CISCO SYSTEMS

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JT2 6.3-MHz Serial Port Adapter (PA-2JT2) Installation and Configuration

Product Numbers: PA-2JT2 and PA-2JT2=

This configuration note describes how to install and configure the Japan T2 Line (JT2) 6.3-megahertz (MHz), 2-port, serial port adapter (PA-2JT2[=]), which is used on the second-generation Versatile Interface Processor (VIP2) in all Cisco 7500 series and in Cisco 7000 series routers using the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI). (For complete and specific compatibility requirements, refer to the section "Software and Hardware Prerequisites" 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.

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Document Contents

This configuration note is organized into two parts:

1 The following sections include general information and information about JT2 port adapter installation:

— If You Need More Information

— JT2 Port Adapter Installation Prerequisites, page 3

— What Is the JT2 Port Adapter?, page 7

2 The following section includes information specific to the JT2 port adapter's use with the VIP2 in Cisco 7000 series and Cisco 7500 series routers—VIP2 and the JT2 Port Adapter, page 11

The section "Cisco Connection Online," on page 27, includes general reference information.

If You Need More Information

The Cisco Internetwork Operating System (Cisco IOS) software running your router contains extensive features and functionality. The effective use of many of these features is easier if you have more information at hand. For additional information on configuring and maintaining the Cisco 7000 series, Cisco 7200 series, and Cisco 7500 series routers, the following documentation resources are available:

- Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more up to date than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription. You can also access Cisco documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

  If you are reading Cisco product documentation on the World Wide Web, you can submit comments electronically. Click **Feedback** in the toolbar, select **Documentation**, and click **Enter the feedback form**. After you complete the form, click **Submit** to send it to Cisco. We appreciate your comments.

- Refer to the following modular configuration and modular command reference publications, as appropriate for your configuration:

  — *Configuration Fundamentals Configuration Guide*

  — *Configuration Fundamentals Command Reference*

  — *Security Configuration Guide*

  — *Security 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*

— *Debug Command Reference*

— *System Error Messages*

— *Cisco IOS Software Command Summary*

— *Cisco Management Information Base (MIB) User Quick Reference*

- For hardware installation and maintenance information on the Cisco 7000 series and Cisco 7500 series routers, and the VIP2, refer to the installation and configuration guide that shipped with your router and to the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (Document Number 78-2658-xx).

- To obtain information about documentation, refer to the following:

— Documentation CD-ROM.

— The section "Cisco Connection Online," on page 27.

— 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.

— The *Cisco Information Packet* that shipped with your router.

JT2 Port Adapter Installation Prerequisites

This section provides specific information you need to ensure a successful installation, and the following information is included:

- Software and Hardware Prerequisites

- List of Parts and Tools, page 4

- FCC Class B Compliance, page 5

- Safety Guidelines, page 5

- Port Adapter Locations on the VIP2, page 8

Software and Hardware Prerequisites

For JT2 port adapters installed on the VIP2-40 in Cisco 7000 series or Cisco 7500 series routers, Cisco IOS Release 11.1(12)CA1, or later, is required.

For JT2 port adapters installed on the VIP2-50 in Cisco 7000 series or Cisco 7500 series routers, Cisco IOS Release 11.1(14)CA, or later, is required.

Note At a minimum, you must use the VIP2-40 (with 2 MB of SRAM and 32 MB of DRAM) or VIP2-50 (with 4 to 8 MB of SRAM and 32 to 128 MB of SDRAM) for use with one or two JT2 port adapters. We do not recommend the use of any other VIP2 model with PA-2JT2.

Caution To prevent system problems, do not operate the VIP2 in Cisco 7000 series systems without the RSP7000 and RSP7000CI. The VIP2 will *not* operate properly with the Route Processor (RP), Switch Processor (SP), or Silicon Switch Processor (SSP) installed in the earlier host Cisco 7000 series routers.

List of Parts and Tools

You need the following tools and parts to install a JT2 port adapter. If you need additional equipment, contact a service representative for ordering information.

- PA-2JT2(=) and a VIP2-40(=) motherboard, with at least one available port adapter slot, and, a Cisco 7500 series router with at least one available interface processor slot, or a Cisco 7000 series router (with an RSP7000 and RSP7000CI installed) with at least one available interface processor slot.

  For specific VIP2 model requirements, refer to the note in the section "Software and Hardware Prerequisites" on page 3.

- The appropriate Cisco IOS release loaded on your router. (For Cisco IOS software prerequisites, refer to the section "Software and Hardware Prerequisites" on page 3.)

- One pair of unbalanced, 75-ohm (5% at 1 MHz), coaxial cables (with BNC connections) for each interface port, appropriate for the port adapter interfaces on your JT2 port adapter. (75-ohm coaxial cables are not supplied by Cisco systems; these cables are available from commercial cable vendors.)

  The 75-ohm coaxial BNC connections must conform to JIS C5412-1976 high-frequency coaxial C02-type connectors, which are equivalent to MIL C 3608 BNC connectors and coaxial cables. (For specific cable requirements, refer to the section "JT2 Port Adapter Interface Connectors and Cables" on page 9.)

  Further, the 75-ohm coaxial cables must have ferrite sleeves around them to reduce the effects of electromagnetic interference (EMI). Four ferrite sleeves are included with your JT2 port adapter have the following specifications: 275 ohms @ 100 MHz.

- A B-type or C-type data service unit (DSU) with a 75-ohm, coaxial BNC input and an optical fiber output, to which you attach the 75-ohm coaxial cables from the receive (RX) and transmit (TX) ports on the JT2 port adapter. (Older A-type DSUs are not supported with PA-2JT2.)

  Your DSU *must* be capable of, and set to accept, external grounding because the JT2 port adapter's TX and RX connections are grounded at the router-chassis side.

- 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.

FCC Class B Compliance

The equipment described in this publication generates and might radiate radio-frequency energy. If it is not installed in accordance with Cisco's installation instructions, it might cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in part 15 of the FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.

- Move the equipment to one side or the other of the television or radio.

- Move the equipment farther away from the television or radio.

- Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

- Modifications to this product not authorized by Cisco Systems, Inc. could void the FCC approval and negate your authority to operate the product.

Safety Guidelines

This section provides safety guidelines you should follow when working with any equipment that connects to electrical power or telephone wiring.

Safety Warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, might harm you. A warning symbol precedes each warning statement.

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. Port adapters and processor modules consist 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.

What Is the JT2 Port Adapter?

PA-2JT2 (see Figure 1) is a port adapter used on the VIP2 in the Cisco 7500 series routers, and in Cisco 7000 series routers using the RSP7000 and RSP7000CI. The JT2 port adapter is available as a spare part: Product Number PA-2JT2=.

