NPE-G1 Overview

This chapter describes the NPE-G1 and contains the following sections:

⚠ **Caution** You must copy and save your running configuration file to a CompactFlash Disk, PC Card, or TFTP server before you install the NPE-G1. For instructions on copying and saving your configuration file, see the "Copying the Configuration File" section on page 7-4 in Chapter 7, "NPE-G1 and NPE-G2 Installation and Configuration Information."

For general preparation for installation instructions, see Chapter 8, "Preparation for Installation." For installation and configuration instructions specific to the NPE-G1, see Chapter 7, "NPE-G1 and NPE-G2 Installation and Configuration Information."

Supported Platforms

The NPE-G1 is supported only in the Cisco 7200 VXR routers, the Cisco uBR7246VXR universal broadband router, and the Cisco uBR7225VXR universal broadband router. For the Cisco 7200 VXR routers, order Part Number NPE-G1 or NPE-G1=. For the Cisco uBR7246VXR and Cisco uBR7225VXR routers, order Part Number UBR7200-NPE-G1 or UBR7200-NPE-G1=.

✎ **Note** Unless otherwise indicated, all references to NPE-G1 in this document also refer to UBR7200-NPE-G1.

Software Requirements

For minimum software release information, see the "Software Requirements" section on page 8-4.

NPE-G1 Description and Overview

This section contains information about the NPE-G1 components and the system management functions. The NPE-G1 is the first net

processing engine for the Cisco 7200 VXR routers and Cisco uBR7200 series routers to provide the functionality of both a network processing engine and I/O controller. If used without an I/O controller, an I/O controller blank panel must be in place.

While its design provides I/O controller functionality, it can also work with any I/O controller supported in the Cisco 7200 VXR routers and Cisco uBR7200 series routers. The NPE-G1, when installed with an I/O controller, provides the bootflash and NVRAM that the Cisco IOS software uses to boot.

Note An I/O controller can be used with the NPE-G1, but an I/O controller is not necessary for system functionality. Installing an I/O controller in a chassis with the NPE-G1 activates the console and auxiliary ports on the I/O controller and automatically disables the console and auxiliary ports on the NPE-G1. However, you can still use the CompactFlash Disk slots and Ethernet ports on both the NPE-G1 and I/O controller when both cards are installed.

The NPE-G1 maintains and executes the system management functions for the Cisco 7200 VXR routers and Cisco uBR7200 series routers and also holds the system memory and environmental monitoring functions.

The NPE-G1 consists of one board with multiple interfaces. It can be used only in the Cisco 7200 VXR routers and Cisco uBR7200 series routers.

Note The Cisco 7200 VXR routers and Cisco uBR7200 series routers use different models of the NPE-G1 processor. For the Cisco 7200 VXR routers , order the NPE-G1 or NPE-G1= product. For the Cisco uBR7200 series router, order the UBR7200-NPE-G1 or UBR7200-NPE-G1= product. The two models of NPE-G1 have different labels and use different boot helper images, and they cannot be interchanged between the Cisco 7200 VXR routers and Cisco uBR7200 series routers.
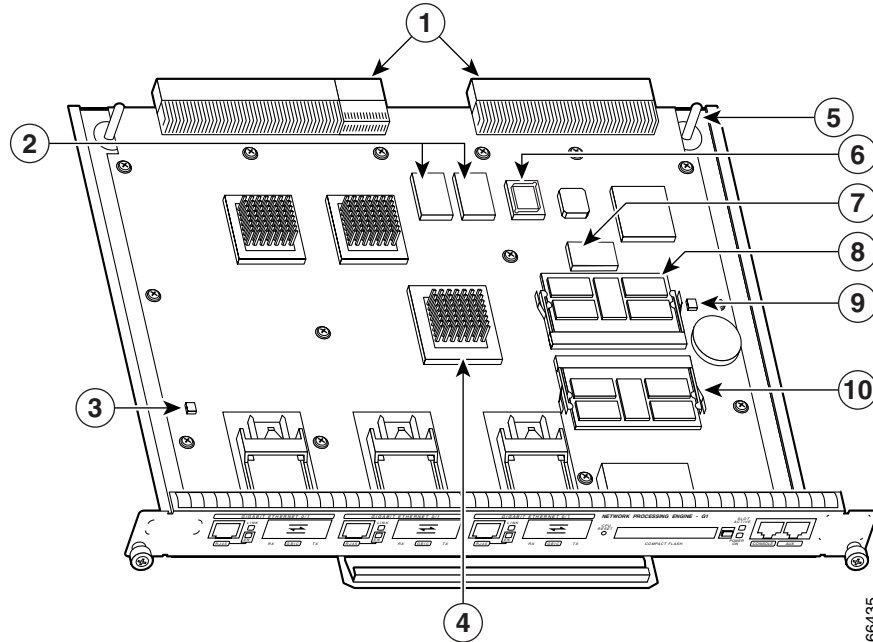
Bandwidth

The NPE-G1 uses no bandwidth points, and when used with any I/O controller, the I/O controller also uses no bandwidth points. None of the Gigabit Ethernet interfaces on the NPE-G1 use bandwidth points.

Components

Figure 5-1 illustrates the NPE-G1 and its major components.

Figure 5-1   *NPE-G1*

1	Midplane connectors	**6**	Boot ROM
2	Flash memory	**7**	NVRAM
3	Temperature sensor	**8**	SODIMM 2 (J4)
4	BCM1250 system	**9**	Temperature sensor
5	Keying post	**10**	SODIMM 1 (J3)

The NPE-G1 consists of the following components:

- BCM1250 system
  - Microprocessor operates at an internal clock speed of 700 MHz.
  - Hardware logic to interconnect the processor, double data rate synchronous dynamic random-access memory (DDR-SDRAM), lightning data transport (LDT) bus, the generic PCI bus, and three direct-interface Gigabit Ethernet interfaces.
- Cache memory

  The NPE-G1 has two levels of cache: primary and secondary cache that are internal to the microprocessor with secondary unified cache for data and instruction.

- The NPE-G1 uses DDR-SDRAM for providing code, data, and packet storage.
- Two environmental sensors for monitoring the cooling air as it enters and leaves the chassis.
- Full-feature I/O controller functionality

- Three Gigabit Ethernet interfaces (six ports: three GBIC [optical] and three RJ-45s [copper]). Any three ports are available at the same time and are linked directly to the BCM1250 system; therefore the interfaces are not charged bandwidth points.

