and verifying the configuration. After configuring the new FE-TX 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.

FE-TX 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
Router(config-if)# ^z
```

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

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

  (display text omitted)

  Encapsulation ARPA, loopback not set, keepalive not set, fdx, 100BaseTX
```

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-duplex
Router(config-if)# ^Z
Router#
```

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

```
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, 100BaseTX

  (display text omitted)
```

The RJ-45 connection is the default. 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
Router(config-if)# ^Z

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 100BaseTX** configuration command to return the interface to its default state for RJ-45 connections.

The **show version** (or **show hardware**) 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 7500 series system:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-A), Version 11.1(1) [mpo 105]
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Fri 06-Oct-95 12:22 by mpo
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 5.3(16645) [biff 571], INTERIM SOFTWARE
ROM: GS Bootstrap Software (RSP-BOOT-M), Version 11.0(1.2), MAINTENANCE INTERIME

honda uptime is 4 hours, 22 minutes
System restarted by reload
System image file is "slot0:rsp-a111-1", booted via slot0

cisco RSP2 (R4600) processor with 32768K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.
1 RVIP controllers (1 FastEthernet)(4 Ethernet).
4 Ethernet/IEEE 802.3 interfaces.
1 FastEthernet/IEEE 802.3 interfaces.
125K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
No slave installed in slot 6.
Configuration register is 0x2
```

Note   For complete VIP command descriptions and examples, refer to the publications listed in the section "If You Need More Information" on page 2.

4E Port Adapter

The following sections discuss the 4E port adapter, which is shown in Figure 23.

- Ethernet 10BASE-T Overview
- 4E Port Adapter Description and 10BASE-T Specifications, page 45
- 4E Port Adapter LEDs, page 47
- 4E Port Adapter Receptacles, Cables, and Pinouts, page 47
- Attaching 4E Port Adapter Interface Cables, page 49
- Configuring the 4E Interfaces, page 50

Figure 23   4E Port Adapter, Faceplate View
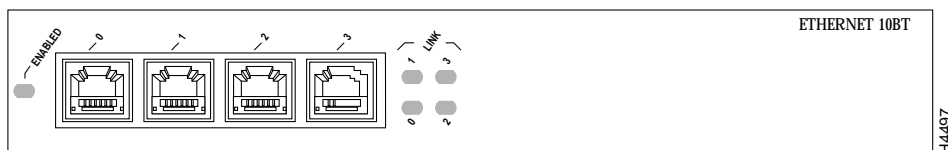
Ethernet 10BASE-T Overview

The VIP 4E port adapter provides up to four IEEE 802.3 Ethernet 10BASE-T interfaces on the VIP. Each Ethernet 10BASE-T interface allows a maximum bandwidth of 10-Mbps, for a maximum aggregate bandwidth of 40 Mbps. All four ports run at line speed.

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 802.3. Ethernet Version 2 and IEEE 802.3 were based on, and developed shortly after, Ethernet Version 1. The slight differences between Ethernet and IEEE 802.3 are implemented in hardware, and both are supported automatically by the 4E without any hardware configuration changes. Together, Ethernet and IEEE 802.3 are the most widely used LAN protocols. They are well suited to applications where a local communication medium must carry sporadic, occasionally heavy traffic at high peak data rates.

Stations on a CSMA/CD LAN can access the network at any time. Before sending data, the station *listens* to the network to see of it is already in use. If it is, the station waits until the network is not in use, then transmits. A collision occurs when two stations listen for network traffic, hear none, and transmit simultaneously. When this happens, both transmissions are damaged, and the stations must retransmit. The stations detect the collision and use backoff algorithms to determine when they should retransmit.

Both Ethernet and IEEE 802.3 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 802.3 specifies several different physical layers, and Ethernet defines only one. Each IEEE 802.3 physical layer protocol has a name that summarizes its characteristics in the format *speed/signaling method/segment length* where *speed* is the LAN speed in Mbps, *signaling method* is the signaling method used (either *Base*band or *Broad*band), and *segment length* is the maximum length between stations in hundreds of meters.

