Doc. No. 78-3851-01

PA-F/FD-SM and PA-F/FD-MM Full-Duplex FDDI Port Adapter Installation and Configuration

Product Numbers: PA-F/FD-MM(=), PA-F/FD-SM(=), and CAB-FMDD=

This configuration note describes the installation and configuration of the full-duplex Fiber Distributed Data Interface (FDDI) port adapters (PA-F/FD-SM and PA-F/FD-MM), which are used on the second-generation Versatile Interface Processor (VIP2) in all Cisco 7500 series routers, and in Cisco 7000 series routers using the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI). (Refer to the section "Software and Hardware Requirements" on page 3.)

Note Use this configuration note in conjunction with the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (Document Number 78-2658-xx), which shipped with your VIP2.

Document Contents

This configuration note is organized into the following sections.

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. For additional information on configuring the Cisco 7000 series and Cisco 7500 series routers and VIP2, the following documentation resources are available:

- Cisco Connection Documentation, Enterprise Series CD-ROM

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

- Refer to the following modular configuration and modular command reference publications, as appropriate for your configuration:
  - *Configuration Fundamentals Configuration Guide*
  - *Configuration Fundamentals Command Reference*
  - *Wide-Area Networking Configuration Guide*
  - *Wide-Area Networking Command Reference*
  - *Network Protocols Configuration Guide*
  - *Network Protocols Command Reference*
  - *Bridging and IBM Networking Configuration Guide*
  - *Bridging and IBM Networking Command Reference*
  - *Configuration Builder Getting Started Guide*
  - *Troubleshooting Internetworking Systems*
- For hardware installation and maintenance information on the Cisco 7000 series and Cisco 7500 series routers, and the VIP2, refer to the following publications:
  - *Cisco 7000 Hardware Installation and Maintenance*
  - *Cisco 7010 Hardware Installation and Maintenance*
  - *Cisco 7505 Hardware Installation and Maintenance*
  - *Cisco 7507 Hardware Installation and Maintenance*
  - *Cisco 7513 Hardware Installation and Maintenance*
  - *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*
- To obtain general information about documentation, refer to the Cisco Connection Documentation, Enterprise Series CD-ROM, to the section "Cisco Connection Online," on page 35, or call Customer Service at 800 553-6387 or 408 526-7208. Customer Service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding company holidays). You can also send e-mail to cs-rep@cisco.com. You can also refer to the *Cisco Information Packet* that shipped with your router.

Port Adapter Installation Prerequisites

This section provides software requirements, a list of parts and tools you will need to perform the port adapter installation, and safety and ESD-prevention guidelines to help you avoid injury and damage to the equipment during installation. Also included is information on the systems in which port adapters can be installed and overview information on interface specifications. The following sections discuss general information and information about port adapter installation requirements:

Software and Hardware Requirements

The full-duplex FDDI port adapters (PA-F/FD-SM and PA-F/FD-MM) require that the host Cisco 7000 series or Cisco 7500 series router is running Cisco IOS Release 11.1(6)CA, or later.

Caution The VIP2 requires that the Cisco 7000 series router has the RSP7000 and RSP7000CI installed. The VIP2 will *not* operate properly with the Route Processor (RP), Switch Processor (SP), or Silicon Switch Processor (SSP) installed in the Cisco 7000 series router.

Note The maximum transmission unit (MTU) sizes available might require additional VIP2 SRAM to ensure adequate buffers when two FDDI port adapters, one FDDI and one 4T, or one FDDI and one 4R port adapter are installed on a VIP2. We recommend the VIP2-20 (with 1 MB of SRAM and 16 MB of DRAM) for use with any combination of two of these port adapters on a VIP2. The minimum recommended VIP2 model is a VIP2-10 (with 512 KB of SRAM and 8 MB of DRAM), *if* you only have one FDDI port adapter on a VIP2.

Verifying Full-Duplex Port Adapter Capability in Your Router

The PA-F/FD-SM and PA-F/FD-MM FDDI port adapters support full-duplex operation. (The PA-F-SM and PA-F-MM FDDI port adapters *do not* support full-duplex operation.) To determine which FDDI port adapters are installed in your system, use the **show diagbus** command and verify that the PA-F/FD-SM or PA-F/FD-MM port adapters are installed. (For an example of the **show diagbus** command, refer to the section “Using show Commands to Display Interface Information,” which begins on page 29.)

If you discover that you do *not* have the appropriate Cisco IOS release *and* PA-F/FD-SM or PA-F/FD-MM full-duplex FDDI port adapters installed on your VIP2, you *cannot* configure your full-duplex operation. You require a minimum Cisco IOS release *and* PA-F/FD-MM or PA-F/FD-SM for full-duplex operation. For specific full-duplex configuration requirements, refer to the section “Configuring Full-Duplex Operation” on page 27.

List of Parts and Tools

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

- PA-F/FD-SM(=) or PA-F/FD-MM(=) full-duplex FDDI port adapters and at least one of the following:
  - VIP2-10(=)—if you will install only one FDDI port adapter on the VIP2
  - VIP2-20(=) or VIP2-40(=)—if you will install two FDDI port adapters on the VIP2 (Refer to the section "Software and Hardware Requirements" on page 3.)
- Cables appropriate for the port adapter interfaces (Single-mode, SC-type simplex or duplex, optical-fiber cables and multimode optical-fiber cables with media interface connectors [MICs] are not available from Cisco Systems; they are available from outside commercial cable vendors.)
- Number 1 Phillips and a 3/16-inch, flat-blade screwdriver (for VIP2 installation only)
- 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, or that uses a laser for data transmission.

Laser Safety Guidelines

The single-mode aperture port contains an FDDI laser warning label, as shown in Figure 1.

Figure 1 Laser Warning Labels on PA-F/FD-SM

Warning Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures*. (For translated versions of this warning, refer to the section "Translated Safety Warnings" on page 33.)

Warning Class 1 laser product. (For translated versions of this warning, refer to the section "Translated Safety Warnings" on page 33.")

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 and 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. Port adapters and processor modules consists of printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap during handling.

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 an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed component board-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.

- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components 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 carrier.

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

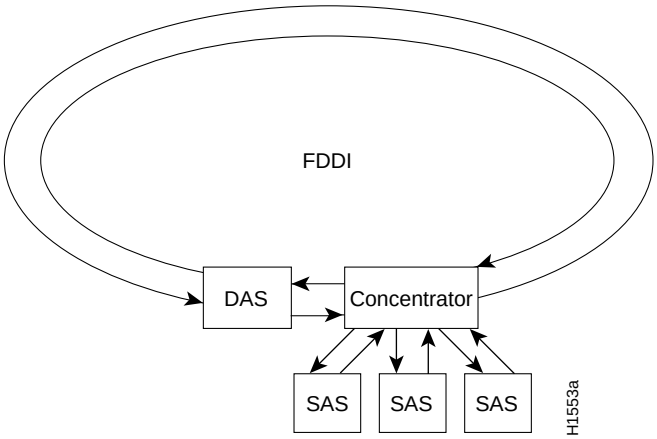
FDDI Overview

FDDI, which specifies a 100-Mbps, wire-speed, token-passing dual-ring network using fiber-optic transmission media, is defined by the ANSI X3.1 standard and by ISO 9314, the international version of the ANSI standard. An FDDI network comprises two token-passing fiber-optic rings: a primary ring and a secondary ring.

A *ring* consists of two or more point-to-point connections between adjacent stations. On most networks, the primary ring is used for data communication, and the secondary ring is used as a backup. Single attachment stations attach to one ring and are typically attached through a concentrator; Class A, or dual attachment stations (DASs), attach to both rings.

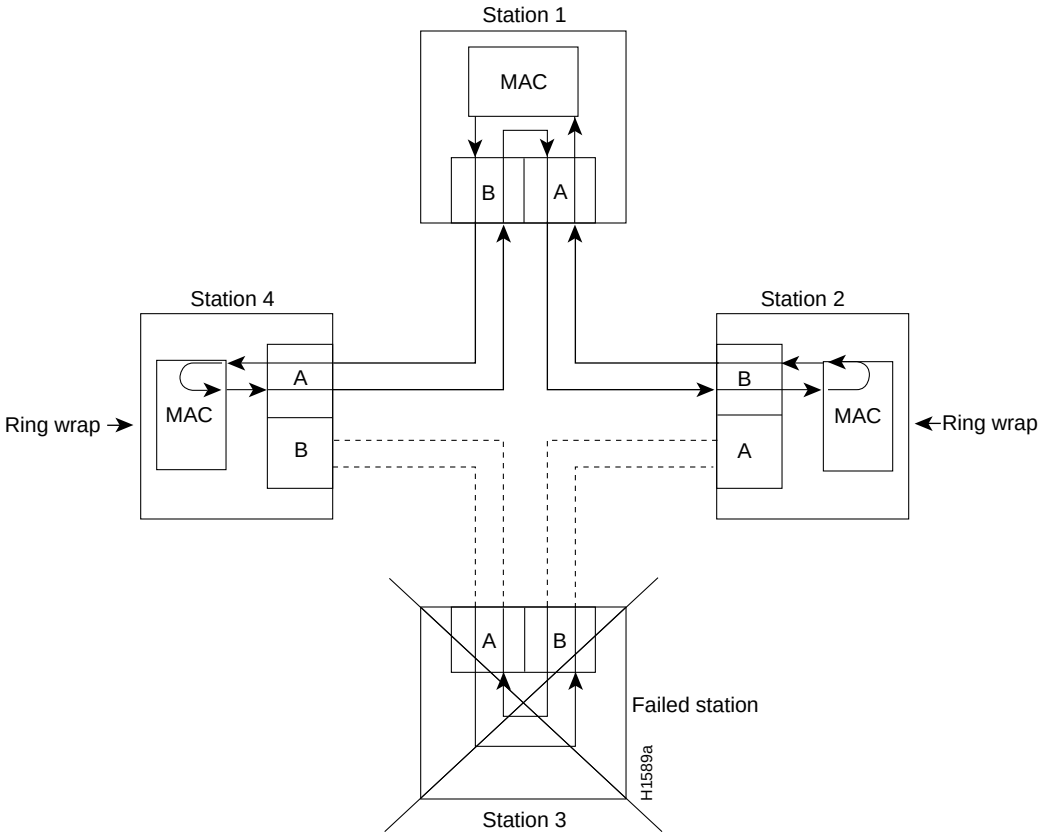
Figure 2 shows a typical FDDI configuration with both dual-attached and single-attached connections. Single attachment stations typically attach to the primary ring through a concentrator, which provides connections for multiple single-attached devices. The concentrator ensures that a failure or power down of any single attachment station does not interrupt the ring. Single attachment stations use one transmit port and one receive port to attach to the single ring. DASs (Class A) have two physical ports, designated PHY A and PHY B, each of which connects the station to both the primary and secondary rings. Each port is a receiver for one ring and a transmitter for the other. For example, PHY A receives traffic from the primary ring, and PHY B transmits to it.