- CompactFlash Disk for storing the default Cisco IOS software image. The CompactFlash Disk slot can be used whether or not an I/O controller is in the router.

- Auxiliary port with full data terminal equipment (DTE) functionality. (Functional when an I/O controller is not present. If an I/O controller is present, its auxiliary port is the default port.)

- Console port with full data communications equipment (DCE) functionality. (Functional when an I/O controller is not present. If an I/O controller is present, its console port is the default port.)

- Boot ROM for storing sufficient code for booting the Cisco IOS software.

- Flash memory for storing the boot helper (boot loader) image. (The boot helper image comes installed on the NPE-G1.) If an I/O controller is present, its flash memory is no longer available.

- NVRAM for storing the system configuration and environmental monitoring logs. NVRAM uses lithium batteries to maintain its contents when disconnected from power. If an I/O controller is present, its NVRAM memory is no longer available.

- Upgradable memory modules

Note   An I/O controller can be used with the NPE-G1, but an I/O controller is not necessary for system functionality. Installing an I/O controller in a chassis with the NPE-G1 activates the console and auxiliary ports on the I/O controller and automatically disables the console and auxiliary ports on the NPE-G1. However, you can still use the CompactFlash Disk slots and Ethernet ports on both the NPE-G1 and I/O controller when both cards are installed.

## Interfaces and LEDs

Figure 5-2   NPE-G1 Interfaces
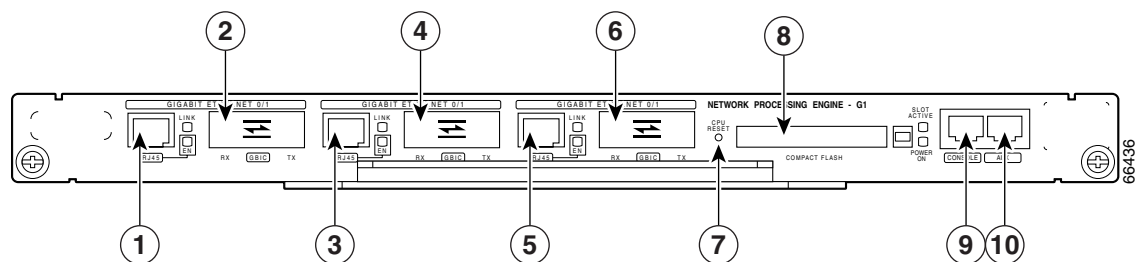
1	Fast Ethernet/Gigabit Ethernet RJ-45 port 0/1	**6**	Gigabit Ethernet port 0/3
2	Gigabit Ethernet port 0/1	**7**	CPU Reset
3	Fast Ethernet/Gigabit Ethernet RJ-45 port 0/2	**8**	CompactFlash Disk slot (disk2)
4	Gigabit Ethernet port 0/2	**9**	Console port
5	Fast Ethernet/Gigabit Ethernet RJ-45 port 0/3	**10**	Auxiliary port

The three interfaces on the NPE-G1 consist of three Gigabit Interface Converter (GBIC) ports and three 10/100/1000 Fast Ethernet/Gigabit Ethernet ports. The rules for using these ports are:

- Only one port per interface can be used at any one time. For example, for interface Gigabit Ethernet 0/1, either the RJ-45 port can be used or the GBIC port, but not both.

- A total of three ports on any of the three interfaces (0/1, 0/2, or 0/3) can be used at any one time; for example, 0/1 GBIC, 0/2 GBIC, and 0/3 RJ-45.

- The port numbering for the interfaces on the NPE-G1 start with 0/1 and not with 0/0, as is typical for other interface cards. This is to avoid conflicts with the Ethernet and FastEthernet ports on an I/O controller, if it is also installed.

Figure 5-3   *NPE-G1 LEDs*
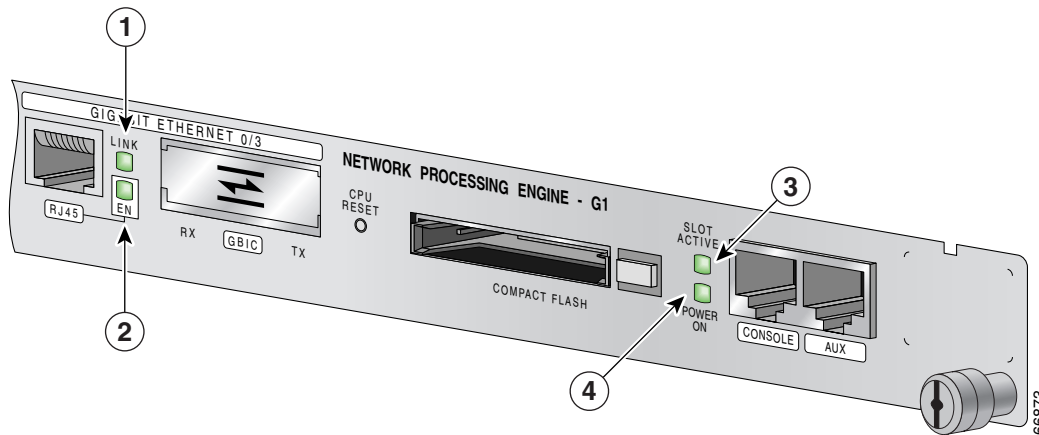
No.	LED Label	LED	Color	In the Power Up state, the LED is	LED flashes when there is traffic
1	LINK (Interfaces 0/1, 0/2, 0/3)	RJ-45 and GBIC ports	Green	On, indicating that a link has been established	No
2	EN (Enable) (Interfaces 0/1, 0/2, 0/3)	RJ-45 ports only	Green	On if the RJ-45 port is selected Off if the GBIC port is selected	—
3	SLOT ACTIVE	CompactFlash Disk	Green	On when the slot is being used	—
4	POWER ON	Power	Green	On and stays on	No

The NPE-G1 faceplate contains LEDs that indicate system and port status. The RJ-45 and GBIC ports share the same LINK LED because only one of these ports per interface (0/1, 0/2, or 0/3) can be used at any one time. The EN (Enable) LED is on if the RJ-45 port is in use.

The POWER ON LED is on whether or not an I/O controller is present in the router. The CompactFlash Disk slot can be used whether or not an I/O controller is present in the router. The SLOT ACTIVE LED is on only when the CompactFlash Disk slot is in use.

LEDs are either on or off. The LED state (on or off), not the color, determines the status of the connection.

CompactFlash Disk

The NPE-G1 has one CompactFlash Disk slot that uses CompactFlash Disks. The device in this slot is always addressed as **disk2:** when using Cisco IOS CLI commands.