4E Port Adapter Description and 10BASE-T Specifications

The 4E port adapter is currently only available on the VIP-FE-TX/4E, which has a single Fast Ethernet (FE-TX) port adapter in port adapter slot 0, and a single Ethernet 10BASE-T (4E) port adapter in port adapter slot 1. (For a description of the FE-TX port adapter, refer to the section "FE-TX Port Adapter" on page 29.) Figure 24 shows the VIP-FE-TX/4E.

Note   VIP configurations using only one 4E port adapter and a port adapter blank, or two 4E port adapters, are currently not supported. The FE-TX and 4E port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Figure 24   VIP with One FE-TX and One 4E Port Adapter Installed, Horizontal Orientation Shown
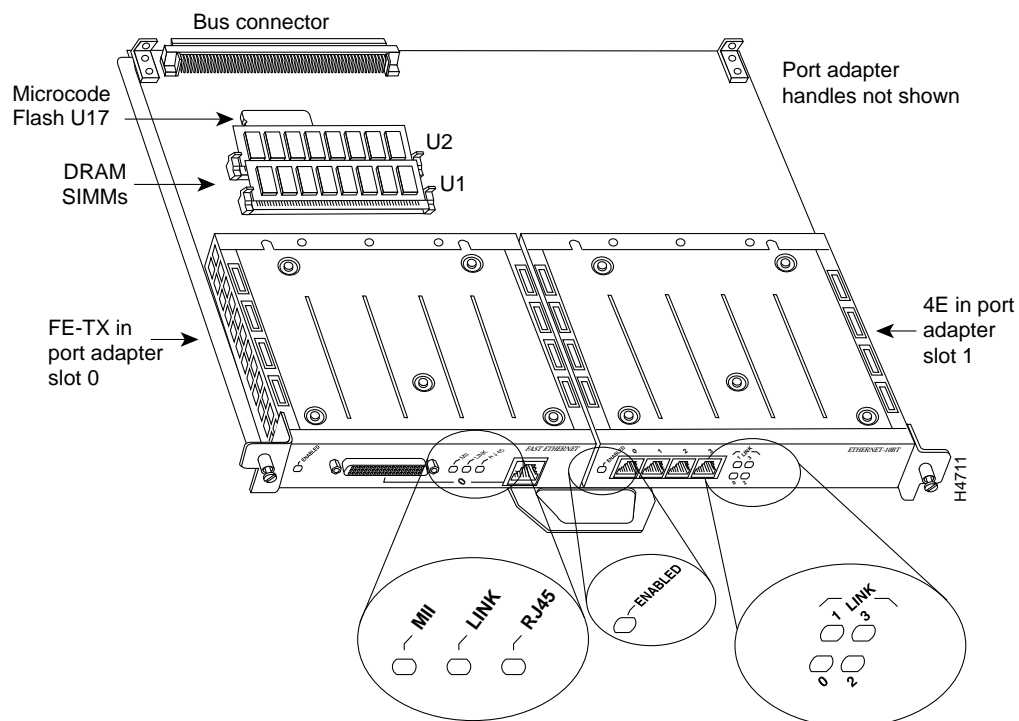
Caution   To prevent system problems, do not remove port adapters from the VIP motherboard, or attempt to install other port adapters on the VIP motherboard.

Table 10 summarizes the characteristics of IEEE 802.3 Ethernet and Ethernet Version 2 for 10BASE-T.

Table 10   IEEE 802.3 and 10BASE-T Ethernet Version 2 Physical Characteristics

Parameter	IEEE 802.3 Ethernet	10BaseT Ethernet Version 2
Data Rate (Mbps)	10	10
Signaling method	Baseband	Baseband
Max. segment length (m)	500	100 (UTP)
Media	50-ohm coax (thick)	Unshielded twisted-pair (UTP)
Topology	Bus	Star

Table 11 lists the cabling specifications for 10-Mbps transmission over UTP and STP cables.

Table 11   Cable Specifications for 10-Mbps 10BASE-T

Parameter	RJ-45
Cable specification	Category 5 UTP[1], 22 to 24 AWG[2]
Maximum segment length	100 m (328 ft.) for 10BASE-T
Maximum network length	200 m (656 ft) (with 1 repeater)

1. Cisco Systems does not supply Category 5 UTP RJ-45 cables; these cables are available commercially.
2. AWG = American Wire Gauge. This gauge is specified by the EIA/TIA-568 standard.