Figure 1   PA-2JT2, Two-Port JT2 Port Adapter (Front Panel View)
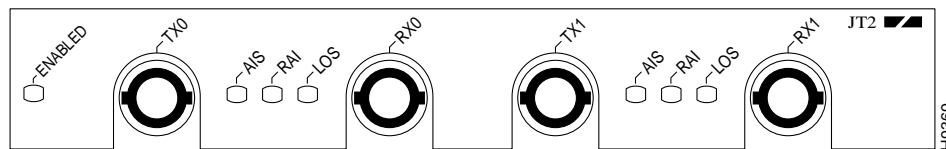
Following are JT2 port adapter features and capabilities:

- Each JT2 interface port consists of two coaxial, BNC connectors.

- Provides two data terminal equipment (DTE), synchronous serial interface ports, which are compatible with and specified by G.703a, and which permit Cisco 7000 series and Cisco 7500 series routers to communicate over a High Speed Digital 6.3 MHz (HSD 6.3) leased line service (specified in ITU Recommendation G.704).

- Uses bipolar with 8-zero substitution (B8ZS) encoding.

- Supports cyclic redundancy check (CRC). (Refer to the section "Configuring CRC5" on page 21.)

- Operates at 6.312 Mbps, with 50-percent pulse-width B8Zs encoding.

- Provides an internal fixed clock rate on each JT2 interface port of 6.144 Mbps (not configurable). The JT2 interfaces automatically use the internal clock for data transmission if no external clock is detected. When a JT2 interface is configured with the **clock source internal** command, external devices will return this clock on the JT2 interface's receive line; therefore, all clocking is properly synchronized. (Refer to the section "Using Software Configuration Commands Specific to the JT2 Port Adapter" on page 25

- Provides the functions needed to frame a wideband payload to ITU G.704 and the Nippon Telegram and Telephone Corporation (NTT)-specified 6.144-Mbps frame format.

- Designed to conform with the following emissions standards: FCC Class Limits (FCC 47 CFR Part 15, Subpart B), EN55022 Class Limits, and the Japanese Voluntary Control Council for Interference (VCCI) and CISPR 22 emission standards.

- Designed to conform with the following safety standards: UL 1950 D3 Dev., CSA 22.2 No. 950, and TUV-IEC 950.

- Received Approval Number N97-K013-0 from the Japan Approvals Institute for Telecommunications Equipment (JATE)

Port Adapter Locations on the VIP2

Figure 2 shows a VIP2 with two installed port adapters. Figure 3 shows a VIP2-50 with two installed port adapters. With the VIP2 oriented as shown, 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. There are no interface processor or port adapter slot restrictions for the VIP2 and JT2 port adapter.

Figure 2   Two Port Adapters on the VIP2-40 (Horizontal Orientation Shown)
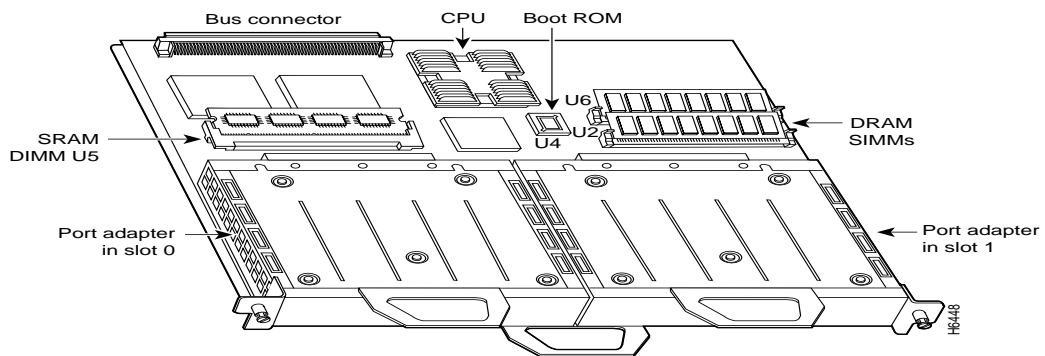
Figure 3   Two Port Adapters on a VIP2-50 (Horizontal Orientation Shown)
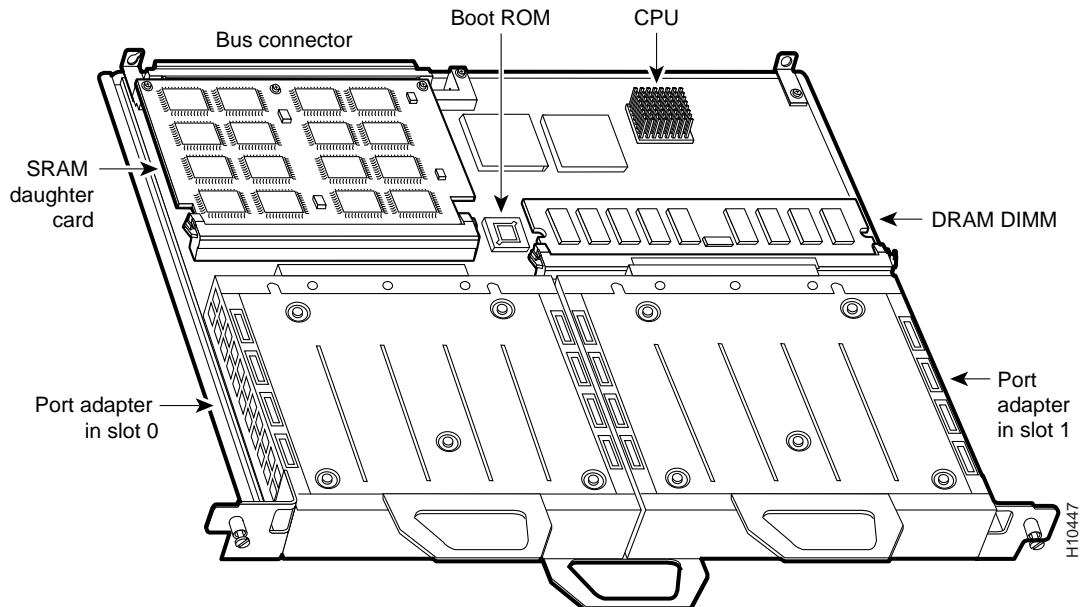
JT2 Port Adapter LEDs

The JT2 port adapter (see Figure 4) contains the enabled LED, which is standard on all port adapters; this green LED goes on after system initialization to indicate that the JT2 port adapter has been enabled for operation.

Figure 4   LEDs on the JT2 Port Adapter (Partial Front-Panel View)

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

- The JT2 port adapter is correctly connected and receiving power.

- The VIP2 contains a valid microcode version that has been downloaded successfully.

- The bus recognizes the VIP2 attached to the backplane.