CompactFlash Disks are smaller in size than Type 2 Flash Disks but provide the same Attachment (ATA) interface and equivalent functionality. This interface complies with the ANSI ATA Interface Document X3T13.1153 D Rev. 9 specification. CompactFlash Disks provide from 64 MB to 256 MB of storage space.

The CompactFlash Disk has controller circuitry that allows it to emulate a hard disk and automatically maps out bad blocks and performs automatic block erasure. The CompactFlash Disk also provides the capability to allocate noncontiguous sectors, which eliminates the need for the **squeeze** command (which was required with older-style linear flash memory cards to recover the space used by deleted files).

The CompactFlash Disk also supports the Cisco IOS File System feature, which provides a single interface to all of the router's file systems, including the Flash Disks and flash memory, as well as network file systems such as File Transfer Protocol (FTP) and Trivial FTP (TFTP) servers.

To install a CompactFlash Disk in the CompactFlash Disk slot, complete the following steps.

Step 1 Attach an ESD wrist or ankle strap, connecting the equipment end of the strap to an unfinished chassis surface.

Step 2 Orient the CompactFlash Disk so that its connector end faces the appropriate slot. (See 1 in Figure 5-4.)

Figure 5-4   *Installing and Removing a CompactFlash Disk*
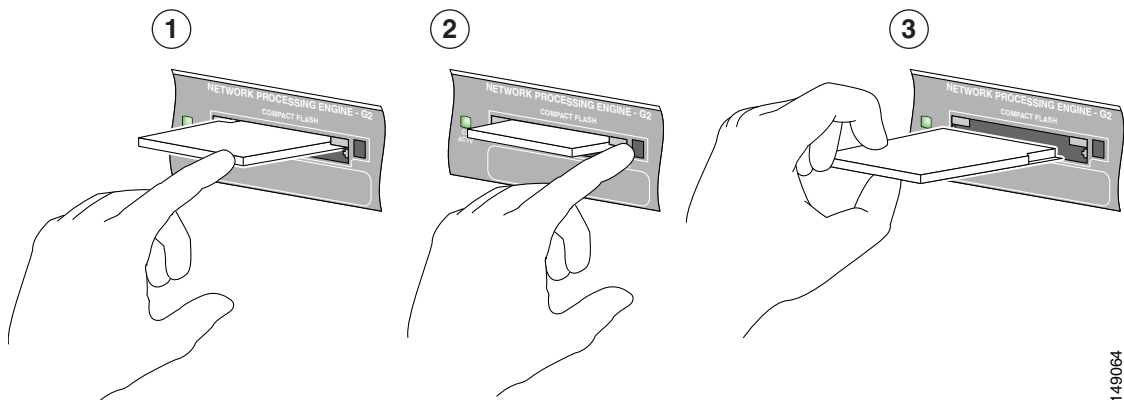
1	Inserting the compact Flash Disk	3	Removing the CompactFlash Disk
2	Pressing the ejector button to release the CompactFlash Disk		

Step 3 Carefully insert the CompactFlash Disk into the slot until it completely seats in the connector, and the ejector button for the slot pops out toward you. (See 2 in Figure 5-4.)

Note The CompactFlash Disk is keyed and cannot be seated the wrong way. The ejector button does not pop out if the CompactFlash Disk is not completely inserted.

]

To remove a CompactFlash Disk from the CompactFlash Disk slot, complete the following steps:

Step 1   Press the ejector button on the slot. (See 3 in Figure 5-4.)

Step 2   Grasp the CompactFlash Disk and pull it from the slot.

Step 3   Place the CompactFlash Disk in an antistatic bag.

Note   All CompactFlash Disks must be formatted before their initial use. CompactFlash Disks shipped with the NPE-G1 are formatted at the factory, but spare memory cards are not formatted.

Summary of Important NPE-G1 Information

Caution   The NPE-G1 requires that you copy and save your running configuration file to a CompactFlash Disk, PC Card, or TFTP server before you install the NPE-G1. For instructions on copying and saving your configuration file, see the "Copying the Configuration File" section on page 7-4 in Chapter 7, "NPE-G1 and NPE-G2 Installation and Configuration Information."

For general preparation for installation instructions, see Chapter 8, "Preparation for Installation." For installation and configuration instructions specific to the NPE-G1, see Chapter 7, "NPE-G1 and NPE-G2 Installation and Configuration Information."

- The RJ-45 ports and GBIC ports are both reported in software as GigabitEthernet 0/1, GigabitEthernet 0/2, and GigabitEthernet 0/3. Only one of the pair of interface ports can be used at a time; for example, GBIC GigabitEthernet 0/2 or RJ-45 GigabitEthernet 0/2.

- The I/O controller GE/E interface reports GigabitEthernet 0/0 and Ethernet 0/0, and the I/O controller 2FE/E interface reports FastEthernet 0/0 and FastEthernet 0/1.

- If the RJ-45 port is in use, the EN (Enable) LED is on. If the GBIC is in use, the EN (Enable) LED is off.

- With the NPE-G1 and an I/O controller both installed, the I/O controller functionality on the NPE-G1 is shared with that of the I/O controller.

- When both an NPE-G1 and an I/O controller are installed, the flash memory and NVRAM of the NPE-G1 are enabled and the flash memory and NVRAM on the I/O controller are no longer accessible.

- The console and auxiliary ports on the NPE-G1 are disabled by Cisco IOS when an I/O controller is present; the console and auxiliary ports on the I/O controller are active.

- Console port messages can be routed to the auxiliary port on either the NPE-G1 or on the I/O controller.

- The default media is the RJ-45 port. To change the media type, use the **media-type** command.

- Only the port selected by the **media-type** command is active. A cable attached to the other of the RJ-45 and GBIC pair will be ignored. For example, if GBIC GigabitEthernet 0/2 is selected using the **media-type** command, RJ-45 GigabitEthernet 0/2 is ignored, even if a cable is attached to RJ-45 0/2.

- The NPE-G1 uses no bandwidth points, and when used with any I/O controller, the I/O controller also uses no bandwidth points. None of the Gigabit Ethernet interfaces on the NPE-G1 use bandwidth points.

- The CompactFlash Disk on the NPE-G1 is available at all times, with or without an I/O controller installed. The CompactFlash Disk is always addressed as the **disk2** device, to avoid conflicts with the **disk0** and **disk1** devices on the I/O controller, if the I/O controller is also installed.