Figure 2 Typical Configuration with DAS, Concentrator, and Single Attachment



The dual rings in an FDDI network provide fault tolerance. If a station on a dual ring shuts down or fails, such as Station 3 in Figure 3, the ring automatically wraps (doubles back on itself) to form a single contiguous ring. This removes the failed station from the ring, but allows the other stations to continue operation. In Figure 3, the ring wraps to eliminate Station 3 and forms a smaller ring that includes only Stations 1, 2, and 4. A second failure could cause the ring to wrap in both directions from the point of failure, which would segment the ring into two separate rings that could not communicate with each other.

Figure 3 DAS Station Failure and Ring Recovery Example



For example, if Station 1 in Figure 3 fails after Station 3 fails, Stations 2 and 4 will each be isolated because no path for communication exists between them. Subsequent failures cause additional segmentation.

Optical Bypass Overview

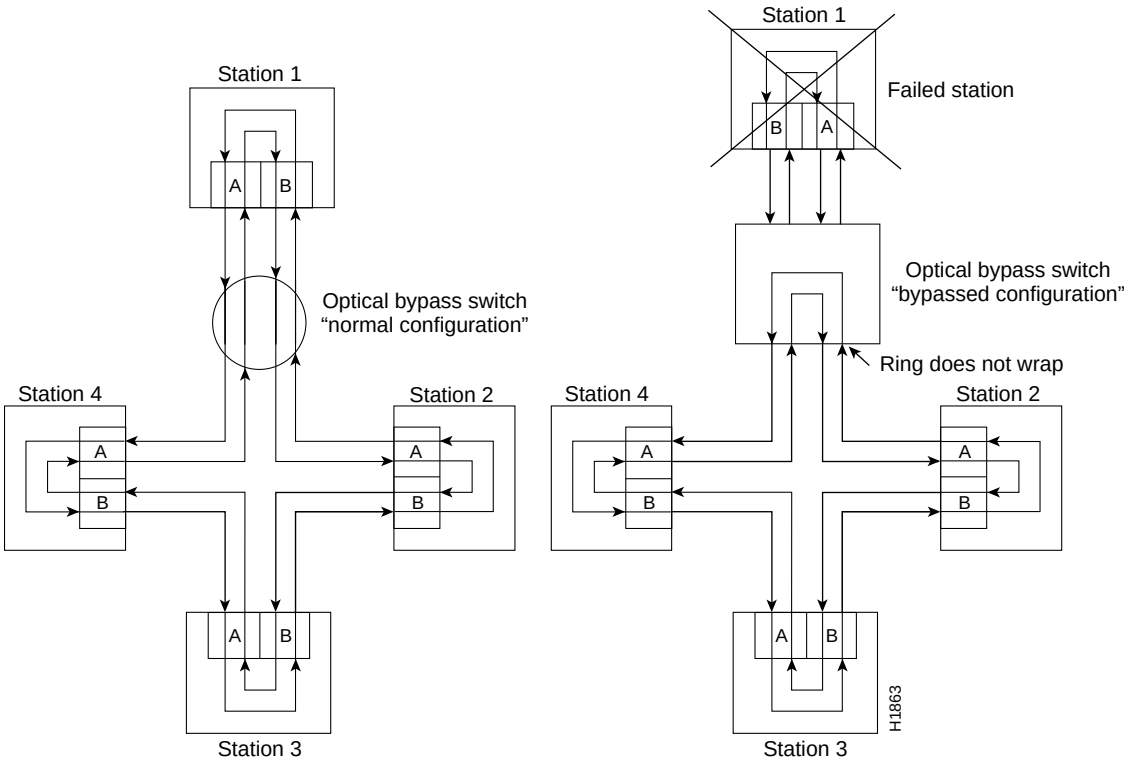
Optical bypass switching avoids segmentation by eliminating failed stations from the ring. An optical bypass switch allows the light signal to pass directly through it, completely bypassing the failed or shut down station.

Note For example, if an optical bypass switch had been installed at Station 3 in the example ring in Figure 3, it would have allowed the light signal to pass through the switch and maintain its existing path and direction without wrapping back on itself.

The FDDI port adapters have an optical bypass switch feature by way of a DIN connection. Optical bypass switches avoid segmentation by eliminating failed stations from the ring. During normal operation, an optical bypass switch allows the light signal to pass uninterrupted directly through itself. When a station with a bypass switch fails, the bypass switch reroutes the signal back onto the ring before it reaches the failed station, so the ring does not have to wrap back on itself.

Figure 4 shows an optical bypass switch installed at Station 1. In the normal configuration shown, Station 1 is functioning normally, so the optical bypass switch appears transparent. The switch essentially allows the signals to pass through it without interruption. However, if Station 1 fails, the optical bypass switch enables the bypassed configuration shown on the right in Figure 4.

Figure 4 Optical Bypass Operation on a DAS



The optical bypass switch reroutes the light signal by intercepting it before it reaches the failed Station 1 and sends it back out to the ring. This allows the signal to maintain its existing path and direction without wrapping back on itself. However, stations that are operating normally repeat the signal when sending it back out to the ring. Optical bypass switches do not repeat or drive the signal (they just allow the signal to pass through them), so significant signal loss can occur when the downstream neighbor (the next station on the ring) is far away.

Another technique for fault tolerance is *dual homing*, whereby critical devices are attached to two concentrators. Only the designated primary concentrator is active unless it (or its link) fails. If the primary does fail, the backup (passive) concentrator is automatically activated and sustains the ring.

FDDI Full-Duplex Overview

FDDI full-duplex allows an FDDI ring with exactly two stations to transform the ring into a full-duplex, point-to-point topology.

In order to operate in full-duplex mode, there must be only two stations on the ring, the two stations must be capable of operating in full-duplex mode, and both stations must complete a full-duplex auto-configuration protocol. There is no FDDI token in full-duplex mode.

Full-duplex auto-configuration protocol allows a station to dynamically and automatically operate in either half-duplex (or ring) or full-duplex mode, and ensures that the stations fall back to ring mode when a configuration change occurs, such as a third station joining the ring.

After booting up, the stations begin operation in ring mode. While the station performs the full-duplex auto-configuration protocol, the station continues to provide data link services to its users. Under normal conditions, the transition between half-duplex mode and full-duplex mode is transparent to the data-link users. The data-link services provided by full-duplex mode are functionally the same as the services provided by half-duplex mode.

FDDI Specifications

Typically, FDDI uses two types of fiber-optic cable:

- Single-mode (also called monomode) optical fiber with SC-type, duplex and simplex connectors
- Multimode optical fiber with MICs

Mode refers to the angle at which light rays (signals) are reflected and propagated through the optical fiber core, which acts as a waveguide for the light signals. Multimode fiber has a relatively thick core (62.5/125-micron) that reflects light rays at many angles. Single-mode fiber has a narrow core (8.7 to 10/125-micron) that allows the light to enter only at a single angle.

Although multimode fiber allows more light signals to enter at a greater variety of angles (modes), the different angles create multiple propagation paths that cause the signals to spread out in time and limits the rate at which data can be accurately received. This distortion does not occur on the single path of the single-mode signal; therefore, single-mode fiber is capable of higher bandwidth and greater cable run distances that multimode fiber. In addition, multimode transmitters usually use LEDs as a light source, and single-mode transmitters use a laser diode, which is capable of sustaining faster data rates. Both types use a photodiode detector at the receiver to translate the light signal into electrical signals.

The FDDI standard sets total fiber lengths of 1.2 miles (2 kilometers) for multimode fiber and 9.3 miles (15 kilometers) for single-mode fiber. (The maximum circumference of the FDDI network is only half the specified distance because of signal wrapping or loopback that occurs during fault correction.) The FDDI standard allows a maximum of 500 stations with a maximum distance between active stations of 1.2 miles.