If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on. The JT2 port adapter has three additional status LEDs for each JT2 port, which are labeled and function as follows:

- AIS—This red alarm indication signal LED indicates physical layer AIS when all ones are detected in the received bit stream.

- RAI—This red remote alarm indication LED indicates the presence of 16 or more repeating RAI bit patterns (1111111100000000) present on the receive data channel. Recovery occurs when four or more consecutive patterns occur, which are not the RAI pattern received.

- LOS—This red loss of signal LED indicates that a loss of signal has occurred on the receive data line when input data is zero for 20–32 consecutive clock cycles. Recovery occurs when the receive signal returns.

JT2 Port Adapter Interface Connectors and Cables

The interface connectors on the JT2 port adapter are coaxial BNC types, with one connector/cable for transmit (TX) and one for receive (RX) for each interface port. Each BNC connection requires an external B-type or C-type DSU (with external grounding capability), with an optical fiber output, and that uses 75-ohm BNC terminations. (Cisco Systems does not supply 75-ohm coaxial cables; they are available from commercial cable vendors.)

Caution   Your coaxial cable's loss must be less than 6 dB when using maximum cable lengths. To prevent problems, you *must* check your 75-ohm coaxial cable's specifications when long cable lengths are required to connect the JT2 port adapter to your DSU. Unbalanced JT2 interfaces allow for a longer maximum cable length than those specified for balanced circuits. Ideally, the maximum cable length for unbalanced, 75-ohm coaxial cable is 1,968.5 feet (600 meters).

Note   The 75-ohm coaxial BNC connections must conform to JIS C5412-1976 high-frequency, coaxial C02-type connectors, which are equivalent to MIL C 3608 BNC connectors and coaxial cables. The cables must be unbalanced, 75-ohm (5% at 1 MHz) coaxial cables.

You must install a ferrite sleeve (also called a *common-mode choke*) on each 75-ohm coaxial cable to reduce the effects of electro-magnetic interference (EMI). (Cisco Systems supplies four ferrite sleeves with your JT2 port adapter; one ferrite sleeve for each of four 75-ohm coaxial cables you can attach to PA-2JT2.)

Note   Attach the ferrite sleeve on the end of the coaxial cable nearest the PA-2JT2, as close to the BNC connector as possible. (See Figure 5.)

Caution   The ferrite sleeve is a required component for proper system operation.

Figure 5   Attaching the Ferrite Sleeve around a Coaxial Cable

Ferrite sleeve   Coaxial cable
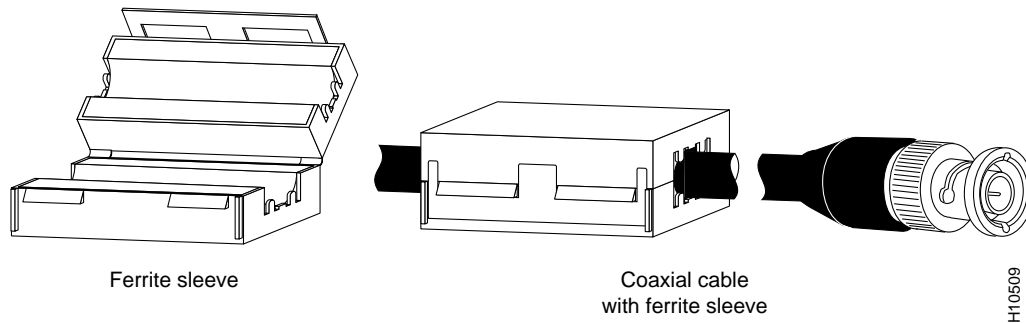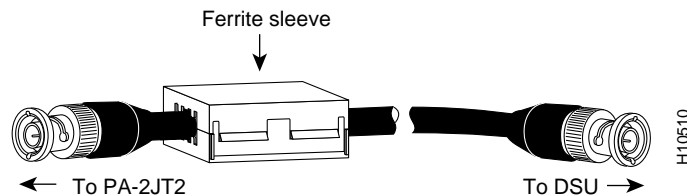   with ferrite sleeve

Figure 6 shows the typical 75-ohm coaxial cable you should use with PA-2JT2. Use only this type cable for all PA-2JT2 connections. Use one 75-ohm coaxial cable for each PA-2JT2 connection: RX0, TX0, RX1, and TX1.

Figure 6   75-Ohm Coaxial Cable with Ferrite Sleeve Attached

Ferrite sleeve

← To PA-2JT2   To DSU →

The pinout and signal descriptions for the BNC connectors on the JT2 port adapter are as follows:

- Transmit (TX) tip and TX shield, for the 75-ohm coaxial cables that attach to the TX0 and TX1 BNC connectors

- Receive (RX) tip and RX shield, for the 75-ohm coaxial cables that attach to the RX0 and RX1 BNC connectors

JT2 Frame Format Description

Japan T2 (JT2) is a 6.312 kilobits-per-second (kbps) line format specified in ITU Recommendation G.704, and described in the Japanese NTT document *Technical Reference for High-Speed Digital Leased Circuit Services*.

A frame consists of 789 bits, and the frame repetition rate is 8 KHz, for a frame duration of 125 microseconds. There are four frames in a multiframe. In each frame, there are 98, 8-bit time slots (bit 1 through bit 784), starting with bit 1 in time slot 1 (TS1).

Note Time slots 1 to 96 are used for the data payload, while time slots 97 and 98 are used for maintenance signaling by the DSU, the terminal equipment (TE), the network termination equipment (NT), or the line termination equipment (LT).

The last five bits of the frame, bit 785 through bit 789, are called the F-bits. The F-bits contain the frame and multiframe alignment signal, which consists of nine bits (110010100) carried in the first two frames of the multiframe.

VIP2 and the JT2 Port Adapter

This section describes the JT2 port adapter and its use with the VIP2.

The following sections provide additional information specific to the JT2 port adapter and its use on the VIP2 in Cisco 7000 series and Cisco 7500 series routers:

- Installing or Replacing a Port Adapter on a VIP2, page 13
- Attaching JT2 Port Adapter Interface Cables, page 17
- Configuring the JT2 Interfaces, page 19
  - — Interface Processor Slot, Port Adapter Slot, and JT2 Interface Port Numbering, page 19
  - — Configuring an Interface, page 20
  - — Checking the Configuration, page 22

Figure 7 shows a VIP2-40 with two JT2 port adapters in port adapter slots 0 and 1. Port adapters can be installed in either (or both) port adapter slot 0 or port adapter slot 1. You can install VIP2s in any interface processor slots in your Cisco 7500 series or Cisco 7000 series router.

