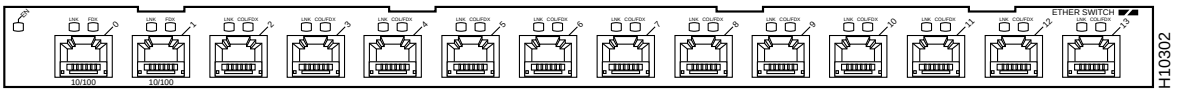
Overview

This chapter describes the PA-12E/2FE port adapter and contains the following sections:

Port Adapter Overview

The PA-12E/2FE, shown in Figure 1-1, provides up to twelve 10-Mbps and two 10/100-Mbps switched Ethernet (10Base-T) and Fast Ethernet (100BaseTX) interfaces for the chassis. The PA-12E/2FE network interfaces provide a direct connection between the high-speed bus in the router and external networks. Each PA-12E/2FE provides an aggregate bandwidth of 435 Mbps, full-duplex.

Figure 1-1 PA-12E/2FE Faceplate View



The PA-12E/2FE is a dual-width port adapter, which means it occupies two horizontally aligned port adapter slots when installed in a Cisco 7200 series router or Cisco uBR7246. (Single-width port adapters occupy individual port adapter slots.)

The PA-12E/2FE has two handles, but the handles are not shown in Figure 1-1 to allow a full view of the port adapter faceplate.

Note Cisco 7200 series and Cisco uBR7200 series routers support online insertion and removal (OIR) of all port adapter types.

The PA-12E/2FE port adapter off-loads Layer 2 switching from the host CPU by using store-and-forward or cut-through packet switching technology between interfaces within the same virtual LAN (VLAN) on the PA-12E/2FE. The PA-12E/2FE supports up to four VLANs (referred to in this document as *bridge groups*).

When using store-and-forward packet switching technology, the PA-12E/2FE receives and processes a packet completely (calculates the cyclic redundancy check [CRC] and checks the packet destination address) before forwarding the packet through the outgoing interface; packets are temporarily stored until the outgoing interface is available. Store-and-forward packet switching is the default for the PA-12E/2FE.

When using cut-through packet switching technology, the PA-12E/2FE reads, processes, and forwards a packet as soon as the packet destination address is looked up and the outgoing interface is determined. While cut-through packet switching technology greatly reduces the amount of time a packet spends in the PA-12E/2FE—the leading edge of the packet exits the output interface before the packet finishes entering the input interface—it enables the PA-12E/2FE to forward packets before calculating the CRC.

All 12E/2FE interfaces (port 0 through port 13) support autosensing and autonegotiation of the proper transmission mode (half-duplex or full-duplex) with an attached device. The first two 12E/2FE interfaces (port 0 and port 1) also support autosensing and autonegotiation of the proper connection speed (10-Mbps or 100-Mbps) with an attached device.

Each 12E/2FE interface connector is an RJ-45 receptacle that supports standard straight-through and crossover Category 3 or Category 5 UTP cables. Cisco Systems does not supply Category 3 and Category 5 UTP cables; these cables are available commercially.

Ethernet 10Base-T and Fast Ethernet 100Base-TX Overview

The term *Ethernet* is commonly used for all carrier sense multiple access collision detection (CSMA/CD) local-area networks (LANs) that generally conform to Ethernet specifications, including IEEE 802.3 and Fast Ethernet under IEEE 802.3u.

Ethernet, IEEE 802.3, 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.

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, and 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 to retransmit.

The 12E/2FE port adapter supports the Ethernet, IEEE 802.3, and IEEE 802.3u specifications for 10-Mbps and 100-Mbps transmission over UTP cables.

IEEE 802.3 10Base-T and IEEE 802.3u 100Base-TX Specifications

Table 1-1 lists the cabling specifications for 10-Mbps transmission over UTP cables.

Table 1-1 Cable Specifications for 10-Mbps 10Base-T

Parameter	RJ-45 Connector
Cable specification	Category 5 UTP[1], 22 to 24 AWG[2]
Maximum segment length	328 ft (100 m)
Maximum network length	656 ft[3] (200 m) (with 1 repeater)

1. Cisco Systems does not supply Category 5 UTP cables; these cables are available commercially.
2. AWG = American Wire Gauge. This gauge is specified by the EIA/TIA-568 standard.
3. This length is specifically between any two stations on a repeated segment.