Table 1 lists the signal descriptions for the mini-DIN optical bypass switch available on the FDDI port adapters. The mini-DIN-to-DIN adapter cable (CAB-FMDD=) allows connection to an optical bypass switch with a DIN connector (which is larger than the mini-DIN connector on the FDDI port adapters).

Table 1 Optical Bypass Switch Pinout

Pin	Direction	Description
1	Out	+5V to secondary switch
2	Out	+5V to primary switch
3	Out	Enable optical bypass switch primary
4	Out	Enable optical bypass switch secondary
5	In	Sense optical bypass switch—1 kohm to +5 V
6	Out	Ground—Sense optical bypass switch return

Note Up to 160 milliamperes (mA) of current can be supplied to the optical bypass switch.

The FDDI port adapter implementation complies with Version 6.1 of the X3T9.5 FDDI specification, offering a Class A dual attachment interface that supports the fault-recovery methods of DAS. The FDDI port adapter supports dual homing and optical bypass and complies with ANSI X3.1 and ISO 9314 FDDI standards.

Maximum Transmission Distances for FDDI Connections

The maximum transmission distances for single-mode and multimode FDDI stations are shown in Table 2. If the distance between two connected stations is greater than the maximum distance shown, significant signal loss can result.

Table 2 FDDI Maximum Transmission Distances

Transceiver Type	Maximum Distance Between Stations
Single-mode	Up to 9.3 miles (up to 15 km)
Multimode	Up to 1.2 miles (up to 2 km)

FDDI Port Adapter Optical Power Parameters

The multimode and single-mode optical-fiber connections conform to the following optical power parameters:

- Output power: –19 to –14 dBm
- Input power: –31 to –14 dBm
- Input sensitivity: –31 dBm @ $2.5x10^{-10}$ BER @ 125 Mbps

What Is the FDDI Port Adapter?

The FDDI full-duplex port adapters provide an interface for both single-mode and multimode fiber-optic cable. The two physical ports (PHY A and PHY B) are available with either single-mode (SC) or multimode MIC receptacles. Each port adapter's FDDI connection allows a maximum bandwidth of 100 Mbps per the FDDI standard.

The following FDDI port adapter combinations are available:

- PA-F/FD-MM—FDDI PHY-A multimode, PHY-B multimode port adapter with optical bypass switch capability and full-duplex capability (see Figure 5)
- PA-F/FD-SM—FDDI PHY-A single-mode, PHY-B single-mode port adapter with optical bypass switch capability and full-duplex capability (see Figure 6)

Figure 5 FDDI Port Adapter PA-F/FD-MM, Faceplate View

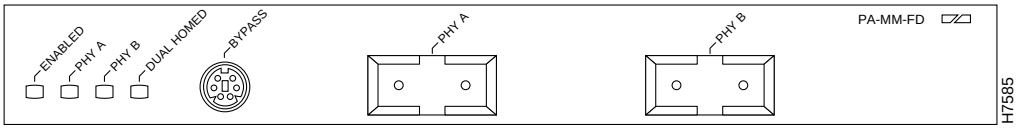
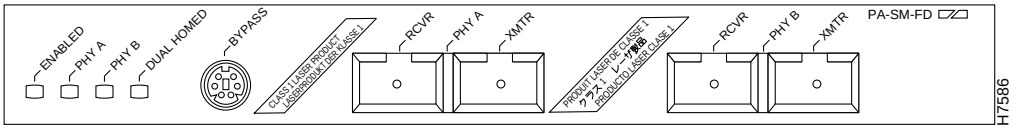


Figure 6 FDDI Port Adapter PA-F/FD-SM, Faceplate View



Warning Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures*. (For translated versions of this warning, refer to the section "Translated Safety Warnings.")

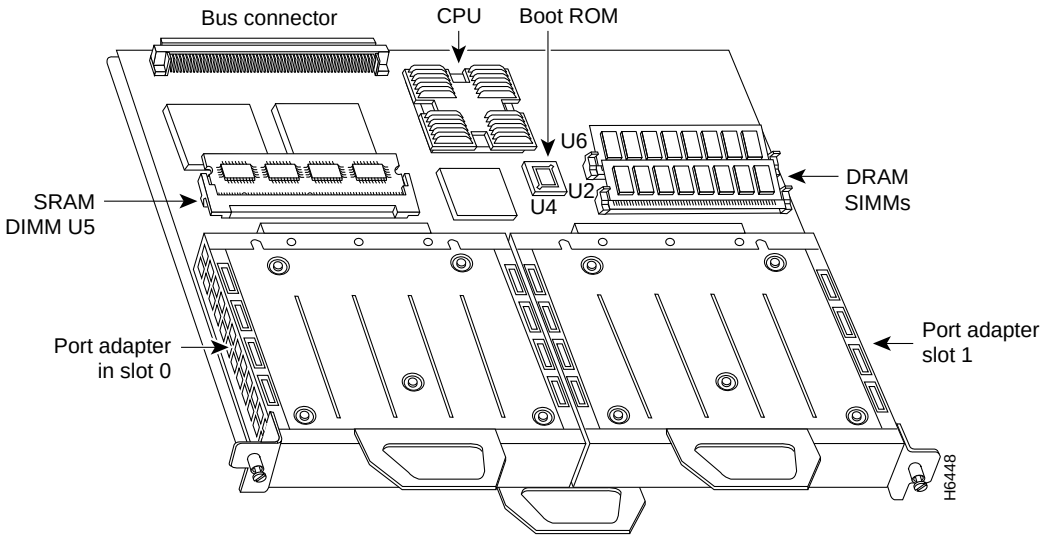
The FDDI port adapters can be installed on the VIP2 in port adapter slot 0 and port adapter slot 1. Port adapters have a handle attached, but this handle is occasionally not shown in this publication to allow a full view of detail on the port adapter's faceplate.

The following sections discuss information specific to the FDDI port adapter:

Port Adapter Locations on the VIP2

Figure 7 shows a VIP2 with installed port adapters. With the VIP2 oriented as shown in Figure 7, the left port adapter is in port adapter slot 0, and the right port adapter is in port adapter slot 1. Port adapters have handles that allow for easy installation and removal; however, they are occasionally not shown in this publication to highlight port adapter faceplate detail. In the Cisco 7000, Cisco 7507, and Cisco 7513 chassis the VIP2 is installed vertically. In the Cisco 7010 and Cisco 7505 chassis the VIP2 is installed horizontally.

Figure 7 Port Adapters on the VIP2 (Horizontal Orientation Shown)

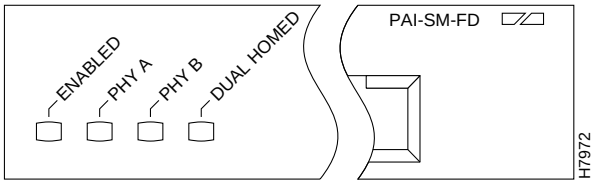


FDDI Port Adapter LEDs

The FDDI port adapter contains the enabled LED, standard on all port adapters, and status LEDs for each port. After system initialization, the enabled LED goes on to indicate that the FDDI port adapter has been enabled for operation. (The LEDs are shown in Figure 8.)

Note The LEDs on both full-duplex FDDI port adapters are identical to the LEDs shown in Figure 8 and described in Table 3 on page 13.

Figure 8 LEDs on the FDDI Port Adapter (Partial Faceplate Shown)



The following conditions must be met before the enabled LED goes on:

- The FDDI port adapter is correctly connected and receiving power.
- The FDDI-equipped card or chassis contains a valid microcode version that has been downloaded successfully.
- The bus recognizes the FDDI-equipped card or chassis.

If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on. In addition to the enabled LED, the FDDI port adapter has the following three LEDs:

- PHY A—This green LED is on when the PHY A connection is active on the FDDI ring
- PHY B—This green LED is on when the PHY B connection is active on the FDDI ring.
- DUAL HOMED—This green LED is on when the FDDI station is dual homed.

The states of the port adapter's LED combinations, and the meanings of each are described in Table 3.

Table 3 FDDI Port Adapter LED States (Refer to Figure 8)

FDDI PA LEDs[1]			Indication
PHY A	**PHY B**	**Dual-Homed**	
—	—	—	Not connected
—	—	O	Not possible
—	O	—	Wrap B
—	O	O	Dual homed (B connected to M port)
O	—	—	Wrap A
O	—	O	Dual homing back-up (A connected to M port; B port is not connected
O	O	—	Thru A
O	O	O	Not possible

1. For the LED patterns "—" means off, "O" means on. Refer also to Figure 8.

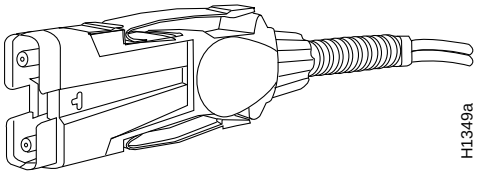
FDDI Port Adapter Fiber-Optic Cables

The interface receptacles on the FDDI port adapter are MICs for multimode and SC-type connectors for simplex and duplex, single-mode applications. The multimode receptacle is an FDDI-standard physical sublayer (PHY) connector that encodes and decodes the data into a format acceptable for fiber transmission. The multimode receptacle accepts standard 62.5/125-micron, multimode fiber-optic cable using the MIC and, with proper cable terminators, can accept 50/125 micron fiber-optic cable.

Note Fiber-optic cables are commercially available; they are not available from Cisco Systems.

Multimode uses the integrated MIC shown in Figure 9, at both the port adapter end and the network end.