Figure 7   VIP2-40 with Two JT2 Port Adapters (Horizontal Orientation Shown)
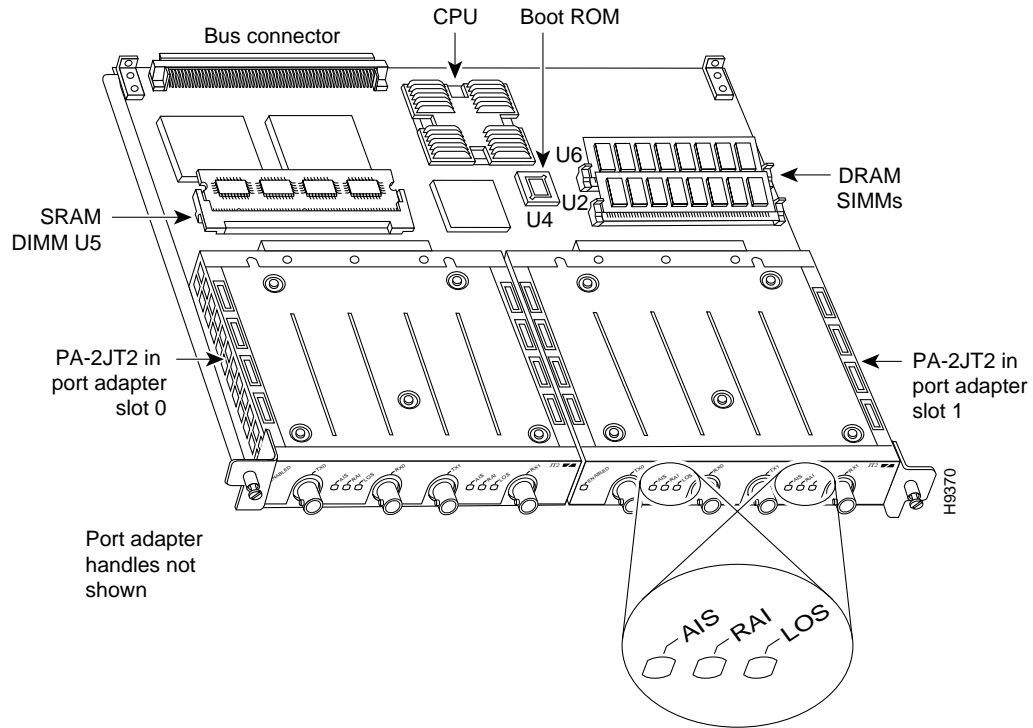
Note   Port adapters and VIP2 carriers have handles attached, but these handles are occasionally not shown in this publication to allow a full view of detail on each port adapter faceplate.

Figure 8 shows a VIP2-50 with two JT2 port adapters installed in port adapter slots 0 and 1.

Figure 8   VIP2-50 with Two JT2 Port Adapters (Horizontal Orientation Shown)
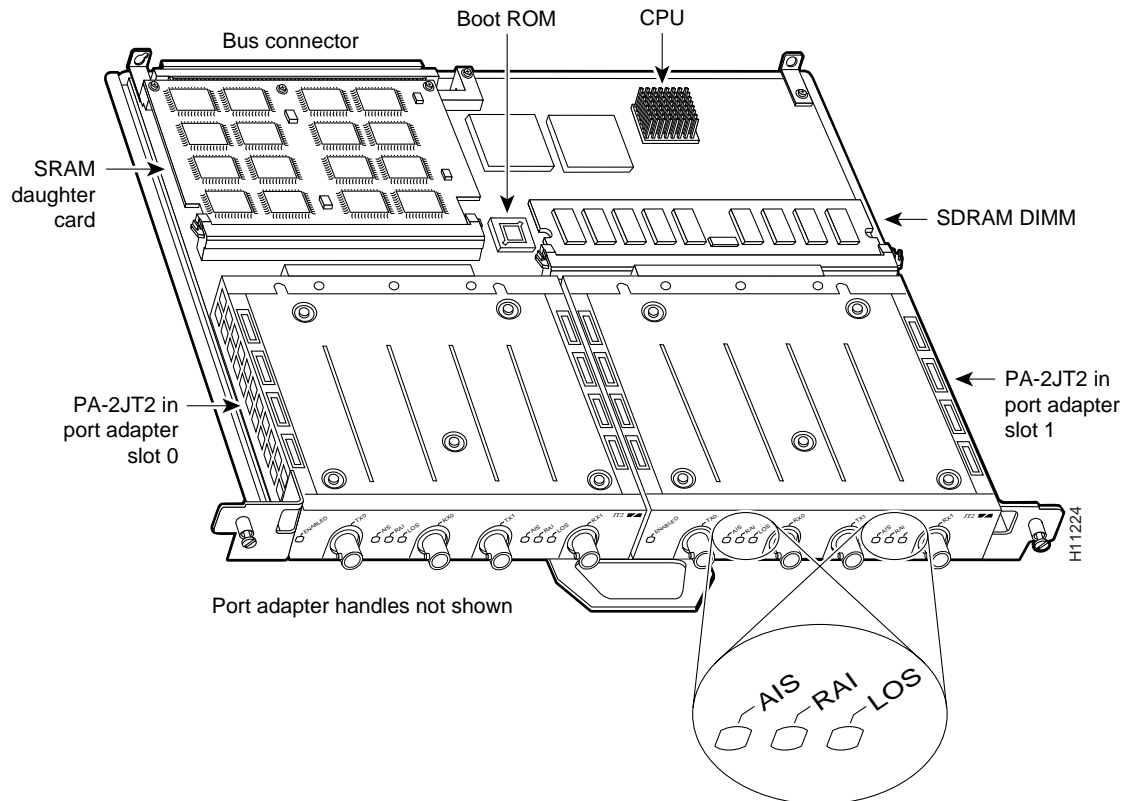
Installing or Replacing a Port Adapter on a VIP2

This section provides the standard procedures for installing or replacing a port adapter on the 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.

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. 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.

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.

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.

The following standard procedure provides steps 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.

> **Note**   For specific VIP2 model requirements for the JT2 port adapter, refer to the section "Software and Hardware Prerequisites" on page 3.

Step 2   For a new port adapter installation or a port adapter replacement, we recommend that you disconnect any interface cables from the ports on the front of the port adapter.

Step 3   Remove the VIP2 from the chassis following 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 9.) This screw secures the port adapter (or blank port adapter) to its slot.