Note The Gigabit Ethernet interfaces on the NPE-G1 do not support the Inter-Switch Link (ISL) VLAN encapsulation protocol. We recommend that customers use the IEEE 802.1Q VLAN encapsulation protocol as an alternative. Where an application requires the use of ISL, this can be provided by the Fast Ethernet or Gigabit Ethernet port adapters or I/O controllers.

System Management Functions

The NPE-G1 performs the following system management functions:

- Sending and receiving routing protocol updates

- Managing tables, caches, and buffers

- Monitoring interface and environmental status

- Providing Simple Network Management Protocol (SNMP) management through the console and Telnet interface

- Accounting for and switching of data traffic

- Booting and reloading images

- Managing port adapters (including recognition and initialization during online insertion and removal)

Terms and Acronyms

- Boot ROM—Read-only memory that stores the boot image for bringing up the Cisco IOS image

- Cache—Memory with fast access and small capacity used to temporarily store recently accessed data; found either incorporated into the processor or near it

- DDR SDRAM—double data rate synchronous dynamic random-access memory

- CWDM GBIC—Coarse Wavelength-Division Multiplexing Gigabit Interface Converter

- Flash memory—Location where the basic boot image is stored

- Instruction and data cache—Instructions to the processor, and data on which the instructions work

- Integrated cache—Cache that is built into the processor; sometimes referred to as internal cache. Cache memory physically located outside the processor is not integrated, and is sometimes referred to as external cache.

- LDT bus—lightning data transport bus

- NVRAM—nonvolatile random-access memory

- OTP—one time programmable

- Primary and secondary cache—Hierarchical cache memory storage based on the proximity of the cache to the core of the processor. Primary cache is closest to the processor core and has the fastest access. Secondary cache has slower access than primary cache.

- RAM—random-access memory

- RISC—reduced instruction set computing

- ROM—read-only memory

- SDRAM—synchronous dynamic random-access memory

- SDRAM-fixed—SDRAM of a fixed size or quantity; can be replaced, but not upgraded

- SODIMM—small outline dual in-line memory module

- Unified cache—Instruction cache and data cache are combined. For example, a processor may have primary cache with separate instruction and data cache memory, but unified secondary cache.

NPE-G1 Memory Information

To determine the memory configuration of your NPE-G1, use the **show version** command.

The following example shows an NPE-G1 installed in a Cisco 7206VXR router. The display for a Cisco uBR7246VXR router is similar.

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-P-M), Experimental Version
12.2(20011112:161132)
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Tue 13-Nov-01 03:58 by
Image text-base:0x600089B8, data-base:0x6130A000

  (display text omitted)

cisco 7206VXR (NPE-G1) processor (revision 0x00) with 245760K/16384K
bytes of memory.
Processor board ID 15191620
BCM12500 CPU at 700Mhz, Implementation 1, Rev 0.1, 512KB L2 Cache
6 slot VXR midplane, Version 2.0

  (display text omitted)
```

Table 5-1 provides memory specifications and Table 5-2 provides user replaceable memory configuration information for the NPE-G1. Table 5-3 provides CompactFlash Disk specifications.

Table 5-1   NPE-G1 Memory Specifications

Memory Type	Size	Quantity	Description	Component Location on the NPE-G1 Board
SDRAM	128 MB, 256 MB, 512 MB	2	128-MB, 256-MB, or 512-MB SODIMMs[1]	J3 and J4
Boot ROM	512 KB	1	Reprogrammable Boot ROM for the ROM monitor program	U1
Flash memory	16 MB	1	Contains the default boot helper (boot loader) image	U25 and U26

Table 5-1   *NPE-G1 Memory Specifications (continued)*

Memory Type	Size	Quantity	Description	Component Location on the NPE-G1 Board
NVRAM	512 KB	1	Nonvolatile EPROM for the system configuration file	U7
Primary cache	32 KB (16 KB instruction, 16 KB data)	—	BCM1250 system, internal cache	U22
Secondary cache	512 KB	—	BCM1250 system, internal, unified cache	U22

1. The NPE-G1 requires that locations J3 and J4 always contain two SODIMMs of the same size.

Table 5-2   *NPE-G1 SDRAM SODIMM Configurations—Configurable Memory Only*

Total SDRAM	SDRAM Bank	Quantity	Product Number
256 MB	J3 and J4	2 128-MB SODIMMs	MEM-NPE-G1-256MB=
512 MB	J3 and J4	2 256-MB SODIMMs	MEM-NPE-G1-512MB=
1 GB	J3 and J4	2 512-MB SODIMMs	MEM-NPE-G1-1GB=

Table 5-3   *NPE-G1 CompactFlash Disk Specifications*

Memory Size	Product Number
64 MB	MEM-NPE-G1-FLD64=
128 MB	MEM-NPE-G1-FLD128=
256 MB	MEM-NPE-G1-FLD256=

Connection Equipment and Specifications

This section contains connection equipment and pinout information for the Gigabit Ethernet RJ-45 ports, Gigabit Interface Converter (GBIC) ports, console port, and auxiliary port that are located on the NPE-G1.

Ethernet and Fast Ethernet RJ-45 Connection Equipment

The NPE-G1 has RJ-45 ports for Ethernet, Fast Ethernet, and Gigabit Ethernet or autosensing Ethernet, Fast Ethernet, and Gigabit Ethernet connections. The RJ-45 port supports IEEE 802.3 (Ethernet) and IEEE 802.3u (Fast Ethernet) interfaces compliant with 10BASET, 100BASETX, and 1000BASET and 1000BASEX specifications.

The RJ-45 ports support standard straight-through and crossover Category 5 UTP cables with RJ-45 connectors. (See Figure 5-5) Cisco does not supply Category 5 UTP cables; these cables are available commercially.

✎
Note   To comply with EMI EN55022 Class B regulations, shielded Ethernet cables must be used with the UBR7200-NPE-G1 in the Cisco uBR7246VXR router. Three shielded cables are included with the UBR7200-NPE-G1.

Figure 5-5 shows an RJ-45 port and connector. Table 5-4 lists the pinouts and signals for the RJ-45 port.

Figure 5-5   RJ-45 Port and Connector
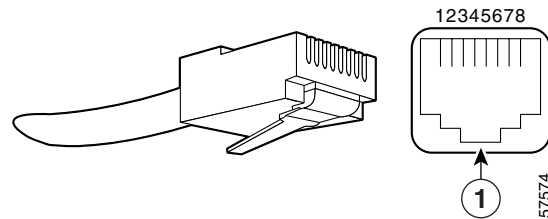
| **1** | RJ-45 connector | | |

⚠
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.** Statement 1021

Table 5-4   RJ-45 Port Pinouts

Pin	10/100 Signal	Gigabit Ethernet Signal
1	Tx Data+[1]	Tx A+
2	Tx Data–	Tx A–
3	Rx Data+[2]	Rx B+
4	N/C	Tx C+
5	N/C	Tx C–
6	Rx Data–	Rx B–
7	N/C	Rx D+
8	NC	Rx D-

1. Tx Data = Transmit Data
2. Rx Data = Receive Data

✎
Note   With reference to the RJ-45 pinout in Table 5-4, proper common-mode line terminations should be used for the unused Category 5 UTP cable pairs 4/5 and 7/8. Common-mode termination reduces electromagnetic interference (EMI).

Depending on your RJ-45 interface cabling requirements, use the pinouts shown in Figure 5-6 and Figure 5-7 for Gigabit Ethernet straight-through and crossover twisted-pair cable connections. Use Figure 5-8 for Ethernet/Fast Ethernet straight-through and crossover twisted-pair cable connections.

Figure 5-6   *Four Twisted-Pair Straight-Through Cable Schematics for 10/100/1000 and 1000BASET GBIC Module Ports*
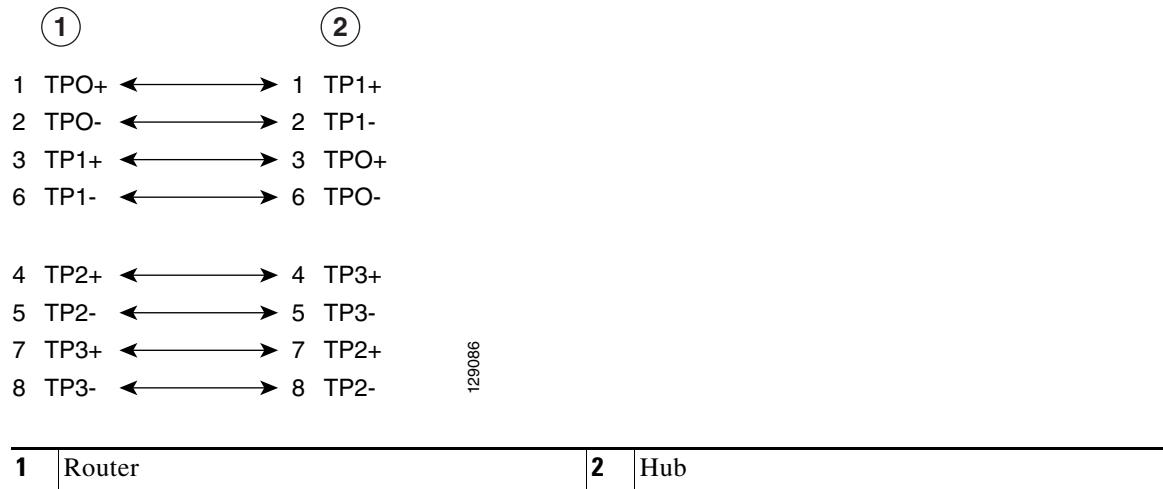
```
        ①                    ②