Figure 9 Multimode FDDI Network Interface MIC



For FDDI single-mode connections, use one duplex SC connector (see Figure 10) or two single SC connectors, at both the port adapter end and the network end. (See Figure 11.) Single-mode optical fiber cable has a narrow core (8.7 to 10/125-micron), which allows the light to enter only at a single angle.

Figure 10 Duplex SC Connector

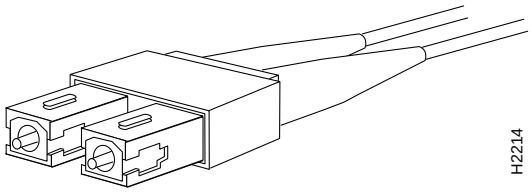
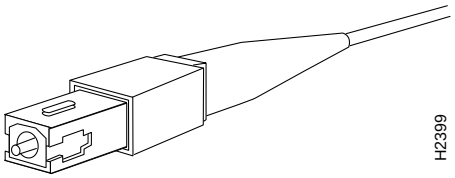


Figure 11 Simplex SC Connector



Warning Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures*. (For translated versions of this warning, refer to the section "Translated Safety Warnings.")

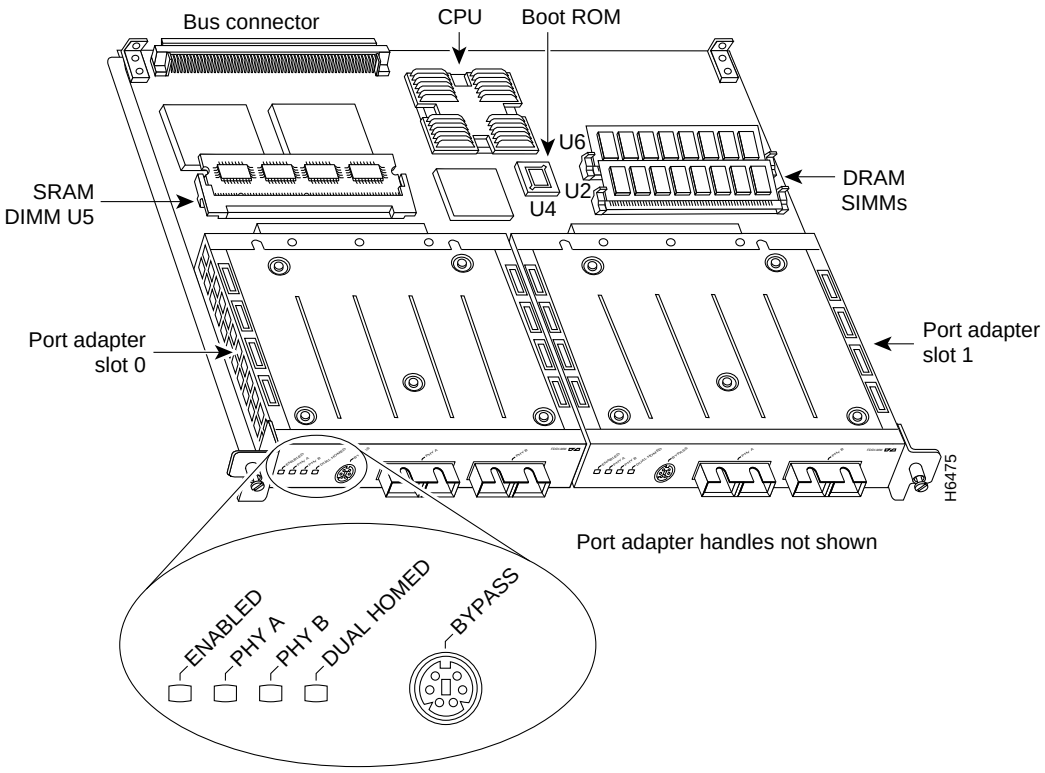
VIP2 and Full-Duplex FDDI Port Adapters

The full-duplex FDDI port adapters are used on the VIP2, and can be installed in either port adapter slot 0 or port adapter slot 1. There are two full-duplex FDDI port adapters: PA-F/FD-MM and PA-F/FD-SM.

PA-F/FD-MM uses multimode MIC optical-fiber interface connections, and PA-F/FD-SM uses single-mode SC-type optical-fiber interface connections. Both PA-F/FD-MM and PA-F/FD-SM have optical bypass switching capability in the form of a mini-DIN connector.

Figure 12 shows PA-F/FD-SM port adapters installed on a VIP2 in port adapter slots 0 and 1.

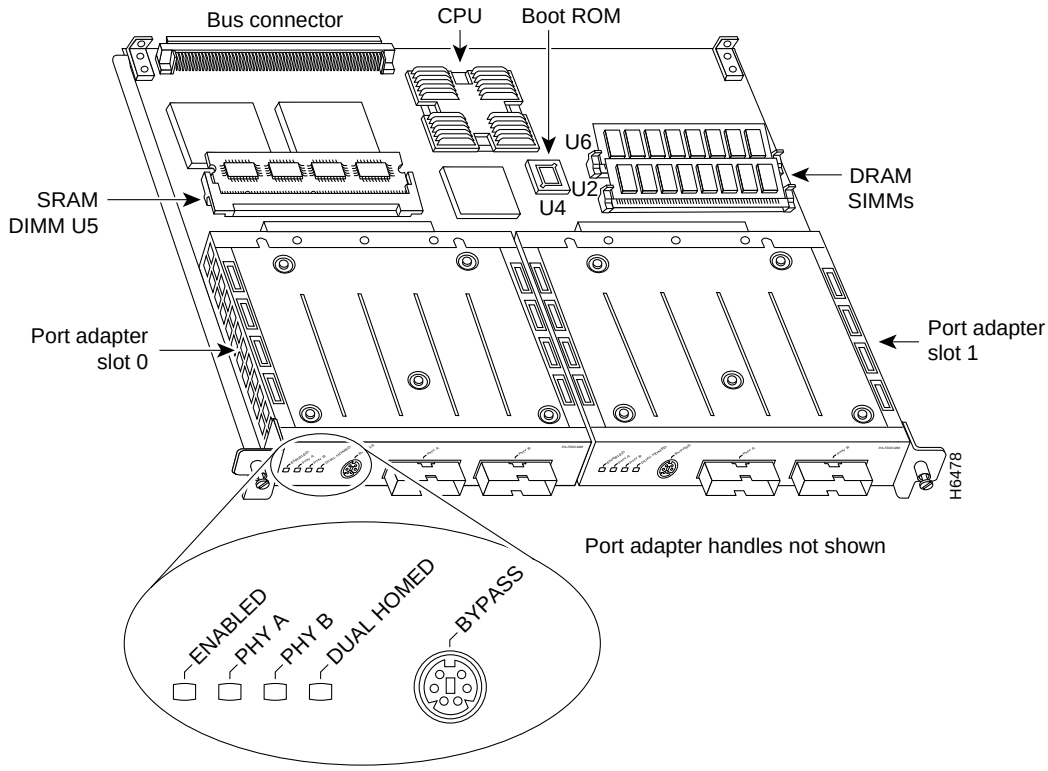
Figure 12 VIP2 with PA-F/FD-SM Port Adapters in Port Adapter Slots 0 and 1



Note 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 13 shows PA-F/FD-MM port adapters installed on a VIP2 in port adapter slots 0 and 1.

Figure 13 VIP2 with Two PA-F/FD-MM Port Adapters in Port Adapter Slots 0 and 1



The following sections include information specific to the full-duplex FDDI port adapters and their use on the VIP2 in Cisco 7000 series and Cisco 7500 series routers:

- Installing or Replacing a Port Adapter on a VIP2, page 17
- Attaching FDDI Port Adapter Cables, page 21
- Attaching an Optical Bypass Switch, page 22
- Configuring the FDDI Port Adapter Interfaces, page 24

Installing or Replacing a Port Adapter on a VIP2

Depending on the circumstances, you might need to install a new port adapter on a VIP2 motherboard or replace a failed port adapter in the field. In either case, you need a number 1 Phillips screwdriver, an antistatic mat onto which you can place the removed interface processor, and an antistatic container into which you can place a failed port adapter for shipment back to the factory.

Caution To prevent system problems, do not remove port adapters from the VIP2 motherboard, or attempt to install other port adapters on the VIP2 motherboard while the system is operating. To install or replace port adapters, first remove the VIP2 from its interface processor slot.

Note Each port adapter circuit board is mounted to a metal carrier and is sensitive to ESD damage. The following procedures should be performed by a Cisco-certified service provider only. While the VIP2 supports online insertion and removal (OIR), individual port adapters do not. To replace port adapters, you must first remove the VIP2 from the chassis, then install or replace port adapters as required. If a blank port adapter is installed on the VIP2 in which you want to install a new port adapter, you must first remove the VIP2 from the chassis, then remove the blank port adapter.

When only one port adapter is installed on a VIP2, a blank port adapter must fill the empty slot to allow the VIP2 and router chassis to conform to electromagnetic interference (EMI) emissions requirements, and so that air flows through the chassis properly. If you plan to install a new port adapter, you must first remove the blank port adapter.