Figure 9   Location of Port Adapter Screw (Partial Port Adapter View)
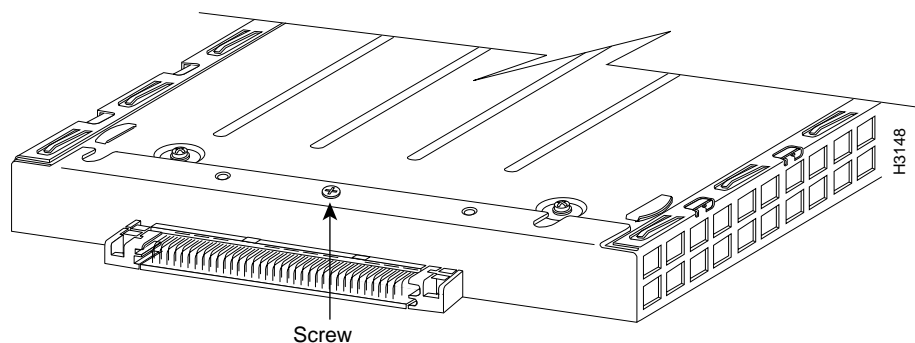
Screw

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 10.)

**Figure 10   Pulling a Port Adapter Out of a Slot (Partial Port Adapter View)**
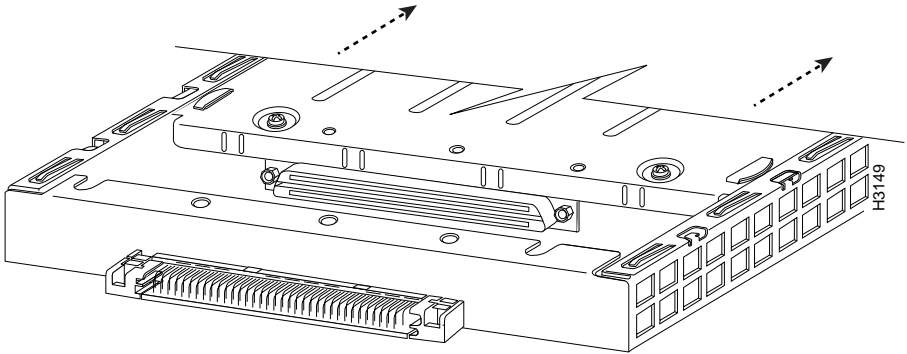
Step 8   If you removed a port adapter, place it in an antistatic container for safe storage or shipment back to the factory. If you removed a blank port adapter, no special handling is required; however, store the blank port adapter for potential future use.

Step 9   Remove the new port adapter from its antistatic container and position it at the opening of the slot. (See Figure 11.)

Step 10   Carefully align the leading edge of the port adapter carrier between the upper and lower slot edges, as shown in the cutaway in Figure 11. Do not jam the carrier between the slot edges.

**Figure 11   Positioning a Port Adapter for Installation**
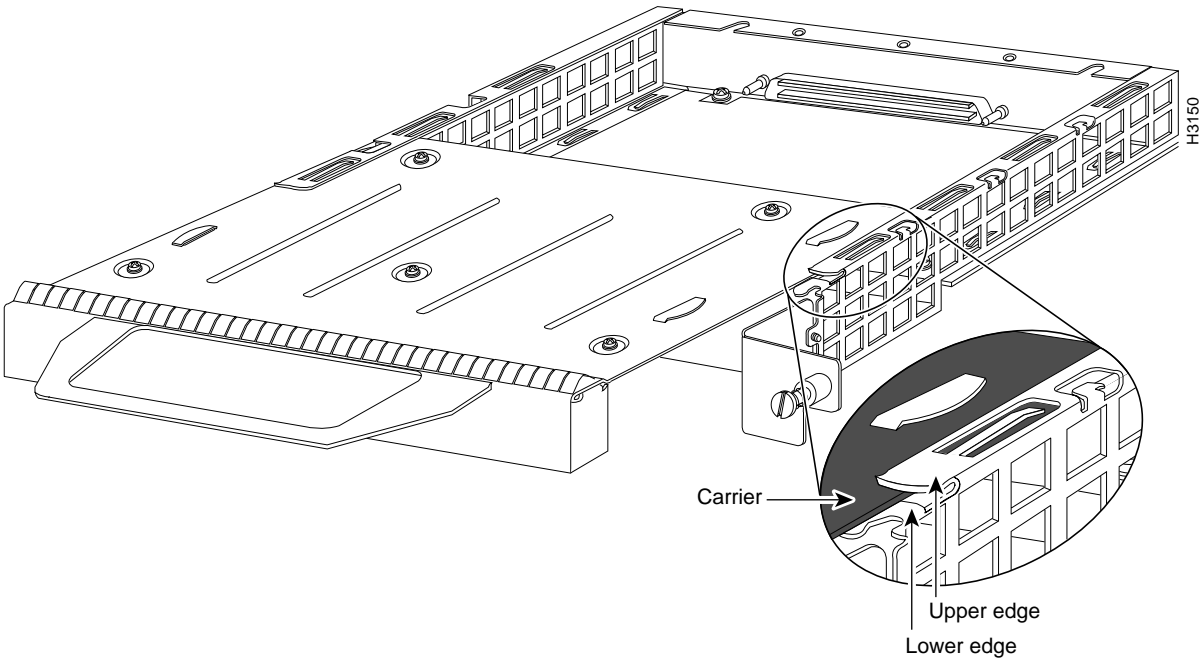
⚠️ **Caution** To ensure a positive ground attachment between the port adapter carrier and the VIP2 motherboard and port adapter slot, and to ensure that the connectors at the rear of the port adapter and slot mate properly, the carrier must be between the upper and lower slot edges, as shown in Figure 12.

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. (See Figure 12.)