1  TPO+  ◄────────►  1  TP1+
2  TPO-  ◄────────►  2  TP1-
3  TP1+  ◄────────►  3  TPO+
6  TP1-  ◄────────►  6  TPO-


4  TP2+  ◄────────►  4  TP3+
5  TP2-  ◄────────►  5  TP3-
7  TP3+  ◄────────►  7  TP2+           129086
8  TP3-  ◄────────►  8  TP2-
```

1	Router	**2**	Hub

Figure 5-7   *Four Twisted-Pair Crossover Cable Schematics for 10/100/1000 and 1000BASET GBIC Module Ports*

```
        ①                    ②

1  TPO+  ◄──╲  ╱──►  1  TP0+
2  TPO-  ◄───╲╱───►  2  TP0-
3  TP1+  ◄───╱╲───►  3  TP1+
6  TP1-  ◄──╱  ╲──►  6  TP1-


4  TP2+  ◄──╲  ╱──►  4  TP2+
5  TP2-  ◄───╲╱───►  5  TP2-
7  TP3+  ◄───╱╲───►  7  TP3+           129088
8  TP3-  ◄──╱  ╲──►  8  TP3-
```

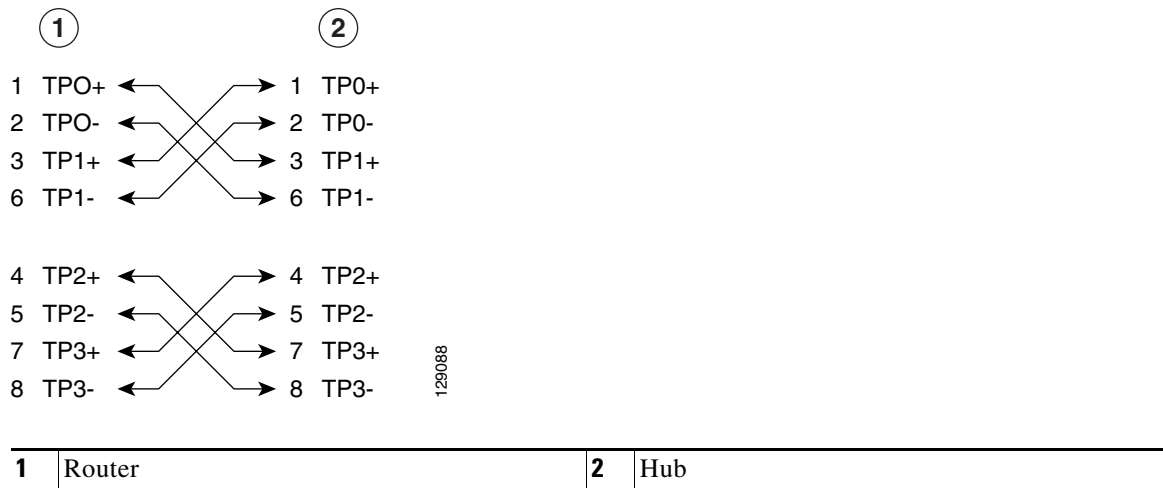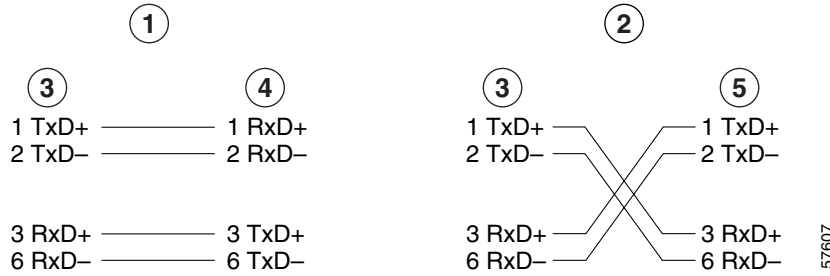| **1**	Router	**2**	Hub

Figure 5-8   Ethernet/Fast Ethernet Straight-Through and Crossover Cable Pinouts

1	Straight-through cable pinout, Ethernet port to a hub or repeater	**4**	Hub
2	Crossover cable pinout, Ethernet port to a DTE	**5**	DTE
3	Ethernet port		

For straight-through and crossover cable information, see the "Console and Auxiliary Port Connection Equipment" section on page 5-17.

Gigabit Ethernet GBIC Connection Equipment

The Gigabit Interface Converter (GBIC) port is a 1000-Mbps optical interface in the form of an SC-type duplex port that supports IEEE 802.3z interfaces compliant with the 1000BASEX standard. (See Figure 5-10.)

Note   The GBIC is a separately orderable part and does not ship installed in your NPE-G1. You must install the GBIC before you connect the cables to it. (For GBIC installation and cabling instructions, refer to the *Installing the Gigabit Interface Converter* document that shipped with your GBIC.)
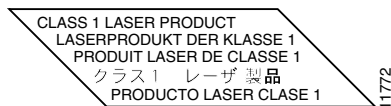
Warning   **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Figure 5-9 shows the Class 1 warning label that appears on the Gigabit Ethernet optical ports.

Figure 5-9   Laser Class 1 Warning Label


Warning   **Class 1 Laser Product.** Statement 1008

Figure 5-10 shows the simplex and duplex SC-type connectors on your multimode or single-mode optical fiber cables. For simplex connectors, two cables are required, one cable for transmit (TX) and a second cable for receive (RX). For duplex connectors, only one cable that has both TX and RX connectors is required. You can use either simplex or duplex connectors for the NPE-G1.

Figure 5-10   GBIC Port Connections
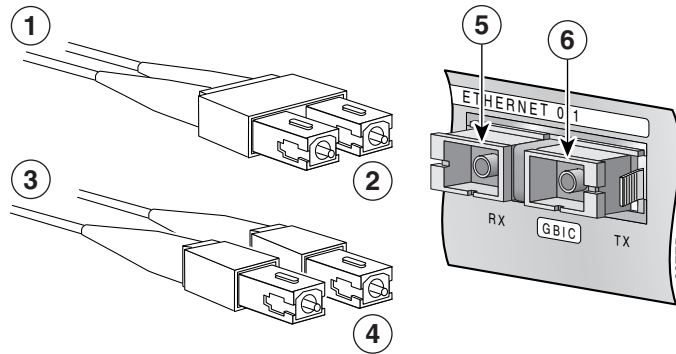
1	To external 1000BASEX network	5	RX (GBIC port 0/1)
2	1 duplex connector (TX and RX)	6	TX (GBIC port 0/1)
3	To external 1000BASEX network		
4	2 simplex connectors		

Table 5-5 describes the available GBIC options.

Table 5-5   GBIC Options

Product Number	GBIC	Description
WS-G5484= or GBIC-SX=	Short wavelength (1000BASESX)	Operates on standard multimode fiber-optic link spans of up to 1804 ft (550 m).
WS-G5486= or GBIC-LX/LH=	Long wavelength/long haul (1000BASELX/LH)	Operates on single-mode and multimode fiber-optic link spans of up to 6.2 miles (10 km).
WS-G5487= or GBIC-ZX=	Extended distance (1000BASEZX)	Operates on ordinary single-mode fiber-optic link spans of up to 43.5 miles (70 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber.

Table 5-6 lists the available CWDM GBIC options.

Table 5-6   CWDM GBIC Options

Product Number	CWDM GBIC	Color
CWDM-GBIC-1470=	Cisco 1000BASE-CWDM GBIC-1470 nm	Gray
CWDM-GBIC-1490=	Cisco 1000BASE-CWDM GBIC-1490 nm	Violet