Following is the standard procedure for removing and replacing any type of port adapter on the VIP2:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

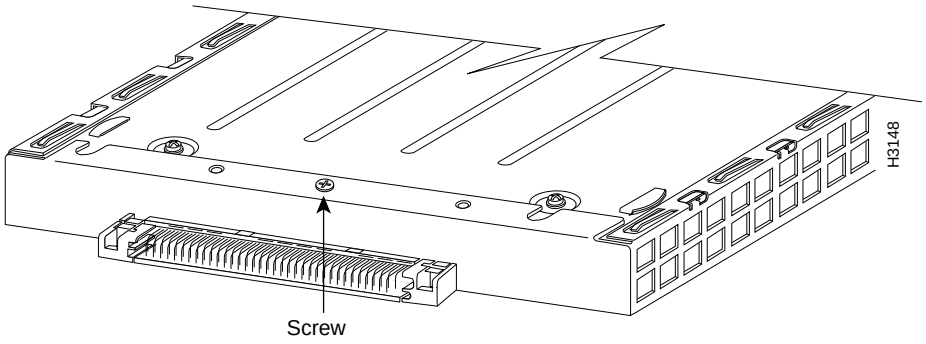
Step 2 For a new port adapter installation or a port adapter replacement, disconnect any interface cables from the ports on the front of the port adapter, although this is not required. You can remove VIP2s with cables attached; however, we do not recommend it.

Step 3 To remove the VIP2 from the chassis, follow the steps in the section “Removing a VIP2” in the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (Document Number 78-2658-xx), which shipped with your VIP2.

Step 4 Place the removed VIP2 on an antistatic mat.

Step 5 Locate the screw at the rear of the port adapter (or blank port adapter) to be replaced. (See Figure 14.) This screw secures the port adapter (or blank port adapter) to its slot.

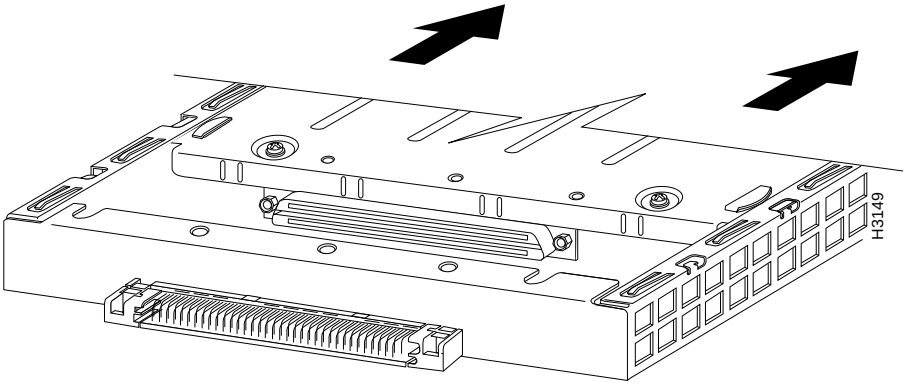
Figure 14 Location of Port Adapter Screw, Partial Port Adapter View



Step 6 Remove the screw that secures the port adapter (or blank port adapter).

Step 7 With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See Figure 15.)

Figure 15 Pulling a Port Adapter Out of a Slot, Partial Port Adapter View

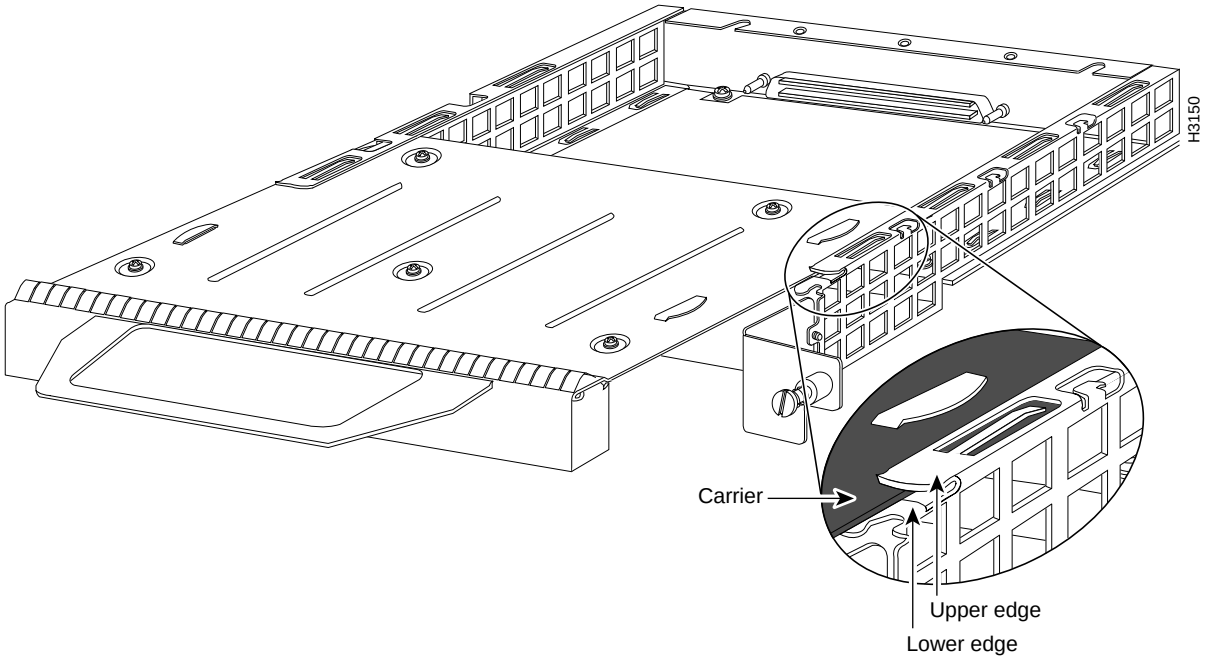


Step 8 If you removed a port adapter, place it in an antistatic container for safe storage or shipment back to the factory. If you removed a blank port adapter, no special handling is required; however, store the blank port adapter for potential future use.

Step 9 Remove the new port adapter from its antistatic container and position it at the opening of the slot. (See Figure 16.)

Caution To prevent jamming the carrier between the upper and lower edges of the port adapter slot, and to assure that the edge connector at the rear of the port adapter mates with the connector at the rear of the port adapter slot, make certain that the leading edges of the carrier are between the upper and lower slot edges, as shown in the cutaway in Figure 16.

Figure 16 Positioning a Port Adapter for Installation

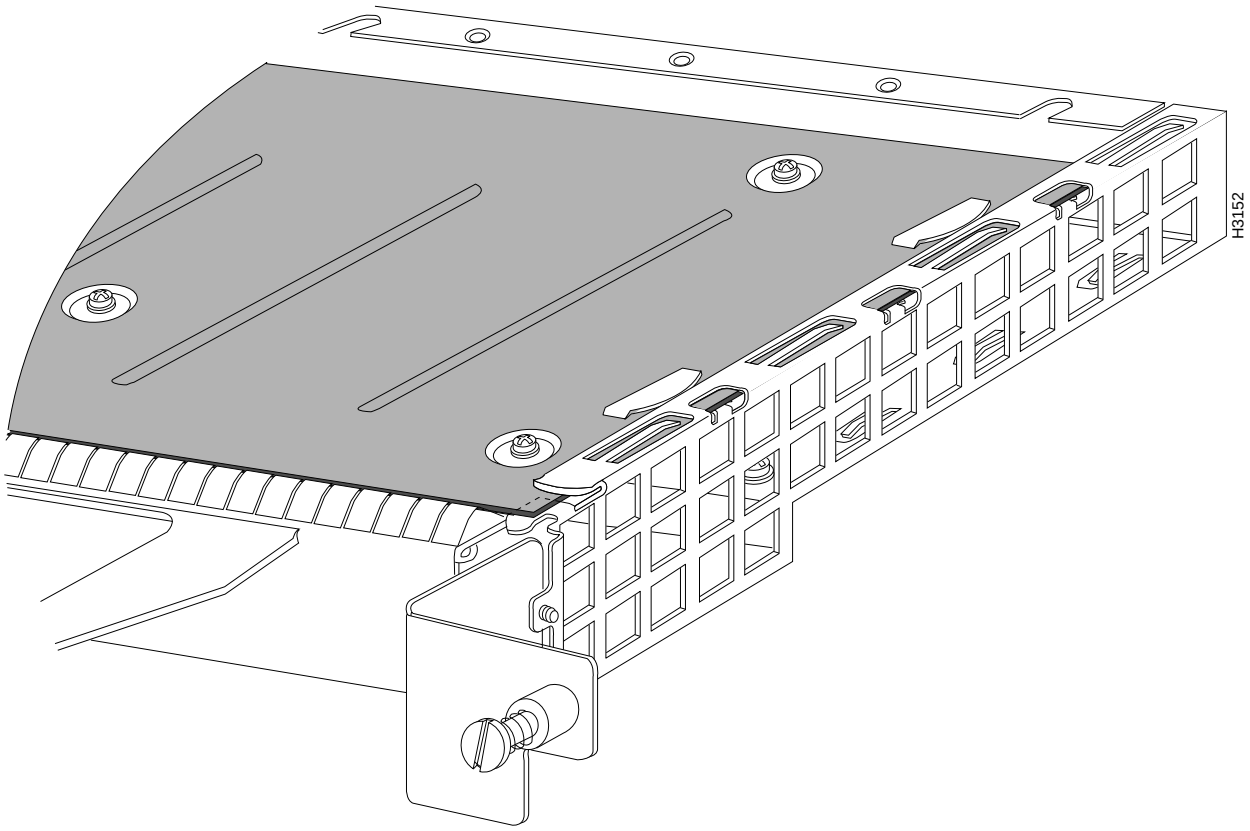


Step 10 Before you begin to insert the new port adapter in its slot, verify that the port adapter carrier is between the upper and lower slot edges, as shown in Figure 17. Do not jam the carrier between the slot edges.