Figure 12   Aligning the Carrier Edge with Upper and Lower Slot Edges (Partial View)
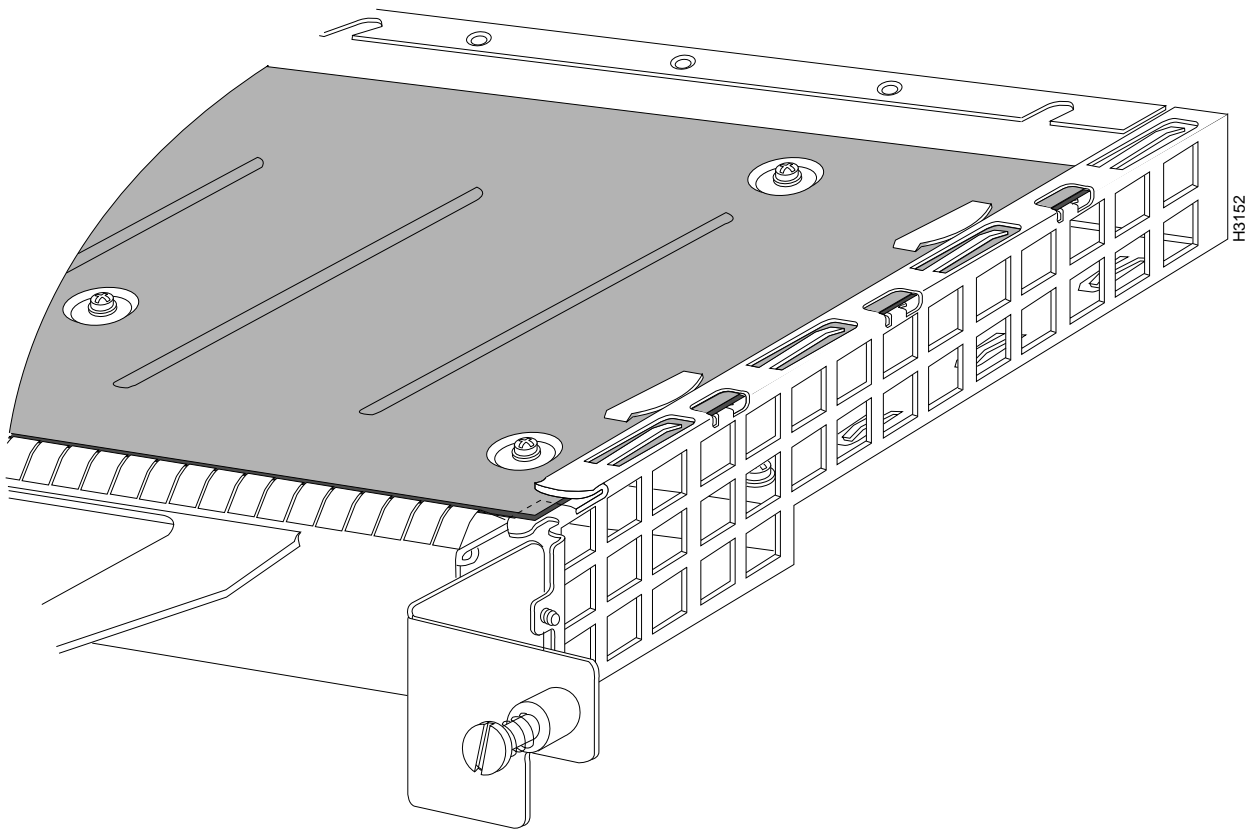
Step 12 Install the screw in the rear of the port adapter slot. (See Figure 9 for its location.) Do not overtighten this screw.

Step 13 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 port adapter.

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

Attaching JT2 Port Adapter Interface Cables

The 75-ohm coaxial cable (see Figure 13) required for the connections to PA-2JT2 are not available from Cisco Systems; they are available from commercial cable vendors. Use only 75-ohm coaxial cables for all PA-2JT2 connections. (For specific cable requirements, refer to the section "JT2 Port Adapter Interface Connectors and Cables" on page 9.)

Note   We recommend that you attach the ferrite sleeves included with PA-2JT2 to all 75-ohm coaxial cables you plan to use for your PA-2JT2 connections. Attach each ferrite sleeve as close to the port adapter end of each 75-ohm coaxial cable as possible.

**Figure 13   75-Ohm Coaxial Cable with Ferrite Sleeve Attached**
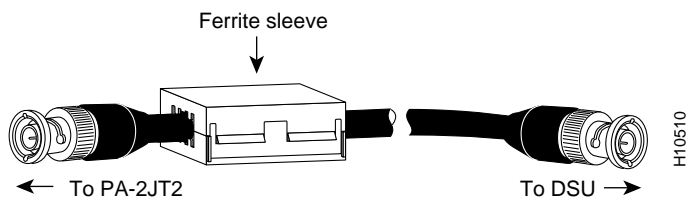
Each E1-G.703/G.704 interface requires separate receive and transmit connections to an external B-type or C-type DSU. A DSU is available from outside vendors.

Use the following procedure to connect the 75-ohm coaxial cables to the JT2 port adapter:

Step 1   Attach the 75-ohm coaxial cables directly to the BNC ports on the JT2 port adapter. Attach one end of a cable to the port labeled TX0 and one end of a second cable to the port labeled RX0. (See Figure 14.)

Figure 14   Connecting 75-Ohm Coaxial BNC Cables (Horizontal Orientation Shown)
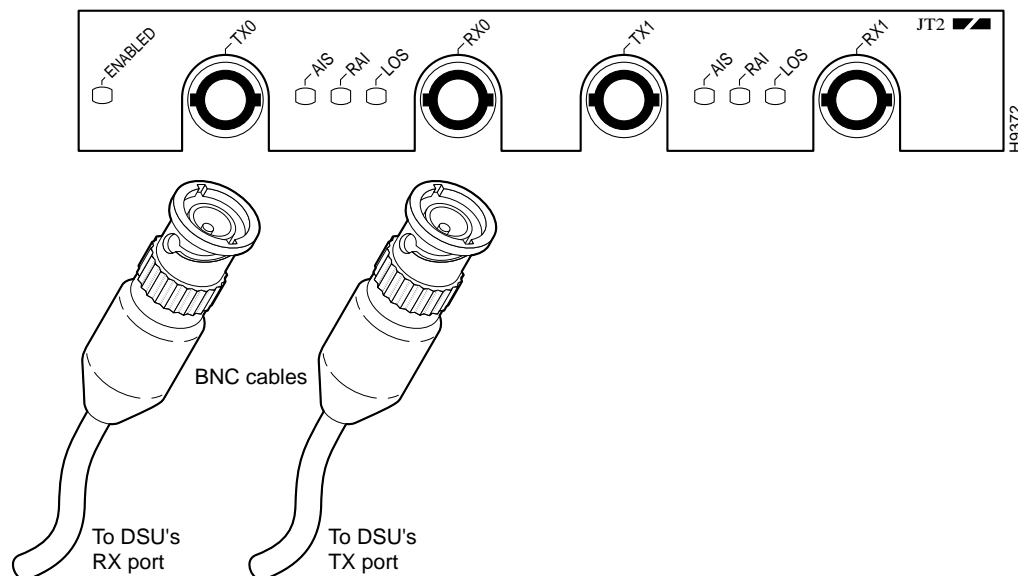
> **Note**   Older A-type DSUs are not supported with PA-2JT2.

Step 2   Referring to Figure 15, attach the network ends of your two 75-ohm coaxial cables to your external DSU as follows:

- Attach the coaxial cable from the JT2 port adapter's TX0 port to the RX port on your external DSU.

- Attach the coaxial cable from the JT2 port adapter's RX0 port to the TX port on your external DSU.

⚠ **Caution**   To prevent system problems and to maintain the proper connection sequences (PA-2JT2's RX port to the DSU's TX port and PA-2JT2's TX port to the DSU's RX port), connect the RX and TX ports on the JT2 port adapter as indicated in Steps 1 and 2.

Step 3   Make the appropriate setting on your DSU to establish an external ground. (See Figure 15.) Remember that the JT2 port adapter's TX and RX connections are grounded at the router-chassis side.