Table 1-2 lists the cabling specifications for 100-Mbps Fast Ethernet transmission over UTP cables.

Table 1-2 Cable Specifications for 100-Mbps 100Base-TX

Parameter	RJ-45 Connector
Cable specification	Category 5[1] UTP[2], 22 to 24 AWG[3]
Maximum segment length	100 m (328 ft)
Maximum network length	200 m (656 ft)[4] (with 1 repeater)

1. EIA/TIA-568 or EIA-TIA-568 TSB-36 compliant.
2. Cisco Systems does not supply Category 5 UTP; these cables are available commercially.
3. AWG = American Wire Gauge. This gauge is specified by the EIA/TIA-568 standard.
4. This length is specifically between any two stations on a repeated segment.

Use Category 3 unshielded twisted-pair (UTP) crossover cables when connecting 10-Mbps 12E/2FE interfaces (port 2 through port 13) to a hub. Use Category 3 UTP straight-through cables when connecting 10-Mbps 12E/2FE interfaces to an end station.

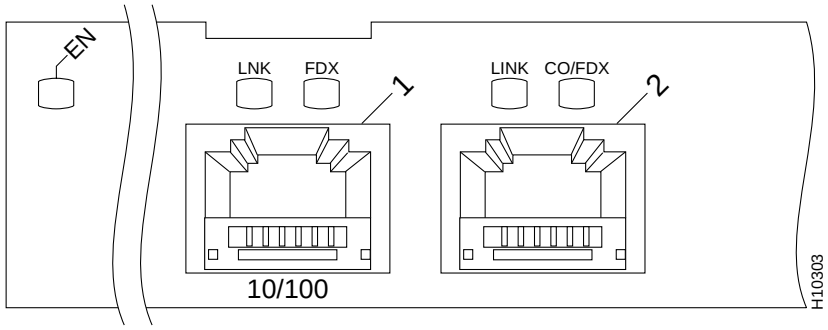
Use Category 5 UTP crossover cables when connecting 10/100-Mbps 12E/2FE interfaces (port 0 and port 1) to a hub. Use Category 5 UTP straight-through cables when connecting 10/100-Mbps 12E/2FE interfaces to an end station.

12E/2FE interfaces do not support VLAN trunking.

LEDs

The PA-12E/2FE has two status LEDs for each port and one enabled LED. (See Figure 1-2.) The green- and amber-colored LED for each port indicates port status.

Figure 1-2 LEDs on the PA-12E/2FE—Horizontal Orientation



After system initialization, the enabled LED goes on to indicate that the port adapter has been enabled for operation.

The following conditions must be met before the PA-12E/2FE is enabled:

- The PA-12E/2FE is correctly connected and is receiving power.
- A valid system software image for the port adapter has been downloaded successfully.
- The system recognizes the PA-12E/2FE.

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

Table 1-3 lists port LED status indications.

Table 1-3 PA-12E/2FE LEDs

LED Label	Color	State	Meaning
ENABLED	Green	On	Port adapter is enabled for operation.
LNK	Green	On	The port is receiving a carrier signal from the network.
FDX[1]	Green	On	The port is configured for full-duplex operation.
		Off	The port is configured for half-duplex operation.
CO/FDX[2]	Green	On	The port is configured for full-duplex operation.
		Off	The port is configured for half-duplex operation.
		Flashing	The port detects a transmission collision on the network.

1. The FDX LED is present on port 0 and port 1.
2. The CO/FDX LED is present on port 2 through port 13.

Cables, Connectors, and Pinouts

The interface connectors on the PA-12E/2FE are 14 individual RJ-45 receptacles. You can use all 14 receptacles simultaneously. The first two receptacles support IEEE 802.3, Ethernet, and IEEE 802.3u interfaces compliant with 10Base-T and 100Base-TX specifications. The remaining 12 receptacles support IEEE 802.3 and Ethernet interfaces compliant with 10Base-T specifications.