The Ethernet specifications call the 4E device a *transceiver*, and it is connected to the station with a *transceiver cable*. The 4E port adapter is not an end station. The IEEE 802.3 specifications refer to the same type of device as a *media attachment unit* (MAU) and to the cable as an *attachment unit interface* (AUI). Only transceiver cables can connect to the 4E ports directly.
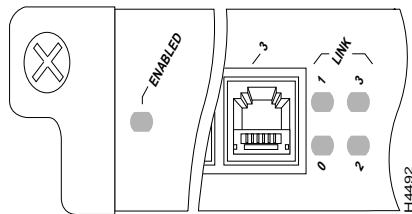
4E Port Adapter LEDs

The 4E port adapter contains the enabled LED, standard on all port adapters, and a one status LED for each port. After system initialization, the enabled LED goes on to indicate that the 4E port adapter has been enabled for operation. (The LEDs are shown in Figure 25.) The following conditions must be met before the enabled LED goes on:

- The 4E interface is correctly connected to the backplane and receiving power.

- The 4E-equipped VIP contains a valid microcode version that has been downloaded successfully.

- The bus recognizes the 4E-equipped VIP.

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

When an RJ-45 port is active, its link LED is on when the 4E port adapter is receiving a carrier signal from the network.

**Figure 25   LEDs on the 4E Port Adapter (Horizontal Orientation Shown)**

4E Port Adapter Receptacles, Cables, and Pinouts

The interface connectors on the 4E port adapter are four individual RJ-45 receptacles. You can use all four simultaneously. Each connection supports IEEE 802.3 and Ethernet 10BASE-T interfaces compliant with appropriate standards. The RJ-45 connections require external transceivers.

Figure 26 shows the RJ-45 connectors. Table 12 lists the pinouts and signals for the RJ-45 connectors.

Figure 26   4E RJ-45 Connections, Plug and Receptacle
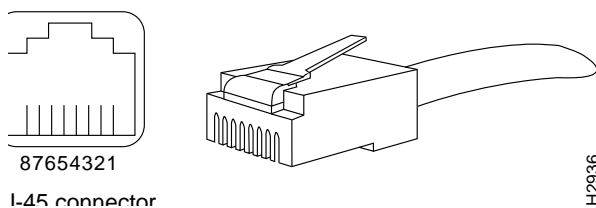
87654321

J-45 connector

Warning   The ports labeled "Ethernet," "10BaseT," "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 57.)

Table 12   4E 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 12, 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 port circuitry in the 4E port adapter.

Depending on your 4E, RJ-45 interface cabling requirements, use the pinouts in Figure 27 and Figure 28.

Figure 27   Straight-Through Cable Pinout, 4E RJ-45 Connection to a Hub or Repeater
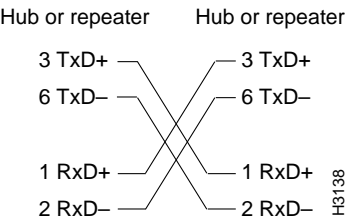
```
 FEIP              Hub or repeater

3 TxD+ ————————— 3 RxD+
6 TxD– ————————— 6 RxD–


1 RxD+ ————————— 1 TxD+     H3137
2 RxD– ————————— 2 TxD–
```
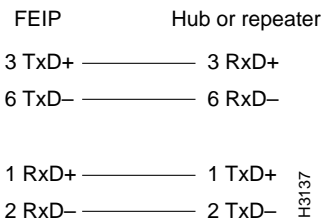
Figure 28   Crossover Cable Pinout, 4E RJ-45 Connections Between Hubs and Repeaters

```
Hub or repeater     Hub or repeater

   3 TxD+ ┐       ┌— 3 TxD+
   6 TxD– ┐╲     ╱┌— 6 TxD–
           ╳
   1 RxD+ ┘╱     ╲┘— 1 RxD+     H3138
   2 RxD– ┘       └— 2 RxD–
```

Attaching 4E Port Adapter Interface Cables

On a single 4E port adapter, you can use up to four RJ-45 connections.


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

Connect RJ-45 cables to the 4E port adapter as follows:

Step 1   Attach the Category 5 UTP cable directly to the RJ-45 port on the 4E port adapter. (See Figure 29.)