⚠ **Caution**   To prevent system grounding and signal problems, your DSU *must* be set to accept an external ground because the JT2 port adapter's TX and RX connections are grounded at the router-chassis side.

Figure 15   Connecting 75-Ohm Coaxial BNC Cables to a DSU and Setting the DSU's External Ground
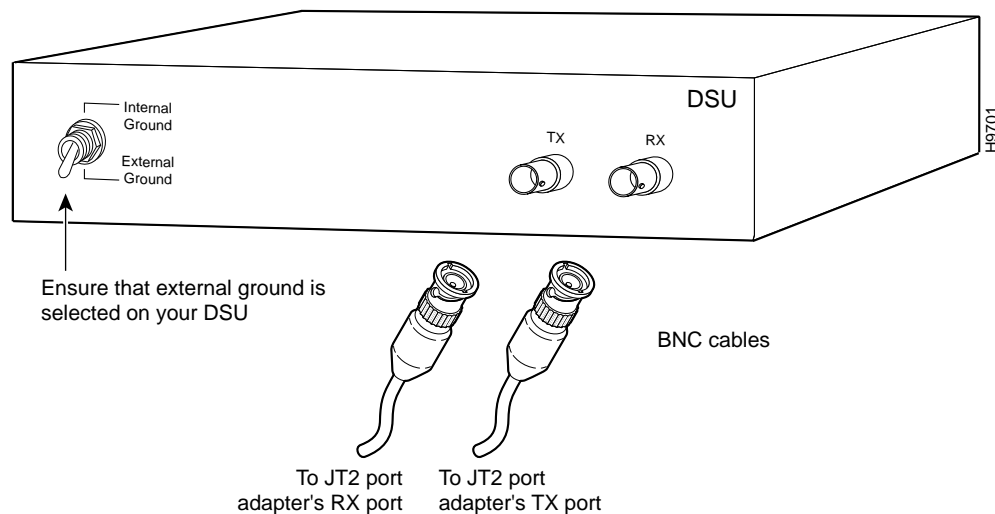
Step 4   Repeat Steps 1 through 3 for the additional JT2 interface as required.

This completes the procedure for attaching cables to the JT2 port adapter and an external B-type or C-type DSU.

Configuring the JT2 Interfaces

If you installed a new JT2 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 JT2 port adapter that was previously configured, the system will recognize the new JT2 interfaces and bring them up in their existing configuration.

After you verify that the new JT2 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 additional instructions for configuring the JT2 interfaces on the JT2 port adapter, refer to the appropriate configuration publications listed in the section "If You Need More Information" on page 2.

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.

Interface Processor Slot, Port Adapter Slot, and JT2 Interface Port Numbering

This section describes how to identify interface processor slot, port adapter slot, and interface 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 16.) This address is composed of a three-part number in the format *interface processor slot number/port adapter number/interface port number*, as follows:

- The first number identifies the interface processor slot in which the JT2-equipped VIP2 is installed (as shown in the example system in Figure 16).

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

- The third number identifies the interface ports on the JT2 port adapter, which are always numbered as 0 and 1. (Each individual interface port has two BNC connections, labeled RX and TX.)

Interface ports on the JT2-equipped VIP2 maintain the same addresses 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 interface processor slot number.

Figure 16 shows the port adapter slots and interface ports of a sample Cisco 7505 system. The JT2 interface addresses on a JT2 port adapter in the first port adapter slot in interface processor slot 3, would be 3/0/0 and 3/0/1, from left to right. The JT2 interfaces on a JT2 port adapter in port adapter slot 1 would be numbered 3/1/0 and 3/1/1, from left to right.

Note   If you remove the JT2-equipped VIP2 from interface processor slot 3 and install it in interface processor slot 2, the addresses of those same ports become 2/0/0 and 2/0/1, respectively, and 2/1/0 and 2/1/1, respectively.

Figure 16   JT2 Interface Port Address Example (Cisco 7505 Shown)
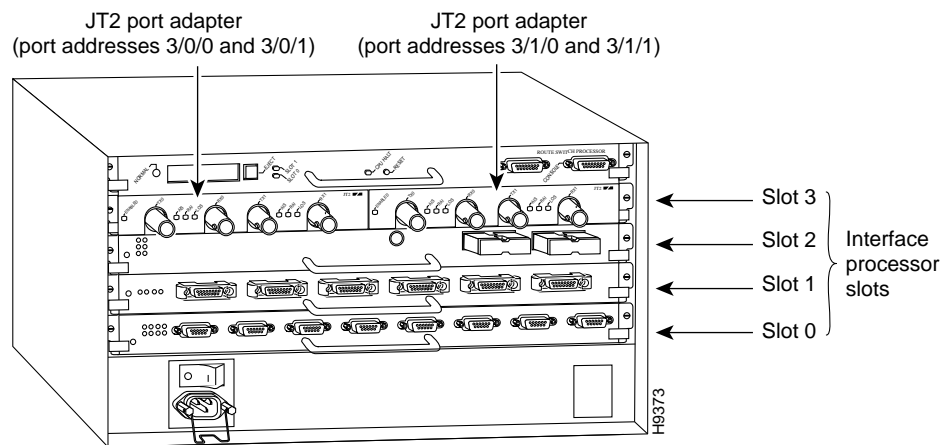
You can identify interface ports by physically checking the slot/port-adapter/interface port location on the back of the router or by using **show** commands to display information about a specific interface or all interfaces in the router.

Configuring an Interface

This section describes a basic configuration. 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>
```

In the following basic configuration procedure, press the **Return** key after each step unless otherwise noted:

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* (**serial**) and *slot/port-adapter/interface* (interface processor slot number). The example that follows is for the first interface of the first port adapter on a JT2 port adapter in interface processor slot 1:

```
Router(config)# interface serial 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 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 **show** commands, proceed to the section "Checking the Configuration."

Configuring CRC5

For data transmission at JT2 (6.312 Mbps), the G.704 standard suggests a 5-bit CRC. (Refer to ITU Recommendation G.704 for the definition of CRC5.)

To enable CRC5 on the JT2 interfaces, specify the slot and port address of the interface and the number of bits to use in the CRC (using **crc 32**), followed by the command **crc bits 5**. Press **Ctrl-Z** after altering the configuration and before exiting configuration mode.