CWDM-GBIC-1510=	Cisco 1000BASE-CWDM GBIC-1510 nm	Blue
CWDM-GBIC-1530=	Cisco 1000BASE-CWDM GBIC-1530 nm	Green
CWDM-GBIC-1550=	Cisco 1000BASE-CWDM GBIC-1550 nm	Yellow
CWDM-GBIC-1570=	Cisco 1000BASE-CWDM GBIC-1570 nm	Orange
CWDM-GBIC-1590=	Cisco 1000BASE-CWDM GBIC-1590 nm	Red
CWDM-GBIC-1610=	Cisco 1000BASE-CWDM GBIC-1610 nm	Brown

Table 5-7 provides cabling specifications for the GBICs that you install in Gigabit Ethernet devices. Note that all GBIC ports have SC-type connectors. Also, the minimum cable distance for the WS-G5484 or GBIC-SX and WS-G5486 or GBIC-LX/LH (multimode fiber [MMF] and single-mode fiber [SMF]) is 6.5 feet (2 m), and the minimum link distance for the WS-G5487 or GBIC-ZX is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the WS-G5487 or GBIC-ZX is 24.9 miles (40 km).

Note   Optical fiber cables are commercially available; they are not available from Cisco.

Table 5-7   GBIC Port Cabling Specifications

GBIC	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
WS-G5484 or GBIC-SX	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	902 ft (275 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
WS-G5486 or GBIC-LX/LH	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
WS-G5487 or GBIC-ZX	1550	SMF	9/10	—	43.5 miles (70 km)
		SMF[3]	8	—	62.1 miles (100 km)

1. Multimode fiber (MMF) only.

2. A mode-conditioning patch cord is required.
    When using the WS-G5486 or GBIC-LX/LH with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the GBIC and the MMF cable on both the transmit and the receive ends of the link when link distances are greater than 984 ft (300 m). We do not recommend using the WS-G5486 or GBIC-LX/LH and MMF with no patch cord for very short link distances (tens of meters). The result could be an elevated bit error rate (BER).

3. Dispersion-shifted single-mode optical fiber cable.

Table 5-8 provides the GBIC transmit and receive power requirements and power budget.

Table 5-8   GBIC Power Requirements and Power Budget

GBIC	Transmit Power		Receive Power		Power Budget
	Minimum	Maximum	Minimum	Maximum	
WS-G5484 or GBIC-SX	–9.5 dBm[1]	–4 dBm[1]	–17 dBm	0 dBm	7.5 dBm[2]
WS-G5486 or GBIC-LX/LH	–9.5 dBm[3] –11.5dBm[4]	–3 dBm[5]	–20 dBm	–3 dBm	7.5 dBm[6] and 8.0 dBm[7]
WS-G5487 or GBIC-ZX	0 dBm	5.2 dBm	–24 dBm	–3 dBm	–24 dBm

1. For fiber types 50/125 μm, NA = 0.20 fiber and 62.5/125 μm, NA = 0.275 fiber.
2. For fiber types 50 μm MMF and 62.5 μm MMF.
3. For fiber types 9/125 μm SMF.
4. For fiber types 62.5/125 μm MMF and 50/125 μm MMF.
5. For fiber types 9/125 μm SMF, 62.5/125 μm MMF, and 50/125 μm MMF.
6. For fiber types 50 μm MMF and 62.5 μm MMF.
7. For fiber type 10 μm SMF.

Mode-Conditioning Patch Cord Description

A mode-conditioning patch cord can be used with the WS-G5486= or GBIC-LX/LH= to allow reliable laser transmission between the single-mode laser source on the GBIC and a multimode optical fiber cable.

When an unconditioned laser source designed for operation on single-mode optical fiber is directly coupled to a multimode optical fiber cable, an effect known as *differential mode delay* (DMD) might result in a degradation of the modal bandwidth of the optical fiber cable.

This degradation results in a decrease in the link span (the distance between a transmitter and a receiver) that can be supported reliably. The effect of DMD can be overcome by conditioning the launch characteristics of a laser source. A practical means of performing this conditioning is to use a device called a mode-conditioning patch cord.