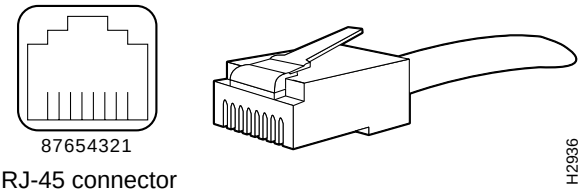
Note Use Category 3 unshielded twisted-pair (UTP) crossover cables when connecting 10-Mbps 12E/2FE interfaces (port 2 through port 13) to a hub. Use Category 3 UTP straight-through cables when connecting 10-Mbps 12E/2FE interfaces to an end station.

Use Category 5 UTP crossover cables when connecting 10/100-Mbps 12E/2FE interfaces (port 0 and port 1) to a hub. Use Category 5 UTP straight-through cables when connecting 10/100-Mbps 12E/2FE interfaces to an end station.

12E/2FE interfaces do not support VLAN trunking.

Figure 1-3 shows an RJ-45 connector. Table 1-4 lists the pinouts and signals for the RJ-45 connectors.

Figure 1-3 PA-12E/2FE RJ-45 Connection, Plug and Receptacle



Warning **To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.**

Table 1-4 PA-12E/2FE RJ-45 Connector Pinouts

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

Note Proper common-mode line terminations should be used for the unused Category 3 and Category 5, UTP cable pairs 4/5 and 7/8. Common-mode termination reduces electromagnetic interference (EMI).

Depending on your 12E/2FE RJ-45 interface cabling requirements, use the pinouts shown in Figure 1-4 and Figure 1-5 for straight-through and crossover twisted-pair cable connections.

Figure 1-4 Straight-Through Cable Pinout, 12E/2FE RJ-45 Connection to an End Station

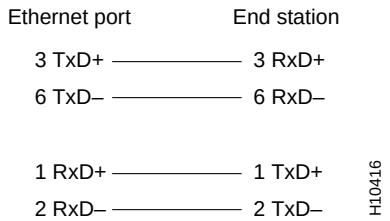
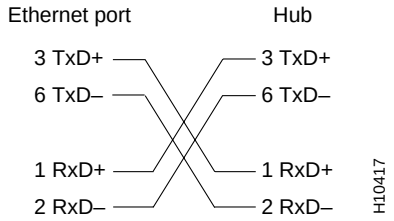
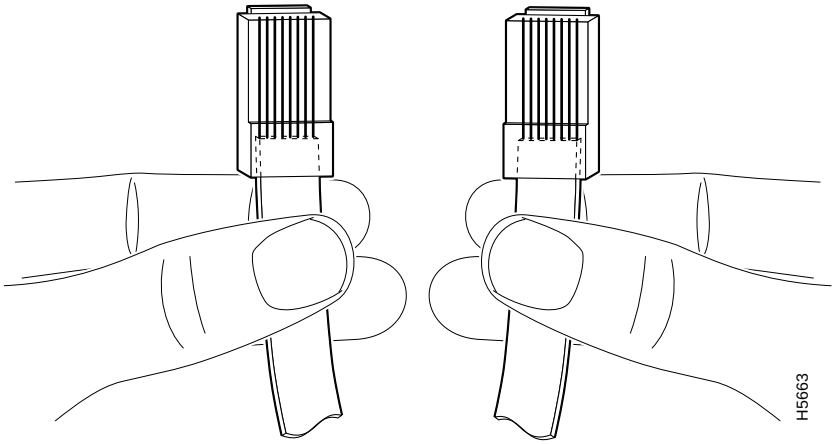


Figure 1-5 Crossover Cable Pinout, 12E/2FE RJ-45 Connections To a Hub



To identify the RJ-45 cable type, hold the two ends of the cable next to each other so you can see the colored wires inside the ends, as shown in Figure 1-6.

Figure 1-6 RJ-45 Cable Identification



Examine the sequence of colored wires to determine the type of RJ-45 cable as follows:

- Straight-through—The colored wires are in the same sequence at both ends of the cable.
- Crossover—The first (far left) colored wire at one end of the cable is the third colored wire at the other end of the cable, and the second colored wire at one end of the cable is the sixth colored wire at the other end of the cable.