The example that follows shows how to enable CRC5 generation on a JT2 interface and also how to set the CRC size to 32 bits; the example refers to JT2 interface 0 on the first JT2 port adapter on a VIP2 in interface processor slot 3:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface serial 3/0/0
Router(config-int)# crc 32
Router(config-int)# crc bits 5
Router(config-int)# ^Z
```

To disable CRC5 and return to the default of no CRC error checking, specify the slot and port address and use the **no crc bits 5** command.

Checking the Configuration

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

Using show Commands to Verify the New Interface 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 to 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 JT2 port adapter 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 and System 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*].

With the **show interfaces** [*type slot/port-adapter/port*] command, use arguments such as the interface type (**serial**) and the slot, port adapter, and port numbers (slot/port-adapter/port) to display information about a specific JT2 interface.

The following example shows all of the information specific to the first JT2 interface port (interface port 0) in interface processor slot 3, port adapter slot 0:

```
Router# sh int serial 3/0/0
Serial3/0/0 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.0.0.1/8
  MTU 1500 bytes, BW 6312 Kbit, DLY 20000 usec, rely 255/255, load 26/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 00:04:31, output 00:04:31, output hang never
  Last clearing of "show interface" counters 00:06:07
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 162000 bits/sec, 8 packets/sec
  5 minute output rate 162000 bits/sec, 8 packets/sec
     20005 packets input, 20080520 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     20005 packets output, 20080520 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     0 cv errors, 0 crc5 errors, 0 frame errors
     rxLOS inactive, rxLOF inactive, rxPAIS inactive
     rxAIS inactive, rxRAI inactive, rxHBER inactive
```

The following counters appear in the output of the **show interfaces serial** command:

- cv errors—B8ZS/B6ZS coding violation counter

- crc5 errors—CRC5 error counter

- frame errors—framing error counter

The following alarm indicators also appear in the output of the **show interfaces serial** command:

- rxLOS—receive loss of signal alarm

- rxLOF—receive loss of frame alarm

- rxPAIS—receive payload alarm indication signal (AIS)

- rxAIS—receive physical AIS

- rxRAI—receive remote alarm indication signal

- rxHBER—receive high bit error rate alarm

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

The **show version** command displays the configuration of the system hardware (the number and type 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:

```
Router# sh version
Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-JV-M), Version 11.1(12)CA1 [biff 137]
Synced to mainline version: 11.1(8)
Copyright (c) 1986-1997 by cisco Systems, Inc.
Compiled Sat 10-May-97 19:19 by biff
Image text-base: 0x600108A0, data-base: 0x609DA000

ROM: System Bootstrap, Version 5.3(16645) [biff 571], INTERIM SOFTWARE
ROM: GS Software (RSP-BOOT-M), Experimental Version 11.1(618) [biff 114]

Router uptime is 16 hours, 2 minutes
System restarted by reload
System image file is "biff/rsp-jv-mz.g703", booted via tftp from 1.1.1.254

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.
G.703/JT2 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).
Chassis Interface.
1 VIP2 controllers (2 Serial).
2 Serial network interfaces.
125K bytes of non-volatile configuration memory.

16384K 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 7.
Configuration register is 0x2
```

The **show controllers cbus** command shows assorted information about the interfaces installed in the router. Following is an example of partial output from the **show controllers cbus** command, showing a JT2-equipped VIP2:

```
Router# sh cont cbus
MEMD at 40000000, 2097152 bytes (unused 4352, recarves 18, lost 0)
  RawQ 48000100, ReturnQ 48000108, EventQ 48000110
  BufhdrQ 48000130 (2643 items), LovltrQ 48000148 (16 items, 2016 bytes)
  IpcbufQ 48000158 (24 items, 4096 bytes)
  IpcbufQ_classic 48000150 (8 items, 4096 bytes)
  3570 buffer headers (48002000 - 4800FF10)
  pool0: 10 buffers, 256 bytes, queue 48000138
  pool1: 720 buffers, 1536 bytes, queue 48000140
  pool2: 145 buffers, 4512 bytes, queue 48000160
  pool3: 4 buffers, 4544 bytes, queue 48000168
  slot9: VIP2, hw 2.3, sw 21.40, ccb 5800FFA0, cmdq 480000C0, vps 8192
    software loaded from flash slot0:vip2_21-40
    IOS (tm) VIP2 Software (SVIP-DW-M), Version 11.1(12)CA1 [biff 162]
    ROM Monitor version 17.0
  Mx JT2 Serial(2), HW Revision 0x2, FW Revision 1.26
    Serial5/0/0, applique is JT2 Unbalanced
      received clockrate 6155735
      gfreeq 48000140, lfreeq 48000278 (1536 bytes), throttled 0
      rxlo 4, rxhi 60, rxcurr 0, maxrxcurr 1
      txq 48001A80, txacc 48001A82 (value 39), txlimit 39
```

To determine which type of port adapter is installed on a VIP2 in your system, use the **show diag** *slot* command. Specific port adapter information is displayed, as shown in the following example of an JT2 port adapter in a VIP2 in interface processor slot 9:

```
Router# sh diag 9
Slot 9:
        Physical slot 9, ~physical slot 0x6, logical slot 9, 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 2.3, board revision A0
        Serial number: 03515977  Part number: 73-1684-03
        Test history: 0x00       RMA number: 00-00-00
        Flags: cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20: 01 15 02 03 00 35 A6 49 49 06 94 03 00 00 00 00
          0x30: 50 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags: 0x4      Insertion time: 0x3C58 (16:06:46 ago)

        Controller Memory Size: 16 MBytes DRAM, 1024 KBytes SRAM

        PA Bay 0 Information:
                JT2 Serial PA, 2 ports
                EEPROM format version 1
                HW rev 1.FF, Board revision UNKNOWN
                Serial number: 4294967295  Part number: 255-65535-255
```

The **show startup-config** command displays the information from the configuration file used at system startup. Following is an example of partial output from the **show startup-config** command from a system with a JT2 port adapter installed and configured:

```
Router# sh startup-conf

(additional display text omitted)

hostname Router
!
interface Serial9/0/0
 ip address 28.0.0.1 255.0.0.0
 ip route-cache distributed
 no keepalive
 crc5
 clock source internal
 no cdp enable
!
```

Using Software Configuration Commands Specific to the JT2 Port Adapter

The JT2 port adapter is capable of clocking transmitted data using an internal clock source or a clock derived from the received data stream. The default is a line-derived clock source; however, each JT2 interface will use its internal clock if no external clock is detected.

The **clock source internal** command sets the clock source as indicated. The **no clock source** command restores the system default.

By default, the system uses no CRC5. The **crc bits 5** interface command allows the frame alignment search criteria to use CRC5. The **no crc bits 5** interface command allows CRC5 to be excluded from the frame alignment search criteria.

Using the ping Command to Verify Network Connection

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 JT2-equipped VIP2 have booted successfully and are operational, you can use this command to verify the status of interface ports. Refer to the publications listed in the section "If You Need More Information" on page 2, for detailed command descriptions and examples.

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 time-out 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); then repeat the **ping** command.

For additional descriptions of interface subcommands and the configuration options available for JT2-related interfaces, refer to the publications listed in the section "If You Need More Information" on page 2.

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- 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 connection rates up to 28.8 kbps.

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

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