A mode-conditioning patch cord is an optical fiber cable assembly that consists of a pair of optical fibers terminated with connector hardware. Specifically, the mode-conditioning patch cord is composed of a single-mode optical fiber permanently coupled off-center (see Offset in Figure 5-11) to a graded-index multimode optical fiber. Figure 5-11 shows a diagram of the mode-conditioning patch cord assembly.

Figure 5-11   Mode Conditioning Patch Cord
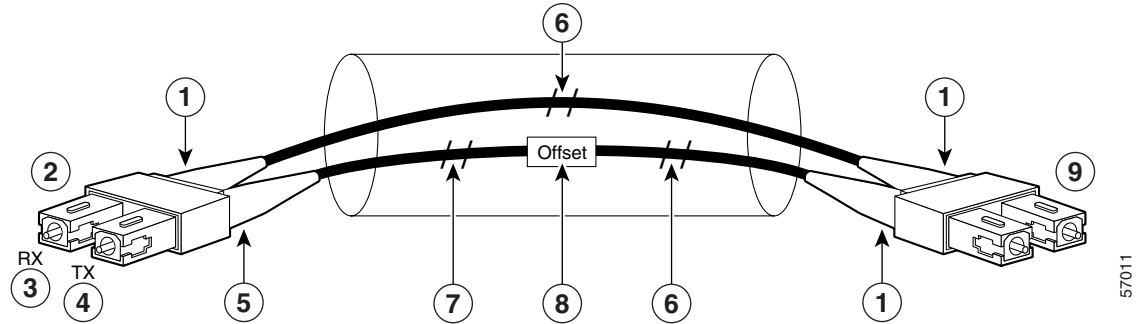
1	Beige color identifier	**6**	Multimode fiber
2	To Gigabit Ethernet interface	**7**	Single-mode fiber
3	RX	**8**	Offset
4	TX	**9**	To cable plant
5	Blue color identifier		

The mode-conditioning patch cord assembly is composed of duplex optical fibers, including a single-mode-to-multimode offset launch fiber connected to the transmitter, and a second conventional graded-index multimode optical fiber connected to the receiver. The use of a plug-to-plug patch cord maximizes the power budget of multimode 1000BASELX and 1000BASELH links.

The mode-conditioning patch cord is required to comply with IEEE standards. The IEEE found that link distances could not be met with certain types of fiber-optic cable cores. The solution is to launch light from the laser at a precise offset from the center, which is accomplished by using the mode-conditioning patch cord. At the output of the patch cord, the WS-G5486 or GBIC-LX/LH is compliant with the IEEE 802.3z standard for 1000BASELX.

Console and Auxiliary Port Connection Equipment

The NPE-G1 has a DCE-mode console port for connecting a console terminal, and a DTE-mode auxiliary port for connecting a modem or other DCE device (such as a CSU/DSU or other router) to your router. However, with an I/O controller also installed in the router, the default console and auxiliary ports are on the I/O controller, and you cannot access the console and auxiliary ports on the NPE-G1.

Note   Both the console and the auxiliary ports are asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. (Asynchronous is the most common type of serial device; for example, most modems are asynchronous devices.)

The NPE-G1 uses RJ-45 media for console port and auxiliary port connections.

Before connecting a terminal to the console port, configure the terminal to match the router console port as follows: 9600 baud, 8 data bits, no parity, 2 stop bits (9600 8N2). After you establish normal router operation, you can disconnect the terminal.

> ✎
> **Note**   When connecting to an auxiliary port on a Cisco 7200 VXR router, the port will not function at baud rates higher than 19.2k. If the baud rate on the connecting device is set higher than 19.2k, either garbled text or nothing will be displayed on the screen.

Refer to Table 5-9 for a list of the pins used on the RJ-45-to-DB-25 adapters, used with an RJ-45 cable, to connect terminals and modems to the Cisco 7200 series routers. The cable you use may be a roll-over cable or a straight cable.
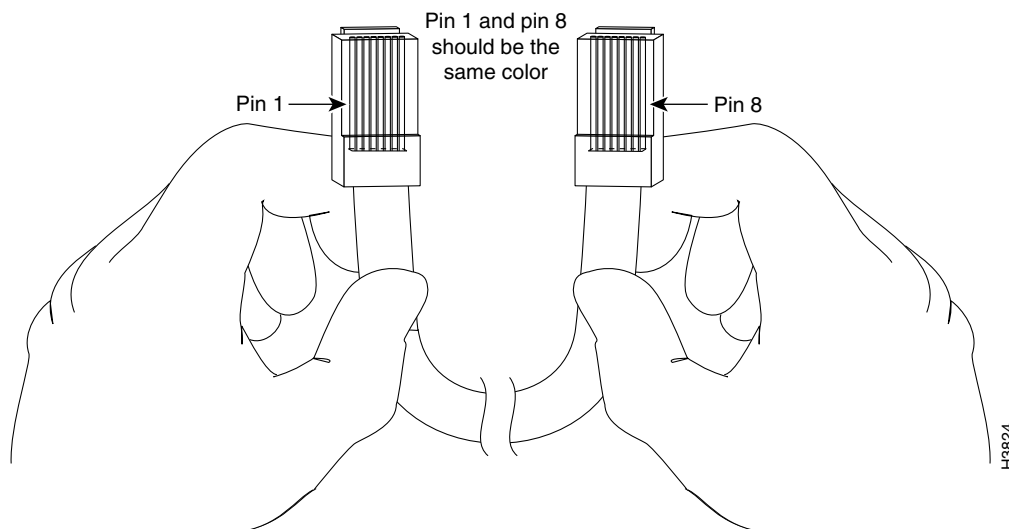
Table 5-9   Pinouts for the RJ-45-to-DB-25 Adapters

Adapter	DTE M/F Pins[1]	DCE M/F Pins	MMOD Pins[2]
1	4	5	5
2	20	6	8
3	2	3	3
4	7	7	7
5	7	7	7
6	3	2	2
7	6	20	20
8	5	4	4

1. The female data terminal equipment (FDTE) adapter that is available from Cisco is labeled "Terminal".

2. The MMOD adapter that is available from Cisco is labeled "Modem".