The 4E port adapter is an end station device and not a repeater. You *must* connect the 4E port adapter to a repeater or hub.

Figure 29   Connecting 4E RJ-45 Cables (Horizontal Orientation—Shown without Handles)
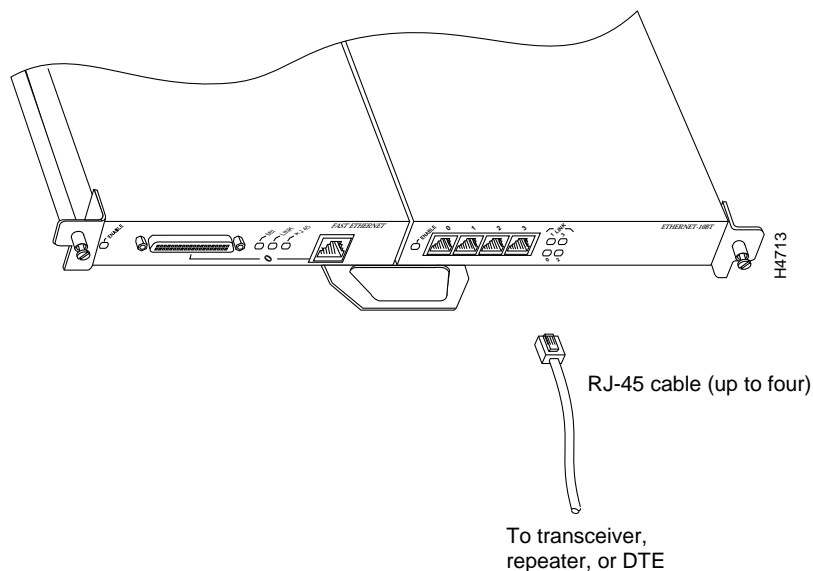
RJ-45 cable (up to four)

To transceiver,
repeater, or DTE

Note   VIP configurations using only one 4E port adapter and a port adapter blank, or two 4E port adapters, are currently not supported. The FE-TX and 4E port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Step 2   Attach the ferrite bead to the RJ-45 cable (at either end), as shown in Figure 30.

⚠ **Caution**   The ferrite bead prevents electromagnetic interference (EMI) from affecting the 4E-equipped system and is a required component for proper system operation.

Figure 30   Attaching the Ferrite Bead around the RJ-45 Cable

Ferrite bead

RJ-45 cable
with ferrite bead

H4202
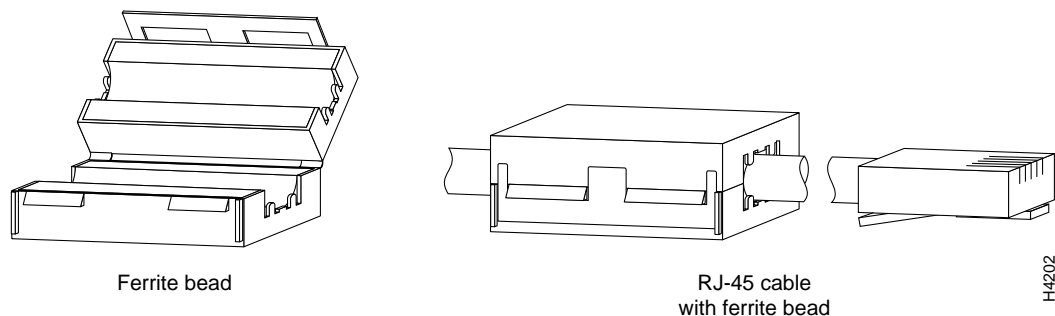
Step 3   Attach the network end of your RJ-45 cable to your 10BASE-T hub or repeater, DTE, or other external 10BASE-T equipment.

This completes the 4E installation. Proceed to the section "Checking the VIP Installation" on page 19, then to the section "Configuring the 4E Interfaces," which follows.

Configuring the 4E Interfaces

If you installed a new 4E port adapter or if you want to change the configuration of an existing interface, you must enter Configuration mode using the **configure** command. If you replaced a 4E port adapter that was previously configured, the system will recognize the new 4E interfaces and bring them up in their existing configuration.

After you verify that the new 4E port adapter 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 plan to 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 4E interfaces on the VIP, refer to the *Router Products Configuration Guide*.