Caution To ensure a positive ground attachment between the port adapter carrier and the VIP2 motherboard and port adapter slot, and to ensure that the connectors at the rear of the port adapter and slot mate properly, the carrier must be between the upper and lower slot edges, as shown in Figure 17.

Step 11 Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely mated with the connector on the motherboard.

Figure 17 Aligning the Carrier Edge with Upper and Lower Slot Edges, Partial View



Step 12 Install the screw in the rear of the port adapter slot. (See Figure 14 for its location.) Do not overtighten this screw.

Step 13 To replace the VIP2 in the chassis, follow the steps in the section "Installing a VIP2," in the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (Document Number 78-2658-xx), which shipped with your VIP2.

Step 14 If disconnected, reconnect the interface cables to the interface processor.

This completes the procedure for installing a new port adapter or replacing a port adapter on a VIP2.

Attaching FDDI Port Adapter Cables

Both single-mode and multimode, dual attachment connections are available. Fiber-optic cable connects directly to the FDDI ports. Single-mode uses simplex or duplex SC-type transmit and receive cables.

Warning Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures*. (For translated versions of this warning, refer to the section "Translated Safety Warnings.")

Connect single-mode, dual attachment as shown in Figure 18 or Figure 19.

Figure 18 Single-Mode Dual Attachment with Four Simplex SC-Simplex Cables

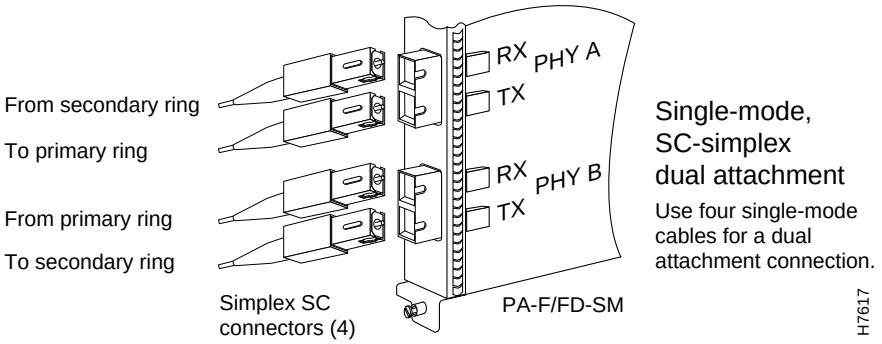
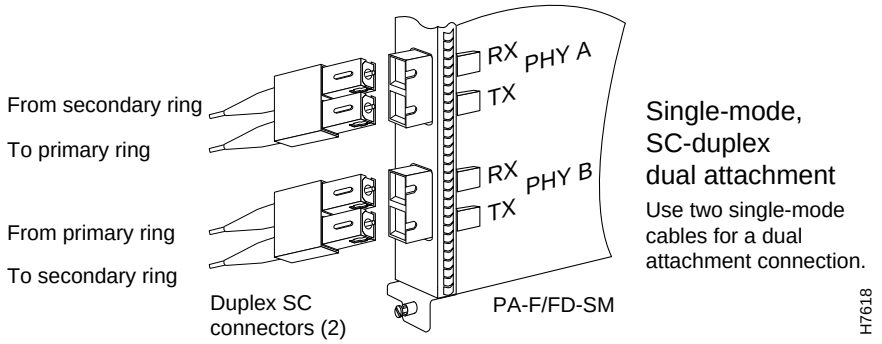
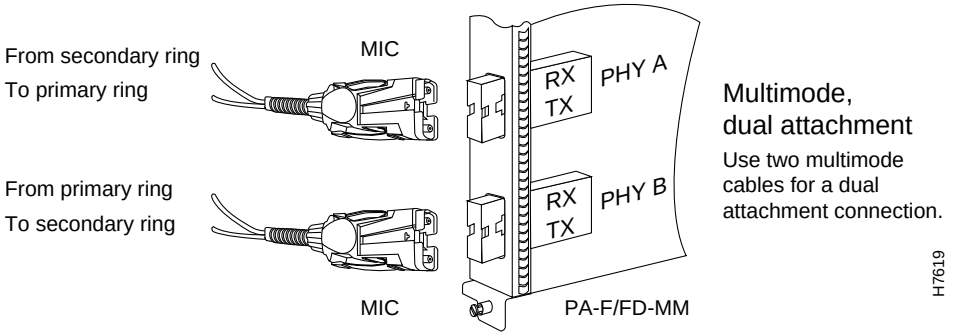


Figure 19 Single-Mode Dual Attachment with Two Duplex SC-Duplex Cables



Multimode uses MIC cables. Connect multimode, dual attachment as shown in Figure 20

Figure 20 Multimode Dual Attachment with MIC Cables



Attaching an Optical Bypass Switch

An optical bypass switch is a device installed between the ring and the station that provides additional fault tolerance to the network. If an FDDI port adapter that is connected to a bypass switch fails or shuts down, the bypass switch activates automatically and allows the light signal to pass directly through it, bypassing the port adapter completely.

Following are general instructions for connecting an optical bypass switch to the FDDI port adapter; however, your particular bypass switch may require a different connection scheme. Use these steps and the illustrations in Figure 21 and Figure 22, on page page 23, as general guidelines, but for specific connection requirements, refer to the instructions provided by the manufacturer of the optical bypass switch.

- Connect the bypass switch to the ring. Unless the documentation that accompanies the bypass switch instructs otherwise, observe the same guidelines for connecting the A/B ports on the bypass switch that you would to connect the ring directly to the FDDI ports. Use the receive label on the cable connectors as a key and connect the multimode or single-mode cables to the network (ring) side of the bypass switch as follows:
  - Connect the cable coming in from the primary ring (*from* PHY B at the preceding station) to the PHY A receive port on the network (ring) side of the bypass switch. This also connects the signal going out to the secondary ring to the PHY A transmit port.
  - Connect the cable coming in from the secondary ring (*from* PHY A at the preceding station) to the PHY B receive port on the network (ring) side of the bypass switch. This also connects the signal going out to the primary ring to the PHY B transmit port.
- Connect the bypass switch to the port adapter. Unless the documentation that accompanies the bypass switch instructs otherwise, consider the bypass an extension of the FDDI ports and connect A to A and B to B. The network cables are already connected to the bypass switch following the standard B-to-A/A-to-B scheme.
  - Connect an interface cable between the PHY A port on the station (port adapter) side of the bypass switch and the FIP PHY A port.
  - Connect an interface cable between the PHY B port on the station (port adapter) side of the bypass switch and the FIP PHY B port.

- Connect the bypass switch control cable. If the control cable on your optical bypass switch uses a mini-DIN connector, connect the cable directly to the female mini-DIN optical bypass port on the FDDI port adapter. If the switch uses a standard DIN connector, use the optical bypass adapter cable (CAB-FMDD=) supplied with each FDDI port adapter. Connect the DIN end of the adapter cable to the DIN on the control cable, and connect the mini-DIN end of adapter cable to the mini-DIN optical bypass port on the FDDI port adapter.

A port for connecting an optical bypass switch is provided on the multimode/multimode port adapter (PA-F/FD-MM shown in Figure 21), and the single-mode/single-mode port adapter (PA-F/FD-SM, shown in Figure 22).

Figure 21 Optical Bypass Switch Connection (PA-F/FD-MM)

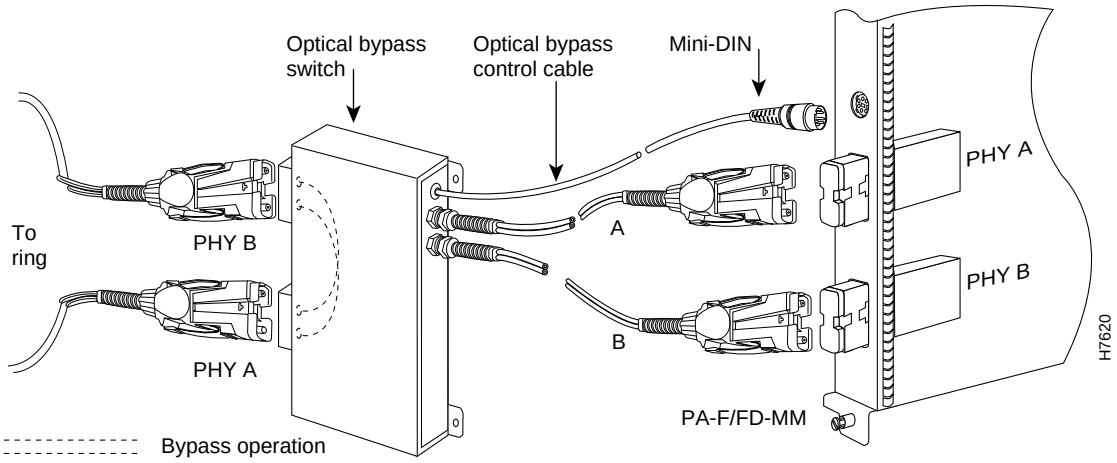
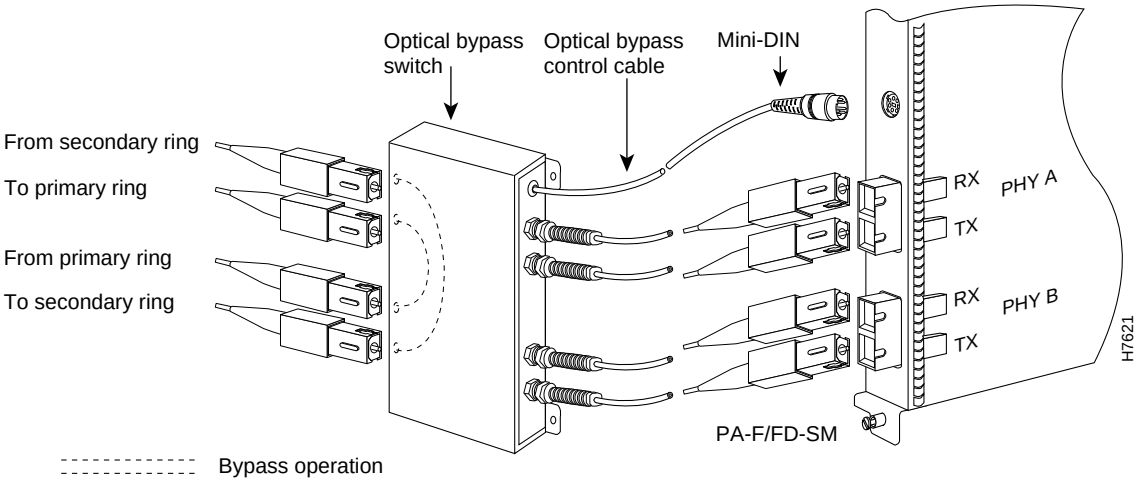