To connect Category 5 UTP crossover or straight-through cables with RJ-45 connectors, connect 10/100-Mbps 12E/2FE interfaces (port 0 and port 1) to a hub using crossover cables or to an end station using straight-through cables.

Note Category 3 and Category 5 UTP cables are not available from Cisco Systems; they are available from commercial cable vendors.

Port Adapter Slot Locations on the Supported Platforms

This section discusses port adapter slot locations on the supported platforms. The illustrations that follow summarize slot location conventions on each platform.

Cisco 7200 Series and Cisco uBR7200 Series Routers Slot Numbering

Figure 1-7 shows a Cisco 7206 with port adapters installed. In the Cisco 7206 (including the Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server), port adapter slot 1 is in the lower left position, and port adapter slot 6 is in the upper right position. (The Cisco 7202 and Cisco 7204 are not shown; however, the PA-12E/2FE can be installed in any two available port adapter slots.)

Figure 1-7 Port Adapter Slots in the Cisco 7206

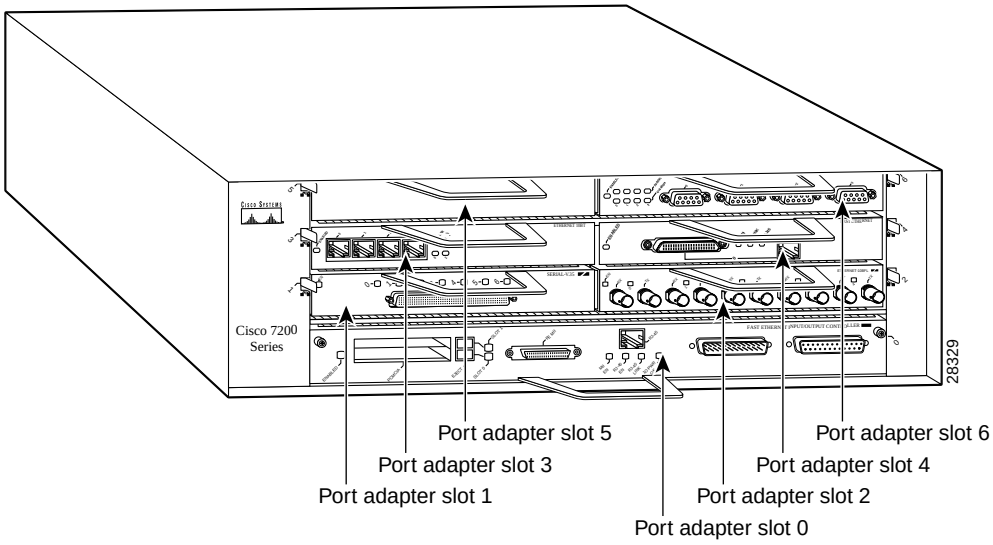
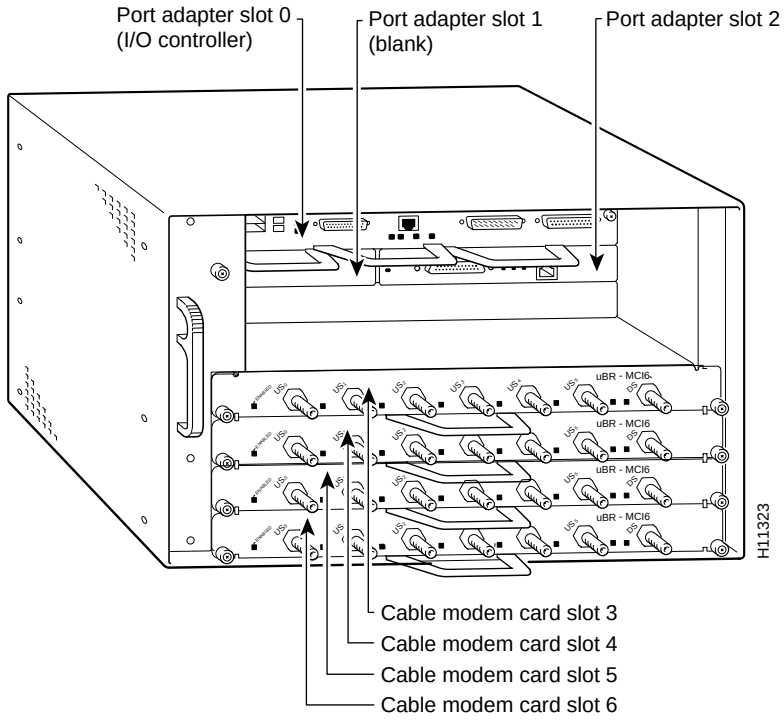