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 4E interfaces on a VIP can both be configured at 10 Mbps, half duplex (HDX) or full duplex (FDX), for a maximum aggregate bandwidth of 40 Mbps.

Selecting Chassis Slot, Port Adapter, and Ethernet 10BASE-T Interface Port Numbers

The following section describes how to identify chassis slot, port adapter, and Ethernet 10BASE-T interface port numbers.

Note Although the processor slots in the seven-slot Cisco 7000 and 13-slot Cisco 7513 are vertically oriented and those in the five-slot Cisco 7010 and Cisco 7505 are horizontally oriented, all models use the same method for slot and port numbering. (Refer to Figure 2, Figure 3, Figure 4, Figure 5, or Figure 6 for interface processor slot orientation in your chassis.)

In the router, physical port addresses specify the actual physical location of each interface port on the router interface processor end. (See Figure 22.) This address is composed of a three-part number in the format *chassis slot number/port adapter number/interface port number.*

The first number identifies the chassis slot in which the VIP is installed (as shown in the example system in Figure 31). The second number identifies the physical port adapter number on the VIP, and is either 0 or 1. The interface ports on each 4E port adapter are always numbered in sequence as interface 0 through 3.

Interface ports on the VIP maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP to a different slot, the first number in the address changes to reflect the new slot number.

Figure 22 shows some of the slot port adapter and interface ports of a sample Cisco 7505 system. For example, on a FE-TX/4E VIP in slot 3, the address of the first Fast Ethernet port adapter is 3/0/0 (chassis slot 3, port adapter slot 0, and interface port 0—see the section "Selecting Chassis Slot, Port Adapter, and Fast Ethernet Interface Port Numbers" on page 38 for the Fast Ethernet numbering scheme), and the addresses for the Ethernet 10BASE-T interface ports on the second port adapter (which is a 4E) are 3/1/0 through 3/1/3 (chassis slot 3, port adapter slot 1, and interface ports 0 through 3).

The first port adapter slot number is always 0. The second port adapter slot number is always 1. The individual interface port numbers always begin with 0. The number of additional ports depends on the number of ports on a port adapter. For example, the four 10BaseT interface ports on a 4E port adapter in the second port adapter slot in chassis slot 3, would have the following addresses: 3/1/0, 3/1/1, 3/1/2, and 3/1/3. (See Figure 31.)

Note If you remove the 4E-equipped VIP from slot 3 and install it in slot 2, the addresses of those same 10BASE-T ports become 2/1/0 through 2/1/3.

Figure 31   10BASE-T Interface Port Number Example (Cisco 7505 Shown)
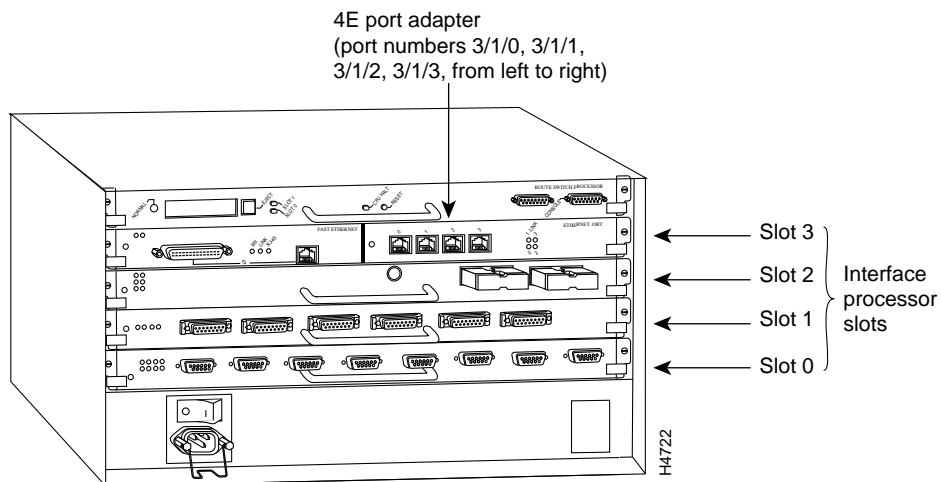
Note VIP configurations using only one 4E port adapter, and a port adapter blank, or two 4E port adapters, are currently not supported.