Figure 22 Optical Bypass Switch Connection (PA-F/FD-SM)



Note Up to 160 milliamperes of current can be supplied to the optical bypass switch.

Configuring the FDDI Port Adapter Interfaces

If you installed a new FDDI 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 an FDDI port adapter that was previously configured, the system will recognize the new FDDI interfaces and bring them up in their existing configuration. After you verify that the new FDDI 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 or source route bridging (SRB)
- Whether or not the PA-F/FD-SM or PA-F/FD-MM port adapters will use full-duplex mode

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. For a summary of the configuration options available and instructions for configuring the FDDI interfaces on the VIP2, refer to the appropriate configuration publications listed in the section "If You Need More Information" on page 2.

Following are the topics included in this section:

Selecting Chassis Slot, Port Adapter, and FDDI Port Numbers

The following section describes how to identify chassis slot, port adapter, and FDDI port numbers.

Note Although the processor slots in the seven-slot Cisco 7000 and Cisco 7507 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.

In the router, physical port addresses specify the actual physical location of each interface port on the router interface processor end. (See Figure 23.) This address is composed of a three-part number in the format *chassis slot number/port adapter number/interface port number*, as follows:

The first number identifies the chassis slot in which the VIP2 is installed (as shown in the example system in Figure 23).

The second number identifies the physical port adapter slot number on the VIP2, and is either 0 or 1.

The third number identifies the interface port on each FDDI port adapter, which is always numbered as interface 0.

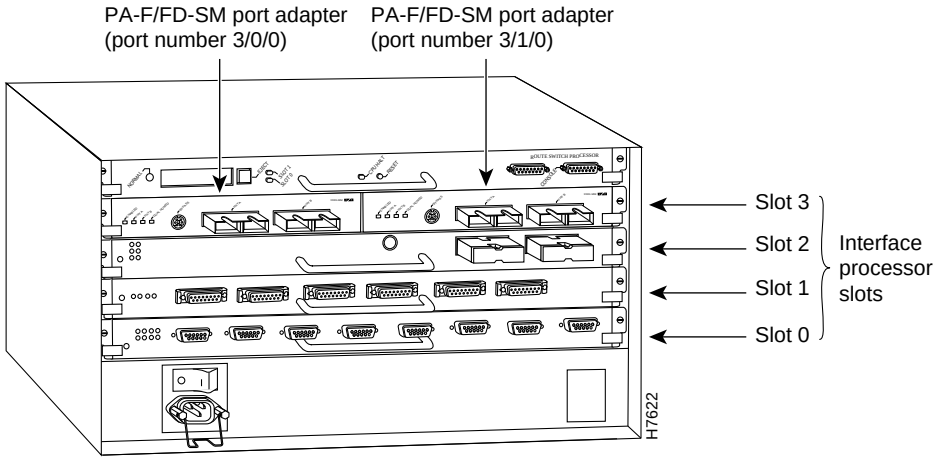
Interface ports on the VIP2 maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP2 to a different slot, the first number in the address changes to reflect the new chassis slot number.

Figure 23 shows some of the slot port adapter and interface ports of a sample Cisco 7505 system. For example, on a VIP2 equipped with two FDDI port adapters in slot 3, the address of the first FDDI port adapter is 3/0/0 (chassis slot 3, port adapter slot 0, and interface port 0), and the address of the second FDDI port adapter is 3/1/0.

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.

Note If you remove a VIP2 with two FDDI port adapters from slot 3 and install it in slot 2, the addresses of those same FDDI ports become 2/0/0 through 2/1/0.

Figure 23 Interface Port Number Example (Cisco 7505 Shown)



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.

Configuring Interfaces

The following steps describe a basic configuration. Press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

Following is a basic configuration procedure:

Step 1 At the privileged-level prompt, enter Configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:

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

Step 2 At the prompt, specify the first interface to configure by entering the subcommand **interface**, followed by the *type* (**fe**) *and slot/port* (interface processor slot number/0). The example that follows is for the first interface of the first port adapter, on a VIP2 in interface processor slot 1:

```
Router(config)# interface fddi 1/0/0
```

Step 3 If IP routing is enabled on the system, you can assign an IP address and subnet mask to the interface with the **ip address** configuration subcommand, as in the following example:

```
Router(config-int)# ip address 1.1.1.10 255.255.255.0
```

Step 4 Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.

Step 5 Change the shutdown state to up and enable the interface as follows:

```
Router(config-int)# no shutdown
```

Step 6 Configure additional interfaces on additional port adapters as required.

Step 7 When you have included all of the configuration subcommands to complete the configuration, press **Ctrl-Z** to exit Configuration mode.

Step 8 Write the new configuration to nonvolatile memory as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

To check the interface configuration using the **show** and **ping** commands, proceed to the section "Checking the Configuration."

Note If you require full-duplex operation, verify that you are using PA-F/FD-SM or PA-F/FD-MM port adapters and that you have the correct minimum Cisco IOS release for full-duplex compatibility; refer to the sections "Software and Hardware Requirements" and "Verifying Full-Duplex Port Adapter Capability in Your Router," on page 3, then proceed to the following section "Configuring Full-Duplex Operation."

Configuring Full-Duplex Operation

Full-duplex operation requires FDDI port adapters PA-F/FD-SM or PA-F/FD-MM, and requires that the host router has a specific, minimum Cisco IOS software release. (Refer to the section "Software and Hardware Requirements" on page 3.)

Full-duplex operation is *not* the default configuration and must be turned on using the **fddi full-duplex** command. To turn off full-duplex operation and reset the interface, use the **no fddi full-duplex** command.

Following is an example of configuring an FDDI interface for full-duplex operation using the **fddi full-duplex** command:

```
Router# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# int f 0/1/0
Router(config-if)# fddi full-duplex
Ctrl-z
Router#
```

Note If the port adapter does not support full-duplex operation, the following error message will appear: "%FDDI-3-FDDIFAIL: Interface Fddi0/0/0, doesn't support, fddi full = 0x0."

The output of the **show interfaces fddi** *slot/port-adapter/port* command displays the state of the FDDI port adapter interface and the state of full-duplex operation. Following is a partial sample output of this command from an FDDI interface with full-duplex operation enabled:

```
Router# show int f 3/0/0
Fddi3/0/0 is up, line protocol is up
  Hardware is cxBus FDDI, address is 0000.0c0c.4444 (bia 0060.3e47.4360)
  Internet address is 14.0.0.2/8
  MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 10/255
  Encapsulation SNAP, loopback not set, keepalive not set
  ARP type: SNAP, ARP Timeout 04:00:00
  FDX supported, FDX enabled, FDX state is *
```

where *, in the last line, could be `idle`, `request`, `confirm`, or `operation`, depending on the state the FDDI interface was in when the show interfaces command is entered.

Note When full-duplex operation is turned off using the **no fddi full-duplex** command, the last line of the preceding display includes the following information: `FDX supported, FDX disabled`.

If the port adapter does *not* support full-duplex, `FDX NOT supported` is displayed. Full-duplex operation requires Cisco IOS Release 11.1(6)CA, or later, *and* port adapters PA-F/FD-SM or PA-F/FD-MM.

Checking the Configuration

After configuring the new interface, use the **show** commands to display the status of the new interface or all interfaces and the **ping** command to check and verify connectivity.

Following are the topics included in this section:

- Using show Commands to Verify the VIP2 Status
- Using show Commands to Display Interface Information, page 29
- Using the ping Command to Verify Connectivity, page 32

Using show Commands to Verify the VIP2 Status

The following steps use **show** commands to verify that the new interfaces are configured and operating correctly.

Step 1 display the system hardware configuration with the **show version** command. Ensure that the list includes the new interfaces.

Step 2 Display all the current interface processors and their interfaces with the **show controllers cbus** command. Verify that the new VIP2 appears in the correct slot.