Figure Figure 1-8 shows the slot numbering of port adapters in a Cisco uBR7246 series router. The port adapter slots are numbered slot 1 and slot 2 for the cisco uBR7246. (Slot 0 is always reserved for the Fast Ethernet port on the I/O controller–if present.)

Figure 1-8 Port Adapter Slots in the Cisco uBR7246



Identifying Interface Addresses

This section describes how to identify interface addresses for the PA-12E/2FE in supported platforms. Interface addresses specify the actual physical location of each interface on a router or switch.

Interfaces on the PA-12E/2FE installed in a router maintain the same address regardless of whether other port adapters are installed or removed. However, when you move a port adapter to a different slot, the first number in the interface address changes to reflect the new port adapter slot number.

Note For dual-wide port adapters, such as the 12E/2FE, the port adapter slot number in the physical port addresses is the left port adapter slot (slot 1 in a Cisco uBR7246, slot 1 or slot 3 in a Cisco 7204, and slot 1, slot 3 or slot 5 in a Cisco 7206).

Note Interface ports are numbered from left to right starting with 0.

Table 1-5 explains how to identify interface addresses.

Table 1-5 Identifying Interface Addresses

Platform	Interface Address Format	Numbers	Syntax
Cisco 7200 series routers	Port-adapter-slot-number/interface-port-number	Port adapter slot–1,3, or 5 (depends on the number of slots in the router)[1] Interface port–0 through 13	`1/1`
Cisco uBR7246 router	Port-adapter-slot-number/interface-port-number	Port adapter slot–always slot 1 Interface port–0 through 13	`1/1`

1. Port adapter slot 0 is reserved for the Fast Ethernet port on the I/O controller (if present).

Cisco 7200 Series and Cisco uBR7246 Routers Interface Addresses

This section describes how to identify the interface addresses used for the PA-12E/2FE in Cisco 7200 series routers or Cisco uBR7246 routers. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number.* See Table 1-5 for the interface address format.

In Cisco 7200 series routers, port adapter slots are numbered from the lower left to the upper right, beginning with port adapter slot 1 and continuing through port adapter slot 2 for the Cisco 7202, slot 4 for the Cisco 7204 and Cisco 7204VXR, and slot 6 for the Cisco 7206 and Cisco 7206VXR. (Port adapter slot 0 is reserved for the optional Fast Ethernet port on the I/O controller–if present.)

The interface addresses of the interfaces on the PA-12E/2FE in port adapter slot 1 are 1/0 through 1/13 (port adapter slot 1 and interfaces 0 through 13). If the PA-12E/2FE was in port adapter slot 5, these same interfaces would be numbered 5/0 through 5/13 (port adapter slot 5 and interfaces 0 through13).

In a Cisco uBR7246 series router, port adapter slots are numbered slot 1 and slot 2. (Slot 0 is always reserved for the Fast Ethernet port on the I/O controller–if present.) The individual interfaces always begin with 0. The number of additional interfaces depends on the number of interface ports on a port adapter.

The interface addresses of the interfaces on a PA-12E/2FE in port adapter slot 1 are 1/0 through 1/13 (port adapter slot 1 and interfaces 0 through 13).

Note For the Cisco 7206 router shelf, physical port addresses are composed of a three-part number in the format *shelf-number/port-adapter-slot-number/interface-port-number*, where the *shelf number* is a number assigned to the Cisco 7206 router shelf during the initial configuration of the Cisco AS5800 Universal Access Server. A Cisco AS5800 Universal Access Server can consist of several shelves; therefore, each shelf is assigned a number.