You can identify interface ports by physically checking the slot/port adapter/interface port location on the back 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 a specific interface, use the **show interfaces** command with the interface type and port address in the format **show interfaces** [*type slot/port adapter/port*].

Following is an example of how the **show interfaces** [*type slot/port adapter/port*] command displays status information (including the physical slot and port address) for the interfaces you specify. In these examples, most of the status information for each interface is omitted, and the four Ethernet 10BASE-T interfaces (0–3) are in chassis slot 3, in port adapter slot 1. (Interfaces are administratively shut down until you enable them.)

```
Router# sh int e 3/1/0
Ethernet3/1/1 is administratively down, line protocol is down
  Hardware is cyBus Ethernet, address is 0000.0ca5.2300 (bia 0000.0ca5.2389)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)

Router# sh int e 3/1/1
Ethernet3/1/2 is administratively down, line protocol is down
  Hardware is cyBus Ethernet, address is 0000.0ca5.2300 (bia 0000.0ca5.238a)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)

Router# sh int e 3/1/2
Ethernet3/1/3 is administratively down, line protocol is down
  Hardware is cyBus Ethernet, address is 0000.0ca5.2300 (bia 0000.0ca5.238b)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)

Router# sh int e 3/1/3
Ethernet3/1/3 is administratively down, line protocol is down
  Hardware is cyBus Ethernet, address is 0000.0ca5.2300 (bia 0000.0ca5.238b)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)
```

Ethernet 10BASE-T interface port adapters are always numbered as port adapter 1 because VIPs currently support only one 4E port adapter with the FE-TX/4E configuration, and the 4E port adapter is always in the second port adapter slot location (port adapter slot 1). With this VIP configuration, a FE-TX port adapter is always in port adapter slot 0.

Note Refer to the section "Selecting Chassis Slot, Port Adapter, and Fast Ethernet Interface Port Numbers," on page 38, for your FE-TX interface.

Refer to Table 13, Table 14, Table 15, Table 16, and Table 17 for the 4E port numbers associated with the interface processor slots in your chassis.

Note Table 13, Table 14, Table 15, Table 16, and Table 17 indicate 4E interface port numbers based on the slots in which they can be installed; they do not represent examples of maximum 4E configurations.

Table 13   4E Slot, Port Adapter, and Port Numbers in a Cisco 7000

Slot 0/ Adapter 1/ Port n	Slot 1/ Adapter 1/ Port n	Slot 2/ Adapter 1/ Port n	Slot 3/ Adapter 1/ Port n	Slot 4/ Adapter 1/ Port n
0/1/0	1/1/0	2/1/0	3/1/0	4/1/0
0/1/1	1/1/1	2/1/1	3/1/1	4/1/1
0/1/2	1/1/2	2/1/2	3/1/2	4/1/2
0/1/3	1/1/3	2/1/3	3/1/3	4/1/3

Table 14   4E Slot, Port Adapter, and Port Numbers in a Cisco 7010

Slot 0/ Adapter 1/ Port n	Slot 1/ Adapter 1/ Port n	Slot 2/ Adapter 1/ Port n
0/1/0	1/1/0	2/1/0
0/1/1	1/1/1	2/1/1
0/1/2	1/1/2	2/1/2
0/1/3	1/1/3	2/1/3

Table 15   4E Slot, Port Adapter, and Port Numbers in a Cisco 7505

Slot 0/ Adapter 1/ Port n	Slot 1/ Adapter 1/ Port n	Slot 2/ Adapter 1/ Port n	Slot 3/ Adapter 1/ Port n
0/1/0	1/1/0	2/1/0	3/1/0
0/1/1	1/1/1	2/1/1	3/1/1
0/1/2	1/1/2	2/1/2	3/1/2
0/1/3	1/1/3	2/1/3	3/1/3

Table 16   4E Slot, Port Adapter, and Port Numbers in a Cisco 7507

Slot 0/ Adapter 1/ Port *n*	Slot 1/ Adapter 1/ Port *n*	Slot 4/ Adapter 1/ Port *n*	Slot 5/ Adapter 1/ Port *n*	Slot 6/ Adapter 1/ Port *n*
0/1/0	1/1/0	4/1/0	5/1/0	6/1/0
0/1/1	1/1/1	4/1/1	5/1/1	6/1/1
0/1/2	1/1/2	4/1/2	5/1/2	6/1/2
0/1/3	1/1/3	4/1/3	5/1/3	6/1/3