A roll-over cable can be detected by comparing the two modular ends of the cable. Holding the cables in your hand, side-by-side, with the tab at the back, the wire connected to the pin on the outside of the left plug should be the same color as the pin on the outside of the right plug. If your cable was purchased from Cisco, pin 1 will be white on one connector, and pin 8 will be white on the other (a roll-over cable reverses pins 1 and 8, 2 and 7, 3 and 6, and 4 and 5). (See Figure 5-12.)

Figure 5-12   Identifying a Roll-Over Cable

The Cisco 7200 series routers ship with a roll-over cable. Connection to a terminal or a modem requires an RJ-45-to-DB-25 adapter, and possibly a DB-25-to-DB9 adapter. Refer to Table 5-10 for the cable and adapter configurations that can be used to connect terminals and modems to the Cisco 7200 series routers.

*Table 5-10 Asynchronous Device Cabling Options*

Access Server Port	RJ-45 Cable Type	DB-25 Adapter	End Device
Console or auxiliary	Roll-over	FDTE[1]	Terminal
Console or auxiliary	Straight	FDCE	Terminal
Auxiliary or console	Roll-over	MMOD[2]	Modem

1. The FDTE RJ-45-to-DB-25 adapter is labeled "Terminal".
2. The MMOD RJ-45-to-DB-25 adapter is labeled "Modem".

The cable and auxiliary ports are configured as asynchronous serial ports. Figure 5-13 shows the RJ-45 console and auxiliary port connections.

Figure 5-13 Console and Auxiliary Port RJ-45 Connections
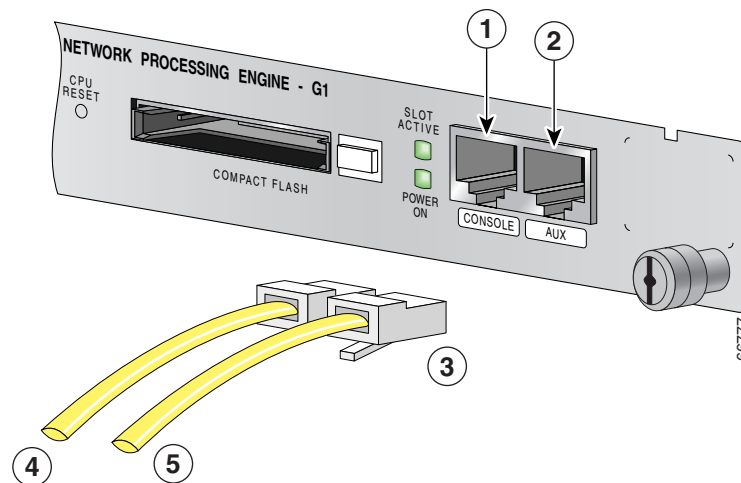
1	Console port	**4**	Cable to console terminal or DTE
2	Auxiliary port	**5**	Cable to modem or DCE
3	RJ-45 connectors		

A cable and adapter kit is available from Cisco (Product Number ACS-2500ASYN=). Table 5-10 describes the cable and adapter configurations that can be used to connect terminals and modems to the console or the auxiliary port.

RJ-45 Console Port Signals and Pinouts

The NPE-G1 console port supports Data Carrier Detect (DCD). Table 5-11 lists the RJ-45 console port signals for the NPE-G1.

Table 5-11   Console Port Signals for the NPE-G1

Pin[1]	Signal	Direction	Description
1	CTS	Out	Clear To Send (tracks RTS)
2	DSR	Out	Data Set Ready (always on)
3	RXD	Out	Receive Data
4	GND	—	Signal Ground
6	TXD	In	Transmit Data
7	DTR	In	Data Terminal Ready
8	RTS	In	Ready To Send

1. Any pin not referenced is not connected.

RJ-45 Auxiliary Port Signals and Pinouts

Table 5-12 lists the RJ-45 auxiliary port signals for the NPE-G1.

Table 5-12   Auxiliary Port Signals for the NPE-G1

Pin[1]	Signal	Direction	Description
1	RTS	Out	Ready To Send
2	DTR	Out	Data Terminal Ready
3	TXD	Out	Transmit Data
4	RING[2]	In	Ring Indication
5	GND	—	Signal Ground
6	RXD	In	Receive Data
7[3]	DSR/DCD(RLSD)	In	Data Set Ready/Data Carrier Detect (Receive Line Signal Detect)
8	CTS	In	Clear To Send (tracks RTS)

1. Any pin not referenced is not connected.

2. RING is not supported on Cisco-supplied adapters. To use this pin, you must create a customized cable.

3. Pin 7 can be used as a DCD input for connection to a modem. The RJ-45-to-DB-25F adapter maps DCD to this pin when used with a straight-through cable.

Fiber Optic Cleaning Information

We strongly recommend cleaning all optical fiber connections before reconnecting optical cables to equipment. For information about cleaning optical connectors, see the *Inspection and Cleaning Procedures for Fiber-Optic Connections* document and the *Compressed Air Cleaning Issues for Fiber-Optic Connections* document.