Step 3 Specify one of the new interfaces with the **show interfaces** *type slot/port adapter/interface* 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 **show protocols** command. If necessary, return to Configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 5 Display the running configuration file with the **show running-config** command. Display the configuration stored in NVRAM using the **show startup-config** 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.

Using show Commands to Display Interface Information

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. The following example shows all of the information specific to the first FDDI port (interface port 0) in chassis slot 3, port adapter slot 0:

```
Router# show int f 3/0/0
Fddi3/0/0 is up, line protocol is up
  Hardware is cxBus FDDI, address is 0000.0c0c.4444 (bia 0060.3e47.4360)
  Internet address is 14.0.0.2/8
   MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 10/255
  Encapsulation SNAP, loopback not set, keepalive not set
  ARP type: SNAP, ARP Timeout 04:00:00
  FDX supported, FDX disabled, FDX state is operation
  Phy-A state is connect, neighbor is Unknown, status QLS
  Phy-B state is active, neighbor is A, status SILS
  ECM is in, CFM is c_wrap_b, RMT is ring_op,
  Requested token rotation 5000 usec, negotiated 0 usec
  Configured tvx is 2500 usec
  LER for PortA = 09, LER for PortB = 0C ring operational 11:36:23
  Upstream neighbor 0000.0c0c.8888, downstream neighbor 0000.0c0c.8888
  Last input 00:02:22, output 00:00:06, output hang never
  Last clearing of "show interface" counters 14:57:58
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 3922000 bits/sec, 147 packets/sec
  5 minute output rate 3962000 bits/sec, 148 packets/sec
     7523044 packets input, 631964210 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     7523554 packets output, 625092443 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 transitions, 0 traces,  0 claims, 0 beacon
```

Interfaces are administratively shut down until you enable them. With the **show interfaces** command, use just the argument *type* to display information about a specific type of interface only. For example, **show interfaces fddi** will display information about just the FDDI ports in the system.

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 in which an FDDI-equipped VIP2 is installed:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-JV-M), Released Version 11.1(6)CA [biff 101]
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Fri 10-May-96 16:20 by biff
Image text-base: 0x600108A0, data-base: 0x608DC000

ROM: System Bootstrap, Version 5.3(18168) [biff 61], INTERIM SOFTWARE
ROM: GS Software (RSP-BOOT-M), Experimental Version 11.1(6)CA [biff 103]

Router uptime is 20 hours, 34 minutes
System restarted by power-on
System image file is "slot0:zippy/biff/rsp-jv-mz.111.6ca", booted via slot0

cisco RSP2 (R4600) processor with 16384K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
SuperLAT software copyright 1990 by Meridian Technology Corp).
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
Primary Rate ISDN software, Version 1.0.
Chassis Interface.
2 VIP2 controllers (8 Ethernet)(2 Fddi).
8 Ethernet/IEEE 802.3 interfaces.
2 FDDI network interfaces.
125K bytes of non-volatile configuration memory.

8192K 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 0x0
```

To determine which type of port adapter is installed on a VIP2 in your system, use the **show diagbus** *slot* command. Specific port adapter information is displayed, as shown in the following examples of PA-F/FD-SM and PA-F/FD-MM port adapters in chassis slots 3 and 5:

```
Router# show diag 3
Slot 3:
        Physical slot 3, ~physical slot 0xC, logical slot 3, CBus 0
        Microcode Status 0xC
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status: Console I/O
        EEPROM format version 1
        VIP2 controller, HW rev 2.2, board revision UNKNOWN
        Serial number: 03507946  Part number: 73-1684-02
        Test history: 0x00        RMA number: 00-00-00
        Flags: cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20: 01 15 02 02 00 35 86 EA 49 06 94 02 00 00 00 00
          0x30: 12 2B 00 2A 1A 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags: 0x4      Insertion time: 0x1988 (20:32:53 ago)

        Controller Memory Size: 8 MBytes

        PA Bay 0 Information:
                FDDI PA, 1 ports, PA-F/FD-SM
                EEPROM format version 1
                HW rev 1.0, Board revision 21
             Serial number: 03524551  Part number: 73-2139-01
```

(Where *Part number:* in the last line refers to a PA-F/FD-SM port adapter.)

```
Router# show diag 5
Slot 5:
        Physical slot 5, ~physical slot 0xA, logical slot 5, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status: None
        EEPROM format version 1
        VIP2 controller, HW rev 2.2, board revision UNKNOWN
        Serial number: 03507948  Part number: 73-1684-02
        Test history: 0x00        RMA number: 00-00-00
        Flags: cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20: 01 15 02 02 00 35 86 EC 49 06 94 02 00 00 00 00
          0x30: 12 2B 00 2A 1A 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags: 0x4      Insertion time: 0x3C3C (20:32:59 ago)

        Controller Memory Size: 8 MBytes

        PA Bay 0 Information:
                FDDI PA, 1 ports, PA-F/FD-MM
                EEPROM format version 1
                HW rev 1.0, Board revision 21
                Serial number: 02825768 Part number: 73-2138-01
```

(Where *Part number:* in the last line refers to a PA-F/FD-MM.)

Using the ping Command to Verify Connectivity

The *packet internet groper* (**ping**) command allows you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. This section provides brief descriptions of the **ping** command. After you verify that the system and VIP2 have booted successfully and are operational, you can use this command to verify the status of interface ports.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the address 1.1.1.10:

```
Router# ping 1.1.1.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 1.1.1.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

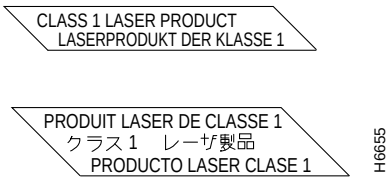
If the connection fails, verify that you have the correct IP address for the server and that the server is active (powered on), and repeat the **ping** command.

For complete descriptions of interface subcommands and the configuration options available for VIP2-related interfaces, and which support VIP2 functionality, refer to the publications listed in the section “If You Need More Information” on page 2.

Translated Safety Warnings

Warning Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI card when no cable is connected. *Avoid exposure and do not stare into open apertures.*

Following is an example of the laser warning labels that appears on the product:



Waarschuwing Wanneer geen kabel aangesloten is, kan er onzichtbare laserstraling geëmitteerd worden uit de apertuurpoorten van de enkelvoudige-modus FDDI-kaart ("Fiber Distributed Data Interface" = "Interface van door glasvezels gedistribueerde gegevens"). *Vermijd blootstelling en staar niet in de open aperturen.*

Varoitus Yksitoimintoisen FDDI-kortin avoimista porteista saattaa vapautua näkymättömiä lasersäteitä kaapelin ollessa irrotettuna. *Vältä säteilyä ja avoimiin aukkoihin katsomista.*

Attention Des rayons laser invisibles peuvent s'échapper des ouvertures prévues pour la carte d'interface des données distribuées par fibres optiques monomode (Fiber Distributed Data Interface ou FDDI) quand un câble n'est pas connecté. *Eviter toute exposition et ne pas approcher les yeux des ouvertures.*

Warnung Wenn kein Kabel angeschlossen ist, wird möglicherweise unsichtbare Laserstrahlung von den Steckanschlüssen der Monomode-FDDI-Karte (Glasfaserdatenübertragungs-Schnittstelle; Fiber Distributed Data Interface) ausgestrahlt. *Schützen Sie sich vor Strahlung, und blicken Sie nicht direkt in offene Steckanschlüsse.*

Avvertenza Radiazioni laser invisibili potrebbero essere emesse dalle porte di apertura della scheda FDDI (Fiber Distributed Data Interface - Interfaccia di dati distribuiti a fibre) a modo singolo quando il cavo non è stato collegato. *Evitare l'esposizione a tali radiazioni e non fissare alcuna porta aperta.*

Advarsel Usynlig laserstråling kan emitteres fra åpningsutgangene på FDDI-kort med kabel av monomodusfiber når de ikke er tilkoblet en ledning. *Unngå utsettelse for stråling, og stirr ikke inn i åpne åpninger.*

Aviso Radiação laser invisível poderá ser emitida através das portas de abertura da placa FDDI (Interface de Dados Distribuídos por Fibra Óptica) de modo simples, mesmo quando não houver nenhum cabo ligado. *Evite exposição e não espreite por estas aberturas.*

¡Atención! La tarjeta FDDI modo sencillo puede emitir radiaciones láser invisibles por los orificios de los puertos cuando no se haya conectado ningún cable. *Evitar la exposición y no mirar fijamente los orificios abiertos.*

Varning! Osynlig laserstrålning kan avges från portöppningarna för FDDI-kortet för enkelmodsfiber när ingen kabel är ansluten (FDDI: Fiber Distributed Data Interface = gränssnitt för dataöverföring med fiberoptik). *Utsätt dig inte för denna strålning och titta inte in i öppningarna.*

Warning Class 1 laser product.

Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Attention Produit laser de classe 1.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

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You can access CCO in the following ways:

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

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

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

This document is to be used in conjunction with the *Cisco 7000 Hardware Installation and Maintenance, Cisco 7010 Hardware Installation and Maintenance, Cisco 7505 Hardware Installation and Maintenance, Cisco 7507 Hardware Installation and Maintenance, Cisco 7513 Hardware Installation and Maintenance,* and *Versatile Interface Processor (VIP2) Installation, Configuration, and Maintenance* publications. (3851fdfd.fm)