Table 17   4E Slot, Port Adapter, and Port Numbers in a Cisco 7513

Slot 0 / Adapter[1]/ Port	Slot 1 / Adapter/ Port *n*	Slot 2/ Adapter/ Port *n*	Slot 3/ Adapter/ Port *n*	Slot 4/ Adapter/ Port *n*	Slot 5/ Adapter/ Port *n*	Slot 8/ Adapter/ Port *n*	Slot 9/ Adapter/ Port *n*	Slot 10/ Adapter/ Port *n*	Slot 11/ Adapter/ Port *n*	Slot 12/ Adapter/ Port *n*
0/1/0	1/1/0	2/1/0	3/1/0	4/1/0	5/1/0	8/1/0	9/1/0	10/1/0	11/1/0	12/1/0
0/1/1	1/1/1	2/1/1	3/1/1	4/1/1	5/1/1	8/1/1	9/1/1	10/1/1	11/1/1	12/1/1
0/1/2	1/1/2	2/1/2	3/1/2	4/1/2	5/1/2	8/1/2	9/1/2	10/1/2	11/1/2	12/1/2
0/1/3	1/1/3	2/1/3	3/1/3	4/1/3	5/1/3	8/1/3	9/1/3	10/1/3	11/1/3	12/1/3

1. The 4E port adapter is always installed in port adapter slot 1 on the VIP.

With the **show interfaces** *type slot/port adapter/port* command, use arguments such as the interface type (ethernet, and so forth) and the slot, port adapter, and port numbers (slot/port adapter/port) to display information about a specific Ethernet 10BASE-T interface only.

The following example of the **show interfaces ethernet** *slot/port adapter/port* command shows all of the information specific to the first 4E interface port (interface port 0) in chassis slot 3, port adapter slot 1:

```
Router# sh int e 3/1/0
Ethernet3/1/0 is administratively down, line protocol is down
  Hardware is cyBus Ethernet, address is 0000.0ca5.2300 (bia 0000.0ca5.2388)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)
  ARP type: ARPA, ARP Timeout 4:00:00
  Last input never, output never, output hang never
  Last clearing of "show interface" counters 2:56:26
  Output queue 0/40, 0 drops; input queue 0/75, 0 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 input packets with dribble condition detected
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets, 0 restarts
     0 output buffer failures, 0 output buffers swapped out
```

Note   For complete VIP command descriptions and examples, refer to the publications listed in the section "If You Need More Information" on page 2.

The **show version** (or **show hardware**) 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 7500 series system:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-A), Version 11.1(1) [mpo 105]
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Fri 06-Oct-95 12:22 by mpo
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 5.3(16645) [biff 571], INTERIM SOFTWARE
ROM: GS Bootstrap Software (RSP-BOOT-M), Version 11.0(1.2), MAINTENANCE INTERIME

honda uptime is 4 hours, 22 minutes
System restarted by reload
System image file is "slot0:rsp-a111-1", booted via slot0

cisco RSP2 (R4600) processor with 32768K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.
1 RVIP controllers (1 FastEthernet)(4 Ethernet).
4 Ethernet/IEEE 802.3 interfaces.
1 FastEthernet/IEEE 802.3 interfaces.
125K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
No slave installed in slot 6.
Configuration register is 0x2
```

For complete descriptions of interface subcommands and the configuration options available for VIP-related interfaces, and which support VIP functionality, refer to the publications listed in the section "If You Need More Information" on page 2.

This configuration note is available on UniverCD, Cisco's online library of product documentation, or in print, and is located in the Cisco 7000, Cisco 7010, Cisco 7505, Cisco 7507, and Cisco 7513 Configuration Notes subdatabases, within the Cisco Product Documentation and Core/High-End Routers databases.

SELV Circuit Warning Translations

Warning The ports labeled "Ethernet," "10BaseT," "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", "10BaseT", "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", "10BaseT", "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 », « 10BaseT », « 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", "10BaseT", "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", "10BaseT", "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", "10BaseT", "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", "10BaseT", "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", "10BaseT", "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", "10BaseT", "